
EURASIAN JOURNAL OF ECONOMICS AND FINANCE

www.eurasianpublications.com

AN ANALYSIS OF BANKRUPTCY LIKELIHOOD ON COAL MINING LISTED FIRMS IN THE INDONESIAN STOCK EXCHANGE: AN ALTMAN, SPRINGATE AND ZMIJEWSKI APPROACHES

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Abstract

This research was conducted to determine the bankruptcy possibility of Coal Mining Companies listed in Indonesia Stock Exchange (IDX), using Altman Model (Z-score, Springate Model (S-Score) and Zmijewski Model (X-Score) approaches. The respondent is 19 Coal Mining Companies listed in IDX taken from 22 companies' population. Purposive sampling was used as the sampling technique which required the following criteria: go public Coal Mining Companies listed in IDX respectively from 2011 until 2011, and have audited financial statements for the fiscal year 2011 – 2014. Data collection methods were desk research. The result of this research showed that Zmijewski Model is the most accurate predictive models that can be applied to coal mining company listed on the Indonesia Stock Exchange (IDX) because this model has the highest level of accuracy compared to other predictive models that are equal to 78.95%, followed by Springate Model which has an accuracy rate of 47.37%, and the last one, Altman Model only has 5.26%.

Keywords: Potential Bankruptcy, Coal Mining Companies, Altman (Z-Score), Springate (S-Score), Zmijewski (X-Score)

1. Introduction

The phenomenon of the bankruptcy in the coal mining industry in Indonesia has begun since 2011 in which it started with the decline in commodity prices on the selling price of coal that had fallen sharply and also accompanied by the increasing cost of production significantly. In Jambi, as many as 331 coal producers have stopped production due to a drastic drop in prices. Those conditions caused a temporary reduction in production while the supply was piling up at the port. In the province, as many as 347 coal producers who have the permission of mining operations, which consists of 206 companies with operating licenses and 141 companies with a production license. Currently, only 12 to 14 companies are still producing and selling coal, with production reaching 50 million tons. This year, sales of coal in Jambi are only 3.5 million tons that is much lower than the 6.8 million tons in 2012. In line with the company's top coal mines in Indonesia PT. Adaro Energy Tbk (ADRO) also felt the impact of the weakening world coal

prices. In a financial report submitted at the AGM stated that the company's net profit fell by 21%. Throughout 2014, the parent company of PT. Adaro Indonesia announced a net profit of USD 183.5 million. Along with PT. Adaro Indonesia, which experienced a decline in net income, there is also some coal mining company listed on the Stock Exchange in 2011-2014 periods, which decreased net income or increasing net loss as presented in Table 1.

The phenomenon that occurred since 2011 until now in both the Coal Industry is exploration, exploitation, trafficking, and others. Some companies have closed, because they are not able to finance operating expenses that increased significantly, and the coal prices since 2011 until now do not get better, even declining. Global Newcastle coal benchmark price index fell from the US \$ 132 per ton in January 2011 to the US \$ 77 per ton in August 2013 and the price has been reduced again to the US \$ 67 per ton in July 2015. More than a few players in the industry are closing coal project, stop or reduce production expansion. As a supplier and the world's largest coal-consuming, for the first time in history a hundred years, China's coal production also fell in 2014 by 2.1%.

Table 1. Net Profit/Loss of coal mining listed firms in the Indonesian Stock Exchange

No.	Company	Code	2011	2012	2013	2014
1	Adaro Energy	ADRO	552.0	383.0	229.0	183.5
2	Atlas Resources	ARII	2.5	(11.1)	(10.6)	(24.6)
3	Borneo Lumbung Energy	BORN	210.0	(571.0)	605.0	-
4	Berau Coal Energy	BRAU	134.0	(180.0)	(162.0)	(84.9)
5	Baramulti Suksessarana	BSSR	4.4	9.8	4.7	2.5
6	Bumi Resources	BUMI	215.0	(705.6)	(660.0)	(465.9)
7	Bayan Resources	BYAN	213.3	54.9	(55.2)	(189.0)
8	Darma Henwa	DEWA	(24.1)	(41.4)	(51.7)	0.3
9	Garda Tujuh Buana	GTBO	73.0	43.0	(5.9)	(4.6)
10	Harum Energy	HRUM	200.0	161.0	49.5	2.6
11	Indo Tambangraya Megah	ITMG	546.0	432.0	230.0	200.0
12	Resource Alam Indonesia	KKGI	50.2	23.5	17.2	8.0
13	Perdana Karya Perkasa	PKPK	(2.9)	(9.1)	0.3	(28.4)
14	Petrosea	PTRO	52.6	49.1	17.3	2.2

In the beginning of 2015, a number of businesses were hit by the declining of the coal price that has happened since 2011. Based on the record of the Indonesian Coal Mining Association (2015), 2015 was a year of low commodity price of coal, from previously at a price of US \$ 110 per ton in 2011, decreased to the US \$ 63.84 per ton in January 2015.

The existence of these phenomena as described above forced the management to be cautious in managing their firms. In addition, the management company should be able to detect as early as they can about the company's financial condition so that it can ensure the firms' sustainability and can prevent the bankruptcy of the company.

An analysis of the financial distress or bankruptcy of a company is very important for the various parties. This is due to the fact that not only the bankruptcy of a company is detrimental to the company, but also it can harm others that are associated with the company, in particular for listed firms on the Stock Exchange. Investors will only invest their capital if they are assured that the company is a healthy firm. Therefore, bankruptcy prediction analysis can be performed to obtain an early warning of the bankruptcy of the company (early signs of the bankruptcy of

the company). Management can immediately take preventive actions so that the company will not be in the state of financial distress.

Furthermore, the information of the bankruptcy prediction is important for the parties related to the company, among others are investors. The information of bankruptcy prediction informs investors whether to invest or not. For the government, bankruptcy prediction can be used to establish government taxation policy and other policies concerning the relationship between the government and the company. For banks and credit institutions, corporate bankruptcy prediction's information is needed to determine the status of the loan that should be given or not to the company that is applying for loans, as well as tools to monitor ongoing loans (outstanding loans).

Studies on the prediction of financial distress or bankruptcy of the company have been carried out by many researchers. However, this study differs from previous studies, in several respects, including: First, Differences Research Object, like other research conducted by Daswir (2010), the observed object is a company listing in the list of Islamic securities, and research conducted by Peter and Yoseph (2011) the object is PT. Indofood Sukses Makmur, Tbk, and research conducted by Dharmanto (2014), the object of the study is the plantation subsector company listed on the Indonesia Stock Exchange. While the object of this study is a Coal Mining Company listed in Indonesia Stock Exchange.

Second, this study used a different model of analysis compared to the study conducted by Kurniasih (2015), who used one bankruptcy prediction model that is the Altman Z-Score model. Meanwhile, this study used three bankruptcy predictions models that are Altman Z-Score model, the Springate Model (S-Score) and the Zmijewski Model (X-Score).

Third, the gap in some previous studies that conclude different things where the best predictor among the three models that were analyzed between models Altman Z-score, Zmijewski models and models Springate. Research by Imanzadeh *et al.* (2011) stated that the model is more conservative than the model Springate Zmijewski. While the research conducted Fatmawati (2012) concluded that the model Zmijewski is a more accurate prediction than the model Altman Z-score and models Springate. While the research conducted by Hadi and Anggraeni (2008) concluded that the predictive model Altman was the best predictor of the three predictors were analyzed in the model Altman Z-score, Zmijewski models and models Springate. With the differences and the gap as described above, then the research will be done this time by comparing potential bankruptcy by third prediction model used is the Altman Z-Score models, the Springate Model (S-Score) and the Zmijewski Model (X-Score), which is carried by a coal mining company listed in Indonesia Stock Exchange period 2011 to 2014.

2. Literature Review

2.1 Financial Distress and Bankruptcy

Financial distress is a situation where the company's operating cash flow is not sufficient to meet the obligations of companies (such as trade credit, or interest expenses) and pressed the company to conduct repairs. Financial distress led companies to neglect the contract on financial restructuring among companies, creditors and property investors. Usually, companies are required to take action where it will not be done if the company has sufficient cash (Rudoni and Ali, 2010). Furthermore, a financial distress is a situation where the company fails or no longer able to fulfill obligations to the debtor because the company experiencing a shortage and insufficiency of funds in which the total liabilities greater than total assets, and cannot be achieving the economic objectives of the company, namely profit (Rudoni and Ali, 2010).

Further, the bankruptcy is a condition when the company has insufficient funds to run its business. Issuers or public companies that fail or are not able to pay its obligations have to report its failure to the superintendent of a securities exchange (BAPEPAM) and the Securities Exchange Commission shortly after a day of its bankruptcy. Bankruptcy is usually interpreted as a failure of the company in running the company's operations to generate profit, also often called liquidation bankruptcy of the company or company closure or insolvency (Hadi and Anggraeni, 2008).

There are several tools used to predict the bankruptcy of a company. The bankruptcy predictors resulting from various studies conducted by experts who focus on bankruptcy at various companies in the world, there are at least five (5) models that can be used to predict bankruptcy and consist of Model Altman Z-Score, Model Springate, Model Zmijewski, Foster Models and Model Grover.

2.2. Altman Model (Z-Score)

The model was developed by Altman (1968), who combines various financial ratios into a model to predict whether a company will be bankrupt or not. Of combining several financial ratios, Altman produces a formula that can predict the bankruptcy of a company by using the Z-Score models. Z-Score is a score determined by a count of the standard time ratio, and the ratio of financial performance indicates the probability of the company's bankruptcy and the purpose of the calculation of Z-Score are to remind going financial problems that may require serious attention and provide instructions for action (Sawir, 2005). Z-Score model using Multiple Discriminant Analysis with five types of financial ratios that Working Capital to Total Assets, Retained Earnings to Total Assets, Earnings Before Interest and Taxes to Total Assets, Book Value of Equity to Book Value of Debt and Sales to the Total Asset (Hadi and Anggraeni, 2008). The criteria used to predict corporate bankruptcy with this model is that a company that has a Z score > 2.99 is classified as a healthy company, while the company has a Z-score <1.81 were classified as a potentially bankrupt company. Furthermore, scores between 1.81 to 2.99 is classified as a company in the gray area or the gray area, with a "cut-off" for the index is 2,675 (Muslich, 2000).

2.3. The Springate Model (S-Score)

This model was developed in 1978 by the Gorgon L.V. Springate. By following the procedures developed Altman, Springate using step - wise multiple discriminate analysis to make your choice of four popular 19 financial ratios that can distinguish companies that are in bankruptcy zone or safe zone. To compare two companies those went bankrupt and were not bankrupt, multi-discriminant analysis can be used, it involves the variables Working Capital to Total Assets, Net Profit Before Interest and Taxes to Total Assets, Net Profit Before Taxes to Current Liabilities and Sales to Total Assets (Hadi and Anggraeni, 2008). If you have a score of less than 0,862, the company classified the company went bankrupt and reversionary

2.4. The Zmijewski Model (X-Score)

The expansion in bankruptcy prediction studies conducted by Zmijewski (1983) adds to the validity of the financial ratios as a means of failure detection of companies' financial condition. Zmijewski conducted a study to examine the bankruptcy field study results of previous research for over twenty years. Financial ratios are selected from ratios - financial ratios of previous studies and taken a sample of 75 companies that went bankrupt, and 3573 healthy company during the years 1972 and 1978, the indicator F-test of the ratio - the ratio of the group, Rate of Return, liquidity, leverage, turnover, fixed payment coverage, trends, firm size, and stock return volatility, showed that there are significant differences between the company healthy and unhealthy. With the assessment criteria the greater the value of X, the greater the possibility/probability of the company went bankrupt, in (Margaretta and Saputra, 2005). This model uses the ratio analysis that measures performance, leverage, and liquidity of a company to its prediction model. The variables used in the equation Zmijewski Model (X-Score) is Return on Assets (ROA), Debt Ratio (leverage), and Current Ratio (liquidity) (Hadi and Anggraeni, 2008). With the assessment criteria the greater the value of X, the greater the possibility/probability of the company went bankrupt and if it is negative then the company is not potentially bankrupt.

2.5. Foster Model

George Foster examined the research for predicting bankruptcy of railway companies in the United States from 1970 to 1971 period. He uses univariate models using two variable ratios separately, namely transportation Operating Expense to Revenue Ratio (TE / OR Ratio) and Time Interest Earned Ratio (TIE Ratio). In this case, Foster uses "Cut off point" $Z = 0.640$, so companies that have $Z < 0.640$ belongs to a group of companies that go bankrupt, while if $Z > 0.640$ included in the group of companies that are not bankrupt.

2.6. Grover Model

Grover Model is a model created by designing and reassessment of the model of the Altman Z-Score. Jeffrey S. Grover using a sample in accordance with the model of the Altman Z-score in 1968, adding thirteen new financial ratios. Samples used as many as 70 companies to 35 companies that went bankrupt and 35 companies that are not bankrupt in 1982 until 1996. Model Grover categorizes the company was bankrupt with a score less than or equal to -0.02 ($Z \leq -0.02$). While the value of the companies that fall within the state is not broke is greater than or equal to 0.01 ($Z \geq 0.01$).

Peter and Yoseph (2011) examined the bankruptcy using Altman Z-score for PT Indofood Sukses Makmur Tbk in the period of 2005 to 2009. They concluded that the firm has the likelihood of bankruptcy. Tambunan *et al.* (2015) investigated PT Bentoel Tbk for the period of 2009 to 2013 and found that the firm in the state of financial distress. Ghosh (2013) stated that the key performance ratios of the company are not satisfactory for the past few years. Based on the Z-score result, the firm is categorized under unhealthy firm during 2009 to 2010, and the firm has undertaken some measures to overcome its insolvency. Furthermore, the Z-score remained in the unhealthy category indicating that the firm was not able to manage the company using its assets pool to yield profits. Thus, the assets pool liquidation is not expected according to the Z-score result.

Research by Imanzadeh *et al.* (2011) states that model Springate is more conservative than Zmijewski models, while the research conducted Fatmawati (2012) concluded that the model Zmijewski is a more accurate prediction than the model Altman Z-score and Springate Model. Also, the research conducted by Hadi and Anggraeni (2008) concluded that the predictive model Altman was the best predictor of the three predictors were analyzed in the model Altman Z-score, Zmijewski Model and Springate Model. Under these conditions, the hypotheses formulated in this research are as follows:

H₁: *There is a difference between the bankruptcy prediction model of Altman Z-score, Springate, Zmijewski, the coal companies that listed in BEI period of 2011-2014.*

H₂: *Zmijewski Model is a bankruptcy prediction model that is more accurate than the Altman Z-score model and models for predicting bankruptcy Springate of coal companies that are listed in BEI period of 2011 through 2014.*

H₃: *Springate bankruptcy prediction model is a model that is more accurate than the Altman Z-score model and Springate Model for predicting bankruptcy of coal companies that are listed in BEI period of 2011 through 2014.*

H₄: *Alman Z-score model is a bankruptcy prediction model that is more accurate than Zmijewski Model and Springate Model for predicting bankruptcy of coal companies that are listed in BEI period of 2011 through 2014.*

3. Research Methodology

The type of data based on sources collected for this research is secondary data. Secondary data is data collected from a second hand or from other sources which had been available

before the study is done. Sources of data in this study came from the Website IDX.co.id, which publishes the financial statements of companies' object of a study.

The population in this study is a sub-sector coal mining company listed on the Indonesia Stock Exchange amounted to 22 companies, which is contained in IDX Statistics, the annual financial statements and their notes have been published during the fourth period, namely from 2011-2014, so there were 88 financial statements. This study used purposive sampling technique used in determining the sample selected based on certain criteria and based on certain considerations tailored to the purpose of research.

There are two criteria used to determine the sample: the sub-sector coal mining company listed on the Indonesia Stock Exchange in a row from 2011-2014 and the sub-sector coal mining companies that publish full financial statements and have been on Audit in a row from 2011-2014.

The sample in this research was 19 sub-sector coal mining companies listed on the Indonesia Stock Exchange using the annual financial statements that have been published during the four periods of 2011-2014. So, there are 76 Audited Financial statements and their notes can be sampled. These samples were taken on the basis that the data relevant to the 19 companies representing a total of 22 sub-sectors of the coal mining company are listed on the Stock Exchange Indonesian.

Comparative analysis is used in this study to interpret and compare the results of quantitative analysis in accordance with the theories that support the research. Based on the calculation model of the Z-Score, S-Score and X-Score, those scores are the most accurate for predicting the potential bankruptcy of a coal mining company listed on the Stock Exchange the period from 2011 until 2014.

4. Findings

Table 2 shows that there is one sample at a coal mining company that had an average score between a cutoff value that is above the value of 1.81 and a value below the value of 2.99, which means the company is in a state of Grey Area.

Model Springate or S-Score has a cutoff value of 0.862 which means that if the company obtained a score of less than 0,862, the company is predicted to be bankrupt, and vice versa, if the company has a score of more than 0,862, the company is predicted not to be bankrupt. From the Table 3, it can be explained that 10 samples in coal mining companies have an average score below the cutoff value, a company with ARII code, ATPK, Brau, BSSR, EARTH, BYAN, DEWA, DOID, PKPK and SMMT, while nine other samples had an average score above the cutoff value. This indicates that Springate models predict there will be a sample of 10 companies that went bankrupt, and the remaining 9 samples would not be expected to go bankrupt.

Table 2. Altman Z-Score

No.	Company	2011	2012	2013	2014	Average	Prediction
1	AdaroEnergy	0.716	0.564	0.492	0.525	0.574	bankrupt
2	AtlasResources	0.358	0.326	0.362	0.110	0.289	bankrupt
3	BaraJayaInternasional	1.231	1.214	0.297	0.392	0.784	bankrupt
4	BerauCoalEnergy	0.816	0.715	0.713	0.770	0.754	bankrupt
5	BaramultiSuksessarana	0.546	0.796	0.904	1.303	0.887	bankrupt
6	BumiResources	0.545	0.384	0.499	0.422	0.463	bankrupt
7	BayanResources	0.927	0.749	0.732	0.705	0.778	bankrupt
8	DarmaHenwa	0.719	0.769	0.614	0.674	0.694	bankrupt
9	DeltaDuniaMakmur	0.634	0.730	0.643	0.677	0.671	bankrupt
10	GoldenEnergyMines	0.907	1.186	1.120	1.360	1.143	bankrupt
11	GardaTujuhBuana	0.703	0.530	0.334	0.380	0.487	bankrupt
12	HarumEnergy	1.603	1.965	1.761	1.091	1.605	bankrupt
13	IndoTambangrayaMegah	1.537	1.660	1.582	1.500	1.570	bankrupt
14	ResourceAlamIndonesia	2.208	2.090	1.838	1.375	1.878	grey
15	SamindoResources	2.091	1.396	1.363	1.506	1.589	bankrupt
16	PerdanaKaryaPerkasa	0.828	0.746	0.566	0.253	0.598	bankrupt
17	BukitAsam	0.942	0.930	0.971	0.892	0.934	bankrupt
18	Petrosea	0.707	0.735	0.712	0.748	0.726	bankrupt
19	GoldenEagleEnergy	3.189	0.078	0.019	0.022	0.827	bankrupt

Model Zmijewski or X-Score has a cutoff value of 0, if a company has a score greater than 0, then the company predicted bankruptcies, and vice versa, if the company has a score of less than 0 then the company would not be expected to experience a bankruptcy. Table 4 shows that there are 4 samples having an average score above the cutoff value which are the companies with the stock code BRAU, EARTH, DOID, and SMMT. Meanwhile, 15 other samples had an average score below the cutoff value. This indicates Zmijewski Model predicts there are 4 samples of companies that will be bankrupt, and the rest as many as 15 samples would not be expected to experience bankruptcy.

Table 3. Springate Model

No.	Company	2011	2012	2013	2014	Average	Prediction
1	Adaro Energy	2.069	1.204	0.706	0.799	1.195	not bankrupt
2	Atlas Resources	0.413	(0.372)	(0.462)	(0.642)	(0.266)	bankrupt
3	Bara Jaya Internasional	(0.106)	0.321	0.244	0.796	0.314	bankrupt
4	Berau Coal Energy	1.531	0.541	0.380	0.293	0.686	bankrupt
5	Baramulti Suksessarana	0.477	1.070	0.355	0.584	0.622	bankrupt
6	Bumi Resources	0.455	(0.282)	(0.473)	(0.360)	(0.165)	bankrupt
7	Bayan Resources	1.092	0.642	0.164	(0.564)	0.334	bankrupt
8	Darma Henwa	0.326	(0.215)	(0.521)	0.509	0.025	bankrupt
9	Delta Dunia Makmur	0.569	0.483	0.238	0.830	0.530	bankrupt
10	Golden Energy Mines	1.936	1.269	0.964	2.515	1.805	not bankrupt
11	Garda Tujuh Buana	3.709	5.444	0.147	(0.637)	2.166	not bankrupt
12	Harum Energy	4.019	3.731	2.032	0.990	2.693	not bankrupt
13	Indo Tambangraya Megah	3.446	3.104	2.157	1.834	2.635	not bankrupt
14	Resource Alam Indonesia	4.965	3.042	2.248	1.462	2.929	not bankrupt
15	Samindo Resources	1.275	1.064	1.468	1.827	1.409	not bankrupt
16	Perdana Karya Perkasa	0.225	0.240	0.371	(0.340)	0.124	bankrupt
17	Bukit Asam	3.387	0.334	2.060	1.623	1.851	not bankrupt
18	Petrosea	1.223	1.150	0.879	0.798	1.013	not bankrupt
19	Golden Eagle Energy	(1.291)	0.710	0.682	0.035	0.034	bankrupt

Table 4. Zjemizewski Model

No.	Company	2011	2012	2013	2014	Average	Prediction
1	AdaroEnergy	(1.506)	(1.416)	(1.465)	(1.634)	(1.505)	notbankrupt
2	AtlasResources	(2.101)	(1.184)	(0.847)	(0.079)	(1.053)	notbankrupt
3	BaraJayaInternasional	0.423	0.238	(2.936)	(2.472)	(1.187)	notbankrupt
4	BerauCoalEnergy	(0.407)	1.128	1.489	1.747	0.989	bankrupt
5	BaramultiSuksessarana	(0.435)	(2.297)	(1.857)	(1.730)	(1.580)	notbankrupt
6	BumiResources	0.354	1.436	2.069	2.364	1.556	bankrupt
7	BayanResources	(1.737)	(0.865)	(0.082)	0.876	(0.452)	notbankrupt
8	DarmaHenwa	(2.747)	(1.730)	(1.430)	(2.172)	(2.020)	notbankrupt
9	DeltaDuniaMakmur	0.952	1.012	1.156	0.735	0.964	bankrupt
10	GoldenEnergyMines	(3.906)	(3.655)	(3.005)	(3.240)	(3.452)	notbankrupt
11	GardaTujuhBuana	(3.368)	(5.704)	(3.039)	(3.178)	(3.822)	notbankrupt
12	HarumEnergy	(4.699)	(4.499)	(3.762)	(3.286)	(4.062)	notbankrupt
13	IndoTambangrayaMegah	(4.069)	(3.744)	(3.299)	(3.213)	(3.581)	notbankrupt
14	ResourceAlamIndonesia	(4.513)	(3.655)	(3.279)	(3.101)	(3.637)	notbankrupt
15	SamindoResources	(1.387)	(0.209)	(0.354)	(3.557)	(1.377)	notbankrupt
16	PerdanaKaryaPerkasa	(0.868)	(1.015)	(1.371)	(0.941)	(1.049)	notbankrupt
17	BukitAsam	(3.871)	(3.457)	(3.012)	(2.558)	(3.225)	notbankrupt
18	Petrosea	(1.637)	(1.038)	(0.971)	0.332	(0.829)	notbankrupt
19	GoldenEagleEnergy	13.585	(3.882)	(2.703)	(2.229)	1.193	bankrupt

4.1. The most accurate analysis of bankruptcy models

Out of the total sample of 19 companies that are used as shown in Table 5, the Altman Z-score model predicts that there are 18 companies that went bankrupt, one company that Grey and no company predicted without bankruptcy. While in reality there is no coal mining company listed on the Stock Exchange that went bankrupt in 2015. Overall it can be concluded that the Altman Z-score has the highest percentage of errors in predicting corporate bankruptcies. So, this model has an accuracy rate of 5.26%, with the type of error of 94.74%.

Table 5. The result of bankruptcy model's summary

No.	Prediction	Altman (Z-Score)	Springate (S-Score)	Zmijewski (X-Score)
1	Bankrupt	18	10	4
2	Grey	1	0	0
3	Not bankrupt	0	9	15
4	Total sample	19	19	19
5	Fact: Not bankrupt	19	19	19
6	Percentage of Accuracy	5.26	47.37	78.95
7	Percentage of Error Type	94.74	52.63	21.05

Springate models predict there will be 10 companies that went bankrupt, while 9 companies predicted no bankruptcy. When compared with the reality, then the model Springate has an error rate in predicting bankruptcy, because in fact, there is no coal mining company in the sample that went bankrupt. From the description above table 5, it can be concluded that this model has an accuracy rate of 47.37% to the type of error of 52.63%.

Zmijewski Model predicts that there are four companies that will bankrupt and 15 companies will not bankrupt. When compared with the reality, then the Model Zmijewski has an error rate that is smaller than the Altman Model and Model Springate in predicting bankruptcy, because in fact there is no company in the sample of mining firms' bankruptcies. From the description above table 5, it can be concluded that this model has an accuracy rate of 78.95% to the type of error of 21.05%.

Based on all the computation of predictive models that have been done, it can be concluded that the model Zmijewski shows the highest level of accuracy that is equal to

78.95%. Further, the Springate has an accuracy rate of 47.37% and this means that Zmijewski Model is the most accurate predictive models that can be used in predicting bankruptcy in coal mining companies listed on the Stock Exchange.

5. Conclusion

In conclusion, there is a potential bankruptcy of a coal mining company listed on the Indonesia Stock Exchange period 2011 to 2014 by implementing Altman analysis model (Z-Score), the Springate Model (S-Score) and the Zmijewski Model (X-Score); and there is a difference between the Altman Z-Score Model, Model Springate and Zmijewski models in predicting bankruptcy in Coal Mining Company listed on the Indonesia Stock Exchange (BEI) in the period of 2011 through 2014; and, of the three models of analysis of bankruptcy in this study, Model Zmijewski is a model of the most accurate predictions that can be applied to the company Coal Mining listed on the Indonesia Stock Exchange (BEI), because this model has a level of accuracy that is the highest compared with the prediction model that counts for 78.95%. Followed by Springate model which has an accuracy rate of 47.37%, the latter is only 5.26% as Altman model.

From the conclusions that have been stated previously, the advice that can be given by researchers are as follows: 1) From the financial ratios used in three models of analysis of the bankruptcy, the company is expected to improve its financial ratios for the level of corporate health that can be maintained and improved; 2) From the calculation accuracy rate of the three models of bankruptcy, the Zmijewski has the higher level of accuracy than the Springate and the Altman model, therefore, the Coal Mining company that is listed on the Stock Exchange should use the Zmijewski Model to predict the risk of bankruptcy of the company; 3) The results of the analysis of bankruptcy prediction are not entirely accurate in predicting bankruptcy, but the results of the analysis remain important to provide early warnings as initial signals of financial difficulty of one company, so that management can undertake corrective measures deemed necessary for the company which is experiencing financial difficulties that the company does not actually bankrupt. Besides, the management company must remain cautious in managing and running the company's operations. Therefore, management must undertake corrective measures to maintain and to increase the performance of the company to avoid or prevent the occurrence of disorders that affect the survival of the company; 4) In a subsequent study, it is advisable to increase the number of samples, the study period, the characteristics of the industry to be sampled as well as using other predictive models that exist, in order to get better research results.

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