Bankruptcy Prediction

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Bankruptcy Prediction Analysis:

A Case Study of Retail Companies in Indonesia

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***Abstract*—This research aims to predict bankruptcy on retail companies in Indonesia. A total sample consist of 22 retail companies in Indonesia Stock Exchange for the period of 2015 to 2018 have been assessed by using Altman, Springate, and Zmijewski model whether those companies are potentially bankrupt or not. There are 4 companies potentially bankrupt (18.18%) by using Altman model, 8 companies are potentially bankrupt (36.36%) by Springate model and 6 companies are potentially bankrupt (27.27%) using Zmijewski model. Refer to Conformity Level, Springate model is most accurate model. The data observed only one industry and one capital market in short time period. A wider research sample, longer period, and more bankruptcy prediction model is needed in future to make better result. This research result can be used by management as information to solve firm financial problem and change business strategy in the uncertain world economic condition. Beside, this also can be used as information for investors, creditors, auditors and other stakeholders to make better financial decision. This research uses data of retail companies in Indonesia and adopted Altman, Springate, and Zmijewski model to predict bankruptcy within period 2015-2018. The Novelty of this research is to combine three analyses, those are bankruptcy prediction, if there is any different result between each Model and the most accurate model.**

***Keywords*—bankruptcy, Altman Z score, Springate, Zmijewski, retail companies**

I. INTRODUCTION

The emergence of many e-commerce in Indonesia has caused disruption of retail companies. Many consumers prefer to buy things online, because it is easier and they can do it anywhere, anytime and the things they bought directly delivered to their house. While in retail companies which still offline, the consumers must come to the mortar and brick store to buy things. Retail companies hereby have decreased sales, unstable financial performance and also experienced losses. Moreover, the world of business also has changed dramatically during the past few years as a result of world economic slowdown that effect of domestic business includes Retail Business. Declining public purchasing power also become one of main factors impact the declining of retail business. Based on Aprindo's data, the growth of retail spending in June 2017 was only 5-6%, or half of the June 2016 period which was 11.75%.

A decrease in sales can cause a decrease in company's profit and if it continuously happens then the company will experience bankruptcy. Bankruptcy begins with financial distress. Financial distress can be seen and measured by analysing financial statements. Ratio analysis have a role in assessing the financial condition of a company. There are five types, namely liquidity ratio, activity ratio, solvency ratio, profitability ratio, and market ratio. Anticipating the company's financial condition early is essential conducted by each company for the continuation of the company's operations and better marketing strategies.

Predicting bankruptcy of a company can be done by using the ratio of the model that had been developed since 1968 in various countries. The model used is the Altman Z-Score, Springate, and Zmijewski. Altman Z-Score model uses five ratios, Springate uses four ratios, while Zmijewski only uses three ratios, calculation and analysis using the three models is certainly very possible to produce different conclusions so that the need for testing using three models [1].

II. LITERATURE REVIEW

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. Bankruptcy is defined as a failure of the company in carrying out operations to achieve its objectives [2]. The detection of company operating and financial difficulties is a subject that has been particularly amenable to analysis with financial ratios [3].

Some of previous research results are as follow. Bankruptcy Analysis with Altman Z-Score, Springate, and Zmijewski in PT. Indofood Sukses Makmur, Tbk. Period 2005-2009. This result shows that Altman and Zmijewski gave different result to predict bankruptcy, while Springate gave similar result with both Altman and Zmijewski Methods [4].

Business Bankruptcy Prediction Methods: A Significant Study of the Altman's Z-Score Method. The results showed that there are majorly five different types of bankruptcy prediction method. Multiple discriminant analysis is the crux of

this research paper. Altman's Method is discussed in detail describing the changes occurring to the equation so as to reach a perfect prediction method [5].

An Analysis of the Efficacy of the Altman and Springate Bankruptcy Methods in Companies Listed on The Stock Exchange of Thailand Period 2006-2012. This research shows that for a delisting company, Altman method is able to predict bankruptcy in 70.56% accuracy and for Springate in 65.56% accuracy [6].

An Analysis with Altman, Springate and Zmijewski Methods shows Nokia suffers from serious financial problem [7].

A. Altman Z-Score Model

Altman's Model has been used in various industries to predict bankruptcy. Altman's Z Score Model can be applied to modern economy to predict distress and bankruptcy one, two & three years in advance. Dr Altman's model has been well researched and many pioneering studies have been done under his z-score yardstick [5].

This analysis can be used to predict company's life cycle with combining several financial ratios and he gives different weighting for each ratios. After selecting 22 financial ratios, it was founded that five ratios can be used in combination to separate a bankrupt and non-bankrupt company. Altman makes Z-Score, a ratio method that use Multiple Discriminant Analysis. This method emphasizes profitability as the most influential ratio to bankruptcy [7].

The Z-Score Model by Altman [3] is explained as below:

$$Z = 1.2\,X1 + 1.4\,X2 + 3.3\,X3 + 0.6\,X4 + 1.0\,X5$$

Remarks:

X1=Net Working Capital / total assets

X2=Retained earnings/total assets

X3=Earnings before interest and taxes/total assets

X4=Market value of common and preferred stock/book value of debt

X5=Sales/total assets

X1: Working Capital/Total Assets (WC/TA). Altman found this liquidity ratio to be the most valuable in predicting bankruptcy, according to statistical significance on both a univariate and multivariate basis. Working capital is the difference between current assets and current liabilities. The working capital ratio on its own is a measure of efficiency and short-term financial health.

X2: Retained Earnings/Total Assets (RE/TA). Retained earnings reports the total amount of profits reserved for reinvestment in the business or specific objectives such as payment of debt or the purchase of a capital asset. Retained earnings are subject to change due to dividend declarations and quasi-reorganizations, leaving a bias on the ratio. Not only a measure of cumulative profitably, this ratio also reflects a firm's leverage. A firm with a high RE/TA ratio suggests the dependence on profits to finance assets rather than debt.

X3: Earnings Before Interest and Taxes/Total Assets (EBIT/TA). This ratio reflects the true productivity of a firm's assets, as this version of return on assets is independent of any leverage of tax factors. The EBIT/TA ratio is appropriate for studies of corporate bankruptcy since a firm's survival is ultimately based on the ability to generate profit by utilizing its assets.

X4: Market Value of Equity/Book Value of Total Liabilities (MVE/TL). Liabilities are the total amount of long and current term, while equity in this ratio is the market value of all shares of stock outstanding, preferred and common. This measure is considered the insolvency ratio, showing how much value a firm can lose before its liabilities exceeds its equity value. A market value is included in this ratio, unlike most insolvency investigations.

X5: Sales/Total Assets (S/TA). This capital-turnover ratio measures the sales generating efficiency of a firm's assets. It also measures management's competitive ability, relating to sales. The S/TA ratio is included due to the many relationships of other variables [8].

The criteria which is used to predict company bankruptcy with this model is that the company that scored $Z > 2.99$ are classified as healthy companies, Z-Score $1.81 < Z < 2.99$ are classified as a company in the grey area, while companies that have a Z-Score <1.81 were classified as potentially bankrupt company.

B. Springate Model

Springate model is a model that uses the ratio of multiple discriminant analysis (MDA). Springate Score is a method to predict company's life that combined several financial ratios with giving different weighting between them [9].

To determine which ratios that can predict bankruptcy, Springate uses Multiple Discriminant Analysis to choose four ratios that can differentiate exactly between a bankruptcy signal and the non-bankruptcy signal from the total of 19 financial ratios available. This method emphasizes profitability as the most influential ratio to bankruptcy.

Springate Score to various companies is mentioned as below:

$$S = 1.03\,A + 3.07\,B + 0.66\,C + 0.4\,D$$

Remarks:

A=Working capital/total assets

B=Earnings before interest and taxes/total assets

C=Profit before tax/current liabilities

D=Sales/total assets

For A, B and D, the ratios are the same with X1, X3, X5 in Altman Z-Score Model, but there is one additional ratio that is C Profit before tax / Current Liabilities. This ratio measures the company's ability in paying off his short-term debt. Profit before tax on current liabilities ratio so that management the company can find out how much profit that is has been deducted with interest expense cover current debt [10].

This Springate model have a standard calculation in which the company has a value S>0.0862 classified as a healthy company, while companies with a value of S<0.862 classified as potentially bankrupt [1].

C. *Zmijewski Model*

Zmijewski model used ratio analysis that measures the performance, leverage and liquidity of a compan for the model prediction [1]. According to Rudianto [9], Zmijewski uses ratio analysis that measure performance, leverage, and company's liquidity. This method emphasizes to debt as the most influential component to bankruptcy.

Zmijewski Score calculation is stated below:

$$X = -4.3 - 4.5\,X1 + 5.7\,X2 - 0.004\,X3$$

Remarks:

X1=Profit after tax/total assets

X2=Total debt/total assets

X3=Current assets/current liabilities

X1 called ROA (Return on Asset Ratio), is a measure of profit per dollar of assets; X2 called Debt Ratio, takes into account all debts of all maturities to all creditors and X3 called Current Ratio, is a measure of short-term liquidity. A high current ratio indicates liquidity but it also may indicate an inefficient use of cash and other short-term assets [11].

This Zmijewski model have a standard calculation in which the company has a value X<0, classified as a healthy company, while companies with a value of X>0 classified as potentially bankrupt.

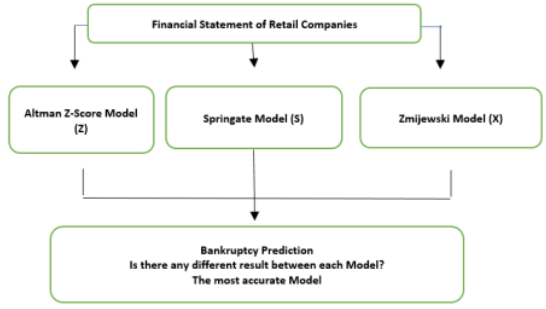

Fig. 1. Conceptual framework.

According to the three models: Altman Z-Score Model, Springate Model, Zmijewski Model, how many retail companies will be categorized as Healthy or Potential Bankrupt, then 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 Retail companies that are listed in Indonesia Stock Exchange. Finally, which model is the most accurate in predicting the bankruptcy?

III. Methods

This study is explanatory research with a comparative approach. The data use for this research gathers from the official website of Indonesia Stock Exchange especially Audited Annual Financial Statement for Retail Sub Sector Companies Period 2015-2018. This research uses independent t-test to analyse different result generated from three of Bankruptcy prediction model used in this study with significance level 5%. Data analysis by using IBM SPSS Statistics 23 [12].

Conformity Level = (Number of true Prediction / Number of Sample) x 100%

Companies that have negative net income can be categorized into financial distress/potentially bankrupt condition [13].

IV. Results and Discussion

A. *Result*

Table 1 showed that in average there are 4 companies potentially bankrupt (18.18%), 6 companies in grey area (27.27%) and the rest is in healthy condition (54,55 %) by using Altman model. Different results show by Springate model that there are 8 companies is potentially bankrupt (36.36%) and the rest is in healthy condition (63.64%). Then Zmijewski model shows that there are 6 companies potentially bankrupt (27.27%) and the rest is in healthy condition (72.73%).

Bankruptcy Prediction of Retail companies using Altman Z-Score, Springate, and Zmijewski model shows in the below table:

TABLE I. Bankruptcy Prediction Analysis using Altman, Springate, and Zmijewski Model

Num	Stock Code	Average Score of Altman	Altman Z-score Prediction	Average Score of Springate	Springate Prediction	Average Score of Zmijewski	Zmijewski Prediction
1	ACES	17,0407	Healthy	3,1838	Healthy	- 4,0204	Healthy
2	AMRT	5,0900	Healthy	1,4219	Healthy	- 0,2882	Healthy
3	CENT	2,1210	Grey Area	- 0,0441	Potentially Bankrupt	- 2,5986	Healthy
4	CSAP	2,6593	Grey Area	1,0240	Healthy	- 0,3958	Healthy
5	DAYA	2,3084	Grey Area	0,3554	Potentially Bankrupt	- 0,8756	Healthy
6	ECII	5,6933	Healthy	0,9825	Healthy	- 3,8391	Healthy
7	ERAA	3,7241	Healthy	1,5489	Healthy	- 1,2293	Healthy
8	GLOB	- 20,9655	Potentially Bankrupt	- 7,6679	Potentially Bankrupt	76,8711	Potentially Bankrupt

Table 1. Cont.

Num	Stock Code	Average Score of Altman	Altman Z-score Prediction	Average Score of Springate	Springate Prediction	Average Score of Zmijewski	Zmijewski Prediction
9	GOLD	1,2398	Potentially Bankrupt	0,0312	Potentially Bankrupt	- 1,7225	Healthy
10	HERO	3,3905	Healthy	0,6528	Potentially Bankrupt	- 2,2887	Healthy
11	KOIN	2,5395	Grey Area	0,9716	Healthy	0,5215	Potentially Bankrupt
12	LPPF	12,2698	Healthy	2,8601	Healthy	- 2,3019	Healthy
13	MAPI	3,0589	Healthy	1,1266	Healthy	- 0,6625	Healthy
14	MIDI	2,8638	Grey Area	1,0241	Healthy	0,0274	Potentially Bankrupt
15	MKNT	16,2649	Healthy	2,7241	Healthy	- 2,1035	Healthy
16	MPPA	2,7880	Grey Area	0,4438	Potentially Bankrupt	0,0652	Potentially Bankrupt
17	RALS	6,4314	Healthy	1,4774	Healthy	- 3,1330	Healthy
18	RANC	4,4537	Healthy	1,4845	Healthy	- 1,9800	Healthy
19	RIMO	- 3,1552	Potentially Bankrupt	- 1,0475	Potentially Bankrupt	5,4482	Potentially Bankrupt
20	SONA	4,3170	Healthy	1,4086	Healthy	- 2,1521	Healthy
21	TELE	5,6408	Healthy	2,6813	Healthy	- 1,2169	Healthy
22	TRIO	- 39,0384	Potentially Bankrupt	- 11,4728	Potentially Bankrupt	95,1991	Potentially Bankrupt
Bankrupt			4		8		6
Healthy			18		14		16

(Source: Calculation Result)

Independent t-test results in Table 2 shows there is different bankrupt prediction calculation proceeds between Altman and Springate model, and also Springate and Zmijewski model (Sig < 0.05). Meanwhile, there is no different result between Altman and Zmijewski model.

TABLE II. INDEPENDENT T-TEST RESULT

Bankruptcy Prediction Model	t-test	Sig
Altman and Springate	0.625	0.049
Altman and Zmijewski	-0.800	0.111
Springate and Zmijewski	-1.160	0.009

(Source: Calculation Result)

The Potential Bankrupt Companies is Springate Model because the accuracy rate is 95.45%, more than Altman and Zmijewski Model which have percentage accuracy rate respectively are 72.73% and 77.27%

B. Discussion

According to three bankruptcy prediction model, there are 11 companies which can be categorized as healthy companies (ACES, AMRT, ECII, ERAA, LPPF, MAPI, MKNT, RALS, RANC, SONA, TELE), 3 companies which can be categorized as potentially bankrupt companies (GLOB, RIMO, TRIO) and the rest are still in doubt because the three model give different result. The number of companies experiencing potential bankrupt is depends on the financial ratios used in conduct predictions. Altman Z-score predict 4 companies (GOLD, GLOB, RIMO, TRIO) are potentially bankrupt using WC/TA, RE/TA, EBIT/TA, MVE/BVD, and S/TA Ratios. Springate predict 8 companies (CENT, DAYA, GLOB, GOLD, HERO, MPPA, RIMO, TRIO) are potentially bankrupt using WC/TA, EBIT/TA, EBT/CL, and S/TA Ratios. While Zmijewski predict 6 companies (GLOB, KOIN, MIDI, MPPA, RIMO, TRIO) are potentially bankrupt using ROA, DR, and CR.

GLOB (Global Teleshop Tbk.) has decreasing sales and total asset for the last four years. RIMO has very bad financial condition in 2015-2016 but has been recovered in 2017-2018. While TRIO has decreasing profit from 2015-2018.

Independent t-test shows that Altman model generates different prediction result with Springate model and also Springate with Zmijewski as long as research period. The result different caused by different in financial ratios variables and coefficient apply in formula equation for each prediction model. Meanwhile, the result from both of models: Altman and Zmijewski are almost same. This research result not in line with research conducted by Januri et al [2] and Mas'ud and Reva [14] which 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 ZScore, Springate, and Zmijewski.

Based on all calculation of prediction model that has been done, it can be concluded that Springate model shows high accuracy of 95.45% and then followed by Zmijewski of 77.27% and Altman Z-score of 72.27%. This means that Springate model is the most appropriate prediction model to be used in predicting bankruptcy in retail companies that are listed in Indonesia Stock Exchange. This result is also not in line with research conducted by Januri et al [2] and Mas'ud and Reva [14] which shows that Zmijewski is the most appropriate prediction model to be used in predicting bankruptcy in cement companies that are listed in Indonesia Stock Exchange.

V. CONCLUSION

It can be concluded as follows, first, according to three bankruptcy prediction model, from 22 retail companies listed in Indonesia Stock Exchange: there are 11 companies which can be categorized as healthy companies (ACES, AMRT, ECII, ERAA, LPPF, MAPI, MKNT, RALS, RANC, SONA, TELE), 3 companies which can be categorized as potentially bankrupt companies (GLOB, RIMO, TRIO) and the rest are still in doubt because the three model give different result. Second, independent t-test shows that Altman model generates different prediction result with Springate model and also Springate with Zmijewski as long as research period. Meanwhile, the result from both models: Altman and Zmijewski are almost same. Third, Springate model is the most appropriate prediction model to be used in predicting bankruptcy in retail companies that are listed in Indonesia Stock Exchange

Based on the limitations in this study, some suggestions are suggested, 1) Further research can use other bankruptcy prediction model that have been found such as Grover, Ohlson, Shirata, CA Score, and 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, and 3) Limitation of this research is not consider the environmental factors outside the retail companies but only analyse the internal financial condition within each retail company.

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