Management Analysis Journal 15 (2) (2026)

https://journal.unnes.ac.id/journals/maj



Contradiction Between Theory and Reality: An Altman Z-Score Analysis of State-Owned Enterprises in the Indonesian Construction and Industrial Sectors

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Article Information

History of article:
Submitted 04 August 2026
Revised 11 September 2026
Accepted 30 September 2026

Keywords:
Financial Distress, Altman Z-Score, Current Ratio, Debt to Asset Ratio, Net Profit Margin, Return on Assets

Abstract

This study examines the effects of Current Ratio (CR), Debt to Asset Ratio (DAR), Net Profit Margin (NPM), and Return on Assets (ROA) on financial distress among industrial and construction companies listed on the Indonesia Stock Exchange, while comparing the original and modified Altman Z-Score models. The study employed a quantitative approach with purposive sampling, involving 35 observations from five selected companies. Data were analyzed using multiple linear regression, simultaneous F-tests, and classical assumption tests. The findings indicate that all independent variables simultaneously have a significant effect on financial distress, with the modified Altman model demonstrating greater explanatory power, as reflected in an increase in adjusted R-squared from 50.35% to 62.38%. Individually, DAR emerges as the strongest negative predictor across both models. Meanwhile, CR has a positive and significant effect in the modified model, whereas NPM and ROA remain statistically insignificant, reflecting the capital-intensive characteristics and long-term project cycles of the sector. These findings suggest that companies should prioritize debt management and maintain adequate short-term liquidity to reduce financial distress risks. Investors are encouraged to consider the modified Altman model and emphasize solvency indicators when evaluating financial conditions. Future research should expand the sample size and examine alternative financial predictors or financial distress models.

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e-ISSN 2502-1451

INTRODUCTION

Companies in the industrial and construction sectors play a crucial role in driving the national economy, especially in the provision of strategic infrastructure and supporting the manufacturing sector (Yosandra & Sembiring, 2022). Entities in this sector are required to continue to maintain operational growth while managing a healthy capital structure amid macroeconomic dynamics (Abdillah & Ratnasari, 2023). However, throughout the 2019-2025 period, the industrial and construction sectors are faced with quite intense financial pressures due to fluctuations in operational costs, high debt burdens, and market uncertainty (Hikmatullah & Kartini, 2022). This phenomenon indicates the presence of symptoms financial distress a critical phase in which the company's liquidity, solvency, and profitability are disrupted, which if not mitigated has the potential to trigger operational failures (Ansyah & Firmansyah, 2023).

Financial distress is notably mirrored in the company's core financial indicators between 2019 and 2025. A diminishing current ratio (CR) highlights a weakening capacity to meet short-term liabilities (Salman & Wulandari, 2021). Concurrently, an elevated debt-to-asset ratio (DAR) indicates an over-reliance on external debt over internal assets, which elevates bankruptcy risks (Cipta & Syaiful, 2025). Furthermore,

instability in the net profit margin (NPM) and return on assets (ROA) points to constraints in operational efficiency, revealing a reduced capability to convert total sales and assets into net earnings (Salsa & Sulindawati, 2022).

Although studies on financial health and early detection financial distress much has been done, there are limitations in previous studies that often rely only on a single measurement model without looking at the relevance of the characteristics of the type of industry (Wiranta, 2011; Yana et al., 2026). The most popular and widely tested bankruptcy prediction model is the Altman z-score model. Altman's (1968) original model is designed primarily for public manufacturing companies with specific variable formulas and weights. Over time, Altman revised and released the modified Altman z-score model (1995) which is more flexible to apply to different types of industries, including non-manufacturing companies and entities in developing countries (Kurniawan & Daryanto, 2022). Therefore, it is important to test the extent of the difference in accuracy and consistency between the two models when combined with fundamental ratio analysis such as CR, DAR, NPM, and ROA in mapping the financial health of issuers in the industrial and construction sectors (Ansyah & Firmansyah, 2023; Cindy, 2026).

While prior literature has extensively evaluated the Altman Z-score models across various corporate sectors (Ansyah & Firmansyah, 2023; Kurniawan & Daryanto, 2022), this study addresses a distinct theoretical mismatch when applying these models to capital-intensive State-Owned Enterprises (SOEs). Specifically, the original 1968 model incorporates the Sales-to-Total-Assets ratio (X5), which inherently penalizes capital-intensive SOEs that operate under prolonged project cycles and heavy asset bases. By contrasting the 1968 original model against the 1995 modified version which eliminates X5 this research uncovers how structural model assumptions distort bankruptcy risk assessments in SOEs, offering a nuanced framework for solvency evaluation in public-sector infrastructure entities.

This study examines the financial health and potential financial distress of companies in the Indonesian construction and industrial sectors during 2019–2025 using the Current Ratio (CR), Debt-to-Asset Ratio (DAR), Net Profit Margin (NPM), and Return on Assets (ROA). It also compares the accuracy, consistency, and classification results of the Altman Z-Score model (1968) and the modified Altman Z-Score model (1995) in identifying potential financial distress.

The analysis further evaluates differences in the scores generated by the two models to determine how CR, DAR, NPM, and ROA relate to variations in bankruptcy risk assessments. This comparison provides insight into how different financial indicators may influence the classification of corporate financial conditions.

The findings are expected to provide a clearer understanding of the applicability of both Altman models in assessing financial distress among construction and industrial companies. By examining their performance over the 2019–2025 period, this study aims to support more informed financial evaluations and strengthen the use of financial ratios in identifying potential bankruptcy risks.

LITERATURE REVIEW

Financial Distress

Financial distress is a condition when a company faces liquidity difficulties or a serious shortage of cash funds, thereby threatening its operational continuity and financial obligations (Salsa & Sulindawati, 2022). This condition is generally a transition phase before the corporation actually experiences bankruptcy or legal liquidation (Salman & Wulandari, 2021). The main symptoms include the inability to pay off short-term and long-term liabilities, a sustained decline in profit margins, and a negative trend in operating cash flows (Kasmir, 2019; Resfitasari et al., 2022). In the financial management literature, early detection of this pressure is crucial so that management can take mitigation steps before defaults occur (Endiramurti et al., 2022).

Financial Ratios as A Fundamental Analysis Variable

Analysis of the financial performance of industrial and construction companies requires fundamental indicators that are able to comprehensively capture aspects of liquidity, solvency, and profitability (Cindy, 2026; Mardiah & Amin, 2022). These variables include: current ratio, debt to asset ratio, net profit margin and return on assets.

Financial Distress *Prediction Model*: Altman Z-Score (1968 Vs 1995)

The Altman Z-Score Model is one of the most established multivariate discriminant analysis tools for predicting corporate bankruptcy. Initially developed by Altman (1968) for publicly traded manufacturing companies, the model combines five financial ratios into a single discriminant equation: **Z = 1.2(X1) + 1.4(X2) + 3.3(X3) + 0.6(X4) + 0.99(X5)**. This model evaluates a company's financial condition by incorporating indicators of liquidity, profitability, leverage, and asset utilization.

As financial theory evolved, Altman introduced a modified model in 1995 to improve

its applicability across different industry sectors. The original model's asset turnover ratio (X5) may vary substantially across industries, particularly in non-manufacturing sectors such as basic industries and construction, potentially distorting bankruptcy predictions (Gisella, 2023). To address this limitation, the modified model eliminates X5 and adjusts the coefficients of the remaining variables, resulting in the following equation: **Z'' = 6.56(X1) + 3.26(X2) + 6.72(X3) + 1.05(X4)**.

Empirical Review of Previous Research

Comparative studies of bankruptcy prediction models have been widely discussed in the financial literature. Altman (1968) demonstrated that combining liquidity and profitability ratios can provide strong predictive power in assessing a company's financial viability. Furthermore, Platt & Platt (2002) emphasized that industry characteristics influence model sensitivity, highlighting the need to adjust predictive variables to improve the accuracy of financial health assessments in non-manufacturing sectors (Bahrum et al., 2024).

Building on these findings, this study addresses the empirical gap by comparing the predictive performance of the Altman models introduced in 1968 and 1995, specifically in industrial and construction companies (Gisella, 2023).

Research and Hypothesis Development Model

Based on the theoretical review, this study develops a conceptual framework to examine the relationship between key financial ratios, namely the current ratio (CR), debt-to-asset ratio (DAR), net profit margin (NPM), and return on assets (ROA), and corporate financial health as measured by the Altman Z-score. The framework proposes that liquidity and profitability contribute positively to financial stability, whereas a higher debt burden may increase the risk of financial distress. Accordingly, the study formulates three hypotheses concerning the effects of CR, DAR, and profitability indicators (NPM and ROA) on the financial health and stability of capital-intensive state-owned enterprises (SOEs).

In addition to examining the influence of financial ratios, this study compares the performance of the original Altman Z-score model (1968) and the modified Altman Z-score model (1995) in assessing the financial distress status of capital-intensive SOEs. The fourth hypothesis (H4) proposes that statistically significant differences exist between the two models in terms of classification consistency and score sensitivity. This comparison is intended to determine whether the choice of model affects the assessment of corporate financial conditions and to identify which model provides a more appropriate evaluation of financial distress in the context of capital-intensive SOEs.

The research framework and the relationships among the variables are further organized into a research roadmap, as presented in Figure 1. The roadmap outlines the logical sequence of the study, beginning with the examination of financial ratios and their relationships with corporate financial health, followed by the comparative assessment of the two Altman Z-score models. Through this structured approach, the study aims to provide empirical evidence regarding the determinants of financial stability and the effectiveness of alternative financial distress prediction models for capital-intensive SOEs.

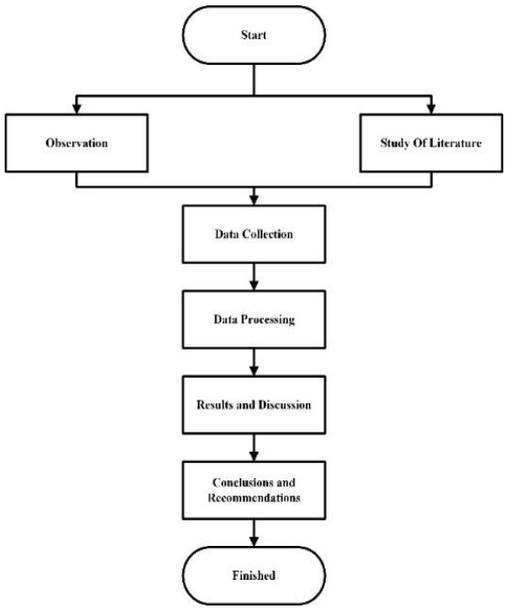


Figure 1. Research Roadmap

RESEARCH METHOD

Research Design

This research employs a quantitative methodology utilizing both descriptive and causal-comparative designs. The descriptive element objectively outlines the financial stability and bankruptcy susceptibility of industrial and construction sector firms through scoring metrics (Pasha et al., 2023). Conversely, the causal-comparative design evaluates the predictive accuracy and consistency between the 1968 and 1995 Altman Z-score models, while also analyzing how core financial ratios specifically the current ratio (CR), debt-to-asset ratio (DAR), net profit margin (NPM), and return on assets (ROA) impact financial distress risks (Alifiah & Tahir, 2018).

The study relies on secondary quantitative data retrieved directly from official financial

disclosures published on the Indonesia Stock Exchange (IDX) website (www.idx.co.id) and official corporate portals (Firdaus & Maulida, 2025). The observation timeframe spans seven years (2019-2025), capturing comprehensive shifts in corporate financial performance across pre-pandemic, pandemic, and post-pandemic cycles. Crucially, all financial statements spanning the 2024-2025 observation window were verified to be fully audited by independent public accounting firms, ensuring data integrity and adherence to Indonesian Financial Accounting Standards (SAK) (Ansyah & Firmansyah, 2023).

Population and Sample Determination

The research population comprises all industrial and construction companies listed on the Indonesia Stock Exchange (IDX). To ensure data validity and relevance, this study employs a purposive sampling technique (Suhartanto, 2019) based on specific inclusion criteria. First, the companies must have been actively listed on the IDX in the industrial and construction sectors throughout the observation period from 2019 to 2025 and consistently published audited annual financial statements without interruption. Second, their financial statements must provide complete and adequate data to calculate all variables required by both the original and modified Altman Z-Score models, as well as the supporting financial ratios, namely the current ratio (CR), debt-to-asset ratio (DAR), net profit margin (NPM), and return on assets (ROA).

Based on the screening process using these criteria, five major companies in the industrial and construction sectors were selected as the final research sample: PT PP (Persero) Tbk (PTPP), PT Waskita Karya (Persero) Tbk (WSKT), PT Krakatau Steel (Persero) Tbk (KRAS), PT Semen Indonesia (Persero) Tbk (SMGR), and PT Semen Baturaja (Persero) Tbk (SMBR). These companies were selected based on the availability and completeness of their financial data in accordance with the established sampling criteria. Covering a seven-year observation period from 2019 to 2025, the study comprises a total of 35 firm-year observations, calculated from five companies observed over seven consecutive years. These observations serve as the basis for analyzing the relationship between financial ratios and corporate financial health, as well as comparing the predictive performance of the two Altman Z-score models in assessing financial distress.

Variable Operational Definition Table

The following section summarizes the operational definitions of the Altman Z-score model components and the independent financial ratio variables examined in this study.

Table 1. Operational Definitions and Measurement of Research Variables

Variable Type	Variable Name	Symbol	Operational Definitions and Formulas	Source
Component Model Altman	Net Working Capital to Total Assets	X1	Measuring A Company's Net Liquidity Based on The Difference Between Current Assets Minus Current Liabilities to Total Assets: **{(Current Assets - Current Liabilities}) / Total Assets}**	(Chen et al., 1995; Sayidah & Assagaf, 2020)
	Retained Earnings to Total Assets	X2	Measures A Company's Cumulative Profitability Over Its Operating History Against Total Assets: **{Retained Earnings / Total Assets}**	(Altman, 1968; Chen et al., 1995; Darmawan, 2022)
	Earnings Before Interest and Taxes on Total Assets	X3	Measuring The Productivity and Efficiency of Assets in Generating Pure Profits Without the Influence of Capital Structure and Taxes: **{EBIT / Total Aset}**	(Chen et al., 1995; Hikmatullah & Kartini, 2022)
	Equity Value to Total Liabilities	X4	Measure The Solvency Level and Debt Safety Cushion (Using the Equity Market Value in the 1968 Model and The Equity Book Value in the 1995 Model Against Total Liabilities): **{Equity Value/Total Liabilities}**	(Altman, 1968; Chen et al., 1995; Rimbano et al., 2024)
	Total Asset Turnover	X5	Measures The Ability of Total Assets to Generate Sales Volume	(Altman, 1968; Chen et al., 1995;

			(Specifically in the 1968 Altman Model): **{Sales / Total Assets}**	Resfitasari et al., 2022)
Independent Variables	Current Ratio	CR	Liquidity Ratio That Measures the Ability of a Current Asset to Pay Off Short-Term Liabilities: **{Current Assets / Current Liabilities}**	(Alifiah & Tahir, 2018; Cindy, 2026)
	Debt To Asset Ratio	DAR	Solvency ratio reflecting the proportion of a company's aggregate assets funded through debt.: **{Total Liabilities / Total Assets}**	(Abdullah et al., 2023)
	Net Profit Margin	NPM	Profitability Ratio That Measures the Percentage of Net Profit from Each Rupiah of Sales Revenue: **{Net Profit / Sales Revenue}**	(Heikal et al., 2014; Yosandra & Sembiring, 2022)
	Return On Assets	ROA	Profitability Ratio That Assesses Management's Effectiveness in Utilizing Overall Assets to Generate Net Profit: **{Net Profit / Total Assets}**	(Endiramurti et al., 2022; Silalahi et al., 2025)
Dependent Variable	Nilai Z-Score / Status Financial Distress	Y	The Composite Score Is the Result of The Calculation of The Altman Model That Represents the Level of Financial Health of The Company.	(Altman, 1968; Chen et al., 1995; Imelda & Alodia, 2017; Zulkarnain et al., 2022)

RESULT AND DISCUSSION

Altman Z Score Calculation Results

The following table presents the overall results of the financial ratio analysis of state-owned enterprises (SOEs) in the construction and industrial sectors listed on the Indonesia Stock Exchange (IDX) during the 2019–2025 observation period.

Table 2. Comparison of Altman Z-Score and Financial Distress Classifications by Company (2019–2023)

Company	Year	Z-Score (1968)	Criterion (1968)	Z-Score (1995)	Criterion (1995)
PTPP	2019	1.38	*Grey Zone*	2.66	*Safe Zone*
	2020	1.16	*Grey Zone*	2.28	*Grey Zone*
	2021	1.42	*Grey Zone*	2.69	*Safe Zone*
	2022	1.5	*Grey Zone*	2.92	*Safe Zone*
	2023	1.08	*Distress Zone*	1.81	*Grey Zone*
WSKT	2019	1.5	*Grey Zone*	2.99	*Safe Zone*
	2020	1.05	*Distress Zone*	1.62	*Grey Zone*
	2021	0.83	*Distress Zone*	1.99	*Grey Zone*
	2022	0.93	*Distress Zone*	2.02	*Grey Zone*
	2023	0.37	*Distress Zone*	0.54	*Distress Zone*
KRAS	2019	2.14	*Grey Zone*	-2.78	*Distress Zone*
	2020	1.06	*Distress Zone*	0.95	*Distress Zone*
	2021	1.06	*Distress Zone*	0.4	*Distress Zone*
	2022	1.06	*Distress Zone*	-1.06	*Distress Zone*
	2023	0.34	*Distress Zone*	-2.45	*Distress Zone*
SMGR	2019	2.14	*Grey Zone*	3.57	*Safe Zone*
	2020	2.49	*Grey Zone*	3.68	*Safe Zone*
	2021	2.31	*Grey Zone*	3.85	*Safe Zone*

	2022	2.55	*Grey Zone*	4.54	*Safe Zone*
	2023	2.66	*Safe Zone*	4.6	*Safe Zone*
SMBR	2019	2.87	*Safe Zone*	2.87	*Safe Zone*
	2020	2.44	*Grey Zone*	2.44	*Grey Zone*
	2021	2.42	*Grey Zone*	2.42	*Grey Zone*
	2022	2.78	*Safe Zone*	2.78	*Safe Zone*
	2023	2.38	*Grey Zone*	2.38	*Grey Zone*

PT PP (Persero)

The results of the five-variable model indicate a relatively conservative assessment of PT PP (Persero) Tbk's financial condition. Throughout the 2019–2025 observation period, the company did not reach the Safe Zone. Instead, its financial condition remained within the Grey Zone from 2019 to 2022 before deteriorating into the Distress Zone from 2023 to 2025, with Z-scores consistently below 1.10. This pattern indicates a sustained decline in the company's financial health and an increasing risk of financial distress during the latter part of the observation period.

In contrast, the results of the four-variable model present a more varied assessment of the company's financial condition. PT PP (Persero) Tbk was classified in the Safe Zone in 2019, 2021, and 2022, reaching its highest Z-score of 2.92 in 2022. However, its financial performance subsequently deteriorated, with the score declining into the Grey Zone in 2023 before falling into the Distress Zone in 2024 and 2025, with scores below 1.00. Despite differences in classification during the earlier years, both models indicate a substantial deterioration in the company's financial health toward the end of the observation period. These findings suggest that PT PP (Persero) Tbk faced increasing financial distress risks in 2024 and 2025.

PT Waskita Karya (Persero)

Based on the 1968 model, wskt's financial condition shows a very consistent and quite critical downward trend. The company was recorded only once in the *grey zone* in 2019 with a value of 1.50, but since 2020, the z-score value has continued to decline and is stuck in the *distress zone* until 2025. The company's lowest point occurred in 2024 with a score of -1.10, which signifies very heavy financial pressure. Until 2025, the company has not shown any significant signs of recovery, with the score still at -0.42

Meanwhile, the 1995 model provides a slightly more varied picture of the firm's resilience. Wskt was in the *safe zone* position in 2019 with a score of 2.99, then shifted to *the grey zone* during the period 2020 to 2022 with scores ranging from 1.62 to 2.02. However, this trend reversed drastically starting in 2023, where the company fell into *the distress zone* with a score of 0.54 and continued to weaken until it reached -1.03 in 2024 and 2025.

PT Krakatau Steel (Persero)

Based on the Z-score calculation using the original 1968 model, PT Krakatau Steel (KRAS) experienced a significant deterioration in financial performance during the 2019–2025 period. In 2019, the company recorded a Z-score of 2.14, placing it in the Grey Zone. However, its financial condition weakened in 2020, when the score declined to 1.06, placing the company in the Distress Zone. This score remained unchanged in 2021 and 2022 before declining further to 0.34 in 2023. The downward trend continued in 2024 and 2025, with the Z-score falling to −1.85 and −3.23, respectively. These results reflect a persistent decline in the company's financial condition and an increasing vulnerability to financial distress throughout the observation period.

Meanwhile, the results obtained using the five-variable model show a similarly concerning financial trajectory. PT Krakatau Steel recorded a Z-score of −2.78 in 2019, indicating that the company was in the Distress Zone. Although its score improved to 0.95 in 2020 and 0.40 in 2021, this recovery was not sustained. The score subsequently declined to −1.06 in 2022 and −2.45 in 2023, before reaching a low of −7.43 in 2024. Despite a partial recovery to −2.55 in 2025, the company remained in the Distress Zone. Overall, the results from both models indicate that PT Krakatau Steel faced persistent financial difficulties throughout the observation period, with the five-variable model showing a more pronounced deterioration in its financial condition.

PT Semen Indonesia (Persero)

The 5-variable model shows a very positive and stable development. In the 2019-2022 period, the company was in the *grey zone* with a score that continued to increase consistently from 2.14 to 2.55. This upward trend continues until the company manages to enter the *safe zone* in 2023 with a score of 2.66. The company's performance is further strengthening in 2024 and 2025, where the z-score jumped to 3.22 and 3.29, respectively. This achievement indicates excellent financial

management and a very strong financial position as well as being free from the risk of bankruptcy.

The 4-variable model gives consistent results with the 5-variable model, but shows a much superior performance in terms of numbers. Throughout the period 2019 to 2025, the company was consistently in the *safe zone* without ever going down to the gray zone or danger zone. The company's score shows a persistent upward trend, starting from 3.57 in 2019 to reaching a high of 5.79 in 2025. A drastic increase in the x3 score (which reflects asset efficiency or profitability) starting in 2024 significantly boosts the company's total z-score.

PT Semen Baturaja (Persero)

The four-variable model indicates that SMBR demonstrates relatively strong overall financial performance. The company remained in the Safe Zone for most of the observation period (2019–2025), although its Z-score declined to 2.57 in 2024, placing it in the Grey Zone. However, SMBR recovered in 2025, with its Z-score increasing to 3.41 and returning to the Safe Zone. This trend suggests that the company has relatively sound financial fundamentals and the capacity to recover from operational pressures.

In contrast, the five-variable model provides a more conservative assessment of SMBR's financial condition. Under this model, the company was classified in the Grey Zone in 2020, 2021, 2023, 2024, and 2025. Although SMBR reached the Safe Zone in 2019 and 2022, its Z-score showed a downward trend from 2023 to 2025, declining from 2.38 to 1.28. This pattern suggests that the five-variable model may be more sensitive to changes in the financial indicators incorporated into the model, particularly those related to asset utilization and capital structure. Consequently, the five-variable model presents a less favorable assessment of SMBR's financial health than the four-variable model.

Multiple Regression Analysis

Altman Z Score Regression Analysis 1968

Table 3. Regression Analysis of the Effects of CR, DAR, NPM, and ROA on Altman Z-Score

Variable	Coefficient	Std. Error	T-Statistic	Prob.
CR	0.225384	0.405651	0.555609	0.5826
DAR	-3.964170	0.848698	-4.670886	0.0001
NPM	0.026964	0.025721	1.048339	0.3029
ROA	-0.007211	0.005278	-1.366371	0.1820
R-Squared	0.561889	Mean Dependent Var		1.345657
Adjusted R-Squared	0.503474	S.D. Dependent Var		1.366648
S.E. Of Regression	0.963003	Akaike Info Criterion		2.894044
Sum Squared Resid	27.82126	Schwarz Criterion		3.116236
Log Likelihood	-45.64577	Hannan-Quinn Crister.		2.970745
F-Statistic	9.618944	Durbin-Watson Stat		1.021236
Prob (F-Statistic)	0.000040			

Utilizing the EViews software for data processing, a multiple regression analysis was conducted to examine the impact of the current ratio (CR), debt-to-asset ratio (DAR), net profit margin (NPM), and return on assets (ROA) on financial distress, as indicated by the Z-score. Derived from the regression output, the resulting multiple linear equation is expressed as follows:

Z-Score = 3.754644 + 0.225384(CR) - 3.964170(DAR) + 0.026964(NPM) - 0.007211(ROA)

Based on this equation, the constant value of 3.754644 indicates that when all independent variables equal zero, the company's average Z-score remains above the standard threshold, placing it within the safe zone. Furthermore, the regression coefficients reveal the directional impact of each variable on corporate financial health.

The current ratio (CR) features a positive coefficient of 0.225384, suggesting that improvements in short-term liquidity correspond to higher financial stability scores. Conversely, the debt-to-asset ratio (DAR) displays a substantial negative coefficient (-3.964170), demonstrating that a higher reliance on debt financing sharply diminishes the Z-score value. Additionally, the net profit margin (NPM) records a marginal positive coefficient of 0.026964, while return on

assets (ROA) exhibits a negative coefficient of -0.007211 within this specification.

Residual Normality Test

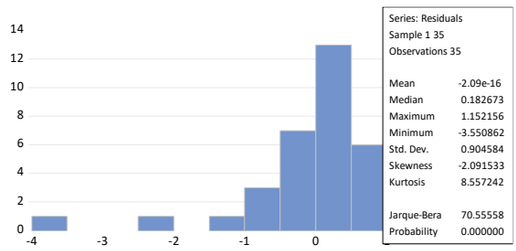


Figure 2. Residual Normality Test Histogram

The normality test is conducted as part of the classical assumption tests to determine whether the residuals of the regression model follow a normal distribution. This assumption is commonly assessed using a histogram, a normal probability plot (P–P plot), or a formal statistical test such as the Jarque–Bera test. Residual normality is particularly relevant for the validity of statistical inference using the t-test and F-test in regression analysis.

Based on the regression results, the Jarque–Bera test indicates that the probability value exceeds the 0.05 significance level. This result suggests that the null hypothesis of normally distributed residuals cannot be rejected, indicating that the residuals do not significantly deviate from a normal distribution. Therefore, the normality assumption is considered satisfied for the estimated regression model. However, this finding alone does not establish that all classical regression assumptions have been fulfilled or that the model satisfies the Best Linear Unbiased Estimator (BLUE) criteria; other relevant diagnostic tests must also be conducted to support that conclusion.

Model Feasibility Test (Goodness of Fit and F Test)

The feasibility of the regression model was evaluated using the coefficient of determination (R-squared and adjusted R-squared) and the simultaneous significance test (F-test) to assess the explanatory power and overall statistical significance of the model. The regression results yielded an R-squared value of 0.561889 and an adjusted R-squared value of 0.503474. These findings indicate that approximately 50.35% of the variation in the Altman Z-scores can be explained by the four independent variables, namely the current ratio (CR), debt-to-asset ratio (DAR), net profit margin (NPM), and return on assets (ROA), after accounting for the number of predictors in the model. The remaining variation is attributable to other factors not included in this study.

Furthermore, the F-test results show an F-statistic of 9.618944 with a probability value of 0.000040, which is below the 0.05 significance level. This indicates that CR, DAR, NPM, and ROA jointly have a statistically significant relationship with the Altman Z-score. Therefore, the regression model demonstrates overall statistical significance, suggesting that the selected financial ratios collectively provide explanatory value in assessing the financial health of industrial and construction companies.

In addition, the Breusch–Pagan–Godfrey test was conducted to examine the presence of heteroskedasticity in the regression residuals. The test produced an F-statistic of 0.658915 with a probability value of 0.6253, while the Obs*R-squared statistic was 2.826603 with a probability value of 0.5872. Both probability values exceed the 0.05 significance level; therefore, the null hypothesis of homoskedasticity cannot be rejected. These results indicate that there is insufficient statistical evidence of heteroskedasticity in the model, suggesting that the residual variance is reasonably constant. Overall, the diagnostic results support the suitability of the regression model for examining the relationship between the selected financial ratios and corporate financial health.

Classical Assumption Test (Multicollinearity and Heteroscedasticity)

Table 4. Multicollinearity and Heteroskedasticity Test Results

Variable	Coefficient	Uncentered	Centered
	Variance	VIVID	VIVID
C	0.884333	33.37552	OR
CR	0.164553	9.699879	1.575389
DAR	0.720288	14.16361	1.635558
NPM	0.000662	1.074113	1.031099
ROA	2.79E-05	1.067761	1.065299

Compliance with classical assumptions is necessary to ensure that the regression model qualifies as a Best Linear Unbiased Estimator (BLUE). In this study, the classical assumption tests involved examining multicollinearity and heteroscedasticity to assess the reliability of the regression model.

The multicollinearity test, based on centered Variance Inflation Factor (VIF) values, showed that CR (1.575389), DAR (1.635558), NPM (1.031099), and ROA (1.065299) were all below the threshold of 10, indicating that no multicollinearity was present. Furthermore, the Breusch-Pagan-Godfrey test for heteroscedasticity produced an Obs*R-squared value of 2.826603 and a chi-square probability of 0.5872. Since the probability value exceeded the 0.05 significance level, the null hypothesis of homoskedasticity could not be rejected, indicating that the model exhibited constant error variance.

Altman Z Score Regression Analysis 1995

Table 5. Multiple Regression Analysis of Financial Distress Based on the Altman Z-Score Model (1995)

Variable	Coefficient	Std. Error	T-Statistic	Prob.
C	2.839632	1.703979	1.666471	0.1060
CR	2.366337	0.735038	3.219341	0.0031
DAR	-5.357657	1.537834	-3.483898	0.0015
NPM	0.060245	0.046605	1.292649	0.2060
ROA	0.006207	0.009563	0.649026	0.5213
R-Squared	0.668092	Mean Dependent Var	1.997632	
Adjusted R-Squared	0.623838	S.D. Dependent Var	2.845095	
S.E. Of Regression	1.744955	Akaike Info Criterion	4.082898	
Sum Squared Resid	91.34605	Schwarz Criterion	4.305091	
Log Likelihood	-66.45072	Hannan-Quinn Crister.	4.159599	
F-Statistic	15.09665	Durbin-Watson Stat	1.295021	
Prob (F-Statistic)	0.000001			

Following the statistical data analysis performed via EViews, a multiple regression model was implemented to examine how significantly the current ratio (CR), debt-to-asset ratio (DAR), net profit margin (NPM), and return on assets (ROA) affect corporate financial distress, as measured by the Z-score. Derived directly from the regression output, the resulting multiple linear equation is presented below:

Z-Score = 2.839632 + 2.366337(CR) - 5.357657(DAR) + 0.060245(NPM) + 0.006207(ROA)

Based on this equation, the constant value of 2.839632 signifies that when all independent variables equal zero, the company's average Z-score remains above the standard cutoff, comfortably placing it within the safe zone category. Furthermore, the regression coefficients illustrate the directional influence of each predictor on corporate financial health. The current ratio (CR) features a positive coefficient of 2.366337, indicating that enhancements in short-term liquidity correspond directly to higher financial stability scores. Conversely, the debt-to-asset ratio (DAR) exhibits a substantial negative coefficient of -5.357657, demonstrating that a greater reliance on debt within the capital structure sharply drives down the Z-score value. Additionally, the net profit margin (NPM) records a positive coefficient of 0.060245, while the return on assets (ROA) displays a marginal positive coefficient of 0.006207 within this model.

Model Feasibility Test (Goodness of Fit and F Test)

Model viability for predicting financial distress was examined via the coefficient of determination and the overall F-test. The findings show an R-squared of 0.668092 and an adjusted R-squared of 0.623838, demonstrating that roughly 62.38% of fluctuations in companies' Z-scores are collectively explained by CR, DAR, NPM, and ROA.

Additionally, an F-statistic of 15.09665 with a p-value of 0.000001 far lower than the 0.05 alpha level establishes that the regression framework is highly valid. Statistically, this proves that the independent predictors simultaneously influence the observed financial distress status of the enterprises.

Classic Assumption Test

To ensure that the regression model meets the criteria of a Best Linear Unbiased Estimator (BLUE), classical assumption tests are conducted, including normality, multicollinearity, and heteroscedasticity tests.

Residual Normality Test

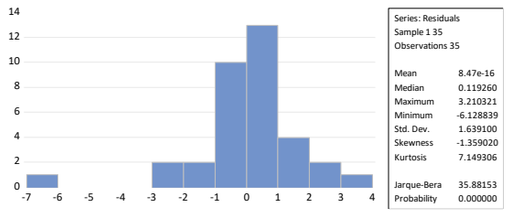


Figure 3. Residual Distribution and Normality Test Result

The fulfillment of the classical assumption in multiple regression analysis requires a normality test to ensure that the residual value (error term) spreads normally so that the hypothesis test through the t-test and f-test has statistical validity. In this study, the evaluation of residual normality was carried out using a formal statistical test approach, namely the jarque-bera test. Based on the test rules, if the probability value of the jarque-bera statistic is greater than the significance level α= 0.05, then the residual is normally distributed. The results of data processing showed that the jarque-bera probability value was above the threshold of 0.05, which proves that the regression model residuals are normally distributed and free from distribution bias.

Multicollinearity Test

Table 6. Multicollinearity Test Results Using Variance Inflation Factor (VIF)

Variable	Coefficient	Uncentered	Centered
	Variance	VIVID	VIVID
C	2.903545	33.37552	OR
CR	0.540280	9.699879	1.575389
DAR	2.364933	14.16361	1.635558
NPM	0.002172	1.074113	1.031099
ROA	9.15E-05	1.067761	1.065299

To evaluate potential multicollinearity, centered Variance Inflation Factor (VIF) values were examined. The analysis yielded VIF statistics of 1.575389 for CR, 1.635558 for DAR, 1.031099 for NPM, and 1.065299 for ROA. Because all figures remain safely beneath the standard threshold of 10, it is confirmed that multicollinearity is absent among the independent predictors within the regression model.

Heteroscedasticity Test

Heteroscedasticity testing was conducted using the Breusch-Pagan-Godfrey method to determine whether the regression model exhibited non-constant residual variance. The test results showed an F-statistic of 0.655696 with a probability of 0.6275, an Obs*R-squared value of 2.813906 with a chi-square probability of 0.5894, and a Scaled Explained SS value of 6.356413 with a chi-square probability of 0.1741.

Since all probability values exceed the 0.05 significance level, the null hypothesis of homoskedasticity cannot be rejected. This indicates that there is insufficient evidence of heteroscedasticity in the regression model, suggesting that the residuals have constant variance. Therefore, the model satisfies the homoskedasticity assumption of the classical linear regression model.

Discussion of the Altman Z Score 1968

PTPP shows a fluctuating trend in financial health but tends to weaken in recent years. Based on the 1968 model, the company was consistently in the gray zone before finally falling into *the distress zone* since 2023. This is reinforced by 1995 model data which shows that after briefly being in the safe zone in 2022, the company experienced a sharp decline to the danger zone in 2024 and 2025. This difference in interpretation shows that there is a sensitivity to liquidity variables and the company's capital structure which is increasingly depressed by operating expenses or debt.

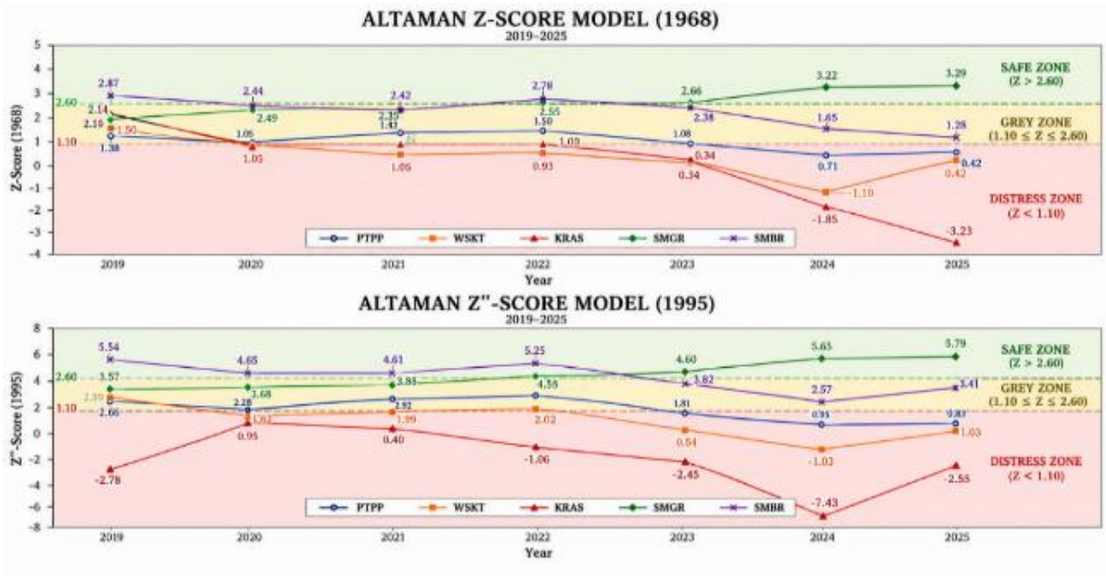


Figure 4. ALTMAN Z Score Model

The comparative analysis of the sample companies across both Altman models reveals distinct performance trajectories within the industrial and construction sector. PT PP (Persero) Tbk (PTPP) faces significant structural challenges, as indicated by a synchronous decline in Z-Scores and an inability to maintain a position above the safe threshold over the past two years, necessitating immediate asset efficiency and capital structure reviews. Meanwhile, PT Waskita Karya (Persero) Tbk (WSKT) exhibits the most critical condition; its persistent placement in the distress zone culminating in negative scores in 2024 and 2025 reflects severe solvency problems and equity erosion driven by consecutive losses, making comprehensive debt restructuring and radical operational reforms imperative. Similarly, PT Krakatau Steel (Persero) Tbk (KRAS) demonstrates a high-risk profile, trapped in hardship or negative zones due to profitability struggles failing to cover operating expenses and financial obligations, signaling a deep crisis. In stark contrast, PT Semen Indonesia (Persero) Tbk (SMGR) serves as a positive anomaly, showcasing exceptional operational efficiency, robust financial governance, and safe-zone scores soaring up to 5.79 by 2025, thereby categorizing its bankruptcy risk as minimal. Finally, PT Semen Baturaja Tbk (SMBR) displays resilient stability; although the 1968 model places it conservatively in the grey zone, the 1995 model highlights a dominant safe-zone presence, proving its ability to avoid distress zones while emphasizing the need for ongoing short-term liquidity maintenance.

Discussion Based on The Original Altman Z-Score Model (1968)

The original Altman (1968) model yielded an R-Squared of 56.19% and an F-statistic of 9.61 ($p < 0.05$), confirming its basic feasibility for mapping initial corporate health. Within this model, the Current Ratio (X1) exhibited a positive yet insignificant effect on the Z-Score ($p = 0.5826$), as capital-intensive traits in industrial and construction sectors often leave current assets tied up in retention receivables or unfinished project inventories. This aligns with findings by Nakamura (2021), who note that liquidity ratios do not always significantly predict bankruptcy due to high non-cash current assets, contrasting with Gultom & Hasyim (2025) and Brigham & Houston (2021), who view liquidity as a primary defense against financial distress.

Conversely, the Debt to Asset Ratio (X2) demonstrated a negative and highly significant impact ($p = 0.0001$, coefficient -3.964), proving debt burden to be the most destructive factor in the original framework where reliance on external financing unbacked by equity growth severely depresses corporate health scores. This is supported by Altman et al. (2017) and Akbar & Fahmi (2020), though it departs from Modigliani-Miller's tax shield theory which suggests debt can add value via tax savings if managed optimally (Cindy, 2026). Meanwhile, Net Profit Margin (X3) showed a positive but statistically insignificant effect ($p = 0.3029$), failing to adequately cover heavy operational and long-term debt costs, which mirrors Putri et al. (2024) while contradicting Harahap (2021) and Ross et al. (2019). Finally, Return on Assets (X4) registered a negative and insignificant coefficient ($p = 0.1820$), reflecting a weight mismatch for asset efficiency when applied to non-manufacturing public issuers consistent with Toly et al. (2020), but divergent from Platt & Platt (2002) and Kurniawan & Daryanto (2022).

Discussion Based on The Modified Altman Z-Score Model (1995)

Transitioning to the Modified Altman Model (1995) substantially improved model quality, with the Adjusted R-Squared jumping to

62.38% and an F-statistic of 15.09 (p = 0.000001), confirming its superior accuracy for non-manufacturing issuers. Partially, the Current Ratio (X1) shifted to a positive and significant effect (t = 3.219, p = 0.0031), as eliminating the sales turnover variable clarified liquidity, proving current assets act as a vital shield against distress. This aligns with Kasmir (2019) and Altman & Hotchkiss (2016), though it diverges from Ansyah & Firmansyah (2023), who argued short-term liquidity is easily manipulated via working capital policies.

Conversely, the Debt to Asset Ratio (X2) maintained a negative and highly significant impact (p=0.0015, coefficient -5.357), underscoring external debt as the deadliest threat to these sectors. Supported by Brigham & Houston (2021) and Cindy (2026), this finding contrasts with Myers & Majluf's Pecking Order Theory, which suggests high-growth firms intentionally issue large debt for project expansions without inevitably facing bankruptcy. Meanwhile, Net Profit Margin (X3) showed a positive yet statistically insignificant relationship (p = 0.2060), unable to offset high operational and interest costs supported by Tandelilin (2017) and Cindy (2026), but contradicting Yosandra & Sembiring (2022). Finally, Return on Assets (X4) shifted to a positive coefficient but remained insignificant (p = 0.5213) due to the capital-intensive nature requiring long-term fixed asset cycles, aligning with Endiramurti et al. (2022) and Abdillah & Ratnasari (2023), while differing from Sembiring & Safrida (2026) and Hermiyetti et al. (2024).

Furthermore, the empirical findings validate Hypothesis 4 regarding classification consistency and score sensitivity between the two models. The observed divergence in scores is fundamentally driven by structural adjustments in model parameters. In capital-intensive SOEs, the 1968 model's inclusion of asset turnover (X5) artificially depresses score values due to the large asset base required for long-term infrastructure projects. In contrast, the 1995 modified model reallocates weight toward liquidity (X1) and solvency (X4) while excluding X5, thereby effectively neutralizing structural asset biases and providing a more realistic reflection of short-term financial stability in public infrastructure enterprises.

CONCLUSION

This study examined the impact of the current ratio (CR), debt-to-asset ratio (DAR), net profit margin (NPM), and return on assets (ROA) on financial distress among industrial and construction firms listed on the Indonesia Stock Exchange (IDX) during the 2019–2025 period. The findings indicate that the four independent variables collectively exert a significant influence on corporate financial health, as measured by the Z-score. The Modified Altman Model, developed in 1995, demonstrates greater explanatory power, with an adjusted R-squared of 62.38%, compared to 50.35% for the Original Altman Model introduced in 1968.

In the partial evaluation under the 1968 framework, CR, NPM, and ROA show no statistical significance, whereas DAR exhibits a negative and robustly significant impact, identifying excessive debt as a primary threat to solvency. Following the non-manufacturing adjustments in the 1995 model, CR emerges as a positive and significant predictor, verifying that strong short term liquidity acts as a vital shield against financial distress. Concurrently, DAR maintains its negative, highly significant influence with an amplified coefficient. Meanwhile, both NPM and ROA display positive relationships but remain statistically insignificant, an outcome attributed to the capital-intensive nature and extended return cycles characteristic of the industrial and construction sectors (Mahardini & Bandi, 2023).

Based on the research findings, discussions, and conclusions, several suggestions are directed toward company management, investors, and future researchers. For industrial and construction sector company management, strict control over new liabilities or debts is essential, as the Debt to Asset Ratio (DAR) has proven to be the most dominant factor dragging companies into the financial distress zone, making debt restructuring and capital structure optimization key to survival. Management must also maintain adequate current asset availability (Current Ratio) to manage daily liquidity risks and improve operational efficiency to accelerate cash conversion cycles. For investors and potential investors, reliance should not be placed solely on profit levels or margins; instead, primary focus should be given to solvency ratios like DAR and short-term liquidity, utilizing the Modified Altman Z-Score Model (1995) for its superior accuracy, stability, and relevance in non-manufacturing contexts.

Future researchers are advised to expand sample sizes beyond the initial five companies to encompass all industrial and construction issuers on the IDX for broader generalization, as well as incorporate additional fundamental variables such as firm size, operating cash flow, or working capital turnover and alternative prediction models like Springate, Grover, or Ohlson to enhance comparative comprehensiveness.

AUTHOR CONTRIBUTIONS

Dian Firdaus: Conceptualization, Methodology, Formal analysis, Investigation, Data collection,

Writing – original draft, Visualization, and Project administration.

Hilda Maulida: Supervision, Validation, Resources, Writing – review and editing, and Research coordination.

Gita Suci Maharani: Investigation, Data analysis, Validation, Resources, and Writing – review and editing.

FINANCIAL DISCLOSURE

No external funding or financial assistance was received to support the completion of this research.

CONFLICT OF INTEREST

The authors declare that they have no competing interests that could have influenced the research, its findings, or the publication of this article.

DECLARATION OF ARTIFICIAL INTELLIGENCE USE

The authors affirm that generative artificial intelligence was not used to produce the manuscript's content, formulate its arguments, or develop its conceptual framework.

REFERENCES

Abdillah, A., & Ratnasari, I. (2023). Prediksi tingkat financial distress perusahaan BUMN Karya dengan metode Altman Z-Score, Springate dan Zmijewski. *Ecobisma (Jurnal Ekonomi, Bisnis dan Manajemen), 10*(1), 15–23.

Abdullah, M., Mirosea, N., Aswati, W. O., & Santi. (2023). Analysis of financial ratios to predict financial distress conditions of manufacturing companies listed on the Indonesian Stock Exchange. *International Journal of Professional Business Review, 8*(7), Article e03156.

Akbar, F., & Fahmi, I. (2020). Pengaruh ukuran perusahaan, profitabilitas dan likuiditas terhadap kebijakan dividen dan nilai perusahaan pada perusahaan manufaktur yang terdaftar di Bursa Efek Indonesia. *Jurnal Ilmiah Mahasiswa Ekonomi Manajemen, 5*(1), 62–81.

Alifiah, M. N., & Tahir, M. S. (2018). Predicting financial distress companies in the manufacturing and non-manufacturing sectors in Malaysia using macroeconomic variables. *Management Science Letters, 8*, 593–604.

Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The Journal of Finance, 23*(4), 589–609.

Altman, E. I., & Hotchkiss, E. (2016). *Corporate financial distress and bankruptcy: Predict and avoid bankruptcy, analyze and invest in distressed debt*. Wiley.

Altman, E. I., Iwanicz-Drozdowska, M., Laitinen, E. K., & Suvas, A. (2017). Financial distress prediction in an international context: A review and empirical analysis of Altman's Z-Score model. *Journal of International Financial Management & Accounting, 28*(2), 131–171.

Ansyah, R. H. A., & Firmansyah, A. M. (2023). Financial distress and the commitment to promoting innovation in state-owned enterprises: A critical perspective. *Jurnal Tata Kelola dan Akuntabilitas Keuangan Negara, 9*(1), 1–16.

Bahrum, S., Hariranto, S., & Mayangsari, S. (2024). Financial distress BUMN di Indonesia: Studi pada perusahaan go-public tahun 2017–2022. *Jurnal Riset Akuntansi dan Keuangan, 6*(1), 15–28.

Brigham, E. F., & Houston, J. F. (2021). *Fundamentals of financial management*. Cengage Learning.

Chen, Y., Weston, J. F., & Altman, E. I. (1995). Financial distress and restructuring models. *Financial Management, 24*(2), 57–75.

Cindy, N. (2026). Pengaruh rasio keuangan terhadap financial distress. *Jurnal Economic Resource, 9*(1), 1212–1225.

Cipta, A. E., & Syaiful. (2025). Pengaruh rasio profitabilitas, likuiditas dan leverage terhadap financial distress pada perusahaan BUMN yang terdaftar di BEI tahun 2019–2023. *Journal of Culture Accounting and Auditing, 4*(1), 144–156.

Darmawan, P. (2022). Analisis financial distress pada PT Wijaya Karya dan PT Adhi Karya yang terdaftar sebagai perusahaan BUMN Indonesia. *Jurnal Bina Akuntansi, 9*(1), 94–106.

Endiramurti, S. R., Chayati, N., & Kurniawati, E. M. (2022). Analisis pengaruh struktur modal terhadap kinerja keuangan BUMN sektor konstruksi: Peran financial distress sebagai variabel moderasi. *Owner: Riset dan Jurnal Akuntansi, 6*(3), 2463–2478.

Firdaus, D., & Maulida, H. (2025). The impact of Shariah-compliant and GCG disclosure on company value (study of Shariah banks

listed on the IDX). *Indonesian Journal of Economics and Management, 6*(1), 1–12.

Gisella, Y. E. (2023). Analisis financial distress pada perusahaan konstruksi BUMN Karya. *Syntax Idea, 5*(11).

Gultom, F. F., & Hasyim, D. (2025). Pengaruh likuiditas dan leverage terhadap financial distress dengan profitabilitas sebagai variabel moderasi pada perusahaan pertambangan di Bursa Efek Indonesia periode 2017–2023. *Jurnal Manajemen dan Akuntansi, 5*, 52–75.

Harahap, S. S. (2021). *Analisis kritis atas laporan keuangan*. Rajawali Pers.

Heikal, M., Khaddafi, M., & Ummah, A. (2014). Influence analysis of return on assets (ROA), return on equity (ROE), net profit margin (NPM), debt to equity ratio (DER), and current ratio (CR) against corporate profit growth in automotive in Indonesia Stock Exchange. *International Journal of Academic Research in Business and Social Sciences, 4*(12).

Hermiyetti, Dharmawan, D., Mulatsih, L. S., Alfiana, & Anantadjaya, S. P. D. (2024). Determinant of financial distress in manufacturing companies. *International Journal of Artificial Intelligence Research, 8*(1), 1–9.

Hikmatullah, & Kartini. (2022). Analisis financial distress badan usaha milik negara (BUMN) yang terdaftar di Bursa Efek Indonesia sebelum dan pada saat pandemi COVID-19. *Selekta Manajemen, 1*(5), 132–145.

Imelda, E., & Alodia, C. I. (2017). The analysis of Altman model and Ohlson model in predicting financial distress of manufacturing companies in the Indonesia Stock Exchange. *Indian-Pacific Journal of Accounting and Finance, 1*(1), 49–61.

Kasmir. (2019). *Analisis laporan keuangan* (Edisi ke-11). RajaGrafindo Persada.

Kurniawan, D. A., & Daryanto, W. M. (2022). Financial evaluation of state-owned enterprises sector construction according to Altman Z-Score in period of 2017–2020. *26*(1), 290–299.

Mahardini, N. Y., & Bandi. (2023). An analysis of factors affecting the financial distress: The case of SOEs in Indonesia. *JAK (Jurnal Akuntansi): Kajian Ilmiah Akuntansi, 10*(1), 172–185.

Mardiah, V. A., & Amin, M. N. (2022). Pengaruh profitabilitas, likuiditas, struktur modal dan sales growth terhadap financial distress pada BUMN tahun 2018–2020. *Jurnal Ekonomi Trisakti, 2*(2), 1765–1774.

Nakamura, T. M. (2021). Analisis financial distress saat krisis keuangan global: Studi empiris pada BUMN. *Media Akuntansi dan Perpajakan Indonesia, 2*(2), 107–124.

Pasha, S. N., Pulungan, N. A. F., & Madelan, S. (2023). Financial distress in BUMN in Indonesia and factors affecting financial performance and health levels in BUMN companies. *Ekonika: Jurnal Ekonomi Universitas Kadiri, 8*(1), 200–222.

Platt, H., & Platt, M. (2002). Predicting corporate financial distress: Reflections on choice-based sample bias. *Journal of Economics and Finance, 26*, 184–199.

Putri, R. A., Masriyanda, M., & Silvi Reni, C. (2024). Pengaruh profitabilitas dan leverage terhadap financial distress. *Jurnal Riset Ekonomi dan Akuntansi, 2*(4), 147–157.

Resfitasari, E., Gumelar, T. M., Ulhaq, A., & Rusmayanti, N. (2022). Analisis prediksi financial distress dengan metode Altman Z-Score pada PT Waskita Karya Tbk. *Jurnal Aktiva: Riset Akuntansi dan Keuangan, 3*(3), 131–140.

Rimbano, D., Sari, T. A., Sari, W. M., & Famalika, A. (2024). The effect of sales growth and leverage on financial distress with profitability as a moderation variable (case study on cosmetics companies listed on the Indonesia Stock Exchange in 2014–2024). *Jurnal Media Ekonomi, 29*(3), 27–35.

Ross, S. A., Westerfield, R., Jaffe, J. F., & Jordan, B. D. (2019). *Corporate finance*. McGraw-Hill Education.

Salman, M., & Wulandari, C. (2021). Prediksi kebangkrutan pada bank BUMN yang terdaftar di Bursa Efek Indonesia. *Niagawan, 10*(2), 130–142.

Salsa, A. H. D., & Sulindawati, N. L. G. E. (2022). Pengaruh financial distress, leverage, audit tenure dan ukuran perusahaan terhadap integritas laporan keuangan (studi empiris pada perusahaan BUMN yang terdaftar di Bursa Efek Indonesia periode tahun 2015–2019). *JIMAT (Jurnal Ilmiah Mahasiswa Akuntansi) Universitas Pendidikan Ganesha, 13*(4), 1221–1232.

Sayidah, N., & Assagaf, A. (2020). Assessing variables affecting the financial distress of state-owned enterprises in Indonesia (empirical study in non-financial sector). *Business: Theory and Practice, 21*(2), 545–554.

Sembiring, G. K., & Safrida, E. (2026). Pengaruh leverage dan likuiditas terhadap financial distress dengan profitabilitas sebagai

variabel moderasi. *Jurnal Akuntansi dan Bisnis, 6*(1), 545–553.

Silalahi, H., Sitompul, G. T., Silalahi, D., Surya, Z., Siregar, P., & Nababan, M. (2025). Key financial determinants in reducing financial distress in Indonesia's manufacturing industry. *Jurnal Ilmiah Akuntansi Kesatuan, 13*(2).

Suhartanto, D. (2019). *Analisis data untuk riset bisnis: SPSS, AMOS, PLS* (Edisi ke-2). Politeknik Negeri Bandung.

Tandelilin, E. (2017). *Pasar modal: Manajemen portofolio dan investasi*. PT Kanisius.

Toly, A. A., Permatasari, R., & Wiranata, E. (2020). The effect of financial ratio (Altman Z-Score) on financial distress prediction in manufacturing sector in Indonesia 2016–2018. In *Proceedings of the 23rd Asian Forum of Business Education (AFBE 2019)* (pp. 47–53).

Wiranta, S. (2011). Privatisasi BUMN dan perannya terhadap pembangunan ekonomi nasional: Kasus PT Garuda. *Jurnal Ekonomi & Kebijakan Publik, 2*(1), 371–394.

Yana, A. R., Fauzan, M., & Aprilian, Y. (2026). Analisis financial distress PT Garuda Indonesia Tbk. dengan metode Altman Z-Score dan Springate periode 2021–2024. *Accounting, Management, and Business Economic Review, 1*(1), 58–67.

Yosandra, D. S. A., & Sembiring, F. M. (2022). Faktor-faktor yang mempengaruhi financial distress (studi pada beberapa badan usaha milik negara di Indonesia). *Ekspansi: Jurnal Ekonomi, Keuangan, Perbankan, dan Akuntansi, 14*(1), 22–41.

Zulkarnain, M., Sumaizar, & Mukarramah. (2022). Analisis financial distress pada perusahaan perbankan syariah yang terdaftar di Bursa Efek Indonesia. *Jurnal Penelitian Ekonomi Akuntansi (JENSI), 6*(2), 109–120.