

# COMPARISON OF BANKRUPTCY PREDICTION MODELS ANALYSIS (ALTMAN, SPRINGATE, GROVER, OHLSON AND ZMIJEWSKI) ON PT. ASURANSI HARTA AMAN PRATAMA, TBK.

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## ***Abstract***

*PT. Asuransi Harta Aman Pratama, Tbk. is a financial services company which is specialized in general insurance. This research is conducted based on five annual reports spanned from 2012 to 2016 which are independently audited. This study, therefore, aims to compare with five models bankruptcy predictions; the Altman, Springate, Grover, Ohlson and Zmijewski. This study uses a quantitative research approach, using the financial statements data of PT. Asuransi Harta Aman Pratama, Tbk. which also has been published in BEI. This paper analyze the prediction of every method using analysis of variance. The result of this analysis show the differences between the applied models.*

**Keywords:** *The Altman, Springate, Grover, Ohlson, Zmijewski*

## **1. INTRODUCTION**

Finance and accounting are complex domains in which multiple components often interact, making them active areas of study for uncovering the challenges posed by the domain complexity. In addition, the challenge of accurate assessment of business failure prediction under scenarios of financial crisis is known to be complicated. A particularly disruptive case is when the markets' volatility and unpredictability introduce great uncertainty. In such scenarios, credit risk is a primary concern for banks and investors that screen firms and monitor their efforts. As a consequence, there is a great need for accurate analytical tools that are able to predict corporate bankruptcy among the companies in which investors are willing to place their investments, along with the design of early warning systems (Antunes, Francisco et al, 2017)

The bankruptcy or predictive models are the early warning systems based on an analysis of selected indicators that have the ability to indicate a threat in the company's financial health. The models are based on the assumption that a few years before the bankruptcy it is possible to identify symptoms of future problems, which are characteristic for these companies (Braunová & Jantošová, 2015). They could detect the indicators of potential future problems whose early solution can prevent serious consequences for the company (Daniela, Rybárová, et al, 2016).

Based on study Gamayuni (2011) the cause of bankruptcy can come from the internal and the external factors of the company. If the company goes bankrupt, of course there are some parties that will be harmed the parties who have interests against companies such as investors and

creditors (Adriana, et al, 2012). To minimize the risk of bankruptcy, a tool or prediction model can be used to predict the presence or absence of potential bankruptcy of the company. Several studies comparing three models of Altman Z-score model, Zmijewski model and Springate model have different conclusion in term of the best prediction models (Putra, Ivan Gumilar Sambas and Rahma Septiani, 2016). In addition to the three prediction models of bankruptcy, there are several other models, Ohlson model and Grover model.

The General Insurance Association of Indonesia (AAUI) recorded a gross premium of the general insurance

industry in 2015 of Rp 58.9 trillion, or increased by 6.7 percent from the previous year. The increment was much less than that of year 2014 which reached 17.9 percent with gross premium bookings worth Rp 55, 2 trillion

(<http://ekonomi.metrotvnews.com>, 2016).

PT. Asuransi Harta Aman Pratama, Tbk. is a going public financial services company which specialized in general insurance. In 2015, this company had a decline in profit due to the drastic weakening in insurance growth nationwide. In 2016 there was no significant significant increase as illustrated in Figure 1

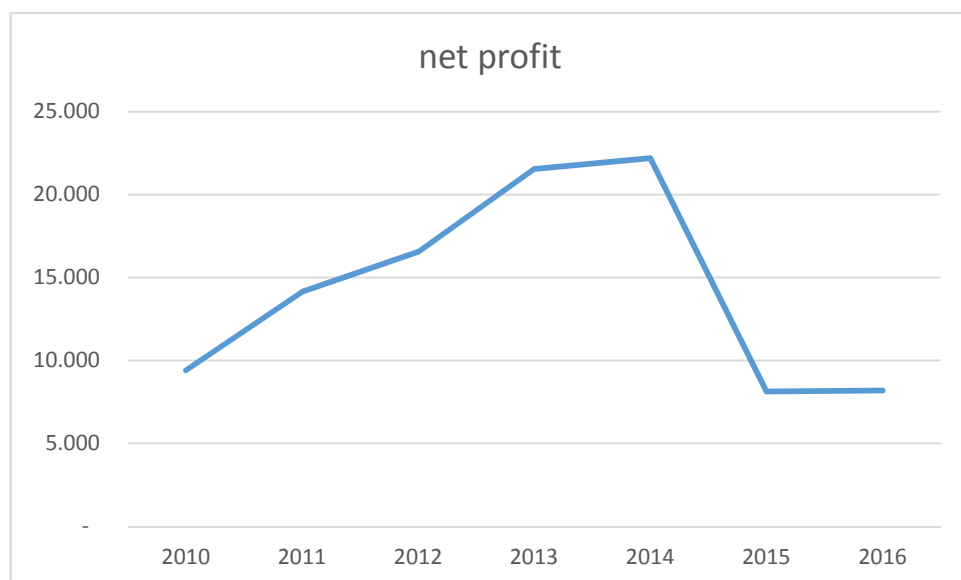


Figure 1 Net Profit Trend

Source : Self Proceed

Based on the above description in this study, the authors analyzed the effectiveness of the implementation of five prediction models of bankruptcy namely Altman Z-score, Springate, Ohlson, Zmijewski and Grover using the financial record of PT. Asuransi Harta Aman Pratama, Tbk.

### 1.1. Formulation of The Problem

The following is the problem formulation in this study:

1. How do the five prediction models of bankruptcy namely Altman Z-score, Springate, Ohlson, Zmijewski and Grover forecast the actual condition of PT. Asuransi Harta Aman Pratama, Tbk. Period 2012 - 2016?
2. Use analysis of variance, Is there any difference analysis of the prediction using Altman Z-score, Springate, Ohlson, Zmijewski and Grover models in the bankruptcy

prediction of PT. Asuransi Harta Aman Pratama, Tbk. in the period of 2012 - 2016?

## 2. LITERATURE REVIEW

### 2.1. Bankruptcy

Bankruptcy is a very severe liquidity hazard situation that a company is no longer be able to run the operation properly; while financial distress is a financial difficulty or liquidity that may lead to bankruptcy. A bankruptcy statement is a legal precedent when creditors or other parties file a bankruptcy suit. The bankruptcy analysis is conducted to attain an early warning of bankruptcy. The earlier signs of bankruptcy are known, the better for the management because they can make improvements. The creditor and shareholder can anticipate a variety of bad possibilities (Kusumo, Willyanto Kartiko, 2002).

Bankruptcy could occur swiftly to companies in countries that are experiencing economic difficulties, because economic destitution will trigger the rapid bankruptcy of companies that may have been bankrupt. There are some managerial and operational signs or indicators that could arise when the company will go bankrupt (Suwarsono, 2000).

### 2.2. Models Of Bankruptcy Prediction

The following are five models of bankruptcy prediction which will be used in these study.

#### 2.2.1. Altman - Z Score Model

The most well-known quantitative model for predicting bankruptcy is Altman's Z-score, which was developed in 1968 by Edward I. Altman, professor at New York's Stern School of Business to measure the distance to default of manufacturing companies. The Z-score is a multiple discriminant analysis which combines ratios in a multivariate context. By taking a sample of 66

companies, Altman examined a list of twenty two possible ratios and finally chose five after numerous tests for the discriminant function (El Khoury, Rim, and Al Beaino, Roy, 2014).

Altman (1968) defined his distress function into:

$$Z = 1.2 X_1 + 1.4X_2 + 3.3 X_3 + 0.6X_4 + X_5$$

Where:

$X_1$  = working capital/total assets;

$X_2$  = retained earnings/total assets;

$X_3$  = earnings before interest and taxes/total assets;

$X_4$  = market value equity/ total debt; and

$X_5$  = annual sales /total assets.

From the calculation of Altman Model (1968) Z-Score is obtained values which are divided into three categories as follows:

1. If the value  $Z > 2.99$ , the company is not going bankrupt.
2. If the value of  $1.80 \leq Z \leq 2.99$ , it means the gray area category where the company has financial problems, although not as serious as the problems of companies that went bankrupt.
3. If the value of  $Z < 1.80$ , it indicate the company in a state of bankruptcy.

#### 2.2.2. Springate's Model

Springate's model developed in 1978. It uses four variables and a two-level system for estimations of the company's status for prediction of bankruptcy. The two levels are "Bankrupt" and "No Bankrupt" (I. Popchev and I. Radeva, 2003).

Just as the steps undertaken by Altman (1968) in study, Springate (1978) originally collected popular financial ratios that could be used to predict financial distress. Unlike the 22 initial ratios collected by the Altman, the Springate only collects an initial ratio of 19 numbers. Later, having the same test as Altman (1968), Springate chose 4 credible ratios to predict financial distress. The Springate model (1978) from the selected 4 ratios are as follows:

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

Where:

$X_1$  = Working Capital / Total Assets

$X_2$  = retained earnings/total assets;

$X_3$  = earnings before interest and taxes/total assets;

$X_4$  = market value equity/ total debt; and

$X_5$  = annual sales /total assets.

The criteria of the scores obtained by a company from this Springate prediction model exceeded 0.862, by which the firm is predicted to have no potential for bankruptcy. On the contrary, if a company has a score less than 0.862, then the company is predicted to have potential for bankruptcy.

### 2.2.3. Ohlson's Model

The next prediction model of bankruptcy was investigated by Ohlson (1980), which was inspired by previous study. Ohlson (1980) derives a bankruptcy prediction model as an alternative to Altman's Z score model. The study employs logistic regression to examine the probability of a firm being bankrupt or non-bankrupt for the period of 1970 – 1976 (Sayari, Naz and Can Simga Muga, 2017). The Ohlson model is different from the previous study model because this model has 9 variables consisting of several financial ratios. Ohlson (1980: 117-118) formulates his calculation model as follows.

$$O = -1,32 - 0,407 X_1 + 6,03 X_2 - 1,43 X_3 + 0,0757 X_4 - 2,37 X_5 - 1,83 ROA + 0,285 X_6 - 1,72 X_7 - 0,521 X_8$$

Where :

$X_1$  = Log (total assets / GNP price-level index)

$X_2$  = Total liabilities / total assets

$X_3$  = Working capital / total assets

$X_4$  = Current liabilities / current assets

$X_5$  = 1 if total liabilities > total assets; 0 if otherwise

ROA = Net income / total assets

$X_6$  = Cash flow from operations / total liabilities

$X_7$  = 1 if Net income is negative; 0 if otherwise

$$X_8 = (NI_t - NI_{t-1}) / (NI_t + NI_{t-1})$$

The criteria of the scores obtained by a company from this Ohlson prediction model exceeds 0.38 by which the company is predicted to have potential for bankruptcy. On the contrary, if a company has a score of less than 0.38 then the company is not predicted to have the potential to experience bankruptcy.

### 2.2.4. Zmijewski's Model

Zmijewski (1984) used financial ratios that measured firm performance, leverage, and liquidity to develop his model. The ratios were not selected on a theoretical basis, but rather on the basis of their performance in prior studies (John Stephen Grice, Jr. and Michael T. Dugan, 2003). Zmijewski (1984) used random sampling techniques in his study, as in Ohlson's (1980) study. The statistical method used by Zmijewski (1984) is the same to that is used by Ohlson, the logit regression. Using this method, Zmijewski model (1984) is as follows:

$$X = -4.803 - 3.599 ROA + 5.406 X_1 - 1.000 X_2$$

Where:

ROA = Net income / total assets

$X_1$  = Total debt / total assets

$X_2$  = Current assets / current liabilities

The criteria of the scores obtained by a company from this prediction model Zmijewski exceeds 0 then the company is predicted to have potential for bankruptcy. On the contrary, if a company has a score less than 0 then the company is predicted to have no potential to experience bankruptcy.

### 2.2.5. Grover's Model

The Grover model was proposed by Jeffrey S. Grover. The Grover model is a model created by re-designing and re-calculating the Altman Z-Score model. Grover in Prianthini and Sari (2014) produces the functions as follows:

$$G\text{-Score} = 1,650 X_1 + 3,404 X_2 - 0.01 ROA + 0,057$$

Where :

$X_1$  = Working capital / Total assets

$X_2 = \text{Earnings before interest and taxes} / \text{Total assets}$

$\text{ROA} = \text{net income} / \text{total assets}$

The Grover model categorizes the company in a bankrupt state with a score less than or equal to -0.02. While the value for companies categorized as non-bankrupt is more than or equal to 0.01.

The following is the framework in this study which explains that this study compares the five models of bankruptcy analysis at PT. Asuransi Harta Aman Pratama, Tbk. :

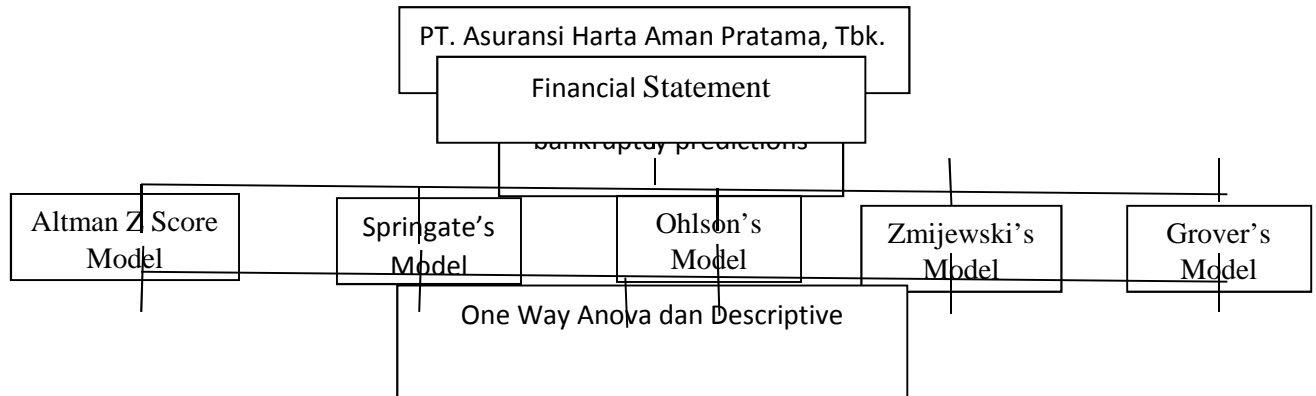


Figure 2 Framework of Thinking

### 3. RESEARCH METHOD

This study is a descriptive quantitative study. Descriptive study is a study conducted to determine and to explain the characteristics of variables studied in a certain situation. Objects in study is the financial statements of PT. Asuransi Harta Aman Pratama, Tbk. annual period 2012 - 2016.

Sources of data used in this study is secondary data which is obtained indirectly by studying the literature or documents related to the study. Study have been done by making PT. Asuransi Harta Aman Pratama, Tbk. as the studied company in the period 2012-2016 through financial statements books that have been obtained, and also can be accessed website [www.idx.co.id](http://www.idx.co.id).

Data collection method used in this study is documentation method.

Documentation method is a method of collecting data source from the investigated objects. The method of documentation in this study is to retrieve financial statements data of PT. Asuransi Harta Aman Pratama, Tbk.

### 4. RESULT AND DISCUSSION

The following is result of this study. There are the results of the score calculation of each prediction models of bankruptcy and result of test one way ANOVA

#### 4.1. The Results Of The Score Calculation Of Each Prediction Models Of Bankruptcy

The results of the score calculation of each prediction models of bankruptcy is listed as follows:

Table 1 The Results Of The Score Calculation Of Each Prediction Models Of Bankruptcy

MODEL										
Tahun	Altman Z		Springate		Ohlson		Zmijewski		Grover	
	Score	result	Score	result I	Score	result	Score	result	Score	result
2012	2.0456	Grey Area	1.1994	Not Bankrupt	-1.6058	Not Bankrupt	-2.8172	Not Bankrupt	0.72558	Not Bankrupt
2013	2.0738	Grey Area	1.2535	Not Bankrupt	-2.4997	Not Bankrupt	-2.8979	Not Bankrupt	0.75302	Not Bankrupt
2014	2.0193	Grey Area	1.1833	Not Bankrupt	-3.3467	Not Bankrupt	-2.8570	Not Bankrupt	0.72636	Not Bankrupt
2015	1.6787	Bankrupt	0.9306	Not Bankrupt	-3.9686	Not Bankrupt	-3.1349	Not Bankrupt	0.66336	Not Bankrupt
2016	1.6371	Bankrupt	0.9130	Not Bankrupt	-4.3580	Not Bankrupt	-3.3981	Not Bankrupt	0.67868	Not Bankrupt

Source : Self Proceed

Based on table 1, Altman Z-Score predicts that the company is in grey area during the period of 2012 – 2014 and bankrupt in 2015 – 2016.

But the result of four other models (Springate, Ohlson, Zmijewski and Grover) showed that company does not bankrupt all year 2012 – 2016.

#### 4.2. Result Test Of One Way ANOVA

The results of One Way ANOVA test of all data to be analyzed in this study are as follow:

Tabel 2 One Way ANOVA Test Of Five Bankruptcy Prediction's Model On PT.Asuransi Harta Aman Pratama, Tbk. In Period 2012 - 2016

Score	Sum Of Squares	df	Mean Squares	F	Sig.
Between groups	115.677	4	28.919	105.026	.000
Within Groups	5.507	20	.275		
Total	121.184	24			

Source : Self Proceed

From the results of One Way ANOVA test, ANOVA sig value (p value) are obtained of 0.000 where <0,05 then it could be concluded that there is difference of bankruptcy level between Altman Z-score, Springate,

Ohlson, Zmijewski, and Grover on PT.Asuransi Harta Aman Pratama, Tbk. in the period of 2012 - 2016.

Furthermore the results of Multiple Comparisons and Homogeneous Subsets are as follows:

Table 3 Multiple Comparisons Of Five Bankruptcy Prediction's Model On PT.Asuransi Harta Aman Pratama, Tbk. In Period 2012 - 2016

	I (Model)	J (model)	Mean difference (I-J)	Std. Error	Sig.	95% confidence interval		
						Lower bound	Upper bound	
LSD	Altman Z-Score	Springate	.7950061*	0.3318748	0.026	0.102728	1.487285	
		Ohlson	5.0467759*	0.3318748	0.00	4.354497	5.739055	
		Grover	1.1815891*	0.3318748	0.02	0.489309	1.873866	
		Zmijewski	4.9120112*	0.3318748	0.00	4.219733	5.604290	
	Springate	Altman Z-Score		-0.7950061*	0.3318748	0.026	-1.487285	-0.102728
			Ohlson	4.2517698*	0.3318748	0.00	3.559491	4.944048
			Grover	0.3865810	0.3318748	0.258	-0.305698	1.078860
			Zmijewski	4.1170051*	0.3318748	0.00	3.424726	4.809284
	Ohlson	Altman Z-Score		-5.0467759*	0.3318748	0.00	-5.739055	-4.354497
			Springate	-4.2517698*	0.3318748	0.00	-4.944048	-3.559491
			Grover	-3.8651888*	0.3318748	0.00	-4.557467	-3.172910
			Zmijewski	-0.1347647	0.3318748	0.689	-0.827043	0.557514
	Grover	Altman Z-Score		-1.1815871*	0.3318748	0.002	-1.873866	-0.489309
			Springate	0.3865810	0.3318748	0.258	-1.078860	0.305698
			Ohlson	3.8651888*	0.3318748	0.00	3.172910	4.557467
			Zmijewski	3.7304241*	0.3318748	0.00	3.038145	4.422703
	Zmijewski	Altman Z-Score		-4.9120112*	0.3318748	0.00	-5.604290	-4.219733
			Springate	-4.1170051*	0.3318748	0.00	-4.809284	-3.424726
			Ohlson	0.1347647	0.3318748	0.689	-0.557514	0.827043
			Grover	-3.7304241*	0.3318748	0.000	-4.422703	-3.038145

\*The mean difference is significant at the 0.05 level

Source : Self Proceed

*Tabel 4 Homogeneous Subsets Of Five Bankruptcy Prediction's Model On PT.Asuransi Harta Aman Pratama, Tbk. In Period 2012 - 2016*

Model		N	Subset for alpha = 0.05		
			1	2	3
Duncan*	Ohlson	5	-3.155789		
	Zmijewski	5	-3.021024		
	Grover	5		0.709400	
	Springate	5		1.095981	
	Altman Z-Score	5			1.890987
	Sig.			0.689	0.258

Means for groups in homogeneous subsets are displayed

\*. Uses Harmonic Mean Sample Size = 5.000

*Source : Self Prosesed*

Based on the results of the analysis in Table 4.3 and Table 4.4, it can be concluded that the Ohlson model has similarities to the Zmijewski model, Grover model has in common with the Springate model, while the Almant Z model is different from the other four models.

## 5. CONCLUSION

Based on the results of the prediction analysis of bankruptcy using PT. Asuransi Harta Aman Pratama, Tbk. financial statements period 2012 – 2016, it can be concluded that:

1. The Almant Z model indicates that the company, during the period of

2012 – 2014, is in the grey area, while in the period 2015 - 2016 is bankrupt.

2. The Springate, Ohlson, Zmijewski, and Grover models result not-bankrupt indications, for the period 2012 – 2016.
3. There are differences among the five models of bankruptcy analysis (Altman Z-score, Springate, Ohlson Zmijewski, and Grover) used in this study.
4. Ohlson model has similarities to the Zmijewski model, Grover model has in common with the Springate model, while the model Almant Z is different to the other four models.

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