

## Predicting Financial Distress using Altman Z-Score, Springate S-Score and Zmijewski X-Score on Tobacco Companies in The Indonesia Stock Exchange

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### ABSTRACT

This study examines the use of three models of financial distress prediction namely Altman Z-Score, Springate S-Score and Zmijewski X-Score on the Tobacco Companies Listed in the Indonesia Stock Exchange. Further, the study tests the the accuracy of the three models to predict the bankruptcy of those companies. The sample consists of 5 firms with 25 observations for each model. To obtain the level of accuracy, the study categories the firms into distress or non-stress firms by comparing between return on equity (ROE) and Bank Indonesia (BI) rate. This study finds that the Springate S-Score model is the most accurate models to predict the bankruptcy of the Tobacco companies listed in the Indonesia Stock Exchange (IDX) by 80%.

**Keywords** : Altman Z-Score, Springate S-Score, Zmijewski X-Score, tobacco companies, bankruptcy prediction.

### INTRODUCTION

A company is an entity established by an individual or institution with the main objective of maximizing shareholders' wealth (Edwards, 2021). To realize such objective, the firm must be able to survive, to operate efficiently, and to grow constantly over the time. In contrast, the firm must be able to avoid the unfavorable conditions such as not liquid, insolvable or other financial distress which lead to bankruptcy or even liquidation (Hartaroe, Mardani and Abs, 2016).

The tobacco industry still has a significant contribution to the Indonesian economy either in terms of corporate tax paid to the government or the absorption of employees. Even, the government raises tobacco excise rates almost every year. From 2015 to 2021, the average increase in tobacco excise tax rates was 10%. The increase of tobacco excise rates will have impact on the performance of tobacco issuers' shares. On the other hand for investors in the tobacco industry, it is necessary to anticipate financial distress that may

occur due to the dynamics of the industry. The sluggish economic growth during the crisis have impact on the tobacco industry in Indonesia.

Arum and Handayani (2018) argue that to reduce the occurrence of financial distress, companies need to undertake a deep analysis to predict the financial distress that will occur. There are some financial distress prediction models that can be used; can be used which consisted of several models, namely Altman Z-Score, Springate S-Score, and Zmijewski X-Score.

The results of research conducted by Meita (2015) concluded that the Altman Z-Score model and the Springate S-Score model are financial distress prediction model that gives the same high value in predicting financial distress of coal mining companies with a financial distress prediction value of 88.89%. However Andriani and Sihombing (2021) stated that the Zmijewski X-Score model is the most accurate model in predicting financial distress in the property and real estate sectors listed on the Indonesia Stock Exchange (IDX) by 90%.

This research aims to examine whether the Altman Z-Score, Springate S-Score, and Zmijewski X-Score models can predict financial distress in tobacco companies listed in the Indonesia Stock Exchange (IDX). Moreover also examine whether there are differences between the results of the three models and look for which model is the most accurate in predicting financial distress.

## **REVIEW OF RELATED LITERATURE AND HYPOTHESES**

### **Financial Distress**

Financial distress is a term used to describe the condition of a company that is experiencing financial difficulties (Cindik and Armutlulu, 2021). Several models in predicting financial distress are Altman model, Zmijewski model, Grover model, Ohlson model, Fulmer model and so on. By knowing the right financial condition prediction models and using the financial information of companies published on the Indonesian stock exchange, it is hoped that investors and other parties with an interest in financial analysis can make the right decisions. (Prasetianingias and Kusumowati, 2019).

This research used the measurements used by (Husein and Pambekti, 2014) that determined financial distress using a comparison of ROE with the BI rate in the year concerned. The dependent measure on this variable is the dummy variable, If the ROE is greater than the BI rate, company categorized to be healthy. Then if the ROE value less than the BI rate but still greater than 0, it means that the company still can produce the net profit but it is under BI Rate so it is categorized as grey area or the company experienced loss. Then if the company's ROE is less than 0 or in negative, it will be concluded that the company experiencing financial distress or potentially financial distress. ROE or return on equity is one of the important elements to determine the extent to which a business is able to manage the capital of its investors. If the ROE calculation is greater, the company's reputation will also increase in the eyes of capital market/share issuers.

### **Financial Distress Prediction Models**

#### **Altman Z-Score**

Altman (developed 1968) introduced the Z-Score model in 1968 and this model has been well-received as a financial distress model for nearly decades, although some models of

financial distress are beginning to be applied, the Altman Model is still considered superior and widely applied by researchers around the world (J. and T., 2015). The Altman formula is used with the multiple discriminant analysis method which has 5 types of financial ratios, namely working capital to total assets(A), retained earnings to total assets(B), earnings before interest and taxes to total assets(C), market value of equity to book value of total debts(D), and sales to total assets(E).

The model formed by Altman for predicting a company's financial distress is  $Z = 0.717A + 0.874B + 3.107C + 0.420D + 0.998E$ , If a company got Z value of greater than 2.99, it can be concluded that a company is in safe zone. When  $Z < 1.81$ , the Z value of less than 1.81 implies that the company will very likely go financial distress in the near future. Hence, if a company has Z value of less than 1.81, it is considered to be in the distress zone. When  $1.81 \leq Z \leq 2.99$ , Z value of anything in between 1.81 and 2.99 indicates that the company is at grey zone (Altman, 1968).

### Springate S-Score

Springate (1978) has conducted research related to predictive model of a company's potential financial distress. Springate model is a model which was developed using multidiscriminant analysis. At first Springate uses 19 financial ratios but after doing Springate testing, it takes four ratios. Namely working capital to total assets (A), net profit before interest and taxes to total assets(B), net profit before taxes to current liabilities(C), and sales to total assets(D). Here is the formula of Springate:  $S = 1.03A + 3.07B + 0.66C + 0.4D$ . If the value of S-Score  $> 0.862$ , the company is predicted as potentially healthy company (not potentially financial distress). While if the value of S-Score  $< 0.862$ , the company is predicted as a company that will potentially experience financial distress.

### Zmijewski X-Score

Zmijewski (1984) used liquidity ratio analysis, leverage, and measuring the performance of a company. Zmijewski performed a potency measurement with 75 sample financial distress companies and 73 healthy companies during 1972 to 1978. The F-test indicator on the ratio of the group rate of return, liquidity, leverage turnover, fixed payment coverage, trend, company size, and stock return volatility showed significant difference between healthy companies and unhealthy. Thus, this model produces the following formula:  $X\text{-Score} = -4.3 - 4.5A + 5.7B + 0.004C$  with these 3 financial ratio as return on assets (A), debt ratio (B), and current ratio (C). The smaller the X-Score value of a company, the smaller the possibility of the company experiencing failure or financial distress.  $X=0$ , it means the company is healthy, but if  $X > 0$ , it can be categorized that the company is in dangerous situation or financial distress.

In a research conducted by Siekelova, Kovalova and Ciurlău (2019), it was shown that using the Altman Z-Score method from 105 manufacturing companies in Romania, 37 companies were in good health, 39 companies were in the gray area position and 29 companies had the potential to go financial distress. In a research conducted by Tanjung (2020), it is said that the Altman Z-Score and Zmijewski methods predict that all companies do not have the potential to go financial distress whereas, according to research conducted by Koto, Pulungan and Hartini (2018) potentially financial distress. Based on the results of those previous studies, the first hypotheses proposed in this research will be:

**H<sub>1</sub>:** *There are differences in the results of financial distress prediction using the Altman Z-Score, Springate and Zmijewski methods*

The results of research conducted by (Meita, 2015), it provides the conclusion of the Altman Z-Score model and the Springate model are financial distress prediction model that gives the same high value in predicting financial distress of coal mining companies with 88.89%. Meiliawati and Isharijadi (2016) the Springate model is the most accurate model in predicting the potential for financial distress of cosmetic sector companies listed on the Indonesia Stock Exchange with an accuracy percentage of 91.66%, where the accuracy of the model is 91.66%. However Andriani and Sihombing (2021) stated in their research that the Zmijewski X-Score model is the most accurate model in predicting financial distress in the property and real estate sectors listed on the Indonesia Stock Exchange (IDX) by 90%. Based on the results of those previous studies, the second hypotheses proposed in this research is:

**H<sub>2</sub>:** *There are differences in accuracy level of the Altman Z-Score, Springate and Zmijewski methods in predicting financial distress.*

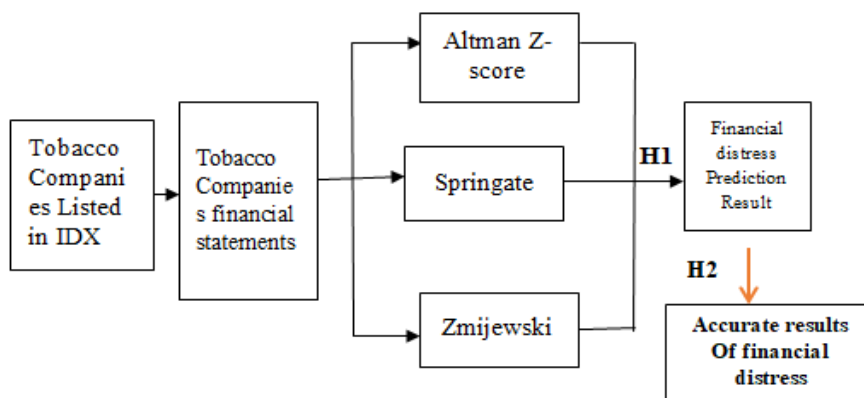


Figure 1. Research Framework

## METHODS

This research used quantitative research with descriptive comparative research approach. The population used in this research were tobacco companies that listed in the Indonesia Stock Exchange for the period of 2017-2021 and using saturation sampling technique in order to obtain all 5 companies.

Table 1. Tobacco Companies

No.	Company name	Code
1.	Gudang Garam Tbk	GGRM
2.	H.M. Sampoerna Tbk	HMSP
3.	Bentoel Internasional Investama Tbk	RMBA
4.	Wismilak Inti Makmur Tbk	WIIM
5.	Indonesian Tobacco Tbk	ITIC

Source: Indonesia Stock Exchange (2021)

To obtain relevant data, it can be used as a basis in the analysis process. The researchers used data collection with the documentation method (using secondary data). The documentation method is a research method sourced from written objects. The documentation method in this research is to obtain secondary data from the financial statements of tobacco companies listed in the Indonesia Stock Exchange (IDX) from [www.idx.co.id](http://www.idx.co.id). In processing the data, the tool that the researcher used were Microsoft Excel 2010 and SPSS 20 version to check the result and hypothesis testing (Kruskall Wallis Test for H1 and Chi Square Test for H2).

The accuracy level of this research used the measurements by Husein and Pambekti (2014) and determines financial distress using a comparison of ROE with the BI rate in the year concerned as the real condition of the company. The dependent measure on this variable is the dummy variable, if the ROE is greater than the BI rate, it will be coded "0" or in other words the company categorized to be healthy. Then if the ROE value less than the BI rate but still greater than 0, it means that the company still can produce the net profit but it is under BI Rate so it is categorized as grey area or the company experienced loss (coded by "2"), then if the company's ROE is less than 0 or in negative, it will be concluded that the company experiencing financial distress (it is coded by "1"). The level of accuracy shows the results of the percentage of the prediction model correctly from the entire sample. The level of accuracy is calculated as follows:

$$Accuracy\ Level = \frac{\text{The Sample that Proven to Be True}}{\text{Total Sample}} \times 100\%$$

## FINDINGS AND DISCUSSION

### Altman Z-Score Method result

The Altman Z-Score prediction, GGRM is a company that is financially healthy. This is shown from the results of the Altman Z-Score in 2017-2021, which are 4.942; 5.575; 5.821; 4.566; and 3.643, indicating that the this company is not predicted to go financial distress. For the prediction results of HMSP, Altman also indicates that in the 2017-2021 period, the company did not experience financial difficulties. Their Altman Z-Score from 2017 to 2021 are as follows 27.147; 30.351; 20.799; 11.053; and 7.311; respectively.

The results of the Altman Z-Score Calculation at RMBA show that from 2017 to 2021 there was a significant decline by 2.993; 2.333; 1.938; 1.760; and 0.890. It can be concluded that RMBA experienced a healthy condition in 2017 then turned into the grey zone or had the potential to go financial distress in 2018 and 2019, and finally the firm experienced financial distress in 2020-2021.

The results of the Altman Z-score of ITIC showed that from 2017 to 2021 there were successive ups and downs, namely 0.069; 0.597; 0.381; 6.111; and 1.778. In these results, it can be concluded that ITIC experienced a financial distress financial conditions in 2017, 2018, 2019, then turned into a healthy financial condition in 2020. However, in 2021 the firm surprisingly experienced a significant decline 1.778 of its Z-score which means the company is in financial distress. The result of the Altman z-score of WIIM shows that from 2017 to 2021 it experienced ups and downs, which were 3.289; 3.072; 2.502; 2.468; and 3.507. From these results, it can be concluded that WIIM experiences a picture of the good financial conditions as their values exceed 1.81.



### Springate S-Score Result

Based on the Springate S-Score prediction, GGRM is a healthy company. This is indicated by the results of the score between 2017 and 2021, which are 1.884; 1.935; 2.064; 2.197 and 1.228. The prediction results of HMSP, Springate model also indicates that in the same period, the company did not experience financial difficulties as their scores are 5.027; 5.023; 4.585; 3.942; and 2.849. The results of the Springate S-Score of RMBA indicate that from 2017 to 2021 experienced financial distress except in 2020. In 2017 RMBA was indicated to be in financial distress with a score of 0.534 which means less than the cut-off value of 0.862. Then in 2018 the score increased by 0.766; but it still experienced financial difficulties. Likewise, in 2019 it decreased to 0.756. However, in 2020 it became a turning point as it reached the score more than the cut-off value of 0.885 indicating that the financial situation has been improving. However, in 2021 it experienced a very large score decline to -0.242; which means that the RMBA is in a state of financial distress.

The results of the Springate S-Score of ITIC showed that from 2017 to 2021 the firm experienced financial distress. All scores are not higher than the cut-off value of 0.862; even though they have increased their scores gradually every year. From 2017-2021, the Springate ITIC's financial improvements have been made every year as follows: -0.332; 0.105; 0.144; 0.209; and 0.432 respectively. Finally, the results of the Springate Calculation of WIIM show that from 2017 to 2021 are in healthy financial condition. All scores are more than the cut-off value of 0.862. In 2017 it was 1.645; 1.405 in 2018; then 1.50 in 2019; 1.308 in 2020; and 1.891 in 2021; the largest score. However, it can be noted that even though all results show healthy financial condition, the scores are unstable.

### Zmijewski X-Score Result

GGRM is one of the companies that is financially healthy according to Zmijewski X-Score. This is shown from the results of the Zmijewski X-Score in 2017-2021, which are -2.652; -2.718; -2.822; -2.906 and -3.305; meaning that all values are less than the cut-off of 0, and indicating the firm is not predicted to go into financial distress. For the prediction results of HMSP, Zmijewski model also indicated that in the 2017-2021 period, the company did not experience financial difficulties because all of Zmijewski's results showed less than the cut-off value of 0. In 2017 it was -4.513; in 2018 it was -4.408; in 2019 it was -4.215; in 2020 it was -3.795; and for 2021 it was -3.761. So it can be predicted that this company will not go into financial distress.

The results of the Zmijewski calculation at RMBA showed that from 2017 to 2021 is very different from the results of the previous method. Previously, in Springate, the results showed that almost every year it went into financial distress, then in Zmijewski, it showed the opposite, namely from 2017 to 2021 RMBA was in a healthy financial position and was not indicated to be in financial distress because Zmijewski's score showed all below the cut-off value of 0. In 2017 it was equal to -1.889; then in 2018 it was -2.051; in 2019 it was -1.614; in 2020 it was -1.423; in 2021 it was -0.239. The results of the Zmijewski X-Score calculation ITIC showed that from 2018 to 2021 not experiencing financial distress except in 2017. All scores in 2018-2021 are not higher than the cut-off value of 0 which is -2.964; -2.005; -1.915; and -1.809; so that it can be categorized as a company in a financially healthy condition. However, in 2017 the Zmijewski score showed a number above the cut-off value of 1.144; which means it is said to be potentially in financial distress. The result of the Zmijewski calculation at WIIM showed that from 2017 to 2021 is in healthy financial condition.

All scores indicate that the results are less than the cut off value of 0. In 2017 it was -3.113; in 2018 it was -3.276; then in 2019 it was -3.323; in 2020 it was -3.202; and in 2021 it was the biggest score of -3.253. Even though the results all show healthy in WIIM, the numbers still go up and down every year.

### Normality Test

Data normality is something that must be done in every parametric test. One of the normality tests is by using the Kolmogorov-Smirnov method. A data can be said to be normal if it has a significance value of more than 0.05 (sig. > 0.05). On the other hand, the data is said to be abnormal if it has a significance value of less than 0.05 (sig. < 0.05). Based on table 2, the data of this research are not normally distributed. These three sig.values by 0.000 are smaller than the significant value of 0.05 to produce data that are normally distributed. Thus Kruskal Wallis Test is the appropriate statistic test for this data.

**Table 2.** Tests of Normality

status	METODE	Kolmogorov-Smirnov <sup>a</sup>		
		Statistic	df	Sig.
	ALTMAN ZSCORE	.367	25	.000*
	SPRINGATE S-SCORE	.409	25	.000*
	ZMIJEWSKI X-SCORE	.539	25	.000*

a. Lilliefors Significance Correction

Source: Processed secondary data (2022)

### Hypothesis Testing

#### Hypothesis 1

**Table 3.** Kruskal Wallis Test Statistics<sup>a,b</sup>

	Prediction status
Chi-Square	10.156
df	2
Asymp. Sig.	.006*

Source: Processed secondary data (2022)

**H<sub>0</sub>:** There are no differences in the results of financial distress prediction using the Altman Z-Score, Springate and Zmijewski methods

**H<sub>a</sub>:** There are differences in the results of financial distress prediction using the Altman Z-Score, Springate and Zmijewski method methods.

The results of the Kruskal Wallis test (table 3) showed that the Asymp Sig. value is 0.006; which means that the value is less than the significant value of 0.05. This means that Ho is rejected and Ha is accepted. In this research cleared that there are differences in the results of financial distress prediction using the Altman Z-Score, Springate and Zmijewski method methods in Tobacco Company that listed in Indonesian Stock Exchange periode 2017-2021.

## Hypothesis 2

In determining to test the hypothesis, first thing must be done namely by calculating the first comparison of the results of the Altman, Springate, and Zmijewski models against real conditions based on the BI rate and ROE formula from 2017-2021 at the tobacco company. If the results are the same it will be categorized as 'accurate', and if the results are not the same it will be categorized as "not accurate".

**Table 4.** Accuracy Status of Altman, Springate, and Zmijewski

MODELS	ACCURACY_STATUS		
	Not_Accurate	Accurate	Total
ALTMAN ZSCORE	9	16	25
SPRINGATE S-SCORE	8	17	25
ZMIJEWSKI X-SCORE	12	13	25
Total	29	46	75

Source: Processed secondary data (2022)

**Table 5.** Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.462 <sup>a</sup>	2	.481*
Likelihood Ratio	1.453	2	.484
Linear-by-Linear Association	.749	1	.387
N of Valid Cases	75		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 9.67.

Source: Processed secondary data (2022)

**$H_0$ :** There are no significant differences in accuracy level of the Altman Z-Score, Springate and Zmijewski methods in predicting financial distress.

**$H_a$ :** There are significant differences in accuracy level of the Altman Z-Score, Springate and Zmijewski methods in predicting financial distress.

The results of the chi square test (Table 5) on the three models in the level of accuracy stated that Asymp. Sig. (2-sided) is 0.481; which means that this value is greater than the significant value of 0.05; so it can be concluded that  $H_0$  is accepted and  $H_a$  is rejected. In other words, in this research, the accuracy of the three models do not experience a significant difference in predicting financial distress against the real condition of tobacco companies.

**Table 6.** Accuracy Level Percentage

	Altman Z-Score	Springate S- Score	Zmijewski X-Score
Accuracy level percentage	72%	80%	64%
Error rate	28%	20%	36%

Source: Processed secondary data (2022)



Based on the results of calculating the accuracy values of the three models, the results obtained if the Springate S-Score model is the most accurate model among the three models, namely with a percentage value of 80% (error rate 20%), then followed by Altman Z-Score with an accuracy percentage value of 72% (error rate 28%), and the last namely the Zmijewski model with a percentage value of 64% (error rate 36%).

So that this research supported by the results of research conducted by Meiliawati and Isharijadi (2016) the Springate model is the most accurate model in predicting the potential for financial distress of cosmetic sector companies listed on the Indonesia Stock Exchange with an accuracy percentage of 91.66%, where the accuracy of the model is 91.66%.

## LIMITATIONS

In doing this research, the obstacles found were that the financial report data was sometimes incomplete and had to be searched from other sources which were also sometimes invalid because there was no auditing. In addition, the limitations of this study are looking for studies that support the results of this study.

## IMPLICATIONS

Investors, creditors, and the government also need information about the financial condition of a company, especially tobacco companies in Indonesia, in order to be able to make the right economic and business decisions to deal with possible corporate financial distress in the future. It can be seen from the results of this study, Springate have a higher accuracy rate than Altman Z-Score and Zmijewski, which is 80% in predicting financial distress/financial distress of Tobacco Companies that go public.

Furthermore, based on the predictions of Altman Z-Score, Springate and Zmijewski, the company that has the brightest performance is HMSP because it has the highest score in both models, followed by GGRM in the second position. then WIIM, ITIC and RMBA are in a position where stakeholders/investors must be careful in investing their money because these three companies are predicted to have the potential to go financial distress, and sure enough, especially RMBA, this company is unfortunate to have to be delisted in 2021 from IDX because it experienced legal financial distress.

## CONCLUSIONS

From 5 companies with a total of 75 financial distress prediction results using the Altman Z-Score, Springate S-Score, and Zmijewski X-Score the results obtained are that the three models can predict the potential for financial distress in cigarette companies in Indonesia.

There is a significant difference in the prediction results of the three models, namely the Altman Z-Score can predict 6 observations in a state of financial distress, 4 in a loss/grey state, and 15 others in a healthy condition. while Springate predicts that there are 4 observations of financial distress, and 21 are healthy, as well as Zmijewski's results, namely 1 in a state of financial distress and 24 others in good health.

However, after comparing the accuracy with real conditions, the three models have differences but are not significant. namely the accuracy results show that Springate has the highest percentage accuracy value among other models at 80%, followed by Altman Z-Score 72% and the last Zmijewski at 64%. Edward, niresh

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