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Financial Distress Prediction Using Springate and Altman Model: Based on Financial Indicators of Industrial Companies

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Keywords *: Financial Distress; Altman Model; Springate; Financial Indicators*

Abstract

Research Aim: *To develop the Altman and Springate models to estimate the likelihood of financial distress in the industrial sector for the 2015-2021.*
Method: *Analysis of data from 52 industrial companies listed on the Indonesia Stock Exchange (2015-2021) using Altman discriminant analysis and Springate S-Score to identify financial distress.*
Research Finding: *Out of 52 companies, 27 experienced financial distress. The Altman model demonstrated better prediction accuracy.*
Theoretical Contribution: *This paper strengthens the validity of the Altman and Springate models in predicting financial distress in the industrial sector.*
Practical Implication: *Provides insights for investors and management to anticipate bankruptcy risks and improve financial stability.*
Research Limitation: *Limited to the industrial sector in Indonesia for the 2015-2021 period and relies solely on financial statement data without considering external factors.*

Abstrak

Tujuan Penelitian: Mengembangkan model Altman dan Springate untuk memperkirakan kemungkinan terjadinya financial distress pada sektor industri periode 2015-2021.
Metode: Analisis data terhadap 52 perusahaan industri di Bursa Efek Indonesia (2015-2021) menggunakan teknik diskriminan Altman dan Springate S-Score untuk mengidentifikasi potensi financial distress.
Temuan Penelitian: Dari 52 perusahaan, 27 perusahaan mengalami kesulitan keuangan. Model Altman menunjukkan akurasi prediksi yang lebih baik.
Kontribusi Teoritis: Memperkuat validitas model Altman dan Springate dalam memprediksi *financial distress* pada sektor industri.
Implikasi Praktis: Memberikan wawasan bagi investor dan manajemen untuk mengantisipasi risiko kebangkrutan dan meningkatkan stabilitas keuangan.
Keterbatasan Penelitian: Terbatas pada sektor industri di Indonesia periode 2015-2021 dan hanya menggunakan data laporan keuangan tanpa mempertimbangkan faktor eksternal.

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Introduction

A Company is established to maximize the value of the Company by maximizing the profits obtained and minimizing costs so that the Company can continue its business in a sustainable period [1] . Economic development requires companies to continue to develop innovation, improve performance, and expand their business in order to survive the competition [2]. The skill level of the company is largely determined by its own performance.

Figure 1. GDP Growth Rate of Manufacturing Industry in Indonesia
Source: Indonesia's National Income, BPS

Based on data on the GDP growth rate of the manufacturing industry in Indonesia during 2015 to 2021 experienced a downward trend from 2015 of 4.33% to -2.93% in 2020, one of the factors was the effect of the global crisis in the middle of 2015 and followed by the effects of Covid-19 in 2020 so that there was a very drastic decline. If the Company is unable to overcome these problems, there will be a decrease in business volume which will later lead to financial difficulties. The growth rate of industry in a region will depend on internal and related relations and synergies between different sectors [3]. 2020 will be a very important year for the manufacturing 4.0 sector. When compared to industry 3.0 which only uses processing, industry 4.0 also discusses the internet and renewal technology. In today's industrial era 4.0, manufacturing companies not only improve processes but also create new systems or business models that not only improve quality and quantity but also increase productivity levels so that businesses can compete effectively in the market [4].

In predicting financial distress using the Company's financial ratios, the Company needs a model to detect early symptoms of bankruptcy. The model can be used as a tool for taking action to anticipate bankruptcy because financial difficulties are the beginning of the cause of the Company's bankruptcy. According to [5] Conditions of financial distress can be identified early through models. Many differences and debates about financial difficulties have originated in the study of capital structure in companies. The static theory of capital structure posits that optimal debt levels arise from a trade-off between the value of tax advantages from borrowed money and the cost of financial hardship experienced by the

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Company. The static theory of capital structure leads some experts to include a measure of the likelihood of financial hardship (FDL) in firms based on the Z-score model [6] , Springate, Gover or other models in predicting financial difficulties. He used as many as 19 financial ratios in his research. However, after being tested in the study, 4 ratios were obtained which were used in determining the criteria for companies that are included in the category of healthy companies or potentially bankrupt companies [7] . According to [8] states that financial distress is caused by external setbacks or failures of internal financial control that indicate the failure of management in managing finances.

States that Springate's models are useful for predicting the solvency of financial firms and can be applied to predict the solvency of financial firms although they have been developed keeping manufacturing firms in mind [9]. On research [10] by using the Springate and Gover method can predict several Coal Companies that experience financial distress. On research [11] with several models of Altman, Springate, Zmijewski, and Grover to predict the financial distress of several companies. Results of research conducted by [12] By comparing the Springate and Fulmer models in predicting financial distress in manufacturing companies, the Springate model is more relevant in predicting financial distress. The springate method is also suggested by researchers [13] who conducted a study by comparing Altman and Springate models to construction companies that found that the Springate model was more correct in predicting financial distress. So that from the recommendations of the results of previous researchers, in this study the research was carried out with the Springate model with different samples and more with a longer period of time to produce wider research results.

Method

The descriptive method is carried out in this study with a quantitative approach because it uses the calculation of the numbers in the financial statements of each company then analyzed to determine the problems that occur with a sample of 52 manufacturing industry companies and then analyzed using the springate model to predict the financial difficulties of these companies. The sample companies are included in the category of industrial companies listed on the Indonesia Stock Exchange with research years from 2015 to 2021.

Springate conducted research to find what models could later be used in predicting the potential (indication) of bankruptcy in a company. Springate uses a sample of 19 financial ratios that are often used in analyzing a company's financial performance to predict financial difficulties in a company. So that the emergence of Springate score which is a method of predicting the survival of a company by combining several commonly used financial ratios with different value weights. The financial parameters used in this model consist of X_1 which is net working capital and total assets, X_2 is EBIT and total assets, X_3 is the EBIT equation

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and total current liabilities, and X_4 is the ratio of sales and total assets. The standard rating in the Springate Score formula is S > 1.062 = healthy condition, 0.862 < S < 1.062 = vulnerable condition and S < 0.862 = serious condition [7].

The model used in the calculation by Springate is as follows

$S = 1.03X_1 + 3.07X_2 + 0.66X_3 + 0.4X_4$

Where

X_1 = working capital / total assets
X_2 = net profit before interest and taxes / total assets
X_3 = net profit before taxes / current liabilities
X_4 = sales / total assets

[6] conduct research to find what models can later be used in predicting potential (indications) of bankruptcy in a company. The financial parameters used in this model consist of X_1 which is net working capital and total assets, X_2 is Retained Earnings and total assets, X_3 is the EBIT equation and total assets, and X_4 is the market value of equity and book value of total debt then X_5 Sales and Total assets. The standard rating in the Altman Score formula is Z < 1.81 = the condition of the Company experiencing financial difficulties and will go bankrupt, $1.81 \leq Z \leq 3$ = potentially experiencing financial difficulties until bankruptcy and Z > 3 = healthy conditions.

The model used in the calculation by [6] is as follows:

$Z = 1.21X_1 + 1.4X_2 + 3.3X_3 + 0.64X_4 + 1.0X_5$

Where

X_1 = Working capital / Total Assets
X_2 = Retained Earnings / Total Assets
X_3 = Earnings Before Interest and Taxes / Total Assets
X_4 = Market Value of Equity / Book Value of Total Debt
X_5 = Sales / Total Assets

Results and Discussion

Analysis of the level of difficulty in manufacturing industry companies listed on the Indonesia Stock Exchange in 2015-2021 was carried out using calculations in the Springate model with the value of the financial ratios of each company as shown in figure 2.

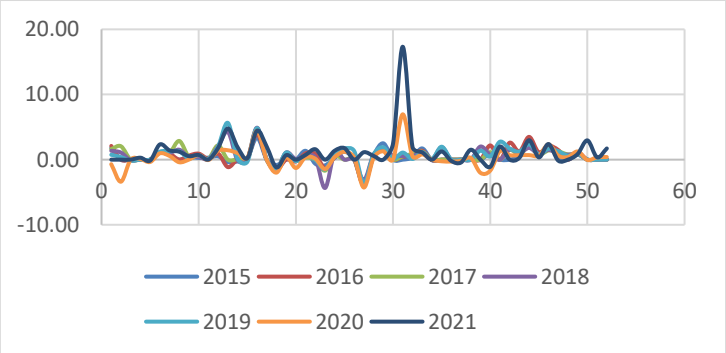

Figure 2. S-Score Movement Rate of Manufacturing Industry Companies
Source: S-Score data processing

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Figure 2 shows the movement of the results of calculating the S-Score value in 52 manufacturing industry companies with an annual average of 0.862<S< 1.062 which based on the sringate model equation shows vulnerable conditions that occur in the 2015-2021 period. To see in detail the companies with the Springate category, an analysis of the Springate model of each company was carried out using the analysis of each ratio in the Springate model. As shown in figure 3 in looking at the ratio X_1 of each Company.

Analysis of the level of difficulty in manufacturing industry companies listed on the Indonesia Stock Exchange in 2015-2021 is carried out using calculations on the Altman model with the value of the financial ratios of each company as shown in figure 3

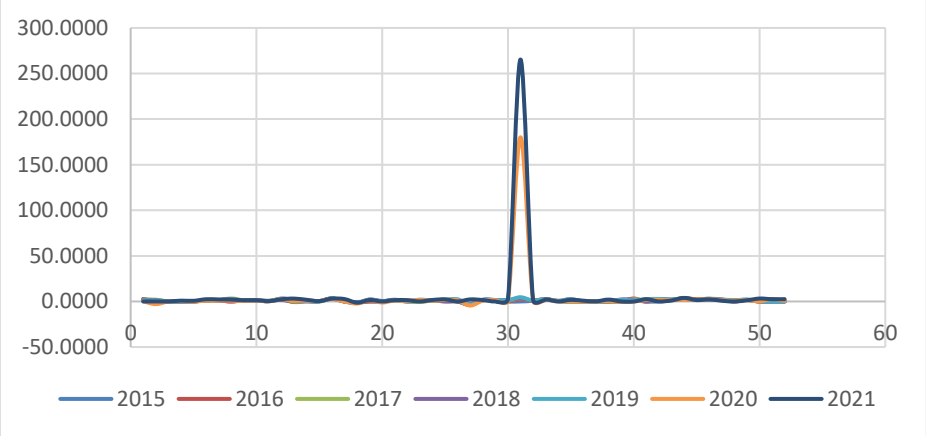

Figure 3. Z-Score Movement Rate of Manufacturing Industry Companies
Source: S-Score data processing

Figure 3 shows the movement of the results of the calculation of the Z-score value in 52 manufacturing industry companies with an annual average of $1.81 \leq Z \leq 3$ which based on the Altman model equation shows financial distress conditions that occurred in the 2015-2021 period. After obtaining the average ratio of each company, then the results of this study can produce predictions of each company's financial distress decisions as shown in the table of company conditions from Springate and Altman.

Table 1. Comparison of Calculation Results from Z-Altman And S-Springate

No	Company Code	S-Springate Result	Z-Altman Result
1	AMIN	1,388	1,564
2	GMFI	0,030	0,173
3	KPAL	-0,052	0,018
4	ARKA	0,079	0,192
5	HOPE	-0,101	0,080
6	ASII	1,788	1,357
7	AUTO	1,397	1,426
8	BOLT	1,298	1,592

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No	Company Code	S-Springate Result	Z-Altman Result
9	GDYR	0,532	1,077
10	GJTL	0,853	1,151
11	IMAS	0,150	0,407
12	INDS	2,182	2,535
13	LPIN	2,923	0,941
14	MASA	0,554	0,702
15	PRAS	0,107	0,264
16	SMSM	6,153	3,138
17	DRMA	0,396	0,375
18	ARGO	-2,018	-1,440
19	BELL	0,859	1,268
20	CNTX	-0,371	-0,005
21	ERTX	0,998	1,397
22	ESTI	0,444	0,578
23	HDTX	-2,238	0,585
24	INDR	0,998	1,154
25	PBRX	1,445	1,351
26	POLU	0,329	0,528
27	POLY	-4,274	-2,747
28	RICY	0,863	1,492
29	SRIL	2,098	1,265
30	SSTM	0,651	1,107
31	STAR	5,379	65,481
32	TFCO	1,021	0,954
33	TRIS	1,693	2,256
34	UNIT	0,002	0,358
35	ZONE	0,976	1,035
36	MYTX	-0,100	0,099
37	SBAT	-0,124	-0,005
38	UCID	0,357	0,351
39	BATA	0,271	0,494
40	BIMA	0,516	1,602
41	CCSI	1,210	0,955
42	IKBI	1,606	1,723
43	JECC	1,166	1,592
44	KBLI	3,084	2,978
45	KBLM	1,070	1,770
46	SCCO	2,664	2,362
47	VOKS	1,194	1,600
48	JSKY	0,513	0,698

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No	Company Code	S-Springate Result	Z-Altman Result
49	PTSN	1,342	1,659
50	RMKE	0,581	0,476
51	SCNP	0,143	0,750
52	SLIS	0,423	0,472

Source: S-Score and Z-Score data processing

Table 1 shows a comparison between the results of S-Springate and Z-altman from each industrial company listed on the Indonesia Stock Exchange (IDX) in the period 2015-2021. From these results, the highest value in the Altman method in the STAR Company code with a value of 65.481 and the lowest value in the POLY Company code with a value of -2.747 while there is a difference with the springate method Where the highest value is found in the SMSM Company code with a value of 6.157 but the lowest value has the same results found in the POLY CFor the next process after obtaining the s-springate and z-altman values, these values will be used to classify these companies into the financial distress zone with the Springate Score formula model, namely S > 1.062 = healthy condition, 0.862 < S < 1.062 = vulnerable condition and S < 0.862 = serious condition and altman model classification, namely Z < 1.81 = condition The company has financial difficulties and will go bankrupt, 1.81 ≤ Z ≤ 3 = potentially experiencing financial difficulties until bankruptcy and Z > 3 = healthy conditionompany code with a value of -4.274.

Table 2. Company Classification with s-springate and z-altman models

No	Company Code	Decision Springate	Decision Altman
1	AMIN	Non Financial Distress	Financial Distress
2	GMFI	Financial Distress	Financial Distress
3	KPAL	Financial Distress	Financial Distress
4	ARKA	Financial Distress	Financial Distress
5	HOPE	Financial Distress	Financial Distress
6	ASII	Non Financial Distress	Financial Distress
7	AUTO	Non Financial Distress	Financial Distress
8	BOLT	Non Financial Distress	Financial Distress
9	GDYR	Financial Distress	Financial Distress
10	GJTL	Financial Distress	Financial Distress
11	IMAS	Financial Distress	Financial Distress
12	INDS	Non Financial Distress	Potential Financial Distress
13	LPIN	Non Financial Distress	Financial Distress
14	MASA	Financial Distress	Financial Distress
15	PRAS	Financial Distress	Financial Distress
16	SMSM	Non Financial Distress	NFinancial Distress
17	DRMA	Financial Distress	Financial Distress
18	ARGO	Financial Distress	Financial Distress
19	BELL	Non Financial Distress	Financial Distress

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No	Company Code	Decision Springate	Decision Altman
20	CNTX	Financial Distress	Financial Distress
21	ERTX	Non Financial Distress	Financial Distress
22	ESTI	Financial Distress	Financial Distress
23	HDTX	Financial Distress	Financial Distress
24	INDR	Non Financial Distress	Financial Distress
25	PBRX	Non Financial Distress	Financial Distress
26	POLU	Financial Distress	Financial Distress
27	POLY	Financial Distress	Financial Distress
28	RICY	Non Financial Distress	Financial Distress
29	SRIL	Non Financial Distress	Financial Distress
30	SSTM	Financial Distress	Financial Distress
31	STAR	Non Financial Distress	NFinancial Distress
32	TFCO	Non Financial Distress	Financial Distress
33	TRIS	Non Financial Distress	Potential Financial Distress
34	UNIT	Financial Distress	Financial Distress
35	ZONE	Non Financial Distress	Financial Distress
36	MYTX	Financial Distress	Financial Distress
37	SBAT	Financial Distress	Financial Distress
38	UCID	Financial Distress	Financial Distress
39	BATA	Financial Distress	Financial Distress
40	BIMA	Financial Distress	Financial Distress
41	CCSI	Non Financial Distress	Financial Distress
42	IKBI	Non Financial Distress	Financial Distress
43	JECC	Non Financial Distress	Financial Distress
44	KBLI	Non Financial Distress	Potential Financial Distress
45	KBLM	Non Financial Distress	Financial Distress
46	SCCO	Non Financial Distress	Potential Financial Distress
47	VOKS	Non Financial Distress	Financial Distress
48	JSKY	Financial Distress	Financial Distress
49	PTSN	Non Financial Distress	Financial Distress
50	RMKE	Financial Distress	Financial Distress
51	SCNP	Financial Distress	Financial Distress
52	SLIS	Financial Distress	Financial Distress

Source: S-Score and Z-Score data processing

Table 2. Shows that from the data processed by the Springate model with data from 52 industrial companies, 25 industrial companies are in good financial condition in the 2015-2021 period with a minimum average S-Score value of > 0.862 which indicates that the Company's condition is in good condition because the value is in the zone of not going bankrupt or the Company is in a healthy condition. This is supported by every good financial ratio of the Company so that negative fundamental conditions do not have too much impact

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on the Company. On average, these companies are large industry companies where their financial condition is better than middle class companies. The company is also easier to carry out the continuity of the Company's operations in the future. As for financial distress conditions, there were 27 companies with a minimum average S value of < 0.86. Altman's model shows that of 52 industrial companies, there are 2 companies that are in the non-financial distress zone with a value of Z > 3, and a number of 4 companies with potential financial distress with an average value of $1.81 \leq Z \leq 3$ and 46 companies experiencing financial distress with an average value of Z < 1.81 which indicates that the company will experience vulnerability bankruptcy because the value is in the bankruptcy-prone zone. The management must immediately take action on the Company's financial performance in order to maintain the sustainability of the Company's operations.

Based on comparison between sample company status prediction models using Altman Z – Score and S-Springet the results are as follows.

Table 3. Level of Accuracy and Level Error Method Altman Z – Score and S-Springate

Models	Financial Distress	Non Financial Distress	Potential Financial Distress	The level of accuracy	The Level of Error
S-Springate	27	25		52%	48%
Z-Altman	46	2	4	88%	12%

Based on an analysis conducted on 52 companies, the Springate Method has an accuracy rate of 52% and Altman 88%.

Table 4. Financial Distress Altman and Springate Models

No	Company code	Decision Springate	Decision Altman
1	GMFI	Financial Distress	Financial Distress
2	KPAL	Financial Distress	Financial Distress
3	ARKA	Financial Distress	Financial Distress
4	HOPE	Financial Distress	Financial Distress
5	GDYR	Financial Distress	Financial Distress
6	GJTL	Financial Distress	Financial Distress
7	IMAS	Financial Distress	Financial Distress
8	MASA	Financial Distress	Financial Distress
9	PRAS	Financial Distress	Financial Distress
10	DRMA	Financial Distress	Financial Distress
11	ARGO	Financial Distress	Financial Distress
12	CNTX	Financial Distress	Financial Distress
13	ESTI	Financial Distress	Financial Distress
14	HDTX	Financial Distress	Financial Distress
15	POLU	Financial Distress	Financial Distress
16	POLY	Financial Distress	Financial Distress

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No	Company code	Decision Springate	Decision Altman
17	SSTM	Financial Distress	Financial Distress
18	UNIT	Financial Distress	Financial Distress
19	MYTX	Financial Distress	Financial Distress
20	SBAT	Financial Distress	Financial Distress
21	UCID	Financial Distress	Financial Distress
22	BATA	Financial Distress	Financial Distress
23	BIMA	Financial Distress	Financial Distress
24	JSKY	Financial Distress	Financial Distress
25	RMKE	Financial Distress	Financial Distress
26	SCNP	Financial Distress	Financial Distress
27	SLIS	Financial Distress	Financial Distress

In addition, from the results of the study, there are 27 companies in both Springate and Z-Altman experiencing financial distress conditions as shown in the following table 4.

Conclusion

The research conducted aims to determine companies that experienced financial distress in the period 2015-2021 due to global economic conditions and the Covid-19 pandemic. The results of research using the Springate model in 2015-2021 from 52 industrial companies there are 25 companies in healthy conditions (non-financial distress) and 27 companies in serious conditions (Financial distress), this is shown by the results of calculating the S-Score value in 52 manufacturing industry companies with an annual average of 0.862<S< 1.062 which based on the Springate model equation shows the vulnerable conditions that occur in the 2015-2021 period.

However, this study can prove that in conditions of global economic pressure and the Covid-19 pandemic, there are 19 industrial companies in good financial condition in the 2015-2021 period with a minimum average S-Score value of > 1,062 which indicates that the Company's condition is in good condition because the value is in the zone of not going bankrupt or the Company is in a healthy condition.

While the results of research using the Altman model in 2015-2021 from 52 industrial companies there are 4 industrial companies that are prone to financial distress, 2 companies in healthy conditions (non-financial distress) and 46 companies in serious conditions (Financial distress), this is shown by the results of calculating the S-Score value in 52 manufacturing industry companies with an average per year of $1.81 \leq Z \leq 3$ which based on the Altman model equation shows Vulnerable conditions that occurred in the 2015-2021 period.

Based on the results of this study, it can provide recommendations to the next researcher about financial distress by using a longer period of time to find out how strong the Company is to be sustainable in running its operations for a longer period of time.

Researchers can also sample companies in other sectors to determine the differences between each business sector in terms of financial distress

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