Analysis Of Bankruptcy Prediction Using Springate, Zmijewski, Grover And Altman Z-Score Models On Retail Companies Listed On The Indonesia Stock Exchange

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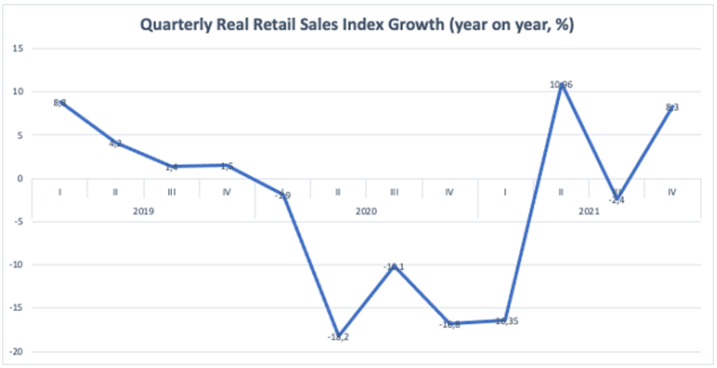
Abstract.

The retail sector plays a significant role and contributes greatly to the national economy. The slowdown in domestic economic growth and decreased consumer purchasing power have significantly impacted the retail business in Indonesia. This is evident from the high number of retail companies declared bankrupt and many large retail companies closing their stores. The aim of this study is to assess the health level of retail companies, determine the differences in scores among the research models, and evaluate the accuracy of the Springate, Zmijewski, Grover, and Altman models. This research is a quantitative study with a descriptive approach. The research objects are retail companies listed on the Indonesia Stock Exchange during the period 2019-2021. Sampling technique used is purposive sampling. The results of this study indicate that the highest accuracy level is achieved by the Grover model with an accuracy of 77.7%, followed by the Zmijewski model with an accuracy level of 72.2%. Meanwhile, the Springate and Altman models have the same accuracy level of 66.6%.

Keywords: *Springate, Zmijewski, Grover, Altman and Financial Distress.*

I. INTRODUCTION

One of the responsibilities of a company is to achieve good performance to avoid financial distress. Financial distress is one of the causes of bankruptcy in terms of a company's finances, while there are many factors beyond financial issues that can lead to a company's bankruptcy [1]. For instance, the impact of the Corona virus (Covid-19) outbreak not only affects health. The virus, which originated from Wuhan, China, has also influenced the economies of countries worldwide, including Indonesia [2]. In addition to the Covid-19 pandemic, the development of Industry 4.0 also affects the retail industry.The digital era has brought changes in consumer behavior. The rise of online shopping and intense competition have led to a decline in retail companies' sales growth over the past five years due to the shift in consumer behavior from traditional methods to more modern approaches. Companies that cannot adapt to these changes will likely fall behind and may even experience financial distress [3]. Besides the shift to online shopping, production costs also significantly affect a company's financial condition. Financial difficulties resulting from decreased sales impact a company's ability to meet its obligations, thereby disrupting its operations [4].Retail is a crucial link in the goods distribution process and is the final link in the distribution chain [5]. The Indonesian Retailers Association reported that 1,200 retail stores closed during the nine months of the pandemic from 2020 to March 2021. The closures were due to the implementation of community activity restrictions (PPKM), which included operational hour limits and visitor capacity constraints, resulting in a significant decline in the retail sector (Media, Kompas Cyber, 2021). The Bank of Indonesia subsequently released the Retail Sales Survey to assess consumer spending on retail goods. Below are the charts and images released by the Bank of Indonesia [6].



Quarterly Real Retail Sales Index Growth (year on year, %)											
2019				2020				2021			
I	II	III	IV	I	II	III	IV	I	II	III	IV
8,8	4,2	1,4	1,5	-1,9	-18,2	-10,1	-16,8	-16,35	10,96	-2,4	8,3

Fig 1. Quarterly Real Retail Sales Growth

Source: Bank Indonesia, 2021

Figure 1 shows the decline in consumer purchases in the retail sector from 2019 to 2021. Companies that cannot maintain their performance will be outcompeted by other, more competitive companies. The longer a company's performance continues to decline, the more likely it is that the company will be pushed out of the business world and eventually face bankruptcy [5].Bankruptcy is a condition where a company can no longer operate effectively due to severe financial difficulties. During the pandemic, the retail sector's business development has been quite concerning. According to a study by Ripha and Muyasaroh in 2021, which used the Altman Z-score method, 9 companies experienced bankruptcy. Below is the data of the companies that went bankrupt [7].

Table 1. Potential Bankruptcy of Companies in the Study by Ripha and Muyasaroh, 2021

No	Company Name	Z-Score	Classification
1	Matahari Department Store Tbk	0.92	Bankrupt
2	Hero Supermarket Tbk	- 1.39	Bankrupt
3	Sumber Alfaria Trijaya Tbk	0.79	Bankrupt
4	Kokoh Inti Aremba Tbk	0.94	Bankrupt
5	Midi Utama Indonesia Tbk	- 0.27	Bankrupt
6	Duta Intidaya Tbk	- 2.21	Bankrupt
7	Matahari Putra Prima Tbk	- 2.96	Bankrupt
8	Trikomsel Oke Tbk	- 292.10	Bankrupt
9	Global Kita Terang Tbk	- 501.53	Bankrupt

Source : (Ripha dan Muyasaroh, 2021).

Several retail companies have closed their stores, such as Matahari Department Store, Hypermart, Trikomsel Oke, and Hero Supermarket. Companies classified as having a potential for bankruptcy during the Covid-19 pandemic tend to be those operating in the supermarket and department store sectors [7]. A company's inability to cope with the Covid-19 pandemic will affect its sustainability, as indicated by a decline in its financial performance. Therefore, companies should conduct bankruptcy risk analysis as early as possible. The benefit of performing bankruptcy prediction analysis is to anticipate and avoid such risks [7].Additionally, bankruptcy prediction analysis can serve as a guide for management to take action and make policy decisions. One way to analyze bankruptcy is by examining financial conditions [8]. A company’s financial condition can be assessed through financial statements prepared at the end of each accounting period. Financial statements are prepared to provide information on financial position, performance, and to communicate between financial data or company activities with stakeholders, as well as changes in the financial position of a company, which is highly useful for users in supporting economic decision-making [9].The increasingly difficult business competition today motivates companies to strengthen their operations. Companies must be able to forecast and anticipate various risks, especially those related to decreased consumer purchasing power, to survive and avoid bankruptcy [10]. Therefore, if a company cannot withstand these conditions, particularly retail companies, it will incur losses that will affect the company's financial condition, eventually leading to bankruptcy [11].

There are several methods that can be used to predict corporate bankruptcy, including Springate, Zmijewski, Grover, and Altman [12]. Springate uses the ratios of working capital to total assets, earnings before interest and taxes to total assets, earnings before taxes to current liabilities, and sales to total assets. These ratios are used to determine whether a company is classified as bankrupt or not [13]. Zmijewski uses the ratios of ROA (net income after tax to total assets), Leverage (total debt to total assets), and Liquidity (current assets to current liabilities). These ratios are used to determine whether a company is classified as bankrupt or not [14]. Grover uses the ratios of working capital to total assets, earnings before interest and

taxes to total assets, and net income to total assets. These ratios are used to determine whether a company is classified as bankrupt or not [15]. Altman Z-SCORE uses the ratios of working capital to total assets, retained earnings to total assets, earnings before interest and taxes to total assets, and book value of equity to book value of total debt. These ratios are used to determine whether a company is classified as bankrupt or not [15].The Springate model was developed by Gordon L.V. Springate in 1978. Gordon L.V. Springate (1978) created a bankruptcy prediction model following the procedures of the Altman Z-Score model. The Springate model is a ratio model that uses Multiple Discriminant Analysis (MDA).

In the MDA method, more than one financial ratio related to corporate bankruptcy is needed to form a good model and determine which ratios can detect the likelihood of bankruptcy. Springate used MDA to select 4 ratios from 19 popular financial ratios in the literature that can differentiate between bankrupt and non-bankrupt businesses [16].The Zmijewski (X-Score) model is a prediction model developed by Zmijewski (1984), based on 20 years of research that was reviewed. Zmijewski uses the ratios of return on assets, leverage, and liquidity to obtain a more accurate pattern. The Zmijewski model employs financial ratio analysis that measures performance through profit, leverage which measures the level of debt, and liquidity in its prediction model [4].The Grover model is one that was developed by redesigning and reassessing the Altman Z-score model. In 1968, Jeffrey S. Grover used a sample consistent with the Altman Z-score model but added 13 new financial ratios. The sample comprised 70 companies, with 35 bankrupt and 35 non-bankrupt, spanning from 1982 to 1996 [17].The Altman Z-score model was first proposed by Edward I. Altman in 1968 as a result of his research. After evaluating 22 financial ratios, he identified 5 ratios that could be combined to distinguish between bankrupt and non-bankrupt companies. Altman conducted several studies with companies in different conditions. As a result, Altman developed several different formulas to be used for companies in varying conditions. This model emphasizes profitability as the component most influential to bankruptcy [17].Previous research using the Springate, Zmijewski, Grover, and Altman models to predict corporate bankruptcy has shown varying results.

Research [18] found that the Springate model was the most accurate prediction model with a 100% accuracy rate compared to the Grover and Zmijewski models. Research [13] indicated that the Zmijewski model had the highest accuracy rate of 96.3% compared to the Springate and Altman models. Oktaviandri's (2017) research found that the Grover model was the best for predicting bankruptcy with an accuracy rate of 82.86% compared to the Springate, Altman, and Ohlson models. Research [19] indicated that the Altman and Springate models provided higher values for predicting bankruptcy at 25% compared to the Zmijewski model at 18.75%. Research [20] stated that the Zmijewski and Grover models had the highest accuracy rates at 100% compared to the Springate model, which had an accuracy rate of 75%.The accuracy and error rates of financial distress prediction models vary depending on the sector of the companies studied, the length of the observation period, and the sample size. These differences in accuracy require both company management and creditors and investors to be more cautious in selecting which prediction model is best and most accurate for use, in order to make informed decisions [21].Springate (1978) used a sample of 40 companies to develop a model that could be used to predict potential bankruptcy using discriminant analysis; this model has an accuracy rate of 92.5% [22]. Zmijewski conducted studies in the field of bankruptcy over twenty years.

The accuracy rate of the Zmijewski model is 94.9% (Purnajaya, 2014). The Grover model has an accuracy rate of 100%, making it the most suitable method for application to publicly traded large wholesale sector companies [23]. Altman's research in 1983 and 1984 introduced a new Z-value for publicly traded companies, with the Altman Z-Score method achieving an accuracy rate of up to 95% [22]. When selecting a bankruptcy prediction analysis model, it is important to consider which model has high accuracy and low error rates to ensure that the results meet expectations [24].The differences in previous research results are due to the fact that each model inherently has different characteristics. A model may be suitable for a particular type of company but may not be appropriate for others. These differences in previous research results serve as the basis for conducting this study to test which bankruptcy prediction model is the most accurate.

II. METHODS

The type of research used in this study is quantitative research. Quantitative research is a type of research that produces findings that can be achieved using procedures or other methods of quantification [25]. This type of research falls into descriptive research. Descriptive research is conducted to determine the value of each variable [25]. The purpose of descriptive research is to describe existing phenomena, such as natural phenomena, man-made phenomena, or to analyze or describe the results of subjects [26].The population of this study consists of retail companies listed on the Indonesia Stock Exchange from 2019 to 2021, totaling 18 companies. The sampling technique used is purposive sampling. Purposive sampling is a technique of selecting samples based on specific considerations or criteria to achieve the research objectives [25].Data collection in this study uses the documentation method.

The data source for this study is secondary data. Secondary data refers to data obtained from records, books, and magazines such as company financial reports, government reports, articles, books as theories, magazines, and so on [25]. The secondary data to be used in this study includes financial statements of retail companies listed on the Indonesia Stock Exchange, specifically balance sheets and income statements for the period 2019-2021, accessed through the Indonesia Stock Exchange website.The data analysis techniques used in this study include the Springate model, Zmijewski model, Grover model, Altman model, and accuracy level. Delisting occurs when a listed stock on the exchange falls below certain criteria and no longer meets the listing requirements. As a result, the stock may be removed from the listing on the Indonesia Stock Exchange [27].

III. RESULTS AND DISCUSSION

Bankruptcy Prediction Results for Retail Companies Using the Springate Model for 2019-2021

From the calculation of the 4 ratios in the Springate model, the results were then applied to the Springate formula to obtain values that are later adjusted according to the cut-off values for categorizing companies. Below are the results of the Springate model calculations for 2019-2021:

Table 2. Results of the Springate Model Calculation for 2019

No	Company Name	X1	X2	X3	X4	Calculation Result	Category
1	AMRT	0,06732	0,07462	0,10739	3,04034	1,58545	Financial Stability
2	HERO	0,02565	0,56944	-0,01906	2,01193	2,56681	Financial Stability
3	MIDI	-0,12886	0,09285	0,09331	2,32957	1,14573	Financial Stability
4	MPPA	-0,18696	-0,05132	-0,12015	2,26513	1,90402	Financial Stability
5	LPPF	0,03123	0,37091	0,67864	2,12634	7,55848	Financial Stability
6	RALS	0,51010	0,10293	0,64559	0,99054	2,70295	Financial Stability
7	MAPI	0,17841	0,74008	0,28650	1,55249	3,26592	Financial Stability
8	ECII	0,23415	0,18787	0,07983	1,07224	1,29954	Financial Stability
9	ERAA	0,23892	0,07972	0,10241	3,37976	0,67534	Financial Distress
10	GLOB	-35,5616	0,95201	-0,12399	28,8238	-33,2468	Financial Distress
11	SLIS	0,40320	0,22118	0,29586	1,32947	1,82139	Financial Stability
12	TRIO	-5,17776	0,60078	-0,12601	7,08569	-0,73758	Financial Distress
13	ACES	0,53993	0,58524	1,61188	1,20246	3,90707	Financial Stability
14	CSAP	0,08285	0,04090	0,02654	1,74424	1,67723	Financial Stability
15	IMAS	-0,10731	0,02391	0,01747	0,41646	0,14100	Financial Distress
16	BOGA	0,04941	0,08343	0,14636	1,36361	0,94908	Financial Stability
17	DAYA	-0,12356	0,51705	0,03071	1,49875	2,07985	Financial Stability
18	DMND	0,29154	0,08816	0,23281	1,24111	0,42176	Financial Distress

Source: Data processed by the author, 2024

Based on the results of the Springate model calculation in Table 2, it can be seen that five companies in 2019 experienced financial distress with values below 0.862. The retail companies that experienced financial distress are ERAA (PT Erajaya Swasembada Tbk), GLOB (PT Global Teleshop Tbk), TRIO (PT Trikomsel Oke Tbk), IMAS (PT Indomobil Sukses Internasional Tbk), and DMND (PT Diamond Food Indonesia Tbk).

Table 3. Results of the Springate Model Calculation for 2020

No	Company Name	X1	X2	X3	X4	Calculation Result	Category
1	AMRT	-0,06806	0,06501	0,08824	2,91970	1,30940	Financial Stability
2	HERO	-0,15250	0,49600	-0,45088	1,83816	1,80332	Financial Stability
3	MIDI	-0,20090	0,07707	0,07687	2,13713	0,93528	Financial Stability
4	MPPA	-0,27221	-0,03109	-0,14668	1,49574	1,10989	Financial Stability
5	LPPF	-0,19719	-0,13768	-0,32713	0,76578	1,26236	Financial Stability
6	RALS	0,43048	-0,04807	-0,19601	0,47830	1,13128	Financial Stability
7	MAPI	0,04648	0,35018	-0,09854	0,84119	1,39438	Financial Stability
8	ECII	0,32116	0,16066	-0,04180	0,93522	1,17055	Financial Stability
9	ERAA	0,21442	0,09840	0,17836	3,04275	0,76236	Financial Distress
10	GLOB	-37,6560	0,15633	-0,12394	2,88907	-38,3096	Financial Distress
11	SLIS	0,38695	0,18451	0,19453	1,07350	1,52280	Financial Stability
12	TRIO	-8,10471	0,25058	-0,28586	4,44285	-5,99011	Financial Distress
13	ACES	0,57813	0,13654	1,09279	1,02286	3,27597	Financial Stability
14	CSAP	0,04709	0,04288	0,02825	1,66217	1,52722	Financial Stability
15	IMAS	-0,12086	0,01640	-0,02023	0,31462	0,03837	Financial Distress
16	BOGA	0,04498	0,06102	0,11828	0,80321	0,63302	Financial Distress
17	DAYA	-0,20525	0,46750	-0,09992	1,25082	1,65818	Financial Stability
18	DMND	0,48616	0,04151	0,32492	1,07561	0,55994	Financial Distress

Source: Data processed by the author, 2024

Based on the results of the Springate model calculation in Table 3, it can be seen that six companies in 2020 experienced financial distress with values below 0.862. The retail companies that experienced financial distress are ERAA (PT Erajaya Swasembada Tbk), GLOB (PT Global Teleshop Tbk), TRIO (PT Trikomsel Oke Tbk), IMAS (PT Indomobil Sukses Internasional Tbk), BOGA (PT Bintang Oto Global Tbk), and DMND (PT Diamond Food Indonesia Tbk).

Table 4. Results of the Springate Model Calculation for 2021

No	Company Name	X1	X2	X3	X4	Calculation Result	Category
1	AMRT	-0,07871	0,10224	0,14797	3,08813	1,56573	Financial Stability
2	HERO	-0,11771	0,24195	-0,22955	0,55490	0,69199	Financial Distress
3	MIDI	-0,18223	0,07694	0,08741	2,14123	0,96271	Financial Stability
4	MPPA	-0,08154	-0,01468	-0,12893	1,43108	1,19334	Financial Stability
5	LPPF	-0,09511	0,19181	0,53279	0,95466	2,51359	Financial Stability
6	RALS	0,46008	0,03055	0,21243	0,50982	1,54851	Financial Stability
7	MAPI	0,09248	0,45834	0,10382	1,09776	2,01000	Financial Stability
8	ECII	0,35537	0,15964	0,03329	0,95474	1,26002	Financial Stability
9	ERAA	0,20619	0,14591	0,34935	3,82220	1,05995	Financial Stability
10	GLOB	-39,3379	0,09457	-0,10882	3,44689	-40,17321	Financial Distress
11	SLIS	0,49883	0,16823	0,24164	1,13353	1,64318	Financial Stability
12	TRIO	-12,6984	0,51584	-0,11856	4,90149	-9,61342	Financial Distress
13	ACES	0,62165	0,12872	1,18875	0,91008	3,16069	Financial Stability
14	CSAP	0,04975	0,06073	0,06449	1,67386	1,58993	Financial Stability
15	IMAS	-0,14804	0,02572	-0,00085	0,37580	0,07624	Financial Distress
16	BOGA	0,25036	0,07847	0,11482	0,68367	0,84803	Financial Distress
17	DAYA	-0,24333	0,53224	-0,09286	1,40946	1,88586	Financial Stability
18	DMND	0,45397	0,06842	0,40662	1,10741	0,66913	Financial Distress

Source: Data processed by the author, 2024

Based on the results of the Springate model calculation in Table 4, it can be seen that six companies in 2021 experienced financial distress with values below 0.862. The retail companies that experienced financial distress are HERO (PT Hero Supermarket Tbk), GLOB (PT Global Teleshop Tbk), TRIO (PT Trikomsel Oke Tbk), IMAS (PT Indomobil Sukses Internasional Tbk), BOGA (PT Bintang Oto Global Tbk), and DMND (PT Diamond Food Indonesia Tbk).

Bankruptcy Prediction Results for Retail Companies Using the Zmijewski Model for 2019-2021.

Table 5. Results of the Zmijewski Model Calculation for 2019

No	Company Name	X1	X2	X3	X4	Category
1	AMRT	0,04746	0,71306	1,12266	-0,44466	Financial Stability
2	HERO	-0,00466	0,39439	1,06868	-2,02669	Financial Stability
3	MIDI	0,04069	0,75532	0,77813	-0,17464	Financial Stability
4	MPPA	-0,14464	0,86110	0,72718	1,26214	Financial Distress
5	LPPF	0,28282	0,63859	1,05810	-1,92849	Financial Stability
6	RALS	0,11467	0,26211	3,53779	-3,30784	Financial Stability
7	MAPI	0,08348	0,47115	1,43827	-1,98432	Financial Stability
8	ECII	0,01802	0,25216	2,08065	-2,93545	Financial Stability
9	ERAA	0,03340	0,48924	1,50459	-1,65560	Financial Stability
10	GLOB	-4,79869	90,98972	0,02132	535,9356	Financial Distress
11	SLIS	0,08530	0,55410	2,01978	-1,51741	Financial Stability
12	TRIO	-0,78959	28,12005	0,12715	159,5379	Financial Distress
13	ACES	0,15412	0,29592	5,57784	-3,28443	Financial Stability
14	CSAP	0,01040	0,70054	1,13788	-0,34915	Financial Stability
15	IMAS	0,00348	0,78951	0,77486	0,18766	Financial Distress
16	BOGA	0,01694	0,26288	1,23761	-2,87285	Financial Stability
17	DAYA	0,02537	0,76771	0,78077	-0,03512	Financial Stability
18	DMND	0,06585	0,41055	1,76880	-2,24911	Financial Stability

Source: Data processed by the author, 2024

Based on the results of the Zmijewski model calculation in Table 5, it can be seen that four companies in 2019 experienced financial distress with values below 0. The retail companies that experienced financial distress are MPPA (PT Matahari Putra Prima Tbk), GLOB (PT Global Teleshop Tbk), TRIO (PT Trikomsel Oke Tbk), and IMAS (PT Indomobil Sukses Internasional Tbk).

Table 6. Results of the Zmijewski Model Calculation for 2020

No	Company Name	X1	X2	X3	X4	Category
1	AMRT	0,04191	0,70596	0,88466	-0,46106	Financial Stability
2	HERO	-0,25103	0,61667	0,67608	0,34739	Financial Distress
3	MIDI	0,03380	0,76387	0,64951	-0,09542	Financial Stability
4	MPPA	-0,08985	0,95904	0,55563	1,57313	Financial Distress
5	LPPF	-0,13818	0,90803	0,56374	1,49988	Financial Distress
6	RALS	-0,02627	0,29638	3,45792	-2,47851	Financial Stability
7	MAPI	-0,03316	0,63177	1,11171	-0,54523	Financial Stability
8	ECII	-0,01184	0,27607	2,39822	-2,66344	Financial Stability
9	ERAA	0,05986	0,49265	1,46744	-1,75537	Financial Stability
10	GLOB	-4,76699	75,9374	0,02194	449,9948	Financial Distress
11	SLIS	0,06907	0,53425	1,88303	-1,55804	Financial Stability
12	TRIO	-2,48524	36,69573	0,07219	216,0495	Financial Distress
13	ACES	0,10091	0,27939	5,95877	-3,13769	Financial Stability
14	CSAP	0,00798	0,73037	1,08832	-0,16845	Financial Stability
15	IMAS	-0,01395	0,73731	0,75580	-0,03147	Financial Stability
16	BOGA	0,01637	0,26545	1,20063	-2,85579	Financial Stability
17	DAYA	-0,06889	0,83043	0,68396	0,74624	Financial Distress
18	DMND	0,03619	0,18044	4,35776	-3,41689	Financial Stability

Source: Data processed by the author, 2024

Based on the results of the Zmijewski model calculation in Table 6, it can be seen that six companies in 2020 experienced financial distress with values below 0. The retail companies that experienced financial distress are HERO (PT Hero Supermarket Tbk), MPPA (PT Matahari Putra Prima Tbk), LPPF (PT Matahari

Department Store Tbk), GLOB (PT Global Teleshop Tbk), TRIO (PT Trikomsel Oke Tbk), and DAYA (PT Duta Intidaya Tbk).

Table 7. Results of the Zmijewski Model Calculation for 2021

No	Company Name	X1	X2	X3	X4	Category
1	AMRT	0,07233	0,67302	0,86784	-0,78579	Financial Stability
2	HERO	-0,15358	0,86071	0,77289	1,30029	Financial Distress
3	MIDI	0,04338	0,74522	0,68686	-0,24471	Financial Stability
4	MPPA	-0,07258	0,87433	0,84474	1,01371	Financial Distress
5	LPPF	0,15601	0,82807	0,73113	-0,27909	Financial Stability
6	RALS	0,03354	0,29271	3,59393	-2,76807	Financial Stability
7	MAPI	0,02920	0,57719	1,23299	-1,13646	Financial Stability
8	ECII	0,00458	0,26164	2,58731	-2,91226	Financial Stability
9	ERAA	0,09830	0,43174	1,54794	-2,27524	Financial Stability
10	GLOB	-4,37547	64,6264	0,02147	383,7605	Financial Distress
11	SLIS	0,06382	0,48261	2,46046	-1,82643	Financial Stability
12	TRIO	-1,58524	43,47094	0,05023	250,6181	Financial Distress
13	ACES	0,09997	0,23325	7,18593	-3,39159	Financial Stability
14	CSAP	0,02649	0,73366	1,09473	-0,23292	Financial Stability
15	IMAS	-0,0050	0,74822	0,71526	-0,00970	Financial Stability
16	BOGA	0,03385	0,42878	1,62431	-2,00182	Financial Stability
17	DAYA	-0,07503	0,89560	0,67156	1,14527	Financial Distress
18	DMND	0,05581	0,20292	3,58364	-3,38012	Financial Stability

Source: Data processed by the author, 2024

Based on the results of the Zmijewski model calculation in Table 7, it can be seen that five companies in 2021 experienced financial distress with values below 0. The retail companies that experienced financial distress are HERO (PT Hero Supermarket Tbk), MPPA (PT Matahari Putra Prima Tbk), GLOB (PT Global Teleshop Tbk), TRIO (PT Trikomsel Oke Tbk), and DAYA (PT Duta Intidaya Tbk).

Bankruptcy Prediction Results for Retail Companies Using the Grover Model for 2019-2021

Table 8. Results of the Grover Model Calculation for 2019

No	Company Name	X1	X2	X3	X4	Category
1	AMRT	0,06732	0,07462	0,04746	0,42286	Financial Stability
2	HERO	0,02567	0,56944	-0,00466	2,03765	Financial Stability
3	MIDI	-0,12887	0,09285	0,04069	0,16108	Financial Stability
4	MPPA	-0,18696	-0,05132	-0,14464	1,15419	Financial Stability
5	LPPF	0,03123	0,37091	0,28282	7,36342	Financial Stability
6	RALS	0,51011	0,10293	0,11467	2,40318	Financial Stability
7	MAPI	0,17841	0,74008	0,08348	2,87197	Financial Stability
8	ECII	0,23415	0,18787	0,01802	1,08317	Financial Stability
9	ERAA	0,23893	0,07972	0,03340	0,72313	Financial Stability
10	GLOB	-35,56164	0,95201	-4,79869	-55,4558	Financial Distress
11	SLIS	0,40320	0,22118	0,08530	1,47656	Financial Stability
12	TRIO	-5,17777	0,60078	-0,78959	-6,45387	Financial Distress
13	ACES	0,53994	0,58524	0,15412	2,94254	Financial Stability
14	CSAP	0,08286	0,04090	0,01040	1,12586	Financial Stability
15	IMAS	-0,10732	0,02391	0,00348	-0,03860	Financial Distress
16	BOGA	0,04941	0,08343	0,01694	0,42280	Financial Stability
17	DAYA	-0,12357	0,51705	0,02537	1,61357	Financial Stability
18	DMND	0,29154	0,08816	0,06585	-0,04703	Financial Distress

Source: Data processed by the author, 2024

Based on the results of the Grover model calculation in Table 8, it can be seen that four companies in 2019 experienced financial distress with values below 0.02. The retail companies that experienced financial distress are GLOB (PT Global Teleshop Tbk), TRIO (PT Trikomsel Oke Tbk), IMAS (PT Indomobil Sukses Internasional Tbk), and DMND (PT Diamond Food Indonesia Tbk).

Table 9. Results of the Grover Model Calculation for 2020

No	Company Name	X1	X2	X3	X4	Category
1	AMRT	-0,06806	0,06501	0,04191	0,16667	Financial Stability
2	HERO	-0,15251	0,49600	-0,25103	1,48973	Financial Stability
3	MIDI	-0,20090	0,07707	0,03380	-0,01157	Grey Area
4	MPPA	-0,27221	-0,03109	-0,08985	0,59251	Financial Stability
5	LPPF	-0,19719	-0,13768	-0,13818	1,25409	Financial Stability
6	RALS	0,43048	-0,04807	-0,02627	1,46090	Financial Stability
7	MAPI	0,04649	0,35018	-0,03316	1,32520	Financial Stability
8	ECII	0,32117	0,16066	-0,01184	1,13365	Financial Stability
9	ERAA	0,21442	0,09840	0,05986	0,74675	Financial Stability
10	GLOB	-37,65605	0,15633	-4,76699	-61,6195	Financial Distress
11	SLIS	0,38696	0,18451	0,06907	1,32465	Financial Stability
12	TRIO	-8,10472	0,25058	-2,48524	-12,5025	Financial Distress
13	ACES	0,57814	0,13654	0,10091	2,73128	Financial Stability
14	CSAP	0,04709	0,04288	0,00798	1,01654	Financial Stability
15	IMAS	-0,12086	0,01640	-0,01395	-0,08679	Financial Distress
16	BOGA	0,04499	0,06102	0,01637	0,33920	Financial Stability
17	DAYA	-0,20526	0,46750	-0,06889	1,30859	Financial Stability
18	DMND	0,48617	0,04151	0,03619	0,21055	Financial Stability

Source: Data processed by the author, 2024

Based on the results of the Grover model calculation in Table 9, it can be seen that three companies in 2020 experienced financial distress with values below 0.02, and one company was in the Grey Area. The retail companies that experienced financial distress are GLOB (PT Global Teleshop Tbk), TRIO (PT Trikomsel Oke Tbk), and IMAS (PT Indomobil Sukses Internasional Tbk). The company in the Grey Area is MIDI (PT Midi Utama Indonesia Tbk).

Table 10. Results of the Grover Model Calculation for 2021

No	Company Name	X1	X2	X3	X4	Category
1	AMRT	-0,07871	0,10224	0,07233	0,27632	Financial Stability
2	HERO	-0,11771	0,24195	-0,15358	0,68390	Financial Stability
3	MIDI	-0,18223	0,07694	0,04338	0,01892	Financial Stability
4	MPPA	-0,08154	-0,01468	-0,07258	0,79723	Financial Stability
5	LPPF	-0,09512	0,19181	0,15601	1,98493	Financial Stability
6	RALS	0,46008	0,03055	0,03354	1,62664	Financial Stability
7	MAPI	0,09248	0,45834	0,02920	1,77027	Financial Stability
8	ECII	0,35537	0,15964	0,00458	1,18687	Financial Stability
9	ERAA	0,20619	0,14591	0,09830	0,89549	Financial Stability
10	GLOB	-39,33791	0,09457	-4,37547	-64,5986	Financial Distress
11	SLIS	0,49884	0,16823	0,06382	1,45378	Financial Stability
12	TRIO	-12,69845	0,51584	-1,58524	-19,1649	Financial Distress
13	ACES	0,62165	0,12872	0,09997	2,60534	Financial Stability
14	CSAP	0,04975	0,06073	0,02649	1,05602	Financial Stability
15	IMAS	-0,14804	0,02572	-0,0050	-0,09979	Financial Distress
16	BOGA	0,25036	0,07847	0,03385	0,73775	Financial Stability
17	DAYA	-0,24333	0,53224	-0,07503	1,46607	Financial Stability
18	DMND	0,45397	0,06842	0,05581	0,24169	Financial Stability

Source: Data processed by the author, 2024

Based on the results of the Grover model calculation in Table 10, it can be seen that three companies in 2021 experienced financial distress with values below 0.02. The retail companies that experienced financial distress are GLOB (PT Global Teleshop Tbk), TRIO (PT Trikomsel Oke Tbk), and IMAS (PT Indomobil Sukses Internasional Tbk).

Bankruptcy Prediction Results for Retail Companies Using the Altman Model for 2019-2021

Table 11. Results of the Altman Model Calculation for 2019

No	Company Name	X1	X2	X3	X4	Calculation Result	Category
1	AMRT	0,06732	0,17374	0,07462	0,40240	1,93204	Grey Area
2	HERO	0,02567	0,07058	0,56944	1,53552	5,83738	Financial Stability
3	MIDI	-0,12887	0,16785	0,09285	0,32393	0,66592	Financial Distress
4	MPPA	-0,18696	-0,35330	-0,05132	0,16129	0,57071	Financial Distress
5	LPPF	0,03123	1,08737	0,37091	0,56593	18,68185	Financial Stability
6	RALS	0,51011	0,70277	0,10293	2,81514	11,55976	Financial Stability
7	MAPI	0,17841	0,25655	0,74008	1,12243	8,15871	Financial Stability
8	ECII	0,23415	0	0,18787	2,96563	5,91250	Financial Stability
9	ERAA	0,23893	0,26784	0,07972	1,04397	4,07245	Financial Stability
10	GLOB	-35,56164	-118,5279	0,95201	-0,98900	-614,3263	Financial Distress
11	SLIS	0,40320	0,09213	0,22118	0,80472	5,27671	Financial Stability
12	TRIO	-5,17777	-57,80112	0,60078	-0,96443	-219,3732	Financial Distress
13	ACES	0,53994	0,54540	0,58524	2,37918	11,75101	Financial Stability
14	CSAP	0,08286	0,10080	0,04090	0,42746	3,16089	Financial Stability
15	IMAS	-0,10732	0,03546	0,02391	0,26659	-0,14773	Financial Distress
16	BOGA	0,04941	0,07592	0,08343	2,80391	4,07643	Financial Stability
17	DAYA	-0,12357	0	0,51705	0,30257	2,98171	Grey Area
18	DMND	0,29154	0,42994	0,08816	1,43572	3,66455	Financial Stability

Source: Data processed by the author, 2024

Based on the results of the Altman model calculation in Table 11, it can be seen that three companies in 2019 experienced financial distress with values below 1.1, and three companies were in the Grey Area with values between 1.1 and 2.6. The retail companies that experienced financial distress are GLOB (PT Global Teleshop Tbk), TRIO (PT Trikomsel Oke Tbk), and IMAS (PT Indomobil Sukses Internasional Tbk), MIDI (PT Midi Utama Indonesia Tbk), and MPPA (PT Matahari Putra Prima Tbk). The retail companies in the Grey Area are AMRT (PT Sumber Alfaria Trijaya Tbk) and DAYA (PT Duta Intidaya Tbk).

Table 12. Results of the Altman Model Calculation for 2020

No	Company Name	X1	X2	X3	X4	Calculation Result	Category
1	AMRT	-0,06806	0,17031	0,06501	0,41650	0,98293	Financial Distress
2	HERO	-0,15251	-0,28615	0,49600	0,62160	2,05248	Grey Area
3	MIDI	-0,20090	0,16472	0,07707	0,30910	0,06160	Financial Distress
4	MPPA	-0,27221	-0,37597	-0,03109	0,04270	-1,01985	Financial Distress
5	LPPF	-0,19719	0,59205	-0,13768	0,10127	3,75278	Financial Stability
6	RALS	0,43048	0,66119	-0,04807	2,37395	8,84224	Financial Stability
7	MAPI	0,04649	0,16083	0,35018	0,58285	3,79450	Financial Stability
8	ECII	0,32117	-0,02309	0,16066	2,62213	5,86451	Financial Stability
9	ERAA	0,21442	0,28555	0,09840	1,02980	4,08015	Financial Stability
10	GLOB	-37,65605	-97,1908	0,15633	-0,98683	-563,8515	Financial Distress
11	SLIS	0,38696	0,09657	0,18451	0,87176	5,00852	Financial Stability
12	TRIO	-8,10472	-73,2665	0,25058	-0,97274	-291,3533	Financial Distress
13	ACES	0,57814	0,57219	0,13654	2,57911	11,75907	Financial Stability
14	CSAP	0,04709	0,09782	0,04288	0,36916	2,75610	Financial Stability
15	IMAS	-0,12086	0,01704	0,01640	0,35627	-0,25294	Financial Distress
16	BOGA	0,04499	0,090248	0,06102	2,76706	3,90481	Financial Stability
17	DAYA	-0,20526	0	0,46750	0,20419	2,00950	Financial Distress
18	DMND	0,48617	0,43631	0,04151	4,54185	8,09899	Financial Stability

Source: Data processed by the author, 2024

Based on the results of the Altman model calculation in Table 12, it can be seen that three companies in 2020 experienced financial distress with values below 1.1, and five companies were in the Grey Area with values between 1.1 and 2.6. The retail companies that experienced financial distress are GLOB (PT Global Teleshop Tbk), TRIO (PT Trikomsel Oke Tbk), AMRT (PT Sumber Alfaria Trijaya Tbk), MIDI (PT Midi

Utama Indonesia Tbk), MPPA (PT Matahari Putra Prima Tbk), BOGA (PT Bintang Oto Global Tbk), and DAYA (PT Duta Intidaya Tbk). The retail company in the Grey Area is HERO (PT Hero Supermarket Tbk).

Table 13. Results of the Altman Model Calculation for 2021

No	Company Name	X1	X2	X3	X4	Calculation Result	Category
1	AMRT	-0,07871	0,21775	0,10224	0,48583	1,39073	Grey Area
2	HERO	-0,11771	-0,37661	0,24195	0,16182	-0,20417	Financial Distress
3	MIDI	-0,18223	0,18756	0,07694	0,34188	0,29206	Financial Distress
4	MPPA	-0,08154	-0,43276	-0,01468	0,14372	-0,06557	Financial Distress
5	LPPF	-0,09512	0,76051	0,19181	0,20761	6,18423	Financial Stability
6	RALS	0,46008	0,72071	0,03055	2,41626	9,50374	Financial Stability
7	MAPI	0,09248	0,19529	0,45834	0,73250	5,09257	Financial Stability
8	ECII	0,35537	0,04588	0,15964	3,01036	6,71453	Financial Stability
9	ERAA	0,20619	0,35115	0,14591	1,31619	4,85995	Financial Stability
10	GLOB	-39,33791	-81,2257	0,09457	-0,98452	-523,2509	Financial Distress
11	SLIS	0,49884	0,15732	0,16823	1,07202	6,04142	Financial Stability
12	TRIO	-12,69845	-85,4702	0,51584	-0,97699	-359,4943	Financial Distress
13	ACES	0,62165	0,61486	0,12872	3,28716	12,53675	Financial Stability
14	CSAP	0,04975	0,11139	0,06073	0,36301	2,88001	Financial Stability
15	IMAS	-0,14804	0,01066	0,02572	0,33648	-0,41020	Financial Distress
16	BOGA	0,25036	0,09970	0,07847	1,33219	3,89355	Financial Stability
17	DAYA	-0,24333	0	0,53224	0,11656	2,10282	Grey Area
18	DMND	0,45397	0,44403	0,06842	3,92781	7,43391	Financial Stability

Source: Data processed by the author, 2024

Based on the results of the Altman model calculation in Table 13, it can be seen that two companies in 2021 experienced financial distress with values below 1.1, and six companies were in the Grey Area with values between 1.1 and 2.6. The retail companies that experienced financial distress are GLOB (PT Global Teleshop Tbk), TRIO (PT Trikomsel Oke Tbk), IMAS (PT Indomobil Sukses Internasional Tbk), MIDI (PT Midi Utama Indonesia Tbk), MPPA (PT Matahari Putra Prima Tbk), and HERO (PT Hero Supermarket Tbk). The retail companies in the Grey Area are AMRT (PT Sumber Alfaria Trijaya Tbk) and DAYA (PT Duta Intidaya Tbk).

Accuracy of Bankruptcy Prediction Models for Retail Companies in Indonesia

After calculating the results for the Springate, Zmijewski, Grover, and Altman models, the next step is to compute the accuracy level to determine the precision of each model in financial distress analysis.

The accuracy level is calculated using the following formula:

$$\textbf{Accuracy Level} = \frac{\text{Number of Correct Prediction}}{\text{Total Sample}} \textbf{100}\%$$

Here are the results of the Springate, Zmijewski, Grover, and Altman models for the years 2019-2021:

Table 14. Results of the Springate Model Calculation for 2019-2021

No	Company Name	2019	2020	2021	Total	Average	Category	Prediction Results
1	AMRT	1,58545	1,30940	1,56573	4,46059	1,48686	Financial Stability	Correct
2	HERO	2,56681	1,80332	0,69199	5,06213	1,68737	Financial Stability	Correct
3	MIDI	1,14573	0,93528	0,96271	3,04373	1,01457	Financial Stability	Correct
4	MPPA	1,90402	1,10989	1,19334	4,20725	1,40241	Financial Stability	Correct
5	LPPF	7,55848	1,26236	2,51359	11,33444	3,77814	Financial Stability	Correct
6	RALS	2,70295	1,13128	1,54851	5,38275	1,79425	Financial Stability	Correct
7	MAPI	3,26592	1,39438	2,01000	6,67032	2,22344	Financial Stability	Correct
8	ECII	1,29954	1,17055	1,26002	3,73012	1,24337	Financial Stability	Correct
9	ERAA	0,67534	0,76236	1,05995	2,49767	0,83255	Financial Distress	Incorrect
10	GLOB	-33,2468	-38,3096	-40,17321	-111,7297	-37,24325	Financial Distress	Incorrect
11	SLIS	1,82139	1,52280	1,64318	4,98739	1,66246	Financial Stability	Correct
12	TRIO	-0,73758	-5,99011	-9,61342	-16,34111	-5,44703	Financial Distress	Incorrect

13	ACES	3,90707	3,27597	3,16069	10,34374	3,44791	Financial Stability	Correct
14	CSAP	1,67723	1,52722	1,58993	4,79438	1,59812	Financial Stability	Correct
15	IMAS	0,14100	0,03837	0,07624	0,25562	0,08520	Financial Distress	Incorrect
16	BOGA	0,94908	0,63302	0,84803	2,43015	0,81005	Financial Distress	Incorrect
17	DAYA	2,07985	1,65818	1,88586	5,62390	1,87463	Financial Stability	Correct
18	DMND	0,42176	0,55994	0,66913	1,65084	0,55028	Financial Distress	Incorrect

Source: Data processed by the author, 2024

Table 15. Results of the Zmijewski Model Calculation for 2019-2021

No	Company Name	2019	2020	2021	Total	Average	Category	Prediction Results
1	AMRT	-0,44466	-0,46106	-0,78579	-1,69153	-0,56384	Financial Stability	Correct
2	HERO	-2,02669	0,34739	1,30029	-0,37900	-0,12633	Financial Stability	Correct
3	MIDI	-0,17464	-0,09542	-0,24471	-0,51478	-0,17159	Financial Stability	Correct
4	MPPA	1,26214	1,57313	1,01371	3,84898	1,28299	Financial Distress	Incorrect
5	LPPF	-1,92849	1,49988	-0,27909	-0,70764	-0,23588	Financial Stability	Correct
6	RALS	-3,30784	-2,47851	-2,76807	-8,55443	-2,85147	Financial Stability	Correct
7	MAPI	-1,98432	-0,54523	-1,13646	-3,66602	-1,22200	Financial Stability	Correct
8	ECII	-2,93545	-2,66344	-2,91226	-8,51116	-2,83705	Financial Stability	Correct
9	ERAA	-1,65560	-1,75537	-2,27524	-5,68622	-1,89540	Financial Stability	Correct
10	GLOB	535,9356	449,9948	383,7605	1369,691	456,563	Financial Distress	Incorrect
11	SLIS	-1,51741	-1,55804	-1,82643	-4,90189	-1,63396	Financial Stability	Correct
12	TRIO	159,5379	216,0495	250,6181	626,238	208,746	Financial Distress	Incorrect
13	ACES	-3,28443	-3,13769	-3,39159	-9,81371	-3,27123	Financial Stability	Correct
14	CSAP	-0,34915	-0,16845	-0,23292	-0,75053	-0,25017	Financial Stability	Correct
15	IMAS	0,18766	-0,03147	-0,00970	0,14647	0,04882	Financial Distress	Incorrect
16	BOGA	-2,87285	-2,85579	-2,00182	-7,73030	-2,57676	Financial Stability	Correct
17	DAYA	-0,03512	0,74624	1,14527	1,85639	0,61879	Financial Distress	Incorrect
18	DMND	-2,24911	-3,41689	-3,38012	-9,04613	-3,01537	Financial Stability	Correct

Source: Data processed by the author, 2024

Table 16. Results of the Grover Model Calculation for 2019-2021

No	Company Name	2019	2020	2021	Total	Average	Category	Prediction Results
1	AMRT	0,42286	0,16667	0,27632	0,86585	0,28861	Financial Stability	Correct
2	HERO	2,03765	1,48973	0,68390	4,21130	1,40376	Financial Stability	Correct
3	MIDI	0,16108	-0,01157	0,01892	0,16843	0,05614	Financial Distress	Incorrect
4	MPPA	1,15419	0,59251	0,79723	2,54394	0,84798	Financial Stability	Correct
5	LPPF	7,36342	1,25409	1,98493	10,60244	3,53414	Financial Stability	Correct
6	RALS	2,40318	1,46090	1,62664	5,49074	1,83024	Financial Stability	Correct
7	MAPI	2,87197	1,32520	1,77027	5,96745	1,98915	Financial Stability	Correct
8	ECII	1,08317	1,13365	1,18687	3,40370	1,13456	Financial Stability	Correct
9	ERAA	0,72313	0,74675	0,89549	2,36538	0,78846	Financial Stability	Correct
10	GLOB	-55,4558	-61,6195	-64,5986	-181,674	-60,55801	Financial Distress	Incorrect
11	SLIS	1,47656	1,32465	1,45378	4,25500	1,41833	Financial Stability	Correct
12	TRIO	-6,45387	-12,5025	-19,1649	-38,12144	-12,70714	Financial Distress	Incorrect
13	ACES	2,94254	2,73128	2,60534	8,27917	2,75972	Financial Stability	Correct
14	CSAP	1,12586	1,01654	1,05602	3,19842	1,06614	Financial Stability	Correct
15	IMAS	-0,03860	-0,08679	-0,09979	-0,22519	-0,07506	Financial Distress	Incorrect
16	BOGA	0,42280	0,33920	0,73775	1,49977	0,49992	Financial Stability	Correct
17	DAYA	1,61357	1,30859	1,46607	4,38824	1,46274	Financial Stability	Correct
18	DMND	-0,04703	0,21055	0,24169	0,40521	0,13507	Financial Stability	Correct

Source: Data processed by the author, 2024

Table 17. Results of the Altman Model Calculation for 2019-2021

No	Company Name	2019	2020	2021	Total	Average	Category	Prediction Results
1	AMRT	1,93204	0,98293	1,39073	4,30572	1,43524	Grey Area	Correct
2	HERO	5,83738	2,05248	-0,20417	7,68568	2,56189	Grey Area	Incorrect

3	MIDI	0,66592	0,06160	0,29206	1,01959	0,33986	Financial Distress	Incorrect
4	MPPA	0,57071	-1,01985	-0,06557	-0,51471	-0,17157	Financial Distress	Incorrect
5	LPPF	18,68185	3,75278	6,18423	28,61886	9,53962	Financial Stability	Correct
6	RALS	11,55976	8,84224	9,50374	29,90575	9,96858	Financial Stability	Correct
7	MAPI	8,15871	3,79450	5,09257	17,04579	5,68193	Financial Stability	Correct
8	ECII	5,91250	5,86451	6,71453	18,49155	6,16385	Financial Stability	Correct
9	ERAA	4,07245	4,08015	4,85995	13,01257	4,33752	Financial Stability	Correct
10	GLOB	-614,3263	-563,8515	-523,2509	-1701,428	-567,1429	Financial Distress	Incorrect
11	SLIS	5,27671	5,00852	6,04142	16,32667	5,44222	Financial Stability	Correct
12	TRIO	-219,3732	-291,3533	-359,4943	-870,2208	-290,0736	Financial Distress	Incorrect
13	ACES	11,75101	11,75907	12,53675	36,04684	12,01561	Financial Stability	Correct
14	CSAP	3,16089	2,75610	2,88001	8,79701	2,93233	Financial Stability	Correct
15	IMAS	-0,14773	-0,25294	-0,41020	-0,81089	-0,27029	Financial Distress	Incorrect
16	BOGA	4,07643	3,90481	3,89355	11,87480	3,95826	Financial Stability	Correct
17	DAYA	2,98171	2,00950	2,10282	7,09404	2,36468	Grey Area	Correct
18	DMND	3,66455	8,09899	7,43391	19,19746	6,39915	Financial Stability	Correct

Source: Data processed by the author, 2024

Based on the results of the Springate, Zmijewski, Grover, and Altman models from 2019-2021, the number of correct predictions is as follows: 12 companies for the Springate model, 13 companies for the Zmijewski model, 14 companies for the Grover model, and 10 companies for the Altman model. The accuracy level of each model is calculated using the formula below:

Springate Model $= \frac{12}{18} x\ 100\% = 66{,}6\ \%$

Zmijewski Model $= \frac{13}{18} x\ 100\% = 72{,}2\ \%$

Grover Model $= \frac{14}{18} x\ 100\% = 77{,}7\ \%$

Altman Z-Score Model $= \frac{10}{18} x\ 100\% = 55{,}5\%$

Table 18. Accuracy Level Results

No	Prediction Model	Accuracy Level %
1	Springate Model	66,6%
2	Zmijewski Model	72,2%
3	Grover Model	77,7%
4	Altman Model	55,5%

From Table 18, it can be seen that the Springate model has an accuracy level of 66.6% based on calculations performed on 18 samples. The Springate model identifies 12 out of 18 samples as having Financial Stability.The Zmijewski model has an accuracy level of 72.2% based on calculations performed on 18 samples. The Zmijewski model identifies 13 out of 18 samples as having Financial Stability.The Grover model has an accuracy level of 77.7% based on calculations performed on 18 samples. The Grover model identifies 14 out of 18 samples as having Financial Stability.The Altman model has an accuracy level of 55.5% based on calculations performed on 18 samples. The Altman model identifies 10 out of 18 samples as having Financial Stability.

IV. CONCLUSION

The conclusion drawn from this research is that in 2019, the Springate model was able to predict retail company bankruptcy by classifying 13 companies as Financial Stability and 5 companies as Financial Distress. In 2020, the Springate model classified 12 companies as Financial Stability and 6 companies as Financial Distress. In 2021, the Springate model classified 12 companies as Financial Stability and 6 companies as Financial Distress. The Zmijewski model in 2019 was able to predict retail company bankruptcy by classifying 14 companies as Financial Stability and 4 companies as Financial Distress. In 2020, the Zmijewski model classified 12 companies as Financial Stability and 6 companies as Financial Distress. In 2021, the Zmijewski model classified 13 companies as Financial Stability and 5 companies as Financial Distress. The Grover model in 2019 was able to predict retail company bankruptcy by classifying

14 companies as Financial Stability and 4 companies as Financial Distress. In 2020, the Grover model classified 14 companies as Financial Stability, 1 company in the grey area, and 3 companies as Financial Distress. In 2021, the Grover model classified 15 companies as Financial Stability and 3 companies as Financial Distress. The Altman model in 2019 was able to predict retail company bankruptcy by classifying 11 companies as Financial Stability, 2 companies in the grey area, and 5 companies as Financial Distress.

In 2020, the Altman model classified 10 companies as Financial Stability, 1 company in the grey area, and 7 companies as Financial Distress. In 2021, the Altman model classified 10 companies as Financial Stability, 2 companies in the grey area, and 6 companies as Financial Distress. There are differences in scores among the Springate, Zmijewski, Grover, and Altman models in predicting retail company bankruptcy from 2019 to 2021. The Grover model had the highest accuracy rate at 77.7%, followed by the Zmijewski model with an accuracy rate of 72.2%, the Springate model with an accuracy rate of 66.6%, and the Altman model with an accuracy rate of 66.6%.For future researchers, it is recommended to use other prediction models to find one with a higher accuracy rate than the Springate, Zmijewski, Grover, and Altman models. For investors looking to invest in retail subsector companies, it is advisable to use the Grover model for bankruptcy prediction analysis. Companies should conduct periodic bankruptcy prediction analyses to reduce or eliminate signs of potential bankruptcy. An evaluation that companies can perform includes reviewing the use of debt in the company's capital structure to avoid losses or financial distress.

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