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"THE MOST-VALUABLE-MODEL" IS AWARDED TO…? FORETELLING THE FINANCIAL INSOLVENCY IN THE CONSTRUCTION BUSINESS

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Abstract

This research seeks to accomplish two goals: to identify a statistical difference between the three financial distress models—Altman, Zmijewski, and Springate—and to describe which model proves to be the "Most-Valuable-Predictor" in terms of the accuracy with which it can predict the insolvency conditions of state-owned enterprises in Indonesia's construction industry. In this study, the purposive sampling approach was used to select the study's objects. With the aid of documentation techniques, financial data samples were gathered and put through the test of the difference analysis. This paper found a significant difference between the calculations of Altman, Zmijewski, and Springate models in predicting the financial difficulty in the SOE's construction sector. The most accurate forecast for the industry's financial problems came from the Zmijewski model. The most influential contribution of this study is that it helps investors understand the financial risks before making an investment in the construction industry.

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1. Introduction

This study aims to address two key issues: (1) whether there is a statistical difference between the three financial distress models—Altman, Zmijewski, and Springate—and (2) which of the three models is the "Most Valuable Predictor" at foretelling state-owned companies' insolvency situations in Indonesia's construction industry.

Government infrastructure work has accelerated significantly under the present administration. This strives to encourage equitable development, particularly in regions outside of Java Island (Dinarjito, 2018). In 2021, the government intends to spend Rp417.8 trillion on infrastructure development (Kementerian Keuangan, 2020). A 48% increase from Rp281.1 trillion in 2020 was made to this budget. In addition to raising the budget for infrastructure, the government also needed to secure financing. This is due to the fact that Indonesia's budgeting system employs a deficit budget system and the tax collection objective was not met (Dinarjito, 2018). The State Revenue and Expenditure Budget (APBN) for 2021 had a budget financing total of Rp1.006,4 trillion, as reported by the Ministry of Finance.

The government's increased infrastructure spending is designed to promote sustainable development in the wake of the Covid-19 outbreak by enhancing digital infrastructure and fostering efficient logistics and communications (Kementerian Keuangan, 2020). This is quite logical given that equitable development and national economic growth will be hampered in the absence of proper infrastructure development (Dinarjito, 2018). This government infrastructure project facilitates inclusive distribution in addition to State Owned Enterprise (SOE) in the construction industry participating in the infrastructure project (Dinarjito, 2018). SOEs require substantial funding to participate.

Consequently, debt is one of the financing methods used by SOEs (Citradi, 2020). In addition, the government would not provide all of the funding for capital projects from 2014 to 2019 in accordance with its commitment (Dinarjito, 2018). The government desires participation from all parties, including SOEs and the private sector (Alam, 2020).

According to Standard & Poor's Global Ratings (Kontan, 2018), the debt ratio of 20 SOEs involved in government infrastructure projects that are listed on the stock exchange and rated by S&P climbed five times to Earnings Before Interest, Tax, Depreciation, and Amortization (EBITDA). The government, nonetheless, claimed that they were acceptable with it since the deterioration of the balance sheet was a sign of the productivity of SOEs. Both viewpoints are reasonable. SOEs cannot make money if there are no jobs, and if they work on the project, attention must be taken to the company's finances (Dinarjito, 2018).

Construction SOEs are affected by the phenomena of dependence on government projects, which is characterized by a decline in the value of finished construction and an increase in business issues. The Construction Value Index for the second quarter of 2020 was 101.53, down 23.67% from the index in 2019 of 133.00, following BPS data (BPS, 2020). In addition, the index fell 10.45% in the second quarter of 2020 compared to the first quarter of 2020 (BPS, 2020). The Construction Value Index is a significant measure of quarterly construction volatility in Indonesia. The Construction Value Index gives a summary of project work that has been physically realized during a quarter in a certain location (BPS, 2020). The graph in Figure 1 indicates that the construction value index is negative in 2020, indicating that many projects won't be finished until the second quarter of 2020 (BPS, 2020).

However, most business owners are pessimistic about their company's performance in the second quarter of 2019, but positive about it in the third quarter of 2019 (BPS, 2020). This is represented in Figure 1 displaying the Business Prospect Index value being larger than 50 and the Business Condition Index value being less than 50. Indicators of business conditions and prospects were 48.02 and 54.77 in the second quarter of 2019 (BPS, 2020).

Entrepreneurs are generally apprehensive about their business climate in the second and third quarters of 2020 (BPS, 2020). This is reflected in the values of the Business Conditions Index and Business Prospects Index which are less than 50. Indicators for the business environment and prospects were 43.50 and 48.44 in the second quarter of 2020 (BPS, 2020).

As evidenced by the Business Problems Index (IMB) in Figure 1, which was 18.31 in the second quarter of 2019 and 21.59 in the second quarter of 2020, construction enterprises were still viewed as having difficulties managing their businesses during this period compared to the previous quarter (BPS, 2020). Entrepreneurs are primarily confronted by three issues: a general decline in demand for construction services, intense competition, and an increase in the cost of construction materials (BPS, 2020). The relationships between business conditions, prospects, and problems in the second quarter of 2020 show a fairly significant index number, business conditions are 43.50 (less than 50), business prospects are 48.44 (less than 50) and followed by business problems at 21.59 (less than 50). These numbers demonstrate that business owners that provide construction services have a propensity toward pessimism (BPS, 2020).

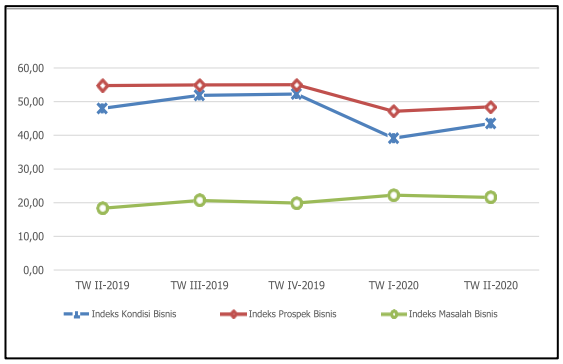

Figure 1. The Construction Business Index
Source: BPS (2020)

From the aforementioned phenomena, we may draw a conclusion that construction enterprises are particularly vulnerable to financial difficulties due to their shifting characteristics and their owners' negative outlooks (Dewi, 2020). A corporation in financial hardship is one that can no longer meet all of its obligations (Prihadi, 2019). An increase in debt means that the business will have more commitments to fulfill (Dinarjito, 2018). Construction SOEs are burdened with significant debt since they are required to participate in infrastructure development. Therefore, it is crucial to conduct research using the Altman, Springate, and Zmijewski models to examine the likelihood of financial hardship in Indonesia's state-owned construction firms.

Numerous academics have conducted research on the subject of financial troubles. The study by Prihanthini and Sari (2013) contrasts the Grover model with the Altman model, the Springate model, and the Zmijewski model in the Indonesian food and beverage industries. Based on the study's findings, the Grover model is more accurate in predicting bankruptcy for Food and Beverage companies listed on the IDX than the Altman, Springate, and Zmijewski models (Prihanthini & Sari, 2013). Permana et al. (2017) did follow-up research to see if there are any differences between evaluating the Grover, Springate, and Zmijewski models in manufacturing firms listed on the IDX between 2006 and 2015. There was a substantial difference in testing the model, as shown by the study's Chi-Square test results (Permana et al., 2017). The Chi-square statistic is a non-parametric technique used to examine group differences when the dependent variable is assessed at a nominal level. (McHugh, 2013).

The next analysis was carried out by Susanti (2016), who examined bankruptcies on cement companies listed on the stock exchange from the years 2011 to 2015 using the Altman, Springate, and Zmijewski Methods. The findings of this study show that, for cement businesses listed on the IDX between 2011 and 2015, there is no statistically significant difference between the Altman, Springate, and Zmijewski methodologies (Susanti, 2016). Kruskal-Wallis's test was used to evaluate differences in a single continuous variable that wasn't normally distributed between three or more independent sample groups (McKight &

Najab, 2010). The differences between the Altman model and the Springate model in predicting insolvency in Indonesian mining businesses were compared in later research by Purwanti (2016). Following the study's findings, there are discrepancies between the predictions of bankruptcy made using the Altman and Springate models for mining companies listed on the IDX. The Altman model's use of Market Value of Equity, which displays a company's financial performance from an external perspective, accounts for the disparity (Irawan & Manurung, 2020). Because of its ability to forecast stock prices, this is significant for shareholders (Purwanti, 2016).

In a recent study, Abdullah and Achsani (2020) evaluated the correlation between the Altman and Zmijewski with Person correlation coefficient and the predictions of bankruptcy of PT. Garuda Indonesia. The study found a favorable correlation between the two forecasts (Abdullah & Achsani, 2020). The degree and direction of a linear connection between two explanatory variables are quantified by the Pearson correlation coefficient (Benesty et al., 2008).

There are commonalities and differences among the previously described studies. Nearly every one of these prior studies used various model groups and test analytic techniques. Despite finding variances among the earlier studies, the results are the same, which are paired test, Chi-square test, and Kruskal-Wallis's test have all been utilized in prior research. Based on prior research, it may be inferred that the outcomes of bankruptcy predictions made using the Altman, Springate, and Zmijewski models diverge. Depending on the object being studied, the accurate model also varies (Prihanthini & Sari, 2013). This study is different from all previous studies because it examines a domain that no other academics have looked at before—the construction SOEs listed on the Indonesia Stock Exchange. The Altman, Springate, and Zmijewski models are three general models utilized in this study to evaluate the likelihood of financial troubles in the industry.

Henceforth, this study focuses on addressing two main research aims: predicting statistical differences between three bankruptcy estimation models: Altman, Zmijewski, and Springate; and identifying the most accurate model for predicting the bankruptcy condition of SOEs in Indonesia's construction sector.

2. Methods

The positivist paradigm, which is a perspective based on established rules and procedures, is the paradigm that we employed in this study. Science is thought to be deductive, moving from the general and abstract to the concrete and specific; Science is regarded as nomothetic since it is founded on universal causal rules that take into account numerous circumstances (Muslim, 2018). Three indicators of financial distress—Altman, Zmijewski, and Springate—were employed as the study's variables. The documentation technique was used to acquire the data for this study. Researchers initially obtained the financial reports from the SOEs in the construction sector for the third quarters of 2018 to 2020 from the official Indonesia Stock Exchange (IDX) website, www.idx.co.id. The documentation strategy entails gathering data on recordings of earlier events, objects, or variables (Sudrajat & Wijayanti, 2019).

Purposive sampling, a technique for selecting samples based on predetermined criteria, is the sampling method employed (Sugiyono, 2007). The following SOEs in the construction industry in Indonesia, SOEs in the construction sector on the IDX, and SOEs in the sector providing comprehensive financial report data for Q3 2018–Q3 2020 constitute the sample criteria for this study. The data analysis technique focuses on the various test methods on the three variables used to gauge the severity of financial troubles, namely the Altman, Zmijewski, and Springate scores. The analysis method is put into use by going through the following ***five stages***. Finding out how financially challenging each SOE is in the building industry is ***the first stage***. In the Altman

model, Formula (1) is used to calculate the degree of financial difficulties.

$$Z = 0{,}717 * \text{X1} + 0{,}847 * \text{X2} + 3{,}107 * \text{X3} + 0{,}420 * \text{X4} + 0{,}988 * \text{X5} \quad (1)$$

Where X1 represents the working capital ratio of total assets. Retained Earnings and Total Assets are divided, yielding X2. Earnings Before Interest and Taxes are divided by Total Assets to calculate X3. When the Book Value of Equity and the Book Value of Total Debt is divided, X4 is the result. Division of Sales by Total Assets yields the number X5. Companies with a Z score of less than 1.23 are considered to be at risk of bankruptcy according to the Altman model. Companies that fall into the gray area are defined as having a Z score between 1.23 and 2.90. Companies are categorized as having no potential for bankruptcy if their Z score is higher than 2.90 (Prihanthini & Sari, 2013).

Formula (2) below calculates the Springate model's measure of the degree of financial trouble.

$$S = 1{,}03\,\text{A} + 3{,}07\,\text{B} + 0{,}66\,\text{C} + 0{,}4\,\text{D} \quad (2)$$

Where B is achieved by dividing Net Profit before Interest and Taxes by Total Assets, while A is obtained by dividing Working Capital by Total Assets. D is generated by dividing Sales by Total Assets, while C is the result of dividing Net Profit before Taxes by Current Liabilities. Companies with an S score of more than 0.862 are classified as not having the potential to go bankrupt by this Springate model. On the other hand, if the company's S score is less than 0.862, it will be deemed unhealthy and at risk of bankruptcy (Prihanthini & Sari, 2013).

Formula (3) below calculates the Zmijewski model's assessment of financial difficulties.

$$X = -4{,}3 - 4{,}5\text{X1} + 5{,}7\text{X2} - 0{,}004\text{X3} \quad (3)$$

Where X1 stands for Return on Asset, X2 for Debt Ratio, and X3 for Current Ratio. A corporation is expected to potentially experience bankruptcy if its score from this bankruptcy prediction model exceeds 0 (X value is greater than 0). On the other hand, a corporation is forecasted to have no chance of going through financial issues if it has an X score of less than 0 (Prihanthini & Sari, 2013).

The second stage involves determining whether the data distribution of the three variables is normal once all the values for the three models have been gathered (Fanny & Retnani, 2017). The Shapiro Wilk test approach was employed in this normality test due to the tiny sample size analyzed, specifically the sample size was less than 50 data. The data are assumed to be regularly distributed if the P-value is greater than 0.05. The data are not normally distributed, however, if the P-value is less than 0.05 (Fanny & Retnani, 2017). ***The third stage*** is to conduct a homogeneity test to see whether the sample variance is the same or different. This test was completed to assess whether to choose the independent sample T Test or the ANOVA. If the significance value is greater than 0.05, the sample data have the same variance, and if the significance value is less than 0.05, the sample data do not have the same variance (Fanny & Retnani, 2017).

In ***the fourth stage***, the test of the difference will be run using three distinct models of financial distress. The ANOVA test is a separate test method used if the results of the normality test demonstrate that the data is normally distributed (Hecke, 2012). Nonparametric statistics, on the other hand, are employed for data that are not normally distributed. This test was conducted using Kruskal-Wallis's test procedure (Siegel & Castellan Jr., 1988). There is no significant difference between the computations of the three bankruptcy prediction models if the significance value is more than 0.05. There is a significant difference between the three models' calculations if the significance value is less than 0.05 (Fanny & Retnani, 2017).

The final stage is to evaluate the model's precision. This test is performed by comparing the predictions made by the Altman, Springate, and Zmijewski models to see if they match the actual circumstances the company is facing or not. The true state of enterprises that are having trouble making ends meet is demonstrated by the negative value of the company's net income. Formula (4) was used to establish each model's level of accuracy (Fanny & Retnani, 2017).

$$Precision\ Level = \frac{Total\ Correct\ Measure}{Total\ Sample} \quad (4)$$

3. Results and Discussion

Data from four state-owned construction firms listed on the Indonesia Stock Exchange for eight consecutive quarters, starting in the third quarter of 2018 and ending in the third quarter of 2020, make up the entire sample employed in this study with respect to the three sampling criteria. There were 32 business quarters in the final sample.

The Altman model has a minimum value of 0.2341, a maximum value of 1.1355, an average value of 0.594622, and a standard deviation value of 0.2556364, according to the descriptive data in Table 1. With a minimum value of -0.0377, a maximum value of 0.7043, an average value of 0.311534, and a standard deviation of 0.1860706, the Springate model has a range of values. The Zmijewski model also has a standard deviation of 0.3170264, a minimum value of -0.5589, a maximum value of 0.5590, an average value of -0.050922, and other values ranging from -0.5589 to 0.5590.

Since the sample size for this study was 32 samples smaller than the required sample size of 50 observations, the Shapiro-Wilk test was employed to determine whether the data were normal. Table 2's normality test results show that the data are normally distributed, and the homogeneity test will be conducted because the significance values for the Altman, Springate, and Zmijewski models are all greater than 0.05.

The homogeneity test results are shown in Table 3, where the significance level is less than 0.05 (0.01 0.05). The findings of these tests lead to the conclusion that Kruskal-Wallis's test, a nonparametric statistical test, must be applied to the test of the difference procedures. After performing the homogeneity test, researchers were using Kruskal-Wallis's procedures to carry out the test of the difference. Table 3 displays the results of the tests showing that the P-Value is 0.000, the Chi-Square value is 49.560, and the degree of freedom is 2.

Table 1. The Descriptive Statistics

Model	N	Minimum	Maximum	Mean	Std. Deviation
Altman	32	0.2341	1.1355	0.594622	0.2556364
Springate	32	-0.0377	0.7043	0.311534	0.1860706
Zmijewski	32	-0.5589	0.5590	-0.050922	0.3170264

Source: Research Analysis (2021)

Table 2. The Normality Test

Model		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Scores	Altman	0.174	32	0. 015	0.934	32	0.050
	Springate	0.124	32	0.200	0.970	32	0.505
	Zmijewski	0.146	32	0.081	0.951	32	0.158

Source: Research Analysis (2021)

Table 3. The Homogeneity Test and The Difference Test

Levene Statistic	df1	df2	Sig.
4.891	2	93	0.010

Chi-Square	49.560
df	2
Asymp. Sig.	0.000

Source: Research Analysis (2021)

The numbers in Table 3 indicate that ***there is a significant difference between the calculations from Altman, Zmijewski, and Springate models*** to estimate the bankruptcy of state-owned construction businesses over 8 quarters because the P-Value is less than 0.05. Differences in how financial ratios are formulated to determine each model's outcomes account for the discrepancy in the average calculation results across the three models (Fanny & Retnani, 2017). The financial statements' signal to investors is what differentiates the Altman, Springate, and Zmijewski models in this study.

Investors utilize firm's financial reports to assess the performance of the company while taking potential risks into account, which are then used to guide investment decisions (Fanny & Retnani, 2017). If investors employ the three models in predicting bankruptcy, the results will be biased because the three models are distinct. Investors must therefore be vigilant and cautious when selecting the model in use, which necessitates an accurate model. These aforementioned results also address ***the first research goal.***

Table 4. Altman's Model Accuracy Results

Altman		ADHI	NI	PTPP	NI	WIKA	NI	WSKT	NI
2018	Q4	0,9886	+	1,0648	+	1,1355	+	0,8474	+
2019	Q1	0,4533	+	0,5535	+	0,6108	+	0,3613	+
	Q2	0,5837	+	0,6727	+	0,6919	+	0,4115	+
	Q3	0,7133	+	0,8196	+	0,8173	+	0,4652	+
	Q4	0,8130	+	0,9165	+	1,0466	+	0,6060	+
2020	Q1	0,3212	+	0,3823	+	0,4099	+	0,2478	+
	Q2	0,3578	+	0,4524	+	0,4034	+	0,2643	-
	Q3	0,4638	+	0,4791	+	0,4393	+	0,2341	-

Source: Research Analysis (2021)

Table 5. Springate's Model Accuracy Results

Springate		ADHI	NI	PTPP	NI	WIKA	NI	WSKT	NI
2018	Q4	0,5712	+	0,6183	+	0,7043	+	0,5029	+
2019	Q1	0,2741	+	0,2912	+	0,3736	+	0,1574	+
	Q2	0,3688	+	0,3628	+	0,4060	+	0,1968	+
	Q3	0,4439	+	0,4727	+	0,4786	+	0,2211	+
	Q4	0,4540	+	0,4937	+	0,6163	+	0,2796	+
2020	Q1	0,1841	+	0,1970	+	0,1839	+	0,0380	+
	Q2	0,1819	+	0,2208	+	0,1281	+	0,0222	-
	Q3	0,2410	+	0,1887	+	0,1338	+	-0,0377	-

Source: Research Analysis (2021)

Table 6. Zmijewski's Model Accuracy Results

Zmijewski		ADHI	NI	PTPP	NI	WIKA	NI	WSKT	NI
2018	Q4	0,1088	+	-0,5432	+	-0,4204	+	-0,0955	+
2019	Q1	0,1676	+	-0,4174	+	-0,3578	+	0,0556	+
	Q2	0,2048	+	-0,3953	+	-0,3844	+	0,1203	+
	Q3	0,2085	+	-0,3946	+	-0,3868	+	0,1455	+
	Q4	0,2463	+	-0,3666	+	-0,5589	+	0,004	+
2020	Q1	0,5145	+	-0,0825	+	-0,1823	+	0,0598	+
	Q2	0,559	+	-0,1032	+	-0,1673	+	0,1578	-
	Q3	0,5456	+	-0,1127	+	-0,1147	+	0,356	-

Source: Research Analysis (2021)

The best model for projecting the financial situation of Indonesian SOEs in the construction sector and for addressing ***the second research goal*** can be summarized as follows. Boundary values for ***the Altman model*** are 1.23 and 2.90. Companies with a score below 1.23 are at risk of going out of business. The score falls into the gray area if it is between 1.22 and 2.90. Additionally, a corporation is in good shape if its Altman is higher than 2.90. All state-owned businesses in the construction sector encountered financial difficulties, according to the calculation results displayed in Table 4. If the computation findings are accurate and Altman's score is red with a negative net income, it may also be assumed that the company under issue is actually in financial trouble. Likewise, if the color is different, the model is no longer accurate. Accordingly, Table 4 shows that the Altman model's accuracy is 6.25%, meaning that there are only 2 data points from 32 companies' quarterly results that match the calculation findings of the Altman model and its net income value.

According to ***the Springate model***, companies with scores below 0.862 are considered to be in financial trouble, and vice versa. All state-owned firms in the construction industry are having financial difficulties, as can be observed from the calculations' findings in Table 5. If the Springate score is red and the company has a negative net income, it can be assumed that the calculation's findings are correct and the company is legitimately in financial trouble. Different hues indicate that the model is inaccurate. Table 5 shows that just 2 data points from 32 companies'-quarters are in agreement between the Springate model's computation findings and its net income value, or 6.25%, of the total.

The Zmijewski model has a cut-off value of 0, meaning that a firm is considered healthy if its score is less than or equal to 0. If a company's score is more than 0, it is predicted that it will go bankrupt. PTPP and WIKA are considered to be financially solid businesses based on the calculation findings displayed in Table 6. WSKT did the same in Q4 2018. However, financial trouble is anticipated for WSKT from Q3 2019 to Q3 2020. In the meanwhile, Q4 2018 through Q3 2020 are projected to be difficult financial quarters for ADHI. The computation findings are accurate if Zmijewski has a red score (indicating financial trouble) and a negative net income, and vice versa. The model is inaccurate if the colors are changed. Based on Table 6, it can be observed that the Zmijewski model's accuracy is 59.38%, or that only 19 data from 32 firms' quarters are in line with the results of the Springate model's computation and its net income value.

The Zmijewski model produces results that more properly represent the real world than the Altman and Springate models, as demonstrated by the model's accuracy test results. ***Therefore, "the Most Valuable Predictor" crown shall belong to the Zmijewski.*** Following the Zmijewski model is the Springate and Altman models, both of which have a 6.25% accuracy rate. Because both the Altman and Springate models employ the Multi-Discriminant Analysis methodology, they are similar in how well they can forecast financial hardship situations (Fatmawati, 2012). The Zmijewski model's prediction outcomes appear different since it measures the firm's performance, leverage, and liquidity using ratio analysis (Fanny & Retnani, 2017).

The accuracy test results in this study are consistent with those reported by Fanny and Retnani (2017). According to the study, there are variances between the Zmijewski, Altman, and Springate models, with the Zmijewski model being the most accurate. The study by Susanti (2016), which used the Altman and Zmijewski models to evaluate the bankruptcy of cement companies in Indonesia, found no differences between the two models. This study, however, is in contrast to that study (Susanti, 2016).

4. Conclusion

This study attempts to determine which model becomes the "Most-Valuable-Predictor"

in estimating the bankruptcy condition of state-owned construction companies in Indonesia by predicting statistical differences between three methods of calculating financial distress: Altman, Zmijewski, and Springate. There is a variation between the calculation results of the Altman, Springate, and Zmijewski models in predicting the bankruptcy situation of the SOEs in concern as a result of the difference test procedures utilized to address the first aim. The results of the test, which provide several results interpretations, show the differences between the three models. It is determined that the Zmijewski model provides a more accurate interpretation of the results than the Altman and Springate models, thereby achieving the second objective. The estimates produced by the Zmijewski model have the highest accuracy rate (59.38%), followed by those produced by the Springate and Altman models (both of which have an accuracy rating of 6.25%).

The limitation of this research is that it only includes four state-owned construction firms that were listed on the IDX for an eight-quarter period starting in Q3 2018 and ending in Q3 2020 due to limited access. This study is anticipated to help investors be more cautious when investing in Indonesian construction SOEs because practically all of them have poor financial health and earnings. To understand the immediate effects of the presence of these conditions, further research may concentrate on the influence of these financial insolvencies on market perceptions.

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