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Comparative Analysis of Modified Altman Z-Score, Springate, Zmijewski, Bankometer, Grover, and RGEC Models for Financial Distress Prediction

(Empirical Study in Banking Companies Listed on IDX 2011-2016)

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Abstract

This study aimed at determining the prediction of financial distress in banking sector companies listed on the Indonesia Stock Exchange (IDX) with the research period of 2011-2016. This study utilized a quantitative approach. Determination of the sample was done by purposive sampling technique. The number of research samples consisted of 30 banking companies. The prediction models included Modified Altman Z-Score, Springate, Zmijewski, Bankometer, Grover, and RGEC. The results showed that (1) Modified Altman Z-Score analyzed that 16 samples were in the gray area criteria and 14 samples were in the bankrupt criteria (2) Springate analyzed 30 samples in the bankrupt criteria (3) Zmijewski analyzed 30 samples in the bankrupt criteria (4) Bankometer analyzed 30 samples in very healthy criteria (5) Grover analyzed 1 sample in gray area criteria and 29 samples in non-bankrupt criteria (6) RGEC analyzed 14 samples in very healthy criteria, 15 samples in healthy criteria, and 1 sample in the criteria of fairly healthy (7) The comparison between the results of the analysis of all models showed that the Modified Altman Z-Score, Springate, and Zmijewski models analyzed all samples included in the distress category.

Keywords: *Modified Altman Z-Score; Bankometer; Financial Distress; Grover; RGEC; Springate; Zmijewski*

Introduction

One of the indicators of development of a country or region in a certain period is its economic growth. Increased economic activity can be indicated by an increase in national income. Gross Domestic Product (GDP) is one of the concepts of national income that is often used to determine the economic growth (Sahara & Yanita, 2013). In 2012-2016, Indonesia's economic growth tended to decline. In 2012, the economic growth was 6.03%, while in 2013 Indonesia's economic growth fell to 5.56%. Moreover, in 2014, Indonesia's economic growth decreased again to 5.01% and fell to 4.88% in 2015. In 2016, its economic growth increased to 5.02% (World Bank Development Indicators, 2017). One of the most important elements in economic growth is the availability of capital to drive the real business sector in a

particular country (Jonnadi *et al.*, 2012). Banking as one of the pillars of the country's economy has an important role of its ability in the financial or capital sector to mobilize savings as a tool to encourage the economic growth of a country by driving the growth of the real sector (Indonesia Financial Services Authority, 2017). Additionally, the banking performance itself declined in 2012-2016. It was reflected in the decline in profit or ROA, where in 2013 ROA decreased to 3.08% from the previous ROA (3.13%) in 2012. In 2014, the value of ROA fell to 2.85%, while in 2015 it dropped again to 2,32% and 2.23% in 2016 (Indonesian Banking Statistics, 2017). Declining banking performance from 2012-2016 could affect Indonesia's overall economic growth in which the role of banks as a financial institution to drive the country's economy is very strategic. In addition, in 2013-2016, the national banking Non-Performing Loan (NPL) also experienced an upward trend when the credit growth and Third-Party Funds (TPF) declined. At the end of 2013, banking NPL was 1.7%, and increased to 2.9% in 2016. Furthermore, the credit growth at the end of 2013 was 21.6% which dropped to 7.9% in 2016.

The similar thing happened to TPF where at the end of 2013 it was 13.6% which dropped to 9.6% in 2016 (Indonesian Banking Statistics, 2018). The phenomenon of decreasing ROA, increasing NPL, and slowing credit growth caused the banking business to experience contraction. Ismawati and Istria (2015) identify each factor in assessing the soundness of a bank to predict financial distress, in which there are three variables that influence the financial distress including ROA, NPL, and LDR. Based on the Analysis of the Stability and Banking System of the Deposit Insurance Corporation in 2016, compared to other economic sectors in Indonesia, the Banking System was in the alert zone or weakened at the end of 2015. Financial distress indicators in the banking system can also be seen based on the Banking Systemic Risk Index (BSRI) issued by *Bank Indonesia* through the Financial Stability Review. It is shown on Figure 1.

Figure 1. Banking Systemic Risk Index (BSRI)
Source: Bank Indonesia, 2017

Although the level of risk in the banking system is different from what happened in 2008 when the global financial crisis occurred, the figure above shows that there is a tendency for an increase in the level of risk in 2013-2015. It is also indicated by the number of banks liquidated during the 2011-2016 period which increased than the period before 2011 and after 2016, as shown in Figure 2.

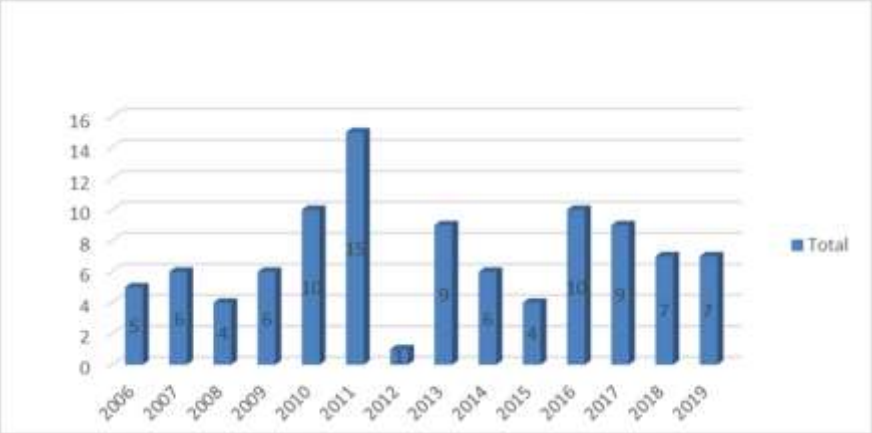

Figure 2. Liquidated Bank
Source: Bank Indonesia, 2019

Bank liquidation is the final stage in financial distress. Financial distress can be detected through several analysis models. In this study, the analysis models used were Modified Altman Z-Score, Springate, Zmijewski, Bankometer, Grover, and RGEC. For this reason, there were a number of issues to be examined in this study: (1) How the prediction of financial distress for banking sector companies listed on the Indonesia Stock Exchange in the 2011-2016 period with the Modified Altman Z-Score model is. (2) How the prediction of financial distress for banking sector companies listed on the Indonesia Stock Exchange in the 2011-2016 period with the Springate model is. (3) How the prediction of financial distress for banking sector companies listed on the Indonesia Stock Exchange in the 2011-2016 period with the Zmijewski model is. (4) How the prediction of financial distress for banking sector companies listed on the Indonesia Stock Exchange in the 2011-2016 period with the Bankometer model is. (5) How the prediction of financial distress for banking sector companies listed on the Indonesia Stock Exchange in the 2011-2016 period with the Grover model is. (6) How the prediction of financial distress for banking sector companies listed on the Indonesia Stock Exchange in the 2011-2016 period with the RGEC model is. (7) How the comparison of analysis between Modified Altman Z-Score, Springate, Zmijewski, Bankometer, Grover, and RGEC models in financial distress prediction in banking sector companies listed on the Indonesia Stock Exchange for the 2011-2016 period.

Previous Research

Kurniawati and Kholis (2016) conducted a study entitled "Analysis of Financial Distress Prediction Models in Islamic Banking Companies in Indonesia". This study utilized the Altman Z-Score, Grover, and Springate models. The results indicated that three models, namely the Altman Z-Score, Grover G-Score and the Springate S-Score can be used as a tool to predict financial distress in Islamic banking companies in Indonesia. In addition, the model that has the highest level of accuracy is the Grover G-Score model with an accuracy value of 96.36%.

Muhammad Iqbal *et al.*, (2018) conducted a research under the title "Mapping of the Level of Difficulties of Islamic Banks in Indonesia" This study used a Modified Altman Z-Score, Bankometer and RGEC models. The results of their research emphasized that Islamic banks in Indonesia are not indicated to experience financial difficulties, but these banks still have the potential to experience financial difficulties with different levels of financial difficulty between one Islamic bank and another Islamic bank. The measurement model of the level of financial difficulties used in this study provides different results in measuring financial difficulties in Islamic banks.

Hantono (2019) conducted a research entitled "Predicting Financial Distress by Using the Altman Z-Score, Grover, Zmijewski Models (Case Study in Banking Companies)". The results of his research showed that the three models namely Altman Z-Score, Grover G-Score and Zmijewski X-Score have differences in measuring the financial distress of banking companies in Indonesia, where the model that has the highest level of accuracy is the Zmijewski model with an accuracy value of 100%.

Methodology

Population and Sample

The population in this study was all banking sector companies listed on the Indonesia Stock Exchange, while the research sample was 30 companies with the criteria:

1) Commercial Banks registered on the IDX before 2011
2) Commercial Banks that did not experience delisting during the 2011-2016 period
3) Commercial Banks that did not experience a merger in the 2011-2016 period

Data Analysis Technique

1. Descriptive Data Analysis

a. Modified Altman Z-Score Model

The Modified Altman Z-Score model can be calculated using the formula (1). This model has the following cut-off values (Rudianto, 2013):

$Z < 1.1$ = bankrupt
$Z > 2.6$ = not bankrupt
$1.1 < Z < 2.6$ = gray area

b. Springate Model

The Springate model can be calculated using the formula (2). This model has the following cut-off values (Kurniawati, 2016):

$S < 0.862$ = bankrupt
$S \geq 0.862$ = not bankrupt

c. Zmijewski Model

The Zmijewski model can be calculated using the formula (3). This model has the following cut-off values (Priambodo & Pustikaningsih, 2017):

$X \geq 0$ = bankrupt
$X < 0$ = not bankrupt

d. Bankometer Model

The Bankometer model can be calculated using the formula (4). This model has the following cut-off values (Budiman et al., 2017):

S < 50% = financial distress
S > 70% = very healthy
50% < S < 70% = gray area

e. Grover Model

The Grover model can be calculated using the formula (5). This model has the following cut-off values (Kurniawati, 2016):

G ≤ -0.02 = bankrupt
G ≥ 0.01 = not bankrupt
-0.02 ≤ G ≤ 0.01 = gray area

f. RGEC Model

The RGEC model can be calculated using the formula (6). This model has the following cut-off values:

Value %	Composite Rating	Description
86-100	PK 1	Very Healthy
71-85	PK 2	Healthy
61-70	PK 3	Fairly Healthy
41-60	PK 4	Unhealthy
<40	PK 5	Not Healthy

Source: Refmasari, 2014

2. Analysis of Comparison of Financial Distress Prediction Models

After being calculated and analyzed with the Altman Z-Score model, Springate, Zmijewski, Bankometer, Grover, and RGEC, the values obtained are classified based on the cut-off point of each model, by which the criteria of values were obtained from each of these models. Furthermore, to compare the results of the analysis of all models, the equalization of criteria from all models had to first be made into a distress group and a non-distress group. The criteria for gray area, financial distress, bankruptcy, unhealthy, and not healthy were included in the distress group since all of these criteria gave an indication of financial issues even with different weights. On the other hand, the criteria of not bankrupt, fairly healthy, healthy, and very healthy were included in the non-distress group.

Results and Discussion

Calculation Results and Discussion of the Modified Altman Z-Score Model

Table 1. Result of the Modified Altman Z-Score model analyzes

Stock Code	Modified Altman Z-Score Model						Average	Criteria
	2011	2012	2013	2014	2015	2016		
AGRO	0.774	0.777	1.352	1.199	1.241	1.369	1.12	Gray area
BABP	0.356	0.579	0.440	0.735	0.880	0.911	0.65	Bankrupt
BACA	0.924	0.876	1.025	0.861	0.816	1.016	0.92	Bankrupt

Stock Code	Modified Altman Z-Score Model						Average	Criteria
	2011	2012	2013	2014	2015	2016		
BBCA	1.355	1.399	1.539	1.692	1.835	1.929	1.63	Gray area
BBKP	0.695	0.862	0.966	0.893	0.804	0.830	0.84	Bankrupt
BBNI	1.205	1.304	1.473	1.802	1.606	1.617	1.50	Gray area
BBNP	0.971	0.804	1.027	1.183	1.371	1.437	1.13	Gray area
BBRI	1.373	1.525	1.548	1.437	1.508	1.575	1.49	Gray area
BBTN	0.796	0.923	0.933	0.873	0.877	0.952	0.89	Bankrupt
BCIC	(1.279)	(1.097)	(1.874)	(2.166)	(2.322)	(1.953)	(1.78)	Bankrupt
BDMN	1.642	1.773	1.607	1.523	1.628	1.830	1.67	Gray area
BEKS	(0.229)	0.177	0.096	0.026	(0.628)	0.576	0.00	Bankrupt
BJBR	1.211	1.078	1.209	1.292	1.239	1.150	1.20	Gray area
BKSW	1.987	1.219	0.996	0.891	1.055	0.565	1.12	Gray area
BMRI	1.616	1.666	1.815	1.811	1.862	1.718	1.75	Gray area
BNBA	1.341	1.348	1.288	1.085	1.054	1.099	1.20	Gray area
BNGA	1.323	1.407	1.432	1.360	1.151	1.329	1.33	Gray area
BNII	0.884	0.999	0.953	1.059	1.075	1.089	1.01	Bankrupt
BNLI	0.315	0.735	0.561	0.960	0.340	0.387	0.55	Bankrupt
BSIM	0.486	0.890	1.183	1.108	0.905	1.009	0.93	Bankrupt
BSWD	1.123	1.564	1.350	1.126	1.129	0.323	1.10	Gray area
BTPN	1.943	2.067	2.286	2.442	2.412	2.419	2.26	Gray area
BVIC	0.957	0.969	1.243	1.148	1.025	1.007	1.06	Bankrupt
INPC	0.856	0.778	1.164	0.974	0.842	0.833	0.91	Bankrupt
MAYA	0.894	0.621	0.902	0.771	0.951	1.073	0.87	Bankrupt
MCOR	0.618	1.030	1.148	0.967	1.022	1.261	1.01	Bankrupt
MEGA	0.649	0.885	0.531	0.676	0.909	1.027	0.78	Bankrupt
NISP	1.162	1.221	1.400	1.471	1.391	1.341	1.33	Gray area
PNBN	1.378	1.361	1.358	1.482	1.493	1.577	1.44	Gray area
SDRA	0.917	0.903	3.159	1.581	1.462	1.420	1.57	Gray area

Source: Company financial statements (data processed)

The Modified Altman Z-Score model analyzes 16 sample companies that are included in the gray area criteria with the result of the model score between 1.1-2.6 which means that these companies are experiencing financial problems but it is not yet too heavy or bad. The remaining 14 sample companies are analyzed into the criteria for bankruptcy with a model score of <1.1, which means that these companies are experiencing financial problems and high potential for bankruptcy. However, the results of this study have been thwarted with evidence that the companies analyzed for high potential for bankruptcy can still survive in the current period. Therefore, this model can only be used as an early warning tool for early financial problems. It is because, in fact, bankruptcy cannot be based on financial statement analysis only, but there are still many other factors that can affect bankruptcy and the state of a company, as well as external factors from outside the company.

The Modified Altman Z-Score model uses 4 types of financial ratios, namely:

1. Working Capital to Total Assets (X1)

The WC/TA ratio is used to measure a company's ability to produce working capital from all of its total assets. According to the results of research conducted by Lakshan from Kelaniya University in Sri Lanka, the ideal standard size for WC/TA ratio is around 16% to 21%. If the ratio is lower, then the situation has the potential for bankruptcy. Improving the value of WC/TA ratios can be done by increasing sales or net income from operating results, bond sales and profits from short-term investments in the form of selling securities and reducing short-term debt that is not effectively utilized.

2. Retained Earnings to Total Assets (X2)

The RE/TA ratio is used to measure a company's ability to generate retained earnings from the total assets used. The age of the company affects this ratio because the longer the company operates with good profitability, it is possible to expedite or increase the accumulation of retained earnings. In addition, the size of the profits obtained each year also has an impact on increasing this ratio. Thus, to increase the value of the RE/TA ratio, the companies must increase revenue or net income or it could be through restrictions on dividend distribution made by the board of directors.

3. Earnings before Interest and Taxes to Total Assets (X3)

The EBIT/TA ratio is used to measure a company's ability to generate operating income from the total assets used. The smaller the value of this ratio, the more ineffective and inefficient the company is in using its entire assets to generate operating profit, and vice versa. To increase the value of the EBIT/TA ratio, the companies must increase sales or revenues and reduce the company's operating costs, so that operating profit can be increased to the maximum.

4. Book Value of Equity to Book Value of Total Debt (X4)

The BVOE/BVOTD ratio is used to measure the company's ability to meet its obligations through the book value of equity if the company is liquidated. To increase the value of the BVOE/BVOTD ratio, the companies must reduce short-term debt and long-term debt which are not used effectively, increase the book value of the company's equity through additional capital either through equity or through the issuance of new shares, and not distribute dividends to increase the amount retained earnings.

Results of Calculation and Discussion of the Springate Model

Table 2. Result of the Springate Model analyzes all samples (30) of companies

Stock Code	SPRINGATE S-SCORE						Average	Criteria
	2011	2012	2013	2014	2015	2016		
AGRO	0.186	0.178	0.251	0.230	0.228	0.240	0.218	Bankrupt
BABP	0.048	0.122	0.079	0.116	0.156	0.168	0.115	Bankrupt
BACA	0.165	0.167	0.190	0.165	0.162	0.188	0.173	Bankrupt
BBCA	0.274	0.267	0.284	0.311	0.335	0.334	0.301	Bankrupt
BBKP	0.157	0.180	0.195	0.173	0.161	0.164	0.172	Bankrupt
BBNI	0.246	0.259	0.291	0.341	0.279	0.284	0.283	Bankrupt

Stock Code	SPRINGATE S-SCORE						Average	Criteria
	2011	2012	2013	2014	2015	2016		
BBNP	0.189	0.163	0.193	0.217	0.228	0.208	0.200	Bankrupt
BBRI	0.304	0.324	0.323	0.289	0.293	0.293	0.304	Bankrupt
BBTN	0.187	0.194	0.194	0.172	0.181	0.189	0.186	Bankrupt
BCIC	0.188	0.142	(0.172)	(0.038)	(0.072)	(0.022)	0.004	Bankrupt
BDMN	0.338	0.360	0.309	0.267	0.277	0.313	0.311	Bankrupt
BEKS	(0.047)	0.150	0.108	0.053	(0.140)	(0.292)	(0.028)	Bankrupt
BJBR	0.264	0.231	0.265	0.261	0.256	0.223	0.250	Bankrupt
BKSW	0.301	0.159	0.154	0.165	0.200	0.007	0.164	Bankrupt
BMRI	0.322	0.325	0.348	0.338	0.337	0.280	0.325	Bankrupt
BNBA	0.217	0.241	0.229	0.193	0.172	0.186	0.206	Bankrupt
BNGA	0.273	0.285	0.274	0.223	0.163	0.206	0.237	Bankrupt
BNII	0.180	0.205	0.197	0.184	0.193	0.203	0.194	Bankrupt
BNLI	0.104	0.159	0.133	0.187	0.062	(0.066)	0.096	Bankrupt
BSIM	0.114	0.196	0.218	0.189	0.162	0.197	0.179	Bankrupt
BSWD	0.233	0.299	0.271	0.234	0.131	(0.333)	0.139	Bankrupt
BTPN	0.411	0.431	0.454	0.449	0.423	0.411	0.430	Bankrupt
BVIC	0.197	0.188	0.231	0.195	0.168	0.162	0.190	Bankrupt
INPC	0.184	0.129	0.220	0.175	0.144	0.126	0.163	Bankrupt
MAYA	0.193	0.158	0.203	0.173	0.205	0.213	0.191	Bankrupt
MCOR	0.126	0.221	0.215	0.170	0.181	0.194	0.184	Bankrupt
MEGA	0.165	0.203	0.124	0.150	0.193	0.210	0.174	Bankrupt
NISP	0.212	0.216	0.238	0.252	0.237	0.227	0.231	Bankrupt
PNBN	0.257	0.247	0.240	0.258	0.232	0.248	0.247	Bankrupt
SDRA	0.223	0.214	0.469	0.191	0.227	0.223	0.258	Bankrupt

Source: Company financial statements (data processed)

The Springate Model analyzes all samples (30) of companies that fall into the bankrupt criteria with a score <0.862. This result is not in accordance with the existing reality, because the company analyzed has high potential for bankruptcy can still survive in the current period. Therefore, this model can only be used as an early warning tool for early financial problems. This is because, in fact, bankruptcy cannot be based on financial statement analysis only, but there are still many other factors that can affect bankruptcy and the state of a company, as well as external factors from outside the company.
The Springate (S-Score) model uses 4 types of financial ratios, namely:

1. Working Capital to Total Assets (A)

The WC/TA ratio is used to measure a company's ability to produce working capital from all of its total assets. According to the results of a research conducted by Lakshan from Kelaniya University in Sri Lanka, the ideal standard size for WC/TA ratio is around 16% to 21%. If the ratio is lower, then the situation has the potential for bankruptcy. Improving the value of WC/TA ratios can be done by increasing sales or net income from operating results, bond sales and profits from short-term investments in the form of the sale of securities as well as reducing short-term debt that is not effectively utilized.

2. Net Profit Before Interest and Taxes to Total Asset (B)

The EBIT/TA ratio is used to measure a company's ability to generate operating income from the total assets used. The smaller the value of this ratio, the more ineffective and inefficient the company is in using its overall assets to generate operating profit, and vice versa. Increasing the value of the company's EBIT/TA ratio must be done by increasing sales or revenue and reducing company operating costs, so that operating profit can be increased to the maximum.

3. Net Profit before Taxes to Current Liabilities (C)

The EBT/CL ratio is used to measure a company's ability to finance its current debt through pre-tax profits generated by the company. The greater the value of this ratio shows the better the company's ability to control its current debt. To improve the value of the EBT/CL ratio, a company must reduce its short-term debt which is not effective, increase sales or revenue of the company, and minimize operational costs so that the company's operating profit can be higher.

4. Sales to Total Assets (D)

The S/TA ratio is used to measure management efficiency in using company assets to generate sales. The greater the value of this ratio, the better. The low value of Sales to Total Assets ratio indicates that the company does not generate enough sales based on the total amount of its assets. To improve the value of the S/TA ratio, the company must increase its sales, delete some assets, or a combination of these steps.

Calculation Results and Discussion of Zmijewski Model

Table 3. Result of the Zmijewski model analyzes all samples (30) of companies

Stock code	Zmijewski X-Score						Average	Kriteria
	2011	2012	2013	2014	2015	2016		
AGRO	0.784	0.834	0.418	0.555	0.430	0.385	0.6	Bankrupt
BABP	0.968	0.848	0.908	0.675	0.590	0.580	0.8	Bankrupt
BACA	0.630	0.696	0.627	0.759	0.868	0.838	0.7	Bankrupt
BBCA	0.641	0.595	0.532	0.437	0.368	0.279	0.5	Bankrupt
BBKP	0.901	0.905	0.825	0.862	0.895	0.833	0.9	Bankrupt
BBNI	0.587	0.556	0.587	(0.123)	0.240	0.267	0.4	Bankrupt
BBNP	0.843	0.890	0.747	0.664	0.569	0.505	0.7	Bankrupt
BBRI	0.647	0.572	0.520	0.565	0.531	0.444	0.5	Bankrupt
BBTN	0.871	0.816	0.840	0.877	0.887	0.831	0.9	Bankrupt
BCIC	0.871	0.887	1.209	1.172	1.195	1.117	1.1	Bankrupt
BDMN	0.248	0.050	0.318	0.372	0.299	0.117	0.2	Bankrupt
BEKS	1.066	0.883	0.893	1.054	1.349	0.805	1.0	Bankrupt
BJBR	0.752	0.589	0.768	0.431	0.514	0.492	0.6	Bankrupt
BKSW	(0.029)	0.365	0.613	0.746	0.832	0.702	0.5	Bankrupt
BMRI	0.645	0.595	0.589	0.233	0.202	0.157	0.4	Bankrupt
BNBA	0.415	0.467	0.538	0.685	0.286	0.308	0.4	Bankrupt
BNGA	0.682	0.644	0.633	0.655	0.703	0.550	0.6	Bankrupt

Stock code	Zmijewski X-Score						Average	Kriteria
	2011	2012	2013	2014	2015	2016		
BNII	0.886	0.872	0.842	0.798	0.793	0.683	0.8	Bankrupt
BNLI	0.831	0.809	0.863	0.831	0.803	0.908	0.8	Bankrupt
BSIM	0.922	0.641	0.439	0.515	0.615	0.524	0.6	Bankrupt
BSWD	0.342	0.459	0.574	0.689	0.385	0.456	0.5	Bankrupt
BTPN	0.574	0.498	0.340	0.199	0.103	0.010	0.3	Bankrupt
BVIC	0.739	0.748	0.542	0.591	0.588	0.540	0.6	Bankrupt
INPC	1.029	0.845	0.647	0.713	0.755	0.421	0.7	Bankrupt
MAYA	0.604	0.714	0.751	0.892	0.781	0.674	0.7	Bankrupt
MCOR	0.878	0.667	0.606	0.659	0.567	0.273	0.6	Bankrupt
MEGA	0.869	0.753	0.836	0.760	0.364	0.330	0.7	Bankrupt
NISP	0.711	0.699	0.554	0.513	0.563	0.533	0.6	Bankrupt
PNBN	0.595	0.650	0.635	0.561	0.398	0.360	0.5	Bankrupt
SDRA	0.786	0.923	(0.261)	0.003	0.158	0.223	0.3	Bankrupt

Source: Company financial statements (data processed)

The Zmijewski model analyzes all samples (30) of companies that fall into the criteria of bankruptcy with a score of > 0. This result is not in line with the reality, because the company analyzed has high potential for bankruptcy can still survive in the current period. Therefore, this model can only be used as an early warning tool for early financial problems. This is because, in fact, bankruptcy cannot be based on financial statement analysis alone, but there are still many other factors that can affect bankruptcy and the state of a company, as well as external factors originating from outside the company. The Zmijewski (X-Score) model uses 3 types of financial ratios, including:

1. Net Income to Total Assets (X1)

The NI/TA ratio is used to measure how efficiently a company is using all of its assets to generate net income. To increase the value of the NI/TA ratio, the company must increase its efficiency and reduce bank operating costs which can increase the company's net profit.

2. Total Liabilities to Total Assets (X2)

The TL/TA ratio is used to measure how much the company's assets are financed by debt. A fairly high level of ratio can have an impact on the level of security of funds in the bank, because the lower the value of this ratio, the better the level of security of funds. The improvement in the value of the TL/TA ratio can be done by making efficiency or selling fixed assets that can increase the company's capital or equity and reduce debts other than deposits or the third party's funds from customers.

3. Current Asset to Current Liabilities (X3)

The CA/CL ratio is used to measure a company's ability to pay its short-term liabilities using current assets. If the value of the CA/CL ratio is low, then the company can improve it by increasing the company's cash and cash equivalents or reducing short-term loans that are not effective for the company.

Calculation Results and Discussion of the Bankometer Model

Table 4. Result of the Bankometer model analyzes

Stock Code	Bankometer Score						Average	Criteria
	2011	2012	2013	2014	2015	2016		
AGRO	124.28	119.83	167.20	152.48	165.89	171.87	150	Very healthy
BABP	115.65	120.23	125.73	158.21	151.17	155.52	138	Very healthy
BACA	145.01	129.68	140.85	123.30	126.59	138.78	134	Very healthy
BBCA	106.45	115.49	125.11	132.49	145.27	158.25	131	Very healthy
BBKP	111.50	125.93	126.02	122.67	117.84	123.64	121	Very healthy
BBNI	130.30	130.34	124.06	131.79	147.02	145.04	135	Very healthy
BBNP	122.27	113.89	132.28	141.78	156.41	168.51	139	Very healthy
BBRI	113.97	125.97	130.91	131.80	144.99	157.34	134	Very healthy
BBTN	119.13	129.39	124.45	123.45	129.37	142.02	128	Very healthy
BCIC	118.84	108.89	149.56	202.04	186.91	141.10	151	Very healthy
BDMN	141.72	145.63	139.00	140.78	150.06	158.64	146	Very healthy
BEKS	135.55	123.96	120.77	117.49	117.23	212.80	138	Very healthy
BJBR	123.82	119.50	122.62	124.21	124.16	133.53	125	Very healthy
BKSW	276.66	210.15	162.56	133.13	140.69	152.94	179	Very healthy
BMRI	117.79	120.43	119.49	125.19	136.62	149.62	128	Very healthy
BNBA	153.07	148.93	143.69	131.07	186.75	180.83	157	Very healthy
BNGA	121.32	126.88	128.35	132.92	134.59	145.78	132	Very healthy
BNII	112.40	114.59	115.77	133.07	124.57	134.93	123	Very healthy
BNLI	121.62	132.20	123.87	121.08	126.52	125.94	125	Very healthy
BSIM	106.93	135.75	156.96	144.93	123.46	133.75	134	Very healthy
BSWD	163.56	153.68	124.12	114.84	161.71	222.32	157	Very healthy
BTPN	145.03	151.18	159.91	166.89	173.75	178.75	163	Very healthy
BVIC	112.38	126.96	129.51	135.49	136.17	154.32	132	Very healthy
INPC	114.35	140.06	143.63	141.58	136.98	168.93	141	Very healthy
MAYA	129.87	109.87	123.34	104.04	116.20	121.57	117	Very healthy
MCOR	117.88	127.83	134.00	135.41	146.81	170.45	139	Very healthy
MEGA	101.49	118.41	120.56	121.27	159.53	170.52	132	Very healthy
NISP	125.43	133.62	148.60	148.23	143.07	143.52	140	Very healthy
PNBN	132.13	121.17	127.03	131.78	156.11	154.88	137	Very healthy
SDRA	116.21	119.06	155.82	165.95	155.19	147.73	143	Very healthy

Source: Company financial statements (data processed)

The Bankometer model analyzes all samples (30) of companies that are in very healthy criteria with a calculation value greater than 70%. This result indicates that banking sector companies in reality can still run their operational activities well and are far from the risk of bankruptcy.
The Bankometer model uses 6 types of financial ratios, namely:

1. Capital to Asset Ratio (CA)

CA ratio is used to measure the company's capital adequacy to meet the needs of its assets. This ratio has a standard above 4%. If the value of the CA ratio is below the standard, then the company can fix it by increasing the company's capital which can be conducted by releasing shares or adding paid-up capital by the company owner.

2. Equity to Asset Ratio (EA)

The EA ratio is used to measure how much the proportion of assets that are self-financed from the capital and company retained earnings. This ratio has standards above 2%. If the value of the EA ratio is below the standard, then the company can fix it by delaying the distribution of dividends to shareholders so that the amount of retained earnings increases, or by increasing sales so that the amount of profit for the current year can increase.

3. Capital Adequacy Ratio (CAR)

CAR ratio is used to measure the company's capital adequacy in covering possible losses in credit and securities trading activities. The CAR standard ratio required for banks is above 8%. To improve or maintain the value of the CAR ratio to be at an ideal figure, the bank needs to make additional capital through both capital from shareholders and through the issuance of new shares through the IDX. In addition, the banking institution should not only focus on increasing the number of high-risk assets that do not contribute to revenue generation, such as land, buildings, equipment, and machinery, but it is better to increase the type of credit assets which, despite having a high risk, credit contributes to the bank's operating income and profitability.

4. Nonperforming Loan Ratio (NPL)

The NPL ratio is used to calculate the level of comparison between bad loans and total loans. The standard NPL ratio allowed by *Bank Indonesia* is below 5%. To improve or maintain the value of the NPL ratio, the bank needs to restructure loans which are included in the collectibility of loss and collect for loans classified as doubtful and substandard.

5. Cost to Income Ratio (CI)

CI ratio is used to measure how efficient the costs incurred to generate revenue. This ratio has a standard below 40%. To improve the value of the CI ratio, the companies must take corrective and efficiency measures on the costs incurred in obtaining income. In addition, the companies can diversify sources of income which can be done through fee-based income or tightening operational costs.

6. Loan to Asset Ratio (LA)

The LA ratio is used to measure the proportion of assets financed through loans by companies. This ratio has a standard below 65%. To improve the LA ratio value, the company must maintain the smooth management of credit in order to meet the needs and support the smooth running of each company's activities. By the smooth activities, it is expected to increase the company's revenue or net profit.

Calculation Results and Discussion of Grover Model

Table 5. Results of the Grover Model Analyzes

Stock Code	Grover G-Score						Average	Criteria
	2011	2012	2013	2014	2015	2016		
AGRO	0.255	0.250	0.362	0.326	0.323	0.349	0.31	not bankrupt
BABP	0.100	0.185	0.144	0.208	0.250	0.261	0.19	not bankrupt
BACA	0.244	0.240	0.274	0.235	0.228	0.273	0.25	not bankrupt
BBCA	0.346	0.344	0.370	0.398	0.423	0.435	0.39	not bankrupt
BBKP	0.205	0.244	0.261	0.236	0.216	0.219	0.23	not bankrupt
BBNI	0.324	0.340	0.382	0.444	0.382	0.387	0.38	not bankrupt
BBNP	0.259	0.220	0.267	0.292	0.316	0.306	0.28	not bankrupt
BBRI	0.365	0.393	0.386	0.351	0.357	0.363	0.37	not bankrupt
BBTN	0.252	0.268	0.267	0.242	0.247	0.263	0.26	not bankrupt
BCIC	0.253	0.203	(0.064)	0.055	0.020	0.062	0.09	not bankrupt
BDMN	0.403	0.428	0.378	0.340	0.355	0.389	0.38	not bankrupt
BEKS	(0.004)	0.140	0.092	0.058	(0.113)	(0.203)	(0.01)	gray area
BJBR	0.341	0.305	0.336	0.343	0.334	0.303	0.33	not bankrupt
BKSW	0.472	0.289	0.265	0.257	0.300	0.108	0.28	not bankrupt
BMRI	0.430	0.433	0.465	0.454	0.451	0.394	0.44	not bankrupt
BNBA	0.301	0.321	0.305	0.261	0.231	0.246	0.28	not bankrupt
BNGA	0.357	0.371	0.362	0.314	0.246	0.291	0.32	not bankrupt
BNII	0.248	0.281	0.268	0.271	0.278	0.278	0.27	not bankrupt
BNLI	0.134	0.228	0.182	0.271	0.095	0.041	0.16	not bankrupt
BSIM	0.160	0.250	0.300	0.272	0.228	0.256	0.24	not bankrupt
BSWD	0.284	0.400	0.353	0.298	0.227	(0.143)	0.24	not bankrupt
BTPN	0.501	0.523	0.560	0.565	0.538	0.531	0.54	not bankrupt
BVIC	0.266	0.258	0.329	0.290	0.254	0.246	0.27	not bankrupt
INPC	0.276	0.227	0.309	0.252	0.213	0.190	0.24	not bankrupt
MAYA	0.249	0.189	0.261	0.226	0.267	0.286	0.25	not bankrupt
MCOR	0.190	0.296	0.307	0.249	0.256	0.293	0.27	not bankrupt
MEGA	0.207	0.253	0.173	0.199	0.237	0.262	0.22	not bankrupt
NISP	0.299	0.313	0.349	0.359	0.338	0.320	0.33	not bankrupt
PNBN	0.346	0.340	0.331	0.350	0.327	0.348	0.34	not bankrupt
SDRA	0.271	0.271	0.636	0.312	0.311	0.304	0.35	not bankrupt

Source: Company financial statements (data processed)

The Grover model analyzes 1 company within the gray area criteria with a score between -0.02 to 0.01. It means that the company is experiencing financial problems, but it is not too heavy yet. The remaining 29 company samples analyzed by the Grover model are in the criteria of not going bankrupt with a score of more than 0.01. These results indicate that banking sector companies, in fact, are still able to carry out operational activities well and far from the risk of bankruptcy.

The Grover (G-Score) model uses 3 types of financial ratios, namely:

1. Working Capital to Total Assets (X1)

The WC/TA ratio is used to measure a company's ability to produce working capital from all of its total assets. According to the results of a research conducted by Lakshan of Kelaniya University in Sri Lanka, the ideal standard size for WC/TA ratio is around 16% to 21%. If the ratio is lower, then the situation has the potential for bankruptcy. The improvements in the value of WC/TA ratios can be done by increasing sales or net income from operating results, bond sales and profits from short-term investments in the form of securities sales, and reducing short-term debt that is not effectively utilized.

2. Earnings Before Interest and Taxes to Total Assets (X3)

The EBIT/TA ratio is used to measure a company's ability to generate operating income from the total assets used. The smaller the value of this ratio, the more ineffective and inefficient the company is in using its overall assets to generate operating profit, and vice versa. To increase the value of the EBIT/TA ratio, the companies must increase sales or revenues and reduce the company's operating costs, so that operating profit can be increased to the maximum.

3. Net Income to Total Assets (ROA)

The NI/TA ratio is used to measure how efficiently a company is using all of its assets to generate net income. To increase the value of the NI/TA ratio, the company must increase its efficiency and reduce bank operating costs which can increase the company's net profit.

Calculation Results and Discussion of the RGEC Model

Table 6. Result of the RGEC Model Analyzes

STOCK CODE	RGEC						RATA-RATA	PK	KRITERIA
	2011	2012	2013	2014	2015	2016			
AGRO	87%	93%	87%	83%	83%	83%	86%	1	Very Healthy
BABP	77%	77%	77%	70%	77%	77%	76%	2	Healthy
BACA	73%	77%	87%	77%	73%	70%	76%	2	Healthy
BBCA	97%	97%	100%	100%	100%	100%	99%	1	Very Healthy
BBKP	80%	87%	83%	83%	80%	80%	82%	2	Healthy
BBNI	100%	100%	90%	90%	90%	90%	93%	1	Very Healthy
BBNP	83%	93%	93%	83%	77%	80%	85%	2	Healthy
BBRI	100%	100%	93%	100%	93%	90%	96%	1	Very Healthy
BBTN	87%	83%	77%	73%	77%	80%	79%	2	Healthy
BCIC	80%	77%	57%	57%	60%	67%	66%	3	Fairly Healthy
BDMN	90%	87%	90%	87%	87%	90%	88%	1	Very Healthy
BEKS	73%	83%	77%	67%	63%	67%	72%	2	Healthy
BJBR	97%	93%	87%	87%	90%	90%	91%	1	Very Healthy
BKSW	87%	73%	77%	83%	77%	70%	78%	2	Healthy
BMRI	100%	97%	97%	100%	93%	90%	96%	1	Very Healthy
BNBA	93%	97%	97%	93%	93%	90%	94%	1	Very Healthy
BNGA	93%	93%	90%	87%	80%	80%	87%	1	Very Healthy
BNII	87%	90%	87%	77%	77%	80%	83%	2	Healthy
BNLI	97%	90%	83%	80%	77%	73%	83%	2	Healthy
BSIM	87%	90%	90%	87%	87%	93%	89%	1	Very Healthy
BSWD	90%	90%	90%	87%	70%	70%	83%	2	Healthy

BTPN	93%	93%	90%	90%	90%	90%	91%	1	Very Healthy
BVIC	87%	90%	90%	80%	80%	77%	84%	2	Healthy
INPC	87%	80%	87%	80%	83%	77%	82%	2	Healthy
MAYA	97%	90%	90%	87%	90%	90%	91%	1	Very Healthy
MCOR	80%	90%	90%	83%	80%	77%	83%	2	Healthy
MEGA	90%	80%	77%	87%	87%	80%	83%	2	Healthy
NISP	87%	87%	83%	83%	83%	83%	84%	2	Healthy
PNBN	93%	87%	83%	83%	83%	87%	86%	1	Very Healthy
SDRA	97%	93%	87%	80%	83%	80%	87%	1	Very Healthy

Source: Company financial statements (data processed)

The RGEC model analyzes 14 companies that are in the "Very Healthy (PK 1)" criteria, 15 companies in the "Healthy (PK 2)" criteria, and 1 company in the "Fairly Healthy (PK 3)" criteria. In this RGEC model, there are no samples analyzed that have financial problems or fall within the criteria of "Poor Health" or "Unhealthy." The predicted results of the RGEC model show that the banking sector companies sampled can still carry out their operational activities well and are far from the risk of bankruptcy.

The RGEC model measures the soundness of a bank by looking at 4 indicators. The Risk Profile Indicator is represented by the ratio of NPL and LDR. Good Corporate Governance (GCG) indicators are measured from the results of self-assessment conducted by the bank concerned. Earning indicator is represented by the ratio of ROA and NIM. The Capital indicator is represented by the CAR ratio.

1. Nonperforming Loan Ratio (NPL)

The NPL ratio is used to calculate the level of comparison between bad loans and total loans. The standard NPL ratio allowed by *Bank Indonesia* is below 5%. To improve or maintain the value of the NPL ratio, the bank needs to restructure loans that are included in the collectibility of bad debts and to collect loans for loans classified as doubtful and substandard.

2. Loan to Deposit Ratio (LDR)

The LDR ratio is used to measure a company's ability to meet short-term obligations. The LDR standard according to *Bank Indonesia* is between 60% to 100%. If the bank's LDR value is lower than the standard, then the bank must deposit the Reserve Requirements (RR) more, and vice versa; if the bank's LDR is far above the standard, the bank needs to lower it to the limit considered ideal.

3. Good Corporate Governance (GCG)

GCG indicators are measured from the results of self-assessments conducted by the bank concerned in evaluating the quality of its management on the implementation of GCG principles.

4. Return on Assets (ROA)

ROA ratio is used to measure how efficient a company is in using all of its assets to generate net income. The smaller the value of this ratio, the more ineffective and inefficient the company is in using its

entire assets to generate net income, and vice versa. To increase the value of the ROA ratio, the companies must increase efficiency and reduce operating costs that can increase the company's net profit.

5. Net Interest Margin (NIM)

The NIM ratio is used to measure how much a company's ability to manage all its productive assets to generate net interest income. The specified NIM ratio is above 1.5%. To improve or maintain the value of the NIM ratio to remain at an ideal value, the bank needs to maintain net profit growth supported by high business activity in both the credit and other services. In addition, it can be done by reducing the cost of funds.

6. Capital Adequacy Ratio (CAR)

CAR ratio is used to measure the company's capital adequacy in covering possible losses in credit and securities trading activities. The CAR standard ratio required for banks is above 8%. To improve or maintain the value of the CAR ratio in order to remain in ideal values or numbers, banks need to make additional capital either through capital from shareholders or through the issuance of new shares through the IDX. In addition, the banking institution should not only focus on increasing the number of high-risk assets that do not contribute to the acquisition of income, such as land, buildings, equipment, and machinery, but also by increasing the types of credit assets that despite having a high risk, credit contributes to bank operating income and profitability.

Analysis of Model Comparison Results

Table 7. The Comparison Results of the Analysis

Stock Code	Model					
	Z-Score	S-Score	X-Score	Bankometer	G-Score	RGEC
AGRO	D	D	D	ND	ND	ND
BABP	D	D	D	ND	ND	ND
BACA	D	D	D	ND	ND	ND
BBCA	D	D	D	ND	ND	ND
BBKP	D	D	D	ND	ND	ND
BBNI	D	D	D	ND	ND	ND
BBNP	D	D	D	ND	ND	ND
BBRI	D	D	D	ND	ND	ND
BBTN	D	D	D	ND	ND	ND
BCIC	D	D	D	ND	ND	ND
BDMN	D	D	D	ND	ND	ND
BEKS	D	D	D	ND	D	ND
BJBR	D	D	D	ND	ND	ND
BKSW	D	D	D	ND	ND	ND
BMRI	D	D	D	ND	ND	ND
BNBA	D	D	D	ND	ND	ND
BNGA	D	D	D	ND	ND	ND
BNII	D	D	D	ND	ND	ND
BNLI	D	D	D	ND	ND	ND
BSIM	D	D	D	ND	ND	ND
BSWD	D	D	D	ND	ND	ND

Stock Code	Model					
	Z-Score	S-Score	X-Score	Bankometer	G-Score	RGEC
BTPN	D	D	D	ND	ND	ND
BVIC	D	D	D	ND	ND	ND
INPC	D	D	D	ND	ND	ND
MAYA	D	D	D	ND	ND	ND
MCOR	D	D	D	ND	ND	ND
MEGA	D	D	D	ND	ND	ND
NISP	D	D	D	ND	ND	ND
PNBN	D	D	D	ND	ND	ND
SDRA	D	D	D	ND	ND	ND

Source: Company financial statements (data processed)

Note:

D = *Distress*

ND = *Non Distress*

The comparison results of the analysis of all models indicate that the Modified Altman Z-Score, Springate, and Zmijewski models have similar analysis results. All samples (30) of the companies analyzed are categorized as distress. This is because the gray area criteria in the Altman model have previously been converted into distress category. In addition, the Bankometer and RGEC models also have similarities in the results of the analysis, in which all the samples (30) of the companies analyzed are included in the non-distress category, so basically these results contradict the results of the analysis of the 3 previous models. Furthermore, Grover model analyzes 29 sample companies that are included in the non-distress category and only 1 company sample (BEKS) is analyzed into the distress category. However, these results do not differ significantly from the results of the analysis of the Bankometer and RGEC models.

The similar results of calculations between the Modified Altman Z-Score, Springate, and Zmijewski models can be caused by the forming ratios and the value intervals used to calculate the criteria of financial distress and non-financial distress. The Modified Altman Z-Score model uses Working Capital to Total Assets (X_1), and *Earnings before Interest and Taxes to Total Assets* (X_3) financial ratios. The same ratio is used by the *Springate* (S-*Score*) model including *Working Capital to Total Assets* (A) and *Net Profit Before Interest and Taxes to Total Asset* (B), while the same ratio is also used by model *Zmijewski* (X-*Score*) which is *Net Income to Total Assets* (X_1). The three models measure the condition of the company or bank based on income or profits and working capital owned compared to the total assets owned by the company, so the results of the calculation of the three models do not show significant differences regarding the condition of the company.

The same results of calculations between Bankometer, Grover, and RGEC models can be caused by the use of some of the same ratios in assessing the condition of a company or bank whether included in financial distress or non-financial distress. The Bankometer model utilizes *Capital to Asset Ratio* (CA), *Equity to Aset Ratio* (EA), *Capital Adequacy Ratio* (CAR), *Nonperforming Loan Ratio* (NPL), *Cost to Income Ratio* (CI) and *Loan to Asset Ratio* (LA). The *Grover* (G-*Score*) model uses 3 types of financial ratios, yaitu *Working Capital to Total Assets* (X_1), *Earnings Before Interest and Taxes to Total Assets* (X_3), *Net Income to Total Assets* (ROA). The RGEC model uses NPL, LDR, Good Corporate Governance (GCG) indicators, ROA, NIM, and CAR. There are similarities in the financial ratios in the Bankometer, Grover, and RGEC models that they use the *Capital Adequacy Ratio* (CAR), *Nonperforming Loan Ratio* (NPL), and *Net Income to Total Assets* (ROA) to see whether the bank's condition is included into the criteria of financial distress or non-financial distress. Therefore, the results of the calculation of the three models do not show significant differences regarding the condition of the company.

Conclusion

This study aimed at determining the potential for financial distress in banking sector companies listed on the Indonesia Stock Exchange in the 2011-2016 period, with the following conclusions: (1) The prediction of financial distress in the banking sector companies listed on the Indonesia Stock Exchange in the 2011-2016 period with the Modified Altman Z-Score model analyzed 16 companies in the gray area criteria, and 14 companies included in the bankrupt criteria. (2) The prediction of financial distress in banking sector companies listed on the Indonesia Stock Exchange in the 2011-2016 period using the Springate model analyzed that all samples (30 companies) included in the bankrupt criteria. (3) The prediction of financial distress in the banking sector companies listed on the Indonesia Stock Exchange in the 2011-2016 period with the Zmijewski model analyzed that all samples (30 companies) were included in the bankrupt criteria. (4) The prediction of financial distress in banking sector companies listed on the Indonesia Stock Exchange in the 2011-2016 period with the Bankometer model analyzed that all samples (30 companies) were included into very healthy criteria. (5) The prediction of financial distress in banking sector companies listed on the Indonesia Stock Exchange in the period 2011-2016 with Grover model analyzed that 1 company (BEKS) was in the gray area and 29 companies were included in the criteria of not bankrupt. (6) The prediction of financial distress in the banking sector companies listed on the Indonesia Stock Exchange in the 2011-2016 period with the RGEC model analyzed that 14 companies were included in the criteria of "Very Healthy" or PK 1, 15 companies were included in the criteria of "Healthy" or PK 2, and 1 company (BCIC) was included in the criteria of "Fairly Healthy" or PK 3. (7) The comparison of the results of the analysis of all models showed that the Modified Altman Z-Score, Springate, and Zmijewski models have the same analytical results that all the analyzed samples were included in the distress category. In addition, the Bankometer, Grover, and RGEC models also have similarities in the results of their analysis, which overall the models analyzed the samples into the non-distress category; therefore, these results contradicted the results of the analysis of the 3 previous models.

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