
Bankruptcy Prediction Model: Altman (Z-Score), Springate (S-Score), Zmijewski (X-Score) And Grove (G-Score) Models in Companies Listed at The LQ 45 Stock Index

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ABSTRACT

This study aims to assess the effectiveness of four prominent bankruptcy prediction models, namely Altman's Z-Score, Springate's S-Score, Zmijewski's X-Score, and Grove's G-Score, in forecasting financial distress among companies listed on the LQ 45 Stock Index. The research leverages financial data spanning a specified period to construct and evaluate the predictive capabilities of these models. By employing a sample of companies operating within the LQ 45 index, the study provides a comprehensive comparative analysis of the models' accuracy, sensitivity, and specificity in identifying firms at risk of bankruptcy. Additionally, this research investigates potential improvements or synergies that may arise from combining the predictive power of multiple models. The findings of this study contribute to the body of knowledge in corporate finance and offer valuable insights for stakeholders, investors, and policymakers involved in risk assessment and financial decision-making within the context of the Indonesian stock market.

Keywords: Altman, springate, zmijewski, grove, bankruptcy, LQ 45

INTRODUCTION

Before making investments, investors and creditors typically evaluate a company's financial well-being by examining its inclusion in the LQ45 index group. The financial reports of companies listed in the LQ45 exhibit favorable indicators, suggesting optimistic prospects for growth. Certain companies can maintain their position in the LQ45 index for prolonged durations. (Hartadi, 2018; Mudzakar, 2019)

The criteria for including stocks in the calculation of the LQ45 index are as follows: 1. The corporation has been officially registered on the Indonesia Stock Exchange for a minimum duration of three months. 2. It currently ranks within the top 60 stocks regarding transaction value within the regular market. The LQ45 index calculation incorporates thirty stocks with the highest value, while regular market transactions, transaction frequency, and market capitalization determine the assessment of the remaining fifteen stocks. Maintaining a position in the LQ45 index is challenging for companies, given that the selection process takes place biannually and is contingent upon pre-established criteria. If a company's stocks fail to satisfy the stipulated criteria, they are delisted from the LQ45 index.

Barito Pacific Tbk/ BRPT, a conglomerate operating in the petrochemical and energy industries, experienced exclusion from the LQ45 index from 2020 to 2021. Nevertheless, it is worth noting that the BRPT made a reappearance in the LQ45 index during the period spanning from February to July 2022. The alteration above was prompted by the ramifications of the COVID-19 pandemic, which reached its zenith in the years 2020 and 2021. This phenomenon exemplifies the ability of companies to exit and subsequently re-enter the LQ45 index during periods of stock stabilization or growth.

The study by Mochamad Kohar Mudzakar (Journal of Economics and Business Sciences) investigates the practical application of the Altman Z-Score method in predicting corporate bankruptcy. The study conducted by Ben Moch, Dzulkirom AR Topowijono, and published in the Accounting and Finance Journal aimed to examine the effectiveness of the Springate (S-score) method in predicting bankruptcy among real estate and property companies listed on the Indonesian Stock Exchange from 2011 to 2013.

According to the research conducted by Anindyajati & Yanuarti, (2018) the study titled "Altman's Z-Score Application to Predict Bankruptcy in Companies Listed on the Indonesian Stock Exchange 2008-2017" reveals that in the year 2019, a total of 15 companies were identified as financially sound, while three companies fell within the ambiguous range. Two companies were deemed to be at risk of bankruptcy. In the year 2020, thirteen companies were deemed to be in a healthy financial state, three companies were classified as uncertain, and four companies were identified as having a high risk of bankruptcy. In the year 2021, a total of 14 financially stable companies, two companies with uncertain financial standing and four at risk of bankruptcy, were observed. The research conducted by Nurminawati, (2021) in the Economics and Business Journal was centered around the prediction of bankruptcy based on share prices. Various models, such as the Altman Z-Score, Zmijewski, and G-Score, were utilized.

In light of the dynamic fluctuations observed in the LQ45 index, corporations and investors must undertake a comprehensive assessment of the likelihood of bankruptcy prior to making investment decisions. The researcher expresses interest in conducting a study titled "An Analysis of Bankruptcy Prediction Utilizing the Altman (Z-score), Springate (S-score), Zmijewski (X-score), Grove (G-score) Model in Companies Listed on the LQ45 Stock Index" based on the provided background information.

LITERATUR REVIEW

Financial Report

A financial report comprehensively represents a company's financial status and operational performance during a specific timeframe or over a designated period. The balance sheet, profit and loss statement, cash flow report, and statement of changes in financial position are among the frequently encountered financial reports. (Ayem & Yuliana, 2019; Rahmah & Kamilah, 2022; Saratih & Abdillah, 2017)

Financial Ratio Analysis

The analysis of financial ratios is a fundamental tool used in assessing a company's financial performance and health. By examining the relationships between various financial figures, such as liquidity,

Financial statement analysis is a valuable tool used to assess a company's performance by examining and comparing financial data from various sections of a financial report. Financial ratios link different components within a financial report, encompassing elements from diverse assets, liabilities, equities, and balance sheet items in conjunction with components from the profit and loss statement. (Kartikasari et al., 2023; Syukur et al., 2021)

One method for examining a financial report entails the utilization of ratio analysis. This analysis is employed to ascertain the correlation between the positions identified within a singular financial report or among different positions. (Hosaka, 2019)

Bankruptcy

Bankruptcy is characterized as a legal state wherein a court ruling designates an entity possessing a minimum of two creditors as bankrupt due to its incapacity to settle at least one outstanding debt that is currently due. Several observable indicators may suggest a business is encountering difficulties and potential financial challenges: There has been a notable decrease in sales or revenue. There is a reduction in both profit and cash flow from operations. There has been a significant decrease in the price of stocks in the stock market. The decrease in the overall value of assets.

There exists a significant probability of encountering failure within the industry or other industries that share comparable levels of risk. Young companies, which often encounter challenges during their initial operational years and lack substantial financial backing, may ultimately face the risk of bankruptcy. According to Agustia et al., (2020); Rahmah & Kamilah, (2022); Son et al., (2019), there were significant reductions in dividend payments.

The Anticipatory Analysis of Financial Distress: A Study on Bankruptcy Prediction

At present, there exist multiple systems that companies can employ to address the issue of bankruptcy. These systems include the Altman (Z-score), Springate (S-score), Zmijewski (X-score), and Grove (G-score) models.

The model was initially formulated by Edward I. Altman in 1968 and subsequently revised in 1995. The objective of the modification was to mitigate the impact of industry-specific factors by incorporating the asset turnover variable (X5). According to Winarso Eddy and T.C.J Adriandra (2019), after excluding the asset turnover variable, the model becomes applicable for assessing bankruptcy in manufacturing and non-manufacturing firms.

In the current study, our empirical analysis focuses on the performance of the Z (Altman).
Metode Altman Z-Score:

$$Z'' = 6,56 X1 + 3,26 X2 + 6,72 X3 + 1,05 X4$$

Information:

Z'': Bankruptcy Index

X1: Working Capital: Total Asset

X2: Retained Earnings: Total Asset

X3: Earning Before Interest and Tax: Total Asset

X4: Book Value of Equity: Total Debt

METHOD

The study is descriptive in nature to describe and measure corporate bankruptcy (secondary data). The population is the number of companies indexed on LQ45 constantly from 2020 to 2022.

Research sample:

1. Companies listed on the LQ 45 stock index
2. Period 2020-2022 (continuously)
3. Companies other than the financial sector

Table 1. List of Company Samples for 2020-2022

NO	CODE	COMPANY NAME
1	ADRO	Adaro Energi Tbk
2	ANTM	Aneka Tambang (persero) Tbk
3	ASII	Astra Internasional Tbk
4	CPIN	Charoen Pokphand Indonesia Tbk
5	ERAA	Erajaya Swasembada Tbk
6	EXCL	XL Axiata Tbk
7	HMSP	H.M Sampoerna Tbk
8	ICBP	Indofood CBP Sukses Makmur Tbk
9	INCO	Vale Indonesia Tbk
10	INDF	Indofood Sukses Makmur Tbk
11	INKP	Indah Kiat Pulp & Paper Tbk
12	INTP	Indocement Tunggul Prakarsa Tbk
13	ITMG	Indo Tambang Raya Megah Tbk
14	JPFA	Japfa Comfeed Indonesia Tbk
15	KLBF	Kalbe Farma Tbk
16	MDKA	Merdeka Copper Gold Tbk
17	MIKA	Mitra keluarga Karya Sehat Tbk
18	MNCN	Media Nusantra Citra Tbk
19	PGAS	Perusahaan Gas Negara (persero) Tbk
20	PTBA	Tambang Batubara Bukit Asam Tbk
21	SMGR	Semen Indonesia Tbk
22	SMRA	Summarecon Agung Tbk
23	TBIG	Tower Bersama Infrastructure Tbk
24	TLKM	Telekomunikasi Indonesia (persero)
25	TOWR	Sarana Menora Nusantara Tbk
26	UNTR	United Tractors Tbk
27	UNVR	Unilever Indonesia Tbk
28	WIKA	Wijaya Karya (persero) Tbk

Source: www.idx.co.id (processed)

RESULTS AND DISCUSSION

Altman, Springate, Zmijewski, Grove model bankruptcy prediction

Table 2. Altman Z-score Model Calculation Values

NO	CODE	YEAR	S-SCORE	PREDICTION
1	ADRO	2020	0,488	Bankrupt
		2021	1,732	Healthy
		2022	3,056	Healthy
2	ASII	2020	0,713	Bankrupt
		2021	0,888	Healthy
		2022	1,096	Healthy
3	ANTM	2020	0,699	Bang
		2021	0,973	Healthy
		2022	1,213	Healthy
4	CPIN	2020	1,747	Healthy
		2021	1,603	Healthy
		2022	1,279	Healthy
5	ERAA	2020	1,806	Healthy
		2021	2,375	Healthy
		2022	1,671	Healthy
6	EXCL	2020	-0,006	Bankrupt
		2021	0,085	Bankrupt
		2022	0,111	Bankrupt
7	HMSP	2020	2,378	Healthy
		2021	1,924	Healthy
		2022	2,359	Healthy
8	ICBP	2020	1,306	Healthy
		2021	0,929	Healthy
		2022	1,108	Healthy
9	INCO	2020	3,914	Healthy
		2021	5,620	Healthy
		2022	6,260	Healthy
10	INDF	2020	0,795	Bankrupt
		2021	0,784	Bankrupt
		2022	0,857	Bankrupt
11	INKP	2020	0,690	Bankrupt
		2021	0,855	Healthy
		2022	1,154	Healthy
12	INTP	2020	1,089	Healthy
		2021	1,069	Healthy

		2022	1,057	Healthy
13	ITMG	2020	1,190	Healthy
		2021	3,158	Healthy
		2022	4,604	Healthy
14	JPFA	2020	1,180	Healthy
		2021	1,444	Healthy
		2022	1,158	Healthy
15	KLBF	2020	2,108	Healthy
		2021	2,167	Healthy
		2022	2,056	Healthy
16	MDKA	2020	0,529	Bankrupt
		2021	0,626	Bankrupt
		2022	0,336	Bankrupt
17	MIKA	2020	2,546	Healthy
		2021	2,877	Healthy
		2022	2,525	Healthy
18	MNCN	2020	1,598	Healthy
		2021	1,907	Healthy
		2022	1,777	Healthy
19	PGAS	2020	0,434	Bankrupt
		2021	0,892	Healthy
		2022	0,965	Healthy
20	PTBA	2020	1,443	Healthy
		2021	2,421	Healthy
		2022	2,783	Healthy
21	SMGR	2020	0,531	Healthy
		2021	0,491	Healthy
		2022	0,536	Healthy
22	SMRA	2020	0,315	Bankrupt
		2021	0,485	Bankrupt
		2022	0,434	Bankrupt
23	TBIG	2020	0,144	Bankrupt
		2021	0,219	Bankrupt
		2022	0,260	Bankrupt
24	TLKM	2020	0,979	Healthy
		2021	1,078	Healthy
		2022	0,902	Healthy
25	TOWR	2020	0,575	Bankrupt
		2021	0,136	Bankrupt
		2022	0,310	Bankrupt
26	UNTR	2020	0,918	Healthy

		2021	1,265	Healthy
		2022	1,728	Healthy
27	UNVR	2020	2,441	Healthy
		2021	2,174	Healthy
		2022	2,156	Healthy
28	WIKA	2020	0,172	Bankrupt
		2021	0,118	Bankrupt
		2022	0,172	Bankrupt
	2020K	Healthy		16
		Grey area		0
		Bankrupt		12
		Amount		28
	2021	Healthy		21
		Grey area		0
		Bankrupt		7
		Amount		28
	2022	Healthy		21
		Grey area		0
		Bankrupt		7
		Amount		28

Source: Financial Report (processed)

The Altman Z-score is a financial metric developed by Edward Altman in 1968. It is used to assess the financial

In the year 2020, a total of 23 companies were classified as healthy, two companies fell into the grey area category, and three companies declared bankruptcy. In the year 2021, a total of 23 companies were classified as healthy, while one company fell into the grey area, and four companies declared bankruptcy. In the year 2022, a total of 23 companies were classified as healthy, while one fell into the grey area, and four companies declared bankruptcy.

Table 3. Springate S-Score Model Calculation Values

NO	CODE	YEAR	S-SCORE	PREDICTION
1	ADRO	2020	0,488	Bankrupt
		2021	1,732	Healthy
		2022	3,056	Healthy
2	ASII	2020	0,713	Bankrupt
		2021	0,888	Healthy
		2022	1,096	Healthy
3	ANTM	2020	0,699	Bang
		2021	0,973	Healthy

		2022	1,213	Healthy
4	CPIN	2020	1,747	Healthy
		2021	1,603	Healthy
		2022	1,279	Healthy
5	ERAA	2020	1,806	Healthy
		2021	2,375	Healthy
		2022	1,671	Healthy
6	EXCL	2020	-0,006	Bankrupt
		2021	0,085	Bankrupt
		2022	0,111	Bankrupt
7	HMSP	2020	2,378	Healthy
		2021	1,924	Healthy
		2022	2,359	Healthy
8	ICBP	2020	1,306	Healthy
		2021	0,929	Healthy
		2022	1,108	Healthy
9	INCO	2020	3,914	Healthy
		2021	5,620	Healthy
		2022	6,260	Healthy
10	INDF	2020	0,795	Bankrupt
		2021	0,784	Bankrupt
		2022	0,857	Bankrupt
11	INKP	2020	0,690	Bankrupt
		2021	0,855	Healthy
		2022	1,154	Healthy
12	INTP	2020	1,089	Healthy
		2021	1,069	Healthy
		2022	1,057	Healthy
13	ITMG	2020	1,190	Healthy
		2021	3,158	Healthy
		2022	4,604	Healthy
14	JPFA	2020	1,180	Healthy
		2021	1,444	Healthy
		2022	1,158	Healthy
15	KLBF	2020	2,108	Healthy
		2021	2,167	Healthy
		2022	2,056	Healthy
16	MDKA	2020	0,529	Bankrupt
		2021	0,626	Bankrupt
		2022	0,336	Bankrupt
17	MIKA	2020	2,546	Healthy

		2021	2,877	Healthy
		2022	2,525	Healthy
18	MNCN	2020	1,598	Healthy
		2021	1,907	Healthy
		2022	1,777	Healthy
19	PGAS	2020	0,434	Bankrupt
		2021	0,892	Healthy
		2022	0,965	Healthy
20	PTBA	2020	1,443	Healthy
		2021	2,421	Healthy
		2022	2,783	Healthy
21	SMGR	2020	0,531	Healthy
		2021	0,491	Healthy
		2022	0,536	Healthy
22	SMRA	2020	0,315	Bankrupt
		2021	0,485	Bankrupt
		2022	0,434	Bankrupt
23	TBIG	2020	0,144	Bankrupt
		2021	0,219	Bankrupt
		2022	0,260	Bankrupt
24	TLKM	2020	0,979	Healthy
		2021	1,078	Healthy
		2022	0,902	Healthy
25	TOWR	2020	0,575	Bankrupt
		2021	0,136	Bankrupt
		2022	0,310	Bankrupt
26	UNTR	2020	0,918	Healthy
		2021	1,265	Healthy
		2022	1,728	Healthy
27	UNVR	2020	2,441	Healthy
		2021	2,174	Healthy
		2022	2,156	Healthy
28	WIKA	2020	0,172	Bankrupt
		2021	0,118	Bankrupt
		2022	0,172	Bankrupt
	2020	Healthy		16
		Gray area		0
		Bankrupt		12
		Amount		28
	2021	Healthy		21
		Gray area		0

		Bankrupt	7
		Amount	28
	2022	Healthy	21
		Gray area	0
		Bankrupt	7
		Amount	28

Source: Financial Report (processed)

Springate (S-score)

Year 2020: Healthy: 16 companies; Gray area:0 ; Bankrupt: 12 companies. Year 2021: Healthy: 21 companies; Gray area: 0; Bankrupt: 7 companies. Year 2022: Healthy: 21 companies; Gray area:0; Bankrupt 7 companies.

Table 4. Zmijewski X-score Model Calculation Values

NO	CODE	YEAR	S-SCORE	PREDICTION
1	ADRO	2020	-2,247	Healthy
		2021	-2,567	Healthy
		2022	-3,240	Healthy
2	ASII	2020	-2,147	Healthy
		2021	-2,265	Healthy
		2022	-2,407	Healthy
3	ANTM	2020	-2,188	Healthy
		2021	-2,469	Healthy
		2022	-3,137	Healthy
4	CPIN	2020	-3,435	Healthy
		2021	-3,111	Healthy
		2022	-2,704	Healthy
5	ERAA	2020	-1,767	Healthy
		2021	-2,287	Healthy
		2022	-1,295	Healthy
6	EXCL	2020	-2,739	Healthy
		2021	-2,739	Healthy
		2022	-2,953	Healthy
7	HMSP	2020	-2,857	Healthy
		2021	-2,346	Healthy
		2022	-2,607	Healthy
8	ICBP	2020	-1,721	Healthy
		2021	-1,562	Healthy
		2022	-1,676	Healthy
9	INCO	2020	-0,459	Healthy
		2021	-1,410	Healthy

		2022	-2,321	Healthy
10	INDF	2020	-1,632	Healthy
		2021	-1,652	Healthy
		2022	-1,794	Healthy
11	INKP	2020	-1,559	Healthy
		2021	-1,897	Healthy
		2022	-2,324	Healthy
12	INTP	2020	-3,531	Healthy
		2021	-3,414	Healthy
		2022	-3,269	Healthy
13	ITMG	2020	-2,922	Healthy
		2021	-4,005	Healthy
		2022	-4,867	Healthy
14	JPFA	2020	-1,326	Healthy
		2021	-1,555	Healthy
		2022	-1,193	Healthy
15	KLBF	2020	-3,791	Healthy
		2021	-3,907	Healthy
		2022	-3,808	Healthy
16	MDKA	2020	-2,195	Healthy
		2021	-2,197	Healthy
		2022	-1,658	Healthy
17	MIKA	2020	-4,209	Healthy
		2021	-4,432	Healthy
		2022	-4,379	Healthy
18	MNCN	2020	-3,616	Healthy
		2021	-4,032	Healthy
		2022	-4,330	Healthy
19	PGAS	2020	-0,971	Healthy
		2021	-1,321	Healthy
		2022	-1,586	Healthy
20	PTBA	2020	-3,072	Healthy
		2021	-3,437	Healthy
		2022	-3,510	Healthy
21	SMGR	2020	-1,526	Healthy
		2021	-1,832	Healthy
		2022	-2,155	Healthy
22	SMRA	2020	-0,728	Healthy
		2021	-1,159	Healthy
		2022	-1,083	Healthy
23	TBIG	2020	-0,184	Healthy

		2021	-0,106	Healthy
		2022	-0,220	Healthy
24	TLKM	2020	-1,931	Healthy
		2021	-2,144	Healthy
		2022	-2,147	Healthy
25	TOWR	2020	-0,671	Healthy
		2021	0,118	Bankrupt
		2022	-0,094	Healthy
26	UNTR	2020	-5,062	Healthy
		2021	-5,116	Healthy
		2022	-5,107	Healthy
27	UNVR	2020	-1,542	Healthy
		2021	-1,253	Healthy
		2022	-1,164	Healthy
28	WIKA	2020	-0,021	Healthy
		2021	-0,051	Healthy
		2022	0,066	Bankrupt
	2020	Healthy		28
		Gray area		0
		Bankrupt		0
		Amount		28
	2021	Healthy		27
		Gray area		0
		Bankrupt		1
		Amount		28
	2022	Healthy		27
		Gray area		0
		Bankrupt		1
		Amount		28

Source: Financial Report (processed)

Zmijewski (X-score)

Year 2020: Healthy: 28 companies; gray area: 0; broke:0. Year 2021: Healthy: 27 companies; gray areas: 1; bankrupt: 0. Year 2022: Healthy: 27 companies; gray area:0; broke: 1.

Table 5. Calculation Value Of The Grover G-Score Model

NO	CODE	YEAR	G-Score	PREDICTION
1	ADRO	2020	0,269	Healthy
		2021	0,985	Healthy
		2022	1,905	Healthy
2	ASII	2020	0,502	Healthy
		2021	0,609	Healthy
		2022	0,712	Healthy
3	ANTM	2020	0,315	Healthy
		2021	0,629	Healthy
		2022	0,863	Healthy
4	CPIN	2020	0,950	Healthy
		2021	0,862	Healthy
		2022	0,682	Healthy
5	ERAA	2020	0,631	Healthy
		2021	0,786	Healthy
		2022	0,510	Healthy
6	EXCL	2020	-0,210	Gray area
		2021	-0,163	Gray area
		2022	-0,086	Gray area
7	HMSP	2020	1,627	Healthy
		2021	1,243	Healthy
		2022	1,302	Healthy
8	ICBP	2020	0,567	Healthy
		2021	0,553	Healthy
		2022	0,579	Healthy
9	INCO	2020	3,717	Healthy
		2021	5,095	Healthy
		2022	5,573	Healthy
10	INDF	2020	0,422	Healthy
		2021	0,457	Healthy
		2022	0,509	Healthy
11	INKP	2020	0,666	Healthy
		2021	0,755	Healthy
		2022	0,979	Healthy
12	INTP	2020	0,811	Healthy
		2021	0,769	Healthy
		2022	0,709	Healthy
13	ITMG	2020	0,842	Healthy
		2021	1,948	Healthy
		2022	2,868	Healthy

14	JPFA	2020	0,641	Healthy
		2021	0,798	Healthy
		2022	0,642	Healthy
15	KLBF	2020	2,108	Healthy
		2021	2,167	Healthy
		2022	2,056	Healthy
16	MDKA	2020	0,277	Healthy
		2021	0,443	Healthy
		2022	0,259	Healthy
17	MIKA	2020	1,335	Healthy
		2021	1,492	Healthy
		2022	1,175	Healthy
18	MNCN	2020	1,013	Healthy
		2021	1,139	Healthy
		2022	1,027	Healthy
19	PGAS	2020	0,315	Healthy
		2021	0,559	Healthy
		2022	0,592	Healthy
20	PTBA	2020	0,820	Healthy
		2021	1,518	Healthy
		2022	1,767	Healthy
21	SMGR	2020	0,287	Healthy
		2021	0,420	Healthy
		2022	0,464	Healthy
22	SMRA	2020	0,350	Healthy
		2021	0,539	Healthy
		2022	0,456	Healthy
23	TBIG	2020	-0,051	Gray area
		2021	0,005	Gray area
		2022	0,048	Healthy
24	TLKM	2020	0,371	Healthy
		2021	0,454	Healthy
		2022	0,316	Healthy
25	TOWR	2020	0,190	Healthy
		2021	-0,097	Gray area
		2022	0,016	Healthy
26	UNTR	2020	0,740	Healthy
		2021	1,054	Healthy
		2022	1,403	Healthy
27	UNVR	2020	0,849	Healthy
		2021	2,218	Healthy

		2022	5,085	Healthy
28	WIKA	2020	0,163	Healthy
		2021	0,071	Healthy
		2022	0,141	Healthy
		2020		Healthy
		Gray area	2	
		Bankrupt	0	
		Amount	28	
2021		Healthy	25	
		Gray area	3	
		Bankrupt	0	
		Amount	28	
2022		Healthy	27	
		Gray area	1	
		Bankrupt	0	
		Amount	28	

Source: Financial Report (processed)

Grove (G-score)

Year 2020: Healthy: 26 companies; gray area 2; Bankrupt: 0. Year 2021: Healthy: 25 companies; Gray area: 3 companies; Bankrupt: 0. Year 2022 Healthy: 27 companies; Gray area 1 company; Bankrupt: 0.

CONCLUSIONS

Conclusion

LQ45 indexed companies for the 2020-2022 period experiencing bankruptcy according to the model: Altman (Z-score), Springate (S-score), Zmijewski (X-score), and Grove (G-Score). The results of the study can be concluded as follows: Altman (Z-score), 2020: healthy 23, a gray area 2, broke 3; 2021: healthy 23, a gray area 1, bench 4; 2022: healthy 23, a gray area 1, broke 4. Springate (S-score) 2020: healthy 16, a gray area 0, bankrupt 12; 2021: healthy 21, a gray area 0, broke 7; 2022: healthy 21, a gray area 0, broke 7. Zmijewski (X-score) 2020: healthy 28, a gray area 0, bankrupt 0; 2021: healthy 27, a gray area 1, broke 0; 2022 healthy 27, a gray area 0, bankrupt 1. Grove (G-score) 2020: healthy 26, a gray area 2, bankrupt 0; 2021: healthy 25, a gray area 3, broke 0; 2022: healthy 27, a gray area 1, broke 0.

Suggestion

Suggestions for companies, investors, and further researchers are: Companies can perform bankruptcy prediction analysis to anticipate problems that will occur. before making investment decisions, investors can use information about financial statement analysis with bankruptcy predictions to minimize risk. It is better to invest in companies that are categorized as healthy. The next researcher adds another model and the research period.

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