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Implementation and Accuracy Testing of a Financial Distress Prediction Model in Indonesian Property and Real Estate Companies

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Abstract. This study aims to determine bankruptcy prediction and find the most accurate model for measuring bankruptcy between the Grover, Springate and Zmijewski models for property and real estate companies listed on the Indonesian Stock Exchange (IDX) in 2017 – 2021. The sampling technique used was purposive. sampling on property and real estate companies with a total sample of 31 companies. Data were obtained from the Indonesia Stock Exchange and the company's official website for 2017 – 2021 respectively. Data analysis techniques used the Grover, Springate and Zmijewski models. Data were analyzed using the calculation of the level of accuracy of each model to be able to predict companies experiencing financial distress. The results showed that there were differences between the Grover, Springate and Zmijewski models in predicting financial distress in property and real estate companies listed on the Indonesia Stock Exchange and the most accurate model with the highest accuracy rate of 96.77%, namely the Springate model.

Keywords: Accuracy; Financial Distress; Grover; Springate; Zmijewski

A. INTRODUCTION

The property and real estate industry is one of the industries that plays an important role in economic growth where this industry contributes to infrastructure development and economic recovery, contributes to government revenues through property taxes, licensing fees and property transactions, and increases long-term investment for individuals, companies and financial institutions. The better the performance conditions of the property and real estate industry, the better the impact on economic growth. However, in recent years, the performance of the property and real estate industry in Indonesia has not been good where most property and real estate companies have experienced a decline in sales which has resulted in a decrease in company profits and even experienced losses and also an increase in the debt level of property and real estate companies. This was caused by various factors including regulatory changes and increased interest rates, uncertain global economic conditions, election issues, and the Covid-19 pandemic.

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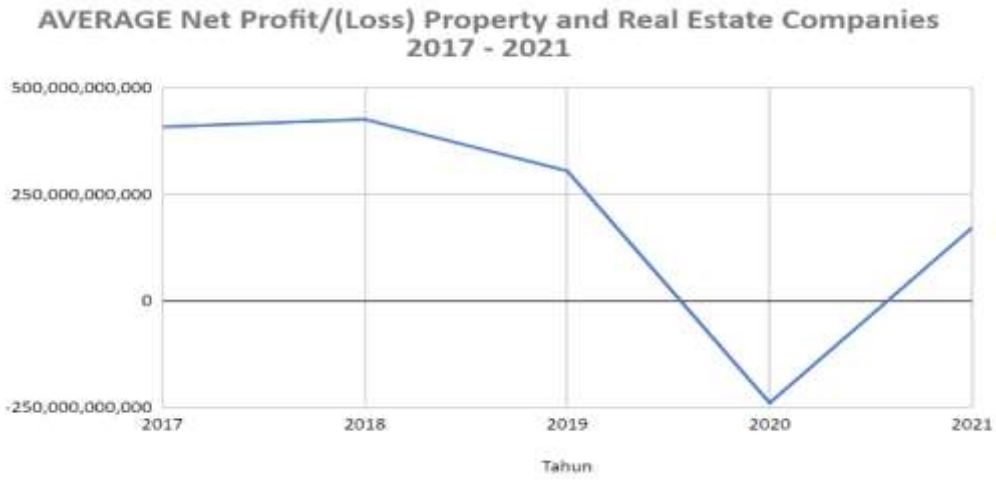

Source: Processed data (2023)

Figure 1. Average Net Profit/(Loss) Property and Real Estate Companies 2017 – 2021

In Figure 1 it can be seen that the average net profit of companies in the property and real estate sector has fluctuated which tends to decrease. The decline in profits until they experienced losses occurred in 2020 where the decline reached (178.34%). The biggest factor for this to happen was the Covid-19 pandemic which hit the whole world, including Indonesia. The Covid-19 pandemic forced the government to issue movement restriction and lockdown policies which had a negative impact on the property sector. Travel restrictions, economic uncertainty and changes in consumer behavior led to a decline in property sales activity. This condition can be the beginning of financial distress. Financial distress is a stage of decreasing the financial condition of a company prior to bankruptcy (Platt and Platt in (Sembiring & Sinaga, 2022)). To overcome and minimize bankruptcy, companies can monitor financial conditions by using financial statement analysis techniques (Mita Pratiwi & Wiweko, 2022).

There is quite a lot of research on financial statement analysis techniques in predicting financial distress, but this study only uses 3 financial distress prediction models, namely the Grover, Springate and Zmijewski models. This financial distress prediction model uses financial ratios such as profitability, solvency and liquidity although expressed by different formulas. This prediction model can be used by companies in evaluating the company's financial condition and also as a signal or early warning whether the company is indicated for bankruptcy or not. The design of a reliable model for predicting bankruptcy is also very important for many decision-making processes (Kang, et al, 2020 in (Iswahyudi, 2022))

Based on research according to (Supitriyani et al., 2022), the Altman model is an accurate predictive model with an accuracy of 85.75%, followed by the Springate model with an accuracy of 73%, the Grover model with an accuracy of 43% and the Zmijewski model with an accuracy of 30% in predicting bankruptcy in transportation sub-sector companies. According to (Letizia & Pandu, 2022), the highest level of accuracy in predicting bankruptcy for the Indonesian FMCG industry is the Zmijewski model, which is 97.8%. This means that the Zmijewski model is more recommended for companies or investors in assessing the

company's financial condition. Then the Altman, Springate, and Grover models have respective accuracy levels of 75%, 81% and 88%. The results of the study (Mita Pratiwi & Wiweko, 2022) explain that the Springate model has the most accurate level of accuracy of 61% compared to other bankruptcy prediction models and the model with the lowest accuracy is Zmijewski which is equal to 20.8% in predicting the bankruptcy of agricultural sector companies. According to (Robiansyah et al., 2022), the results of his research show that the Altman model is the most appropriate model in predicting the bankruptcy of Indonesian manufacturing companies. Based on research (Sembiring & Sinaga, 2022), the Springate model is a model that has the highest accuracy rate of 79% in predicting the bankruptcy of retail companies in Indonesia.

Based on the results of previous studies that differ from one another, the researcher is interested in implementing and testing the accuracy of bankruptcy prediction models, namely the Grover, Springate and Zmijewski models in Indonesian property and real estate companies.

B. LITERATURE REVIEW

Signalling Theory

This signaling theory was developed by Ross (1977). Signaling theory is a theory that underlies management actions to provide signals or news to shareholders and potential investors regarding the company's future prospect. Ross (1977) shows that companies that perform well can provide signals in the form of high returns on their capital structure. Companies that have poor performance can be seen from the high use of debt in their capital structure. The higher the use of debt in the capital structure, the higher the probability of company bankruptcy.

Financial Distress

According to Platt and Platt in (Sembiring & Sinaga, 2022), financial distress is a stage of decreasing the financial condition of a company before bankruptcy occurs. Financial distress is a condition that occurs when a company experiences a decline in its financial position over several periods (Letizia & Pandu, 2022). According to Brigham and Daves in (Mita Pratiwi & Wiweko, 2022), there is a definition of financial distress which is classified into five types, namely: 1) Economic failure; Economic failure is a situation where the company's income cannot cover the total costs, including the cost of capital. 2) Business failures; Business failure is defined as a business that ceases operations with consequent losses to creditors. 3) Technical insolvency; A company is said to be in a state of technical insolvency if it cannot meet its current obligations when they fall due. 4) Insolvency in bankruptcy; A company is said to be insolvent in bankruptcy if the book value of debt exceeds the market value of assets. 5) Legal bankruptcy; The company is said to be bankrupt if it has been officially filed by law.

Model Grover

The Grover model was created by Jeffrey S.Grover (2003) where this model was created by designing and reassessing the Altman Z-Score model in 1968, by adding 13 new financial ratios (Sembiring & Sinaga, 2022). Jeffrey S.Grover (2003) in (Wahyuningsih & Venusita, 2022) produces the following equation:

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G-Score = 1.650X1 + 3.404X2 – 0.016X3 + 0.057

Where:

G-Score = Grover's Score

X1 = Working capital/Total assets

X2 = Earning before interest and taxes/Total assets

X3 = Net income/Total Assets

The Grover model classifies companies as follows:

G-Score value < -0.02 means the company is in an unhealthy/bankrupt condition

G-Score value > 0.01 means the company is in good health

Model Springate

Gordon L.V. Springate conducted research that produced a bankruptcy prediction model by following the Altman Z-Score model procedure. The Springate model is a model using Multiple Discrimante Analysis (MDA) which requires more than one financial ratio related to company bankruptcy. The Springate model uses 4 financial ratios based on 19 financial ratios in various literature (Diana & Hidayat, 2023). The model produced by Gordon L.V. Springate:

S-Score = 1.03X1 + 3.07X2 + 0.66X3 +0.4X4

Where:

S-Score = Springate Value

X1 = Working capital/Total assets

X2 = Net profit before interest and taxes/Total assets

X3 = Net profit before taxes/Current Liability

X4 = Sales/Total Assets

The Springate model classifies companies as follows:

S-Score value < 0.862 means the company is in an unhealthy/bankrupt condition

S-Score value > 0.862 means the company is in good health

Model Zmijewski

The Zmijewski model, also known as the X-Score model, is a financial distress prediction model developed by Edward I. Altman and J. Edward Zmijewski. Zmijewski predicted a sample of 75 bankrupt companies and 73 healthy companies during 1972 – 1978. The Zmijewski model is a potential bankruptcy method that applies profitability, solvency and liquidity ratios when assessing a company's financial performance (Supitriyani et al., 2022). This model produces the following equation (Robiansyah et al., 2022):

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X-Score: -4.3 – 4.5X1 + 5.7X2 – 0.004X3

Where:

X-Score = Zmijewski Score

X1 = Return on assets (ROA)

X2 = Debt ratio (DAR)

X3 = Current ratio (CR)

Zmijewski's model classifies firms as follows:

X-Score value < 0 means the company is in good health

X-Score value > 0 means the company is in an unhealthy/bankrupt condition

C. RESEARCH METHODOLOGY

This research method uses a quantitative method where the quantitative method is a research approach using numerical data or data that can be measured quantitatively to analyze and draw conclusions. The data source used is secondary data, namely from the website of the Indonesian stock exchange via www.idx.co.id as well as the official website of each company. Other sources come from scientific books, journals and other literature that are considered relevant to research. Data collection techniques using documentation techniques and literature studies. The population of this study are property and real estate companies listed on the Indonesia Stock Exchange in 2017 – 2021 based on Indonesia's IDX Annualy Statistics 2021, namely 80 companies. The sample in this study uses a purposive sampling technique where the criteria are 1) property and real estate companies listed on the Indonesia Stock Exchange in 2017 – 2021 based on (IDX, 2022), 2) property and real estate companies that have complete annual financial reports during the period research, and property and real estate companies that have negative profits in the study period. The total companies studied were 31 companies. The data analysis method of this research is to calculate the ratio in the Grover, Springate and Zmijewski prediction models and test the accuracy of predictions with the level of accuracy using Google Sheets. The level of accuracy is a measure of how accurate or correct a system or method is in predictions or classifications. The level of accuracy can be expressed in the form of a percentage, the higher the percentage of accuracy, the better the performance of the system or method. According to (Supitriyani et al., 2022), to find out the level of accuracy and error rate of the 3 models, the formula is used

- Accuracy rate $= \frac{\text{The number of predictions is correct}}{\text{Predicted sample size}} \text{ x } 100\%$
- Error rate $= \frac{\text{The number of predictions is wrong}}{\text{Predicted sample size}} \text{ x } 100\%$

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D. RESULTS AND DISCUSSION

Grover's Model Analysis

The results of financial distress data analysis using the Grover model for property and real estate companies can be seen in table 1 below:

Table 1. Calculation Results of the Grover Model

Company Code	G-Score						
	2017	2018	2019	2020	2021	Average	Status
APLN	0.5011	0.2016	0.3666	0.4996	0.3801	**0.3898**	**NB**
ASRI	0.1759	0.2358	0.3666	-0.0581	0.1641	**0.1769**	**NB**
BAPA	1.0818	0.8454	1.3636	1.1396	1.1919	**1.1245**	**NB**
BEST	1.0842	0.9902	0.9166	0.2355	0.5805	**0.7378**	**NB**
BIKA	1.0842	0.9902	0.9166	0.2355	0.5805	**0.7614**	**NB**
BIPP	0.0811	0.2602	0.5121	0.7620	0.6874	**0.4606**	**NB**
BKDP	-0.2486	-0.3190	-0.1691	-0.2492	-0.1316	**-0.2235**	**B**
BKSL	0.3439	0.2814	0.2062	0.0732	0.4007	**0.2611**	**NB**
CSIS	-0.0626	-0.6616	-0.6721	0.7379	0.8479	**0.0379**	**NB**
DART	0.0267	-0.0319	-0.2313	-0.0951	-0.2621	**-0.1187**	**B**
DILD	0.1015	0.1536	0.3219	0.1744	0.1517	**0.1806**	**NB**
ELTY	0.0623	1.0850	-0.0198	0.0321	0.0256	**0.2370**	**NB**
EMDE	1.0308	0.8958	0.9173	0.6624	1.2884	**0.9590**	**NB**
FMII	0.5188	0.5479	0.4088	0.4080	0.1987	**0.4164**	**NB**
GAMA	0.4942	0.5135	0.5149	0.4104	0.3939	**0.4654**	**NB**
GMTD	0.3758	0.4176	0.1360	-0.0562	0.3038	**0.2354**	**NB**
GWSA	0.3395	0.3891	0.3142	0.2954	0.3315	**0.3339**	**NB**
INPP	0.1046	0.1886	1.1008	-0.0132	0.3026	**0.3367**	**NB**
LPCK	1.2742	1.8957	0.9013	-0.3947	0.9306	**0.9214**	**NB**
LPKR	1.1825	1.1680	0.9181	0.2858	0.8263	**0.8761**	**NB**
LPLI	0.3151	0.5724	0.8214	0.7430	2.9313	**1.0767**	**NB**
MDLN	0.3027	0.2739	0.0171	-1.1051	0.0408	**-0.0941**	**B**
MMLP	0.3049	0.2675	0.1739	0.3789	0.4757	**0.3202**	**NB**
MPRO	-0.7926	-0.2621	-0.0650	-0.1426	-0.2384	**-0.3001**	**B**
NIRO	0.6609	0.7725	0.5734	0.3794	0.3349	**0.5442**	**NB**
MORE	0.0413	0.1729	0.0543	-0.1234	-0.1922	**-0.0095**	**B**
PLIN	0.4012	0.3963	0.2996	0.0086	0.2999	**0.2811**	**NB**
PUDP	0.3262	0.5619	0.7629	0.6766	0.7484	**0.6152**	**NB**
RBMS	0.3151	0.3798	0.1695	-0.0223	0.0892	**0.1862**	**NB**
RODA	0.8409	0.6552	0.3926	0.3543	0.6533	**0.5793**	**NB**
TARA	0.1074	0.0721	0.0298	-0.0270	0.1440	**0.0653**	**NB**

Source: Processed data (2023)

Information:

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The criteria for the Grover model are that if the G-Score is < -0.02 then the company is in a state of bankruptcy and if the G-Score is > 0.01 then the company is in good health. Based on Table 1, the Grover G-Score model predicts that with an average G-Score value from 2017 – 2021, 5 property and real estate companies will experience financial distress and 26 property and real estate companies will be in good health.

Springate Model Analysis

The results of financial distress data analysis using the Springate model for property and real estate companies can be seen in table 2 below:

Table 2. Springate Model Calculation Results

Company Code	S-Score						
	2017	2018	2019	2020	2021	Average	Status
APLN	0.614	0.188	0.280	0.390	0.220	**0.338**	**B**
ASRI	0.498	0.554	0.703	-0.260	0.182	**0.335**	**B**
BAPA	0.997	0.671	1.685	0.348	0.516	**0.843**	**B**
BEST	0.995	1.448	1.737	-0.283	0.244	**0.828**	**B**
BIKA	0.668	0.595	0.505	0.083	0.528	**0.428**	**B**
BIPP	-0.170	0.016	0.325	0.669	0.466	**0.369**	**B**
BKDP	-0.440	-0.430	-0.291	-0.346	-0.372	**-0.376**	**B**
BKSL	0.353	0.268	0.127	-0.125	0.335	**0.191**	**B**
CSIS	-0.037	-0.621	-0.464	0.537	0.643	**0.012**	**B**
DART	0.031	-0.030	-0.300	-0.553	-0.424	**-0.255**	**B**
DILD	0.137	0.153	0.357	0.164	0.125	**0.187**	**B**
ELTY	-0.014	1.563	-0.315	-0.115	-0.093	**0.205**	**B**
EMDE	0.932	0.607	0.504	0.351	1.773	**0.833**	**B**
FMII	0.400	0.372	0.296	0.241	0.157	**0.293**	**B**
GAMA	0.293	0.316	0.318	0.185	0.149	**0.252**	**B**
GMTD	0.439	0.471	-0.098	-0.311	0.118	**0.124**	**B**
GWSA	1.361	1.174	0.375	-0.330	0.435	**0.603**	**B**
INPP	0.157	0.238	4.786	-1.749	0.090	**0.704**	**B**
LPCK	0.973	3.000	0.898	-1.672	0.697	**0.779**	**B**
LPKR	0.819	0.916	0.383	-0.554	0.404	**0.404**	**B**
LPLI	-2.616	0.070	0.402	0.306	18.030	**3.238**	**NB**
MDLN	0.470	0.227	-0.002	-0.943	0.033	**-0.043**	**B**
MMLP	0.873	0.809	0.504	-0.006	1.636	**0.763**	**B**
MPRO	-0.517	-0.237	0.093	-0.057	-0.189	**-0.181**	**B**
NIRO	0.402	0.422	0.285	0.316	0.062	**0.297**	**B**
MORE	-0.392	0.480	-0.288	-0.666	-0.387	**-0.250**	**B**
PLIN	0.522	0.393	0.914	-0.974	0.918	**0.355**	**B**
PUDP	0.279	0.484	0.537	-0.009	0.049	**0.268**	**B**
RBMS	0.395	0.304	-0.120	-0.672	-0.418	**-0.102**	**B**
RODA	0.564	0.376	-0.169	0.042	0.485	**0.260**	**B**
TARA	0.069	0.038	0.004	-0.243	0.732	**0.120**	**B**

Source: Processed data (2023)

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The criteria in the Springate S-Score model are if the S-Score value is < 0.862, then the company is in a state of bankruptcy and if the S-Score value is > 0.862 then the company is in good health. Based on Table 2, it can be concluded that the Springate S-Score model with an average S-Score value from 2017 – 2021 predicts 30 property and real estate companies will experience financial distress and 1 property and real estate company will be in good health.

Zmijewski Model Analysis

The results of financial distress data analysis using the Zmijewski model for property and real estate companies can be seen in table 3 below:

Table 3. Zmijewski Model Calculation Results

Company Code	S-Score						
	2017	2018	2019	2020	2021	Average	Status
APLN	-1.176	-0.986	-1.109	-0.764	-0.562	**-0.919**	**NB**
ASRI	-1.261	-1.418	-1.563	-0.903	-1.111	**-1.251**	**NB**
BAPA	-2.767	-2.970	-4.256	-3.915	-4.003	**-3.582**	**NB**
BEST	-2.827	-2.714	-2.898	-2.433	-2.630	**-2.700**	**NB**
BIKA	-0.202	-0.134	0.062	2.158	1.394	**0.656**	**B**
BIPP	-2.481	-1.559	-1.557	-2.045	-1.874	**-1.903**	**NB**
BKDP	-1.989	-1.845	-1.947	-1.895	-1.680	**-1.871**	**NB**
BKSL	-2.531	-2.433	-2.153	-1.650	-2.262	**-2.206**	**NB**
CSIS	-2.422	-1.282	1.487	1.289	-1.886	**-0.563**	**NB**
DART	-1.813	-1.562	-1.176	-0.826	-0.481	**-1.172**	**NB**
DILD	-1.443	-1.278	-1.528	-0.820	-0.685	**-1.151**	**NB**
ELTY	-1.014	-3.556	-2.379	-2.547	-2.474	**-2.394**	**NB**
EMDE	-1.268	-0.834	-0.604	0.222	-2.445	**-0.986**	**NB**
FMII	-3.513	-2.733	-2.636	-2.698	-2.819	**-2.880**	**NB**
GAMA	-3.077	-3.187	-3.143	-2.983	-2.968	**-3.072**	**NB**
GMTD	-2.080	-2.302	-1.874	-1.500	-1.451	**-1.841**	**NB**
GWSA	-4.036	-4.003	-3.892	-3.896	-3.986	**-3.963**	**NB**
INPP	-2.329	-2.242	-4.280	-2.627	-2.326	**-2.761**	**NB**
LPCK	-2.290	-4.362	-3.844	-0.783	-2.680	**-2.792**	**NB**
LPKR	-1.686	-1.689	-2.011	-0.367	-0.934	**-1.337**	**NB**
LPLI	-2.324	-2.793	-3.052	-3.021	-6.102	**-3.459**	**NB**
MDLN	-1.558	-1.173	-0.924	0.314	-0.231	**-0.714**	**NB**
MMLP	-3.814	-3.780	-3.532	-3.451	-3.796	**-3.675**	**NB**
MPRO	0.248	-2.203	-3.095	-3.040	-2.947	**-2.207**	**NB**
NIRO	-2.891	-3.219	-3.053	-2.216	-1.682	**-2.612**	**NB**
MORE	-3.929	-3.903	-3.641	-3.255	-3.112	**-3.568**	**NB**
PLIN	-0.095	-0.189	-4.062	-3.532	-3.920	**-2.359**	**NB**
PUDP	-2.438	-2.606	-2.253	-1.895	-1.967	**-2.232**	**NB**
RBMS	-1.805	-2.630	-2.749	-2.535	-2.584	**-2.461**	**NB**
RODA	-2.709	-2.521	-1.840	-1.604	-2.137	**-2.162**	**NB**
TARA	-3.474	-3.955	-3.943	-4.011	-4.277	**-3.932**	**NB**

Source: Processed data (2023)

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The criteria for the Zmijewski X-Score model are if the X-Score value is > 0, then the company is in a state of bankruptcy and if the X-Score value is < 0, the company is in good health. Based on Table 3, it can be concluded that the Zmijewski X=Score model with an average X-Score value from 2017 – 2021 predicts 1 property and real estate company experiencing financial distress and 30 property and real estate companies in a healthy condition.

Accuracy Level Calculation

In calculating the level of accuracy and error rate, it is necessary to know clearly and with certainty the data related to financial distress calculations using the Grover, Springate and Zmijewski models for property and real estate companies. In accordance with the sample from this study, which are companies with negative profits in the study period, namely in 2017 – 2021, the companies selected are actually in a state of financial distress. The following is the calculation of the accuracy and error rate of the financial distress prediction model:

Table 4. Accuracy Levels and Error Rates of the Grover, Springate and Zmijewski Models in Property and Real Estate Companies in 2017 – 2021

Model	Healthy	Bankrupt	Total	Level of accuracy	Error Rate	Total
Grover	26	5	31	16.12%	83.88%	100%
Springate	1	30	31	96.77%	3.23%	100%
Zmijewski	30	1	31	3.23%	96.77%	100%

Source: Processed data (2023)

Table 4 can be seen that each bankruptcy prediction model has different predictive results between Grover, Springate and Zmijewski with different levels of accuracy and error rates. For the prediction model that has the highest level of accuracy is the Springate model where the model has an accuracy rate of 96.77% with an error rate of 3.23%. Then in second place is the Grover model with an accuracy rate of 16.12% and an error rate of 83.88%. Lastly, the Zmijewski model with an accuracy rate of only 3.23% and an error rate of 96.77%.

E. CONCLUSIONS AND SUGGESTIONS

The results of the study show that there are differences in predictions between the Grover, Springate and Zmijewski models in predicting bankruptcy (financial distress) in property and real estate companies listed on the Indonesia Stock Exchange in 2017 – 2021. The Springate model is the most accurate predictive model with an accuracy rate of 96.77% and an error rate of only 3.23%, followed by the Grover model with an accuracy rate of 16.12% and an error rate of 83.88%, the last ranking is the Zmijewski model with an accuracy rate of 3.23% and an error rate of 96.77%. This ranks first for the Springate model in predicting bankruptcy (financial distress) in property and real estate companies listed on the Indonesia Stock Exchange in 2017 – 2021. From the results of this study, researchers also provide suggestions for management to consider the results of the Springate model for minimize or avoid the risk of financial distress and for investors to consider using calculations and financial ratios in the Springate model to predict the possibility of financial distress in property and real estate companies so that investors can make the right investment decisions.

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