



Comparative Analysis of The Altman, Ohlson, and Zmijewski Models to Predict Financial Distress during The Covid-19 Pandemic

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Abstract

This study analyses financial distress predictions by comparing modified Altman Z-Score, Ohlson O-Score, and Zmijewski X-Score models (Case Study of Companies in the Transportation and Logistics Sector for the 2019-2021 Period). The population in this study is represented by transportation and logistics companies listed on the IDX. The sample collection technique in this study utilizes purposive sampling techniques using predetermined parameters, and as many as 23 companies were obtained as samples. The data used in this study was taken from the company's transportation and logistics financial statements. This research utilizes descriptive statistical tests, normality tests, and accuracy tests of prediction models as hypothesis tests. The results of this study show that the modified Altman Z-Score model is the most accurate model, with an accuracy level of 68.12%.

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Introduction

In December, the health outbreak in Wuhan, China, led to a global health crisis (Cahyani & Iramani, 2022; OECD, 2021). The virus was identified as Corona Virus Disease (COVID-19). The initial mishandling since this virus was detected caused the spread of COVID-19 to spread globally, so that on March 11 2020, the World Health Organization (WHO) officially revealed that the virus had become a pandemic due to the seriousness of the impact it had caused and that it had spread throughout the world (Kaushik & Guleria, 2020). Indonesia is one of the countries that felt the consequences of this incident and confirmed its first case in March 2020, followed by increasing daily cases that still need to be adequately resolved (Gunawan & Debbianita, 2022; Hartanto et al., 2023). Therefore, to control transmission and the increase in total COVID-19 cases, the government implemented decisions such as Large-Scale Social Restrictions (PSBB) and the Implementation of Community Activity Restrictions (PPKM) as prevention efforts (Gitiyarko, 2021).

The existence of large-scale social restrictions (PSBB) means that transportation sector companies in Indonesia are threatened with bankruptcy because the company's performance has decreased, which also impacts the company's revenue (Hafsari & Setiawanta, 2021; Ifada et al., 2023). Implementing large-scale social restrictions will also reduce people's interest in using transportation services. A survey conducted by Jakpat in 2020 shows that the majority of people, namely 66.9%, prefer private transportation, and less than 20% choose to use trains, buses and planes (Gunawan & Debbianita, 2022). As a result, there has been a decrease in the number of people using various types of transportation, be it land, sea or air. The public transportation business has experienced the impact of the COVID-19 pandemic due to the ongoing PSSB and the ban on returning home (Rahma et al., 2022).

According to information from the Directorate General of Land Transportation of the Ministry of Transportation, around 346 companies operating in inter-city inter-provincial (AKAP) bus services, 56 inter-provincial travel transport (AJAP), as well as 1,112 tourist bus agencies experienced the impact of the Covid-19 pandemic by experiencing reductions. Not a small number of passengers (Anwar, 2020). Apart from that, the CNBC Indonesia Research Team summarized that several shares of transportation companies experienced a decline since the implementation of large-scale social restrictions (PSBB), including PT Garuda Indonesia Tbk, which operates in air transportation services which experienced a decline in shares of 6.25% to IDR 195/share and PT Blue Bird Tbk which engaged in land transportation services, especially taxis, there was also a decline in shares of 2.46% to IDR 990/share (Haryanto, 2020). If the decline in passenger numbers and falling shares continue over a long period, the company will face losses and could experience severe financial distress.

Financial distress is when a company's finances face severe, emergency or unstable problems that can occur before the company faces bankruptcy (Lewaru & Loupatty, 2021). Financial distress or failure is often caused by significant losses that cause an imbalance in liabilities, a decrease in asset values, and the company's inability to fulfil obligations to other parties (Panigrahi, 2019). If a company's liquidity is disrupted, this could be an early sign of entering a period of financial distress, leading to bankruptcy if not resolved immediately (Marginingsih, 2022). It is essential to detect early signs of financial difficulties in a company so that preventative action can be taken immediately to reduce the risk that could lead to bankruptcy in the future (Permatasari et al., 2023; Piscestalia & Priyadi, 2019). Financial distress is one of the earliest predictors of a company's impending bankruptcy (Seto, 2022). Therefore, conducting research or analysis of financial distress predictions is necessary to see whether the company's financial condition is healthy. Through this research, company management can take appropriate action to take precautions if the company is experiencing financial distress.

Predictions of financial distress can be carried out by utilizing financial ratios as an analysis of company financial reports and as a standard method that helps companies face the risk of bankruptcy (Marginingsih, 2022). Until now, several models have been developed as analytical tools that can link several financial ratios

and predict financial distress in companies (Toly et al., 2019). For example, Altman Z-Score, Ohlson O-Score, and Zmijewski X-Score. In previous studies, several researchers have revealed various results related to predicting financial distress, as in research by Puro et al. (2019) for the hospital industry, showing that the modified Altman model had the highest level of accuracy, namely 88.67%. Likewise, research by Humairoh et al. (2022) stated that the Altman model had the most significant level of accuracy in predicting companies that had been delisted from the Indonesian Stock Exchange, and Lutfiyyah and Bhilawa (2021), whose research referred to English football clubs, resulted in the Zmijewski model showing the highest level of accuracy, namely 72%. Research Lestari (2022), which applied this model to companies in the property and real estate sub-sector, also showed the same results and research conducted by Zidane and Tojibussabirin (2022) at PT Garuda Indonesia stated that the Zmijewski model had the highest level of accuracy, namely 100%. Meanwhile, the research by Stankevičienė and Prazdeckaitė (2021) shows that the Ohlson and Zmijewski model has the greatest accuracy for predicting bankruptcy in Lithuanian companies.

This research is aimed at logistics and transportation companies listed on the Indonesia Stock Exchange. The reason for choosing a company in the transportation and logistics sector is that, during the Covid-19 pandemic, this industry felt quite a significant impact. One of them was in the aviation sector, which experienced losses of up to 812 million dollars or the equivalent of one trillion rupiah in the domestic market and 749 million dollars or the equivalent of 1.2 trillion rupiah in the international market in the period February-April 2020 (Khairunnisa, 2020). General Chair of Indonesia National Air Carriers Association (INACA) Denon Prawiraatmadja said that the number of domestic or international passengers in 2019 was around 91 million, and as a result of the Covid-19 pandemic Indonesia lost around 60-70 million passengers (Ramadhian, 2020). Executive Director of the Centre for Public Policy Studies (CPPS), Bambang Istianto, also revealed that the transportation sector experienced severe changes of 80% due to the Covid-19 pandemic, and many autobus businesses went out of business (Lazuardi, 2021).

This research differs from previous research in that the sample used is a transportation and logistics companies because previous research focused on property and real estate companies, the hospital industry, English football clubs, and companies that were delisted and focused on only one transportation company, PT Garuda Indonesia. Apart from that, what is new in this research is the application of the modified Altman, Ohlson, and Zmijewski prediction models to companies in the transportation and logistics sector during the Covid-19 pandemic to find out the prediction model with the highest level of accuracy in predicting financial distress (Zainal Abidin Putera, 2021).

The application of the modified Altman, Ohlson, and Zmijewski prediction model to companies in the transportation and logistics sector aims to increase understanding of the effectiveness of financial distress predictions and provide in-depth insight into the impact of the Covid-19 pandemic on the financial health of companies in this sector. Validation of these models helps confirm the accuracy or reliability and deficiencies of these models in predicting the company's financial condition. This research can support the development of financial analysis methodology by testing prediction models, which will help increase the accuracy of future predictions in industrial sectors affected by similar crises.

Methods

This quantitative study uses a comparative approach using statistical analysis methods on the available data. The population studied were companies in the transportation and logistics sector officially listed on the Indonesia Stock Exchange in 2019-2021. The sample was selected using a purposive sampling method at a predetermined level: companies that published complete financial reports during the 2019-2021 period, resulting in 23 companies for three years. The data used for this research is based on secondary data in the form of company annual reports obtained on the official website of the Indonesia Stock Exchange (<https://www.idx.com>).

The data analysis technique applied in this research is a descriptive statistical test which aims to illustrate or explain the data that has been accumulated as is, without the aim of making conclusions or generalizations with the method of detailing or illustrating data that has been accumulated as is without the aim of concluding for general or generalization (Sugiyono, 2018).

Then, to test the hypothesis in this research using the model accuracy test, the estimated level of accuracy in each model can be calculated using the formula below (Gupita et al., 2020):

$$\text{Level of accuracy} = \frac{\text{number of correct predictions}}{\text{number of samples}} \times 100\%$$

Apart from the accuracy level of each model, another consideration is also needed, namely the error rate. Two types of errors may occur in testing: Type I and Type II. Type I Error occurs when a sample of companies are not expected to face financial distress but experience financial difficulties. Meanwhile, Type II Error is an error that occurs if a sample of companies is predicted to experience financial distress but in reality, does not experience financial distress (Sudrajat & Wijayanti, 2019). The error type is calculated using the formula below (Widiasmara & Rahayu, 2019) :

$$\text{Type Error I} = \frac{\text{number of type I error}}{\text{number of samples}} \times 100\%$$

$$\text{Type Error II} = \frac{\text{number of type II error}}{\text{number of sample}} \times 100\%$$

This research applies the Modified Altman, Ohlson, and Zmijewski models as independent variables. At the same time, financial distress is used as a dependent variable, which is grouped into two classifications, namely non-financial distress companies (classification 0) with the criteria of companies that have not had negative profits for two years consecutively, while companies in financial distress (classification 1) have the criteria of companies having negative profits for two consecutive years.

Result and Discussion

Result

Descriptive statistical analysis for this study includes minimum, maximum, mean and standard deviation values. The results of descriptive statistics for each variable are as follows:

Table 1. Descriptive Statistics

Variable	Min	Max	Mean	Std. Dev.
Altman	-58.27	52.05	0.8662	14.27852
Ohlson	-4.96	12.13	1.5215	3.13687
Zmijewski	-4.13	20.67	1.3724	5.38568
Valid N (listwise)				

Source: Secondary data processed, 2023

Based on Table 1, it can be seen that the Altman type has a minimum level of -58.27 in BLTA companies in 2019 and explains that based on this model, BLTA companies were the companies experiencing the most financial distress at that time. This maximum level of 52.05 was obtained by the KJEN company in 2019, indicating that at that time, the KJEN company could be called the company with the safest conditions from financial distress compared to other companies.

Furthermore, for the Ohlson model, it can be seen that the minimum score of -4.96 was found in TNCA companies in 2020, and the maximum score of 12.13 was found in CMPP companies in 2021. This minimum value explains that TNCA companies in 2020 have the conditions with the healthiest finances, and the maximum value for CMPP companies in 2021 shows that this company has the most unhealthy conditions according to the Ohlson model.

Then, for the Zmijewski model, it can be seen that the minimum value is -4.13, and the maximum score is 20.67. The lowest score for the Zmijewski model was found in the KJEN company in 2019, explaining that the company had the healthiest condition. Meanwhile, the highest score was found in the CMPP company in 2021, indicating that the company was in very financial distress compared to other companies at that time.

Table 2. Results of Altman Model Prediction Accuracy

Year	Correct Prediction		False Prediction		Sample	
	Distress	Non Distress	Error Type I	Error Type II	Distress	Non Distress
2019	8	6	7	2		
2020	10	5	5	3		
2021	10	8	5	0		
Total	28	19	17	5	45	24
Level of accuracy			68,12%			
Error Type I rate			37,78%			
Error Type II rate			20,83%			

Source : Secondary data processed, 2023

Table 2. above depicts the calculations for 69 samples in total, composed of samples from Classification 0 and Classification 1. The table shows that the Modified Altman prediction model has an accuracy level of 68.12%. A total of 24 research samples (three years) were included in classification 0 (non-financial distress). The Modified Altman model was accurate in predicting companies in a state of non-financial distress (healthy) with 19 sample data, and the remaining five samples were estimated to be inaccurate, namely in financial distress conditions. A total of 45 research samples (three years) were included in classification 1 (financial distress); it can be seen that the Modified Altman model correctly predicted 28 sample data in financial distress, and the remaining 17 sample data were mispredicted, which were in non-financial conditions distress. Calculate the error rate results from the Modified Altman model to show the error rate of the prediction model. Based on the table above, it can be seen that the result for type I error is 37.78% and type II error is 20.83%. The Modified Altman model has a relatively low error rate in Error Type I and II. This shows that this model tends to provide more accurate predictions regarding the company's financial condition, both those facing financial distress and those not.

Table 3 above depicts the calculations for 69 samples containing samples of classification 0 and 1. The table shows that the Ohlson prediction model has an accuracy level of 47.83%. A total of 24 research samples (three years) are included in classification 0 (non-financial distress), the Ohlson model is correct in predicting companies in a state of non-financial distress (healthy) worth eight sample data and the remaining 16 samples are expected to be inaccurate, namely in the condition financial distress. A total of 45 research samples (three years) were included in classification 1 (financial distress); it can be seen that the Ohlson model correctly predicted 25 sample data in financial distress, and the remaining 20 sample data were misestimated, which were non-financial conditions distress—calculation results of the error rate from the Ohlson model or the error rate of the prediction model. Based on the table above, it can be seen that the result for type I error is 44.44% and type II error is 66.67%. It can be seen that the Ohlson model has a

reasonably significant error rate, especially Type II Error, which shows the tendency of the model to predict companies in financial distress incorrectly.

Table 3. Results of Ohlson Model Prediction Accuracy

Year	Correct Prediction		False Prediction		Sample	
	Distress	Non Distress	Error Type I	Error Type II	Distress	Non Distress
2019	7	2	8	6		
2020	10	3	5	5		
2021	8	3	7	5		
Total	25	8	20	16	45	24
Level of accuracy	47,83%					
Error Type I rate	44,44%					
Error Type II rate	66,67%					

Source: Secondary data processed, 2023

Table 4. Results of Zmijewski Model Prediction Accuracy

Year	Correct Prediction		False Prediction		Sample	
	Distress	Non Distress	Error Type I	Error Type II	Distress	Non Distress
2019	7	5	8	3		
2020	8	7	7	1		
2021	10	3	5	5		
Total	25	15	20	9	45	24
Level of accuracy	57,97%					
Error Type I rate	44,44%					
Error Type II rate	37,50%					

Source: Secondary data processed, 2023

Table 4 describes the calculations for 69 samples in total, composed of samples in classifications 0 and 1. The table shows that the Zmijewski prediction model achieved an accuracy level of 57.97%. A total of 24 research samples (three years) are included in classification 0 (non-financial distress). The Zmijewski model is correct in predicting companies in a state of non-financial distress (healthy) for 15 sample data, and the remaining nine samples are estimated to be inaccurate, which is in financial distress conditions. A total of 45 research samples (three years) were included in classification 1 (financial distress); it can be seen that the Zmijewski model correctly predicted 25 sample data in financial distress, and the remaining 20 sample data were mispredicted, which were non-financial conditions distress. The results of the error rate calculation from the Zmijewski model show the error rate of the prediction model. Based on the table above, it can be seen that the result for type I error is 44.44% and type II error is 37.50%. The Zmijewski model has significant error rates in both types of errors. Although Type I Error has a higher error rate than Type II Error, both show that this model has challenges in accurately predicting a company's financial condition and financial and non-financial distress.

Discussion

The comparison of model accuracy results can be known after carrying out the model accuracy calculations that were carried out in the previous discussion. The following is a comparison of the results of the accuracy calculations of the prediction models:

Table 5. Comparison of Prediction Model Accuracy Results

Prediction Model	Level of Accuracy	Error Type I	Error Type II
Altman Modifikasi	68.12%	37.78%	20.83%
Ohlson	47.83%	44.44%	66.67%
Zmijewski	57.97%	44.44%	37.50%

Source: Secondary data processed, 2023

Based on Table 5, it can be observed that the prediction model with the highest level of accuracy is the Modified Altman model, reaching 68.12%. This model provides more accurate predictions and identifies companies likely to experience financial distress. Apart from that, judging from the error rate, this model tends to be lower than the Ohlson and Zmijewski prediction model, namely, Type I Error of 37.78% and Type II Error of 20.83%. The level of type II error in a modified Altman model shows that the model has relatively low errors in predicting companies experiencing financial distress. So, the modified Altman model can be said to be the best model for predicting financial distress. Then, followed by the Zmijewski model with an accuracy level of 57.97%; even though it is lower than the Altman Modification, it still shows a decent ability to predict the company's financial situation.

In contrast, the Ohlson model has a smaller level of accuracy, only 47.83%, compared to the other two models. This condition indicates that the Ohlson model has limitations in accurately identifying companies with the potential to face financial distress. This comparison highlights that the Modified Altman is the best model for providing accurate predictions related to financial distress. These results are supported by research conducted by [Puro et al. \(2019\)](#) showing that the modified Altman model is effective for predicting financial distress. The results of this research are also in line with research conducted by [Humairoh et al., \(2022\)](#) that the Altman prediction model has the highest level of accuracy in predicting financial distress. However, the results of this research contradict research conducted by [Lutfiyah and Bhilawa \(2021\)](#), research by [Lestari \(2022\)](#) and research by [Zidane and Tojibussabirin \(2022\)](#) which shows that the Zmijewski model received the highest level of accuracy. Apart from that, the results of this study also contradict research conducted by [Stankevičienė and Prazdeckaitė \(2021\)](#) showing that the Ohlson and Zmijewski model shows the greatest accuracy for predicting bankruptcy.

Conclusions and Recommendations

Based on the analysis carried out in this research regarding the comparison of the Modified Altman, Ohlson, and Zmijewski models to estimate financial distress in companies in the transportation and logistics sector on the Indonesian Stock Exchange during the 2019-2021 Covid-19 pandemic, it can be concluded that the Modified Altman model has the most significant level of accuracy for estimating financial distress at 68.12% with a type I error rate of 37.78% and type II of 20.83%. Meanwhile, the Zmijewski model achieved an accuracy 57.97 using a type I error rate of 44.44% and type II 37.50%. The Ohlson model shows the lowest level of accuracy among the three, with an accuracy rate of 47.83%, a type I error rate of 44.44%, and a type II error rate of 66.67%.

The limitations of this research are that the sample size needs to be larger and the research year span needs to be longer. Apart from that, only three prediction models are used, namely modified Altman, Ohlson, and Zmijewski, even though there are many other models which may have a higher level of accuracy than the three models, for example, the Springate, Grover, Taffler, Zavgren models and so on. So, in future research, it is recommended to apply other prediction models to companies in other fields, for example, companies in mining and finance, and add a research period of more than just three years. Apart from that, it is also suitable for company management to know from the start about signs of financial difficulties which could lead to bankruptcy.

References

- Cahyani, A. P. R., & Iramani. (2022). Studi Financial Distress Pada Perusahaan Transportasi Dan Logistik Di Indonesia: Pandemi Covid-19 Tidak Berdampak. *Jurnal Ilmu Manajemen*, 10(4), 1073–1086.
- Gitiyarko, V. (2021). *PSBB Hingga PPKM, Kebijakan Pemerintah Menekan Laju Penularan Covid-19*. Kompaspedia.
- Gunawan, E., & Debbianita, D. (2022). Analisis Financial Distress pada Perusahaan Sub Industri Penerbangan dan Kereta Api yang Terdaftar di Bursa Efek Indonesia Sebelum dan Sesudah Pandemi Covid-19. *Jurnal Akuntansi*, 14(1), 112–126.
- Gupita, N., Soemoedipiro, S. W., & Soebroto, N. W. (2020). ANALISIS PERBANDINGAN MODEL ALTMAN Z-SCORE , (Studi Pada Perusahaan Sektor Infrastruktur Yang Terdaftar Di BEI Periode 2015-2019). *JURNAL AKTUAL AKUNTANSI KEUANGAN BISNIS TERAPAN*, 3(1), 145–162.
- Hafsari, N. A., & Setiawanta, Y. (2021). ANALISIS FINANCIAL DISTRESS DENGAN PENDEKATAN ALTMAN PADA AWAL COVID-19 DI INDONESIA (STUDI EMPIRIS PERUSAHAAN TRANSPORTASI DAN LOGISTIK PERIODE 2019). *Jurnal Akuntansi Dan Pajak*, 22(01), 394–403. <https://doi.org/http://dx.doi.org/10.29040/jap.v22i1.2309>
- Hartanto, M. C., Prajanto, A., & Nurcahyono, N. (2023). Determinants of going-concern audit opinions: Empirical evidence from listed mining firms in Indonesia. *Maksimum: Media Akuntansi Universitas Muhammadiyah Semarang*, 13(1), 17–27. <https://doi.org/10.26714/mki.13.1.2023.17-27>
- Haryanto. (2020). *Ramai Penerapan PSBB, Sabam-sabam ini Kena Getahnya*.
- Humairoh, R., Sunarto, S., & Alfasadun. (2022). Analisis Akurasi Model Altman Z-Score, Springate S-Score, Dan Ohlson O-Score Dalam Memprediksi Financial Distress. *Jurnal Ilmiah Indonesia p-ISSN*, 7(6), 6865–6880.
- Ifada, L. M., Ghoniyah, N., & Nurcahyono, N. (2023). How Do Tax Avoidance and Profitability Influence a Firm'S Intrinsic Value? *Jurnal Akuntansi Multiparadigma*, 14(1), 115–125. <https://doi.org/10.21776/ub.jamal.2023.14.1.08>
- Kaushik, M., & Guleria, N. (2020). The Impact of Pandemic COVID -19 in Workplace. *European Journal of Business and Management*, 12(15), 9–18. <https://doi.org/10.7176/ejbm/12-15-02>
- Khairunnisa, S. N. (2020). *INACA: Kerugian Maskapai Penerbangan Selama Corona Capai 812 Juta Dollar AS*. Kompas.Com.
- Lazuardi, G. (2021). *Direktur CPPS: Pemerintah Bertanggungjawab Sediakan Transportasi Umum Aman dan Nyaman Artikel ini telah tayang di TribunBanten.com dengan judul Direktur CPPS: Pemerintah Bertanggungjawab Sediakan Transportasi Umum Aman dan Nyaman*.
- Lestari, S. S. (2022). Analisis Potensi Kebangkrutan Menggunakan Model Altman, Ohlson, Dan Zmijewski Pada Perusahaan Subsektor Properti Dan Real Estate Yang Terdaftar Di Bei Periode 2017 – 2019. *Jurnal Keuangan Negara Dan Kebijakan Publik*, 2(1), 96–103.
- Lewaru, T. S., & Loupatty, L. G. (2021). Prediction of Financial Distress As The Impact of The Covid-10 Pandemic on Trade, Service and Investment Companies in Indonesia Using Altman Z-Score Discriminant Analysis (Study on the Indonesia Stock Exchange). *International Journal of Multi Science*, 2(8), 1–20.
- Lutfiyah, I., & Bhilawa, L. (2021). Analisis Akurasi Model Altman Modifikasi (Z''-Score), Zmijewski, Ohlson, Springate Dan Grover Untuk Memprediksi Financial Distress Klub Sepak Bola. *Jurnal Akuntansi*, 13(1), 46–60.
- Marginingsih, R. (2022). Financial Distress Analysis Using The Altman Z-Score Method For Retail Companies During The Covid-19 Pandemic. *Enrichment: Journal of Management*, 12(2), 1796–1803.
- OECD. (2021). Revenue Statistics in Asia and the Pacific 2021 Emerging Challenges for the Asia-Pacific Region in the Covid-19 Era. *OECD Publishing*, 24, 0–1. <https://www.oecd.org/tax/tax-policy/revenue-statistics-asia-and-pacific-indonesia.pdf>
- Panigrahi, C. M. A. (2019). Validity of Altman's 'z'score model in predicting financial distress of pharmaceutical companies. *NMIMS Journal of Economics and Public Policy*, 4(1).
- Permatasari, M., Nurcahyono, N., Bilqis, L. K., & Nugroho, W. S. (2023). The Effect of Good Corporate Governance and Financial Ratios on Financial Distress. *International Conference on Business, Accounting, Banking, and Economics*, 1(1), 321–336. <https://doi.org/10.2991/978-94-6463-154-8>
- Piscestalia, N., & Priyadi, M. P. (2019). Analisis Perbandingan Model Prediksi Financial Distress Dengan Model Springate, Ohlson, Zmijewski, Dan Grover. *Jurnal Ilmu Dan Riset Akuntansi*, 8(6), 1–17.
- Puro, N., Borkowski, N., Hearld, L., Carroll, N., Byrd, J., Smith, D., & Ghiasi, A. (2019). Financial Distress and Bankruptcy Prediction: Acomparison of Three Financial Distress Prediction Model in Acute Care Hospitals. *Journal of Health Care Finance*, 1–15.
- Rahma, A. M., Nurcahyono, N., & Sinarasri, A. (2022). Moderating Effects of Institutional Ownership on the Relation Between Capital Structure. *International Conference on Business, Accounting, Banking, and Economics*, 1, 293–306. <https://doi.org/10.2991/978-94-6463-154-8>

- Ramadhian, N. (2020). *Pandemi, Jumlah Penumpang Pesawat di Indonesia Turun Drastis*. Kompas.Com.
- Seto, A. A. (2022). Altman Z-Score Model , Springate , Grover , Ohlson and Zmijweski to Assess the Financial Distress Potential of PT . Garuda Indonesia Tbk During and After the Covid-19 Pandemic. *Enrichment: Journal of Management*, 12(5), 3819–3826.
- Stankevičienė, J., & Prazdeckaitė, G. (2021). Analysis of the accuracy of bankruptcy prediction models: the case of Lithuanian companies. *Science and Studies of Accounting and Finance: Problems and Perspectives*, 15(1), 44–53. <https://doi.org/https://doi.org/10.15544/ssaf.2021.05>
- Sudrajat, M. A., & Wijayanti, E. (2019). Analisis Prediksi Kebangkrutan (Financial Distress) Dengan Perbandingan Model Altman, Zmijewski Dan Grover. *Inventory : Jurnal Akuntansi*, 3(2), 116–129.
- Sugiyono. (2018). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Alfabeta.
- Toly, A. A., Permatasari, R., & Wiranata, E. (2019). The Effect of Financial Ratio (Altman Z-Score) on Financial Distress Prediction in Manufacturing Sector in Indonesia 2016-2018. *Economics, Business and Management Research*, 144(Afbe 2019), 47–53.
- Widiasmara, A., & Rahayu, H. C. (2019). Perbedaan Model Ohlson, Model Taffler Dan Model Springate Dalam Memprediksi Financial Distress. *Inventory : Jurnal Akuntansi Vol.*, 3(2), 141–158.
- Zainal Abidin Putera, F. Z. (2021). Pengaruh Kepemilikan Institusional dan Struktur Modal Terhadap Kinerja Keuangan. *Maksimum: Media Akuntansi Universitas Muhammadiyah Semarang*, 11(2), 85. <https://doi.org/10.26714/mki.11.2.2021.85-95>
- Zidane, M. M., & Tojibussabirin, M. (2022). An Analysis of Altman, Zmijewski, Grover, Ohlson, and Springate Models in Predicting Financial Distress (A Case Study on PT Garuda Indonesia (Persero) Tbk in 2010-2020). *REVIU AKUNTANSI, KEUANGAN, DAN SISTEM INFORMASI*, 1(2), 34–42. <https://doi.org/http://dx.doi.org/10.21776/reaksi.2022.01.2.01>.