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The Analysis of the Bankruptcy Potential Comparative by Altman Z-Score, Springate And Zmijewski Methods at Cement Companies Listed In Indonesia Stock Exchange

Januri[1], Eka Nurmala Sari[2], and Armida Diyanti[3]
[1.2)] *Lecturer in University of Muhammadiyah Sumatera Utara*
[3)] *FreshGraduate University of Muhammadiyah Sumatera Utara*
Coresponden Author: ekanurmala@umsu.ac.id

Abstract: *This study aims to analyze the differences of prediction results between 3 models of Altman Z-Score Model, Springate Model, and Zmijewski Model at cement companies which are listed in Indonesia Stock Exchange. This study belongs to Comparative research. The population in this study is all companies which are listed in the Stock Exchange of the Year 2011 to 2015 while the sample is determined by purposive sampling method so that it is obtained 3 sample companies. The analytical method is the analysis of kruskal-wallis difference test and the accuracy with accuracy level and error type. Based on data analysis by using IBM SPSS Statistics 22, it can be concluded that there are differences in potential bankruptcy of the three predictive models. This can be proved through the Kruskal-Wallis test which has been done with significance value of 0.043. Based on the above study results, it is advisable to use other analysis tools of potential bankruptcy that have been found such as Ohlson, Shirata, CA Score, Fulmer etc and to extend the observation time as well as to increase the number of company samples so that the results that are provided can generalize the research.*
Keywords: *Altman Z-Score, Springate, Zmijewski, Bankruptcy, Financial distress*

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I. Introduction

Each company is founded in the hope of making a profit so as to be able to survive and develop in the long term which is not limited. This means it can be assumed that the company will continue to live and is expected not to be liquidated. In practice, such assumptions do not always come true. It is often the companies that have been operating within a certain period of time are forced to disperse because of financial distress that led to bankruptcy (Nafir and Ririh, 2015).

Financial distress is a broad concept that consists of several situations in which a company faces financial difficulties. Common terms to describe the situation are bankruptcy, failure, inability to pay off debts, and defaults/companies that violate regulations with creditors and may be subject to punishment (Mhd Nur, 2014). Financial distress is a condition where company is experiencing financial difficulties and is threatened with bankruptcy. The condition of financial distress should be avoided by the company. In addition can lead to bankruptcy, it can also influence investor confidence in investing capital. Bankruptcy is usually interpreted as a failure of the company in running the company's operations to generate profits.

Various analyzes which are conducted are expected to predict the survival of a company. For that we need a special method that can provide assessment and predict the company in the present and the future. There are various bankruptcy analysis tools that have been found, but the widely used bankruptcy analysis tools are Altman Z-Score Model, Springate Model, and Zmijewski Model. Based on the above description, the problem formulations of this study are:

1) Is there any difference in bankruptcy prediction results which are generated by the three prediction models
2) Which model is the most accurate in predicting the bankruptcy of Cement companies that are listed in Indonesia Stock Exchange

II. Theory And Hypotheses Development

Financial statements

Financial statements are records of a company's financial information in an accounting period that can be used to describe the performance of the company. Financial statements are part of the financial reporting process. The financial statements in a company have a very important meaning, especially for those who have an interest in the company (Wahyu, 2015).

In a simple sense, the financial statements are reports that indicate the financial condition of the company at this time or in a certain period. The purpose of financial statements that indicate the current condition of the company is the current condition. The current condition of the company is the company's financial condition on a certain date (for balance sheet) and certain period (for profit and loss) (Kasmir, 2013: 7).

Bankruptcy

In general, bankruptcy is defined as a failure of the company in carrying out operations to achieve its objectives. Bankruptcy is an accumulation of mismanagement of the company in the long run (Rudianto, 2013: 253). According to Lesmana (2013: 174) the definition of bankruptcy is as a risk of bankruptcy which is related to uncertainty about the ability of a company to continue its operations if the condition that is the financial condition which is owned has decreased.

Bankruptcy is usually interpreted as a failure of the company in running the company's operations to generate profits. The definition of bankruptcy as a failure is as follows (Komang Devi & Ni K. Lely, 2014).

1. Economic Failure in which the company has the possibility if the cost that is incurred exceeds the income that is earned by the company.
2. Financial Failure (Financial Distressed), in which the company is said to experience financial failure, it means the company has difficulty in funding either in the sense of funds in terms of cash or in terms of working capital.
3. Insolvency Technique (Technical Insolvency), which more leads to the failure of the company in undergoing technical/provisions of applicable obligations.
4. Insolvency in the sense of bankruptcy, in which the present value of the expected cash flows is lower than the liabilities that are held.
5. Legal bankruptcy, in which the company is declared bankrupt legally and only if it is filed formally with the Act.

The Benefits of Bankruptcy Information

Bankruptcy information is very useful for some of the following parties (Rudianto, 2013: 253):

1. Management, if a company's management can detect the possibility of bankruptcy early, then the precautions can be done.
2. The lender (creditors), bankruptcy information of a company can be useful for a business entity that plays as a creditor to take decisions on the granting of the act in lending to the company.
3. Investors, bankruptcy information of a company can be beneficial to a business entity that plays as an investor of another company. If an investor company intends to buy shares or bonds which are issued by a company that has detected a possible bankruptcy, then the prospective investor may decide to buy or not to buy any securities which are issued by the company.
4. The Government, in some business sectors, government agency is responsible for overseeing the business. Government agency has an interest in seeing the signs of bankruptcy early so that the necessary actions need to be done early.
5. Public accountant, public accountant needs to assess the potential of the survival of the business entity that is being audited, because the accountant will assess the going concern ability of the company.

Altman Z-Score Model

Altman Z-Score is a tool which is used to predict the bankruptcy rate of a company by calculating the value of several ratios which are then included in a descriptive equation. The Z-Score analysis was developed in 1968 by Edward I. Altman. The samples that were used at the time included 66 companies consisting of 33 bankrupt companies and 33 non-bankrupt companies in 1960-1965. The research was applied using Multiple Discriminant Analysis (MDA). Equation model which is applied, that is:

$$\mathbf{Z = 0{,}012X1 + 0{,}014X2 + 0{,}03X3 + 0{,}006X4 + 0{,}999X5}$$

Description

X1 : *Working Capital / Total Assets*
X2 : *Retained Earnings / Total Assets*
X3: *Earning Before Interest and Taxes to Total Assets*
X4: *Market Value Equity to Book Value of Total Debt*
X5: *Sales to Total Assets*

From the equation above, the criteria which is used to predict bankruptcy is if the value of $Z < 1.8$ then the company is included in the bankrupt company, whereas if the value of Z between 1.81 to 2.99 then the company is included in the gray area company and if the value of $Z > 2.99$ then the company is a healthy company.

In 1984, Altman revised the equation. This equation is made so that this prediction model can not only be used in manufacturing companies that go public but it can also be implicated in private companies. Altman developed the newest equation by replacing the original X4 which was previously the capital market value to the debt book value into the equity market value to the debt book value. The latest revised result equation is:

$$\mathbf{Z = 0{,}717X1 + 0{,}847X2 + 3{,}107X3 + 0{,}420X4 + 0{,}998X5}$$

The criteria that is used in this revision equation is if the value of $Z < 1.23$ then the company is included in the bankrupt company, whereas if the value of Z between 1.23 to 2.9 then the company is included in the gray area company, and if the value of $Z > 2.9$ then the company is included in a healthy company.

In its development, Altman then modifies the model so that the equation which he has made can be used in all companies. In this modification, Altman eliminates variable X5 because this ratio is highly variable in industries with different asset sizes. The equation of this modification model is:

$$\mathbf{Z = 6{,}56X1 + 3{,}26X2 + 6{,}72X3 + 1{,}05X4}$$

The criteria for the model equation is that if the value of $Z < 1.1$ then the company is included in the bankrupt company whereas if the value of Z between 1.1 to 2.6 then the company is included in the gray area company, and if the value of $Z > 2.6$ then the company is included in a healthy company.

Springate Model

This model was introduced by Gordon L. V. Springate in 1978. The Springate model is the ratio model which is used to measure the company's financial condition. It is almost the same as the Altman model, this model also uses more than one financial ratios that are considered to be related to conditions that can measure the bankruptcy level of a company. To determine the ratios that can detect the possibility of bankruptcy, Springate uses multiple discriminant analysis (MDA) methods to select 4 ratios of 19 popular financial ratios in the literature that are capable of distinguishing the companies that are going to bankrupt and in good condition. The Springate model is as follows:

$$\mathbf{Z = 1{,}03X1 + 3{,}07X2 + 0{,}66X3 + 0{,}4X4}$$

Description

X1 : *working capital / total asset*
X2 : *net profit before interest and taxes / total asset*
X3 : *net profit before taxes / current liabilities*
X4 : *sales / total asset*

If the value of Z equals 0.82 then the company is classified as a bankrupt company, this model produces a level of accuracy of 92.5% by using 40 companies that are tested by Springate (Syafrida, 2014: 93)

Zmijewski Model

This model was introduced in 1984. This model uses ratio analysis that measures the performance, leverage, and liquidity of a company. Zmijewski used a random sampling technique in his research. The sample which was used is 840 companies consisting of 40 companies that went bankrupt and 800 that did not go bankrupt. The equations of this model are:

$$\mathbf{Z = -4{,}3 - 4{,}5\ X1 + 5{,}7\ X2 - 0{,}004\ X3}$$

Description:

X1 = ROA (*earning after tax / total asset*)
X2 = Leverage (*total debt / total asset*)
X3 = Likuiditas (*current asset / current liabilities*)

Conceptual Framework

In this study there are three dependent variables namely the value of Altman Z-Score Model, Springate Model, Zmijewski Model. Then, through these variables, it will be observed whether there is a significant difference between the analysis results of Altman Z-Score Model, Springate Model and Zmijewski Model in predicting the bankruptcy of Cement companies that are listed in BEI.

Of the three company bankruptcy prediction models, each have advantages and disadvantages, but a lot of the research which has shown that the most excellent is the model of the Altman Z-Score (Syafrida, 2014: 93), while the research which is conducted by Nafir Rizky Herlambang Yami (2013), which concludes that the Zmijewski model is the most appropriate model that is applied to property and real estate firms, because of its high accuracy compared to other prediction models. And the research which is conducted by Komal Devi Methili Purnajaya & Ni K. Lely A. Merkusiwati namely by Kruskal-Wallis test that there are differences in the bankruptcy potential of the cosmetic industries that are listed in BEI by the method of Altman Z-Score models, Springate models, and Zmijewski models.

So from these differences, it can be known which model is the most accurate in predicting bankruptcy. Based on the existing theoretical framework, the conceptual framework of the study can be described as follows:

Conceptual Framework

Hypothesis

Hypothesis is the answer of a problem. Therefore it needs to be tested its truth through a research of data analysis. According Sugiyono (2007, p.: 70) hypothesis is a temporary answer to the formulation of research problems that have been expressed in the form of a question sentence. It is said temporarily because the answer given is based on relevant theory it is not yet based on the empirical facts which are obtained through data collection.

The hypothesis which is proposed on the problem formulation that has been proposed is:

H1: There are differences in bankruptcy prediction results which are generated from the three prediction models.

H2: The most accurate model in predicting the bankruptcy of Cement companies that are listed in Indonesia Stock Exchange.

III. Research Methods

In this study, it is by using a comparative research approach. Comparative research is a research that is comparing the problem of an object with other objects. In this study, the variables are self-sufficient but for more than one sample or at different times. The technique to collect data in this study is documentation that is by collecting, recording, and reviewing secondary data in the form of financial statements of companies that are published by BEI by accessing the website www.idx.co.id, with data financial statements used from 2011 to 2015.

This study uses Different Test Technique of mean/K sample independent test/kruskal-wallis test. Kruskal-Wallis is used to analyze the mean differences of "more than two" sample groups that are unrelated to each other. After doing a different test, then do the calculation to find the predicted model of bankruptcy which is the most accurate by using accuracy level and error type. The accuracy level shows the proximity of the measured result to the true value.

Accuracy rate = (correct number of predictions / number of samples) × 100%

Type error = (number of errors / number of samples) × 100%

IV. Research Result And Discussion

1. Altman Z-Score Model in Cement Companies Listed In Indonesia Stock Exchange

The criteria which is used in this model is if the value of Z < 1.23 then the company is included in the bankrupt company, whereas if the value of Z between 1.23 to 2.9 then the company is included in the gray area company and if the value of Z > 2.9 then the company is included in the healthy company. The calculation of altman z-score model analysis is shown in table 1 below:

Table 1
The calculation of altman z-score model

Year	Company	X1	X2	X3	X4	X5	Z-Score	Code	Rank
2011	INTP	0,49	0,60	0,26	6,51	0,77	5,17	1	1
	SMCB	0.072	0,097	0,14	2,46	0,69	2,29	1	2
	SMGR	0,24	0,62	0,26	2,9	0,83	3,55	1	1
2012	INTP	0,53	0,64	0,27	5,82	0,76	4,94	1	1
	SMCB	0,052	0,15	0,15	2,25	0,74	2,31	1	2
	SMGR	0,13	0,57	0,24	2,16	0,74	2,97	1	1
2013	INTP	0,53	0,67	0,25	6,331	0,702	5,06	1	1
	SMCB	-0,079	0,125	0,129	1,433	0,650	1,69	1	2
	SMGR	0,152	0,592	0,17	2,426	0,57	2,73	1	1
2014	INTP	0,444	0,69	0,236	5,705	0,692	4,7	1	1
	SMCB	-0,088	0,103	0,076	1,038	0,612	1,31	1	2
	SMGR	0,166	0,612	0,168	2,628	0,6	2,9	1	1
2015	INTP	0,378	0,69	0,205	6,326	0,644	4,79	1	1
	SMCB	-0,079	0,084	0,053	0,952	0,533	1,22	1	2
	SMGR	0,103	0,62	0,163	2,561	0,706	2,9	1	1

If it is viewed as a whole from 2011-2015, INTP and SMGR do not have the potential for bankruptcy despite the Z-Score decrease while SMCB remains in gray area and also decreases Z-Score.

2. Springate Model on Cement Companies Listed In Indonesia Stock Exchange

If the value of Z equals 0.82 then the company is classified as a bankrupt company, this model yields an accuracy rate of 92.5% by using 40 companies that are tested by Springate (Syafrida, 2014: 93). The calculation of Springate model analysis is presented in table 2 below:

Table. 2
The calculation of Springate model

Year	Company	X1	X2	X3	X4	Springate	Code	Rank
2011	INTP	0,49	0,26	0,26	0,77	1,78	2	1
	SMCB	0,072	0,16	0,14	0,69	0,96	2	1
	SMGR	0,24	0,26	0,26	0,83	1,55	2	1
2012	INTP	0,53	0,28	0,27	0,76	1,89	2	1
	SMCB	0,052	0,17	0,15	0,74	0,97	2	1
	SMGR	0,13	0,24	0,24	0,74	1,33	2	1
2013	INTP	0,53	0,25	2,41	0,702	3,18	2	1
	SMCB	-0,08	0,13	0,41	0,65	0,85	2	2
	SMGR	0,152	0,17	0,95	0,57	1,53	2	1
2014	INTP	0,444	0,236	2,082	0,692	2,83	2	1
	SMCB	-0,09	0,08	0,27	0,61	0,58	2	2
	SMGR	0,166	0,168	0,048	0,6	1,62	2	1
2015	INTP	0,378	0,205	2,1	0,644	2,66	2	1
	SMCB	-0,08	0,05	0,09	0,53	0,22	2	2
	SMGR	0,103	0,163	0,887	0,706	1,47	2	1

In 2011-2012 all cement companies that are listed in Indonesia Stock Exchange are in good health or have no potential to go bankrupt but, in 2013-2015 INTP and SMGR are in healthy condition while at SMCB of the year 2013-2015 are in gray area condition and impaired Z vslue.

3. Zmijewski Model On Cement Companies Listed In Indonesia Stock Exchange

The value of Z that is used is 0 where if the positive (+) Z value, it means the company has the potential to go bankrupt. While the more negative (-) value of Z then the company is getting away from bankruptcy. The calculation of Zmijewski model analysis is shown in table 3 below:

Table.3
The calculation of Zmijewski model

Year	Company	X1	X2	X3	Zmijewski	Code	Rank
2011	INTP	0,198	0,133	6,982	-4,405	3	1
	SMCB	0,096	0,313	1,466	-2,942	3	1
	SMGR	0,20	0,257	2,647	-3,725	3	1
2012	INTP	0,209	0,147	6,028	-4,378	3	1
	SMCB	0,114	0,308	1,405	-3,052	3	1
	SMGR	0,185	0,317	1,706	-3,319	3	1
2013	INTP	0,196	0,136	6,148	-4,382	3	1
	SMCB	0,064	0,411	0,639	-1,667	3	1
	SMGR	0,126	0,291	1,882	-3,2	3	1
2014	INTP	0,178	0,142	4,934	-4,272	3	1
	SMCB	0,04	0,49	0,60	-1,685	3	1
	SMGR	0,126	0,276	2,085	-3,29	3	1
2015	INTP	0,154	0,136	4,887	-4,198	3	1
	SMCB	0,01	0,51	0,65	-1,435	3	1
	SMGR	0,119	0,281	1,597	-3,23	3	1

Z value that is obtained from all cement companies that are listed in Indonesia Stock Exchange obtains negative value which means that all cement companies are in good condition or have no bankruptcy potential during 2011-2015 despite a decrease in Z value.

The Differences of Potential Bankruptcy on the Model of Altman Z-Score, Springate, and Zmijewski at Cement companies listed in Indonesia Stock Exchange

The results of potential bankruptcy analysis on cement companies that are listed in Indonesia Stock Exchange by using 3 analysis models are then ranked based on the Z value criteria of each analysis model. Where the rank is categorized in 1 healthy, 2 gray area. The following is shown in table 4 the level of rank which is produced by each analysis model.

Table. 4
The Rank of Potential Bankruptcy on the Model of Altman Z-Score, Springate, and Zmijewski at Cement companies listed in Indonesia Stock Exchange

Year	Company	ALTMAN	SPRINGATE	ZMIJEWSKI
2011	INTP	1	1	1
	SMCB	2	1	1
	SMGR	1	1	1
2012	INTP	1	1	1
	SMCB	2	1	1
	SMGR	1	1	1
2013	INTP	1	1	1
	SMCB	2	2	1
	SMGR	1	1	1
2014	INTP	1	1	1
	SMCB	2	2	1
	SMGR	1	1	1
2015	INTP	1	1	1
	SMCB	2	2	1
	SMGR	1	1	1

The rank which is obtained is then analyzed using IBM SPSS 22 to test the difference of bankruptcy potential analysis results on cement companies that are listed in Indonesia Stock Exchange by using Altman Z-Score, Springate, Zmijewski methods. table 5 below shows the results of kruskal-wallis analysis using SPSS.

Table 5
Kruskal-Wallis Test

	Metode	N	Mean Rank
P	Altman	15	27.00
	Springate	15	22.50
	Zmijewski	15	19.50
	Total	45	

The table above is kruskall-wallis output with SPSS, Mean Rank value shows the rank of each method. The altman method rank is higher than the average springate method rank, the average springate method rank is higher than the average zmijewski method rank. This means that there is a difference between one method and another. To see the output of kruskal-wallis hypothetical answers, it can be seen in the following table 6.

Table 6
Test Statistics[a,b]

	P
Chi-Square	6.286
Df	2
Asymp. Sig.	.043

a. Kruskal Wallis Test
b. Grouping Variable: metode

The above table is the output of kruskall-wallis hypothesis answer with SPSS: P value is indicated by Asymp value. Sig of 0.043 where less than 0.05 which means there are differences in predicted results of bankruptcy that are generated by three prediction models. It shows that there are differences in the potential bankruptcy of cement companies that are listed in the Indonesia Stock Exchange by the method of Altman Z-Score, Springate, and Zmijewski.

The Most Accurate Model of Bankruptcy

To test the accuracy of the bankruptcy prediction model of the three models, the calculations are shown in table 7 as follows

Table7
Recapitulation prediction bankruptcy Model Altman Z-Score, Springate Model, and Model Zmijewski

Prediksi	Altman Z-Score	Springate	Zmijewski
Bangkrut	0	1	0
Grey area	1	0	0
Tidak bangkrut	2	2	3
Total	3	3	3
% akurasi	66,7%	66,7%	100%
Tipe *error*	33,3%	33,3%	0%

Of the total sample of 3 companies which are used, Zmijewski model predicts that no company is bankrupt in other words, all companies are declared healthy and it can be concluded that Zmijewski model has the correct number of 3 samples or 100% accuracy rate. Altman Z-Score model predicts that 2 companies are not bankrupt and 1 company is in gray area or it can be said in financial distress and it can be concluded that Altman Z-score model has the correct number of 2 samples so that the accuracy level is 66,7 % with error type 33.3%. Springate model predicts that 2 companies are not bankrupt and 1 bankrupt company and it can be concluded that Springate model has the correct number of 2 samples and one of the samples so that the accuracy rate is 66.7% with the error type 33.3%.

Based on all calculation of prediction model that has been done, it can be concluded that Zmijewski model shows high accuracy of 100% and then followed by Altman Z-Score and Springate of 66.7%. This means that Zmijewski model is an appropriate prediction model to be used in predicting bankruptcy in cement companies that are listed in Indonesia Stock Exchange.

V. Discussion

The predicted results of bankruptcy after the testing in this study are concluded that from the three models in the results show there is a difference between the results of bankruptcy analysis with Altman Z-Score model, Springate model, and Zmijewski model on cement companies that are listed in Indonesia Stock Exchange. This difference occurs in because the variables and coefficients in the formula calculation of each method vary so as to produce different predictions.

So that the phenomenon that existed in the initial research was indeed true and this is also supported by the results of this study where there are differences in bankruptcy prediction results that are generated from the three prediction models on cement companies that are listed in Indonesia Stock Exchange.

The accuracy of bankruptcy prediction from the three prediction models yields different results from previous research. This study found the more accurate prediction SPSS test is Altman Z-Score but by using the level of accuracy or error type, it is Zmijewski model. In this case Altman Z-Score results are not exactly as an accurate model because the model has several weaknesses.

According to BAPEPAM (2005) in Ibrah (2012) the weaknesses of Altman Z-Score result are:

1. Z-Score value can be either engineered or biased through incorrect accounting principles or other financial engineering
2. Z-Score Formula is less appropriate for new companies whose profits are still low or even still lose so that Z-Score value will usually be low.
3. Z-Score calculation in a quarter on a company may provide inconsistent results if the company has a policy to remove receivables at the end of the year simultaneously.

So Zmijewski is an appropriate prediction model which is used in predicting bankruptcy in cement companies that are listed in Indonesia Stock Exchange due to its high degree of accuracy compared to other prediction models.

VI. Conclusions And Suggestions

Based on the descriptions that have been expressed by the author in the previous chapters, it can be concluded as follows:

1. Based on data analysis and discussion in this study then it gets answer from problem formulation that is there is difference of bankruptcy potential on cement companies that are listed in Indonesia Stock Exchange by using model of Altman Z-Score, Springate, and Zmijewski. Based on data analysis using IBM SPSS Statistics 22 it can be concluded that there is a difference of potential bankruptcy of the three prediction models. This can be proved by Kruskal-Wallis test which has been done with significance value of 0.043. Based on the criteria if the probability value 0.05 then H0 is accepted and Ha is rejected, whereas if the probability 0.05 then H0 is rejected and Ha is accepted, then the hypothesis H0 is rejected and Ha is accepted. So it can be concluded there are differences in bankruptcy potential of the three prediction models.
2. The most accurate model based on SPSS is Altman Z-Score but by using the type of error, the most accurate model is Zmijewski. And the exact/accurate model which is used by the cement companies that are listed in Indonesia Stock Exchange is Zmijewski Model.

Based on the limitations in this study, some suggestions are suggested:

1. Further research can use other bankruptcy potential analysis tools that have been found such as Ohlson, Shirata, CA Score, Fulmer etc.
2. Further research can extend the observation time and increase the number of samples of the company so that the results which are given can generalize the research.

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