

# Precision of the models of Altman, Springate, Zmijewski, and Grover for predicting the financial distress

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## ABSTRACT

Financial distress models need to be developed as a model of an early warning system. Such an effort is intended to anticipate the conditions that can lead to the bankruptcy of the company. This study aims to analyze the accuracy of the model of Altman, Springate, Zmijewski, and Grover as the best predictor of financial distress. This research is a quantitative study in which the data were collected by means of a data pool. This is done by using a dummy variable. The sample consists of 132 companies which are listed on the list of Daftar Efek Syariah (DES) in 2009-2012. The analysis is done by using an analytical tool that is a Binary Logistic Regression. It shows that the model of Altman, Zmijewski models, Springate, and Grover can be used for prediction of financial distress. However, the model of Zmijewski is the most appropriate model to be used for predicting the financial distress because it has the highest level of significance compared to the other models. Zmijewski model is used for having more emphasis on the leverage ratio as an indicator of financial distress.

## ABSTRAK

Model kesulitan keuangan perlu dikembangkan sebagai model sistem peringatan dini. Seperti upaya ini dimaksudkan untuk mengantisipasi kondisi yang dapat mengarah pada kebangkrutan perusahaan. Penelitian ini bertujuan untuk menganalisis akurasi model Altman, Springate, Zmijewski, dan Grover sebagai prediktor terbaik dari kesulitan keuangan. Penelitian ini merupakan penelitian kuantitatif di mana data dikumpulkan melalui kolam data. Hal ini dilakukan dengan menggunakan variabel dummy. Sampel terdiri dari 132 perusahaan yang terdaftar di daftar Daftar Efek Syariah (DES) di 2009-2012. Analisis dilakukan dengan menggunakan alat analisis yaitu Binary Logistic Regression. Hasilnya menunjukkan bahwa model Altman, model Zmijewski, Springate, dan Grover dapat digunakan untuk prediksi kesulitan keuangan. Namun, model Zmijewski adalah model yang paling tepat digunakan untuk memprediksi kesulitan keuangan karena memiliki tingkat tertinggi signifikansi dibandingkan dengan model lainnya. Model Zmijewski digunakan untuk kasus yang lebih menekankan pada leverage ratio sebagai indikator kesulitan keuangan.

## 1. INTRODUCTION

The condition of being bankrupt or insolvent is probable in any company, even in big company that has long been in operation. In that case, it is imperative to analyze the symptoms of bankruptcy in order to anticipate the future condition of a company. One of the ways is to analyze the financial ratios of the company based on certain models. This is due to the fact that a few companies were liquidated due to bankruptcy.

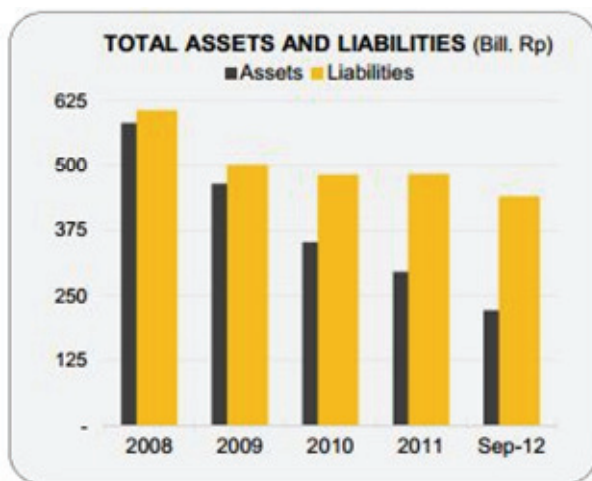
Since 2009-2013, the Indonesia Stock Exchange

(IDX) has issued 20 companies or delisted from the exchange. Revocation of registration of shares by IDX may result from the issuers declining into a good financial performance or operational performance. Such a revocation of registration of shares can also occur at the request from the issuer, called the voluntary delisting.

For example, PT *Panasia Filamen Inti Tbk* (PAFI), garment company that delisted from the Stock Exchange as a result of poor financial performance. Prior to that delisting position from the

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**Figure 1**  
Total Asset and Liability of PAFI



Company Report: February 2013.

**Figure 2**  
Total Equity of PAFI



Company Report: February 2013

Stock Exchange in 2013, PAFI has been experiencing financial difficulties sustained from 2008 to 2012. Figure 1 shows that the total debt is higher than the total assets. It has bigger corporate debt than assets of the company which shows that such a company's depends on the third-party financing.

Figure 2 shows the performance of the share capital which is not managed properly. The second chart that is PAFI is signaling net income from 2008 to 2012 in the minus condition. As such, it cannot cover the costs and then later on it was declared to be bankrupt. Bankruptcy begins when there is a financial distress that cannot be repaired. The graph of assets, debt, and equity in PAFI represents an overview of financial difficulties that cannot be tackled.

The company's being in financial difficulties are influenced by both internal factors and external factors. Internal factors emerge from the financial performance and capital asset management company that is not good, so the income received could not cover the costs. External factors can emerge from the economic condition of the enterprise environment, such as inflation. However, for these external factors, the study does not discuss them.

A financial difficulty is something that is considered by the shareholders. In this case, return on equity (ROE) is the most preferred ratio to evaluate the management skills in utilizing the company's equity, Traub, Ellis (2001). In addition, financial ratios in the financial statements the company have benefits to analyze the soundness of the company and the anticipated problems of financial difficulties in future. For example, a study by Evanny (2012), profitability ratios were indicated by the return on assets (ROA) affects financial distress

manufacturing company in IDX. High ROA shows the company is able to use its assets to generate earnings from sales and investment. Therefore, the company got sufficient funds to cover their costs and make a profit. Conversely, a low ROA is avoided because it causes financial difficulties. Leverage ratio as indicated by current liabilities Total assets also affect financial distress.

A current liabilities total asset indicates a company's ability to meet all obligations. Therefore, the higher the total assets current liabilities, the company said more liquid or the higher the company's ability to pay all liabilities. For example, a study by Luciana (2006), uses a logic multinomial in three equations. The first equation includes financial ratios of profit or loss statements and balance sheets. The second equation incorporates the financial ratios of cash flow. Third equations incorporate the financial ratios of profit/loss, balance sheet and cash flow. Of the three equations there are at least eight financial ratios that affect firm financial distress. These ratios are financial leverage (total liabilities/total assets), cash flow from operations or total assets, cash flow from operations or current liabilities, current assets/total assets, total liabilities or total assets, net fixed assets or total assets, cash flow from operations or total shareholders, cash flow from operations or total liabilities. The conclusion is that the financial ratios were able to identify financial distress.

Several financial ratios can be used for the identification of financial distress as the result above. Altman (1968) summarized financial ratios into of a bankruptcy prediction model of Altman as an early warning system. There are five ratios used by Altman in the model, namely the working capi-

tal or total assets, retained earnings or total assets, earnings before interest and taxes or total assets, book value of equity or book value of total debt, sales or total assets. Furthermore, the model becomes a pioneer Altman bankruptcy emergence of other models.

Jouzbarband, M et al. (2013) examined the financial performance and predict the risk of bankruptcy of a cement company in India using the model of the Altman Z-Score. The result Z-Score identifies companies KCP Ltd and Kilogram Industries Ltd. experiencing poor financial performance or financial distress. Yet, Dalmia Bharat Ltd. is on the threshold of bankruptcy. This suggests the use of a model Altman bankruptcy for research is still applicable.

Test model of bankruptcy has been prevalently done for the purpose of finding the right model of bankruptcy for determining a corporate bankruptcy prediction models along with the many emerging post-bankruptcies with Altman model. For example, Evi, Ni Made et al. (2013) analyzed the bankruptcy prediction model of Grover, Altman z-score, Springate and Zmijewski on food and beverage companies. This research used a paired analysis techniques for the sampled-test with the help of Microsoft Excel program. The study states there is a difference between the model of Grover and that of Altman Z-Score models, models with models Springate Grover and Grover models with models in predicting bankruptcy Zmijewski on Food and beverage companies listed in Indonesia Stock Exchange (IDX). Grover model is the most suitable prediction model applied to the Food and Beverage companies listed in Indonesia Stock Exchange (IDX) because this model has the highest level of accuracy compared with other prediction models.

Mila Fatmawati (2012) conducted a study of using the models for bankruptcy of Zmijewski, Altman, and Springate as predictors on delisted companies in Indonesia Stock Exchange. The sample was obtained from 30 companies delisting ranging from 2003 to 2009 with a comparison of 30 companies are still listed on the Stock Exchange. Analysis using logistic regression models and the results are proved to be the more precise models Zmijewski used as a predictor of delisting.

Thus, so far a study on prediction of bankruptcy and delisting the company has been done a lot. However, only a few studies have attempted to predict financial distress of a company with the right bankruptcy models. It is given by Altman (1968), the model defaults as an early warning sys-

tem. Then, the prediction of financial distress should be done first before bankruptcy prediction. Basically, every model has both some advantages and disadvantages. In more specific circumstances, a certain model can be said to be right, but in other circumstances the model may not be suitable. This study tries look for the right model used for predicting a financial distress in the current condition.

From various studies that have been done previously, the researcher is motivated to develop financial distress prediction study. This study uses four models that are often used for bankruptcy prediction such as the models of Altman, Springate, Zmijewski, and Grover, will be used for the prediction of financial distress. This study focused on the accuracy of the test models for the prediction of financial distress bankruptcy.

Based on the above reasoning, the formulation of the problem in this research is which prediction model is the most well-applicable for the prediction of financial distress of companies. The urgency of this research is financial distress that should be identified early before delisting or bankruptcy, using the correct prediction models. This attempts to find the financial distress prediction model to predict a company financial distress the most accurately.

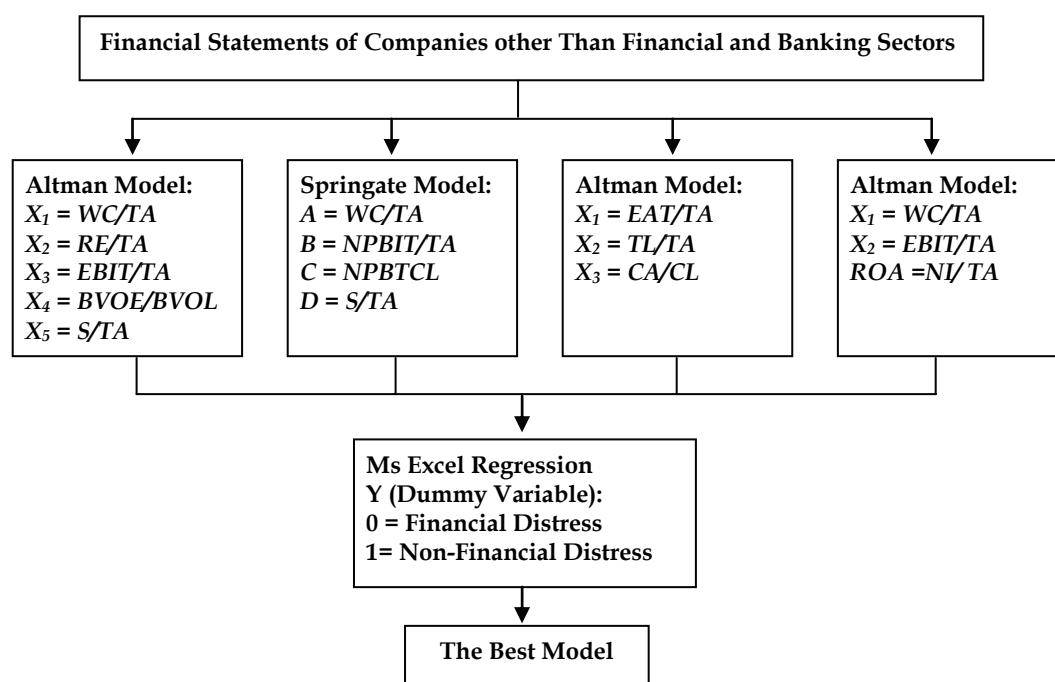
## **2. THEORETICAL FRAMEWORK, AND HYPOTHESIS**

### **Bankruptcy**

Bankruptcy is a situation in which the company's assets exceed liabilities, generally occurs due to the lack of capital as it does not utilize capital resources well, not maintain sufficient cash, inefficient management in all activities. It has a decline in sales and market situation, Ramana, N. Venkata et al. (2012). Bankruptcy usually does not only show up in the company but it can be indicated or identified early. Financial difficulty (financial distress) is an early indication of the bankruptcy of the company, Haryetti (2010). Another important issue is the existence of the common mistakes that interpret financial distress and bankruptcy are the same thing. In fact, financial distress is just an early indicator of a company bankruptcy. A company experiencing financial distress does not mean bankruptcy, if the financial condition appears to have been improved.

To predict a bankruptcy remains a concern for the various stakeholders in a company, including the owners, managers, investors, creditors and business partners, as well as government agencies, Martin et al. (2011). As a result of the bankruptcy, the company's stock ownership among the general

Figure 3  
Research Framework



public in particular suffer financial hardship. Not only the owner, but also other users of financial statements, such as investors, creditors, and the general economy are all affected. Therefore, early warning of bankruptcy should be done as a preventive measure to reduce the level of risk and danger of bankruptcy of the company, Alkhatib, Khalib, and Ahmad Al Bzour Eqab (2011).

#### Financial difficulties (Financial Distress)

To survive financially is essential for all companies so that they can be considered in the analysis of a company's financial statements. The survival of the company is reflected in the financial statement, describing its future financial condition that is also called continuity. According Brédart, Xavier (2014), many bankruptcy cases are likely originated from being lack of a corporate governance, which in turns, impact on financial hardship. The predicted survival of the company is very important for the company internally or managerial and owner of the company or its shareholders to anticipate the possibility of a potential financial difficulties or financial distress. As such, financial difficulty is defined as the final stage of decline in the company or as an early warning model for financial health, which is used in predicting bankruptcy or liquidation of the company issues, Sayari, Naz, and FN Can Simga Mugan (2013).

Hanafi, M, and Halim (2002) describes the condition of the actual financial difficulties between

the two extremes, namely the difficulties in terms of short-term liquidity (the lightest), and insolvency (most severe). A financial difficulty in the short term is usually temporary, but could develop into severe if there is no effort of improvement. Management of short-term financial difficulties (unable to pay obligations at maturity) is not appropriate, potentially solvable conditions (amount of debt is greater than the amount of assets) and lead to bankruptcy.

Financial distress is a condition in which the operating cash flow in the company cannot repay its current liabilities such as accounts payable or interest expense. Financial distress is a disruption of the company's liquidity, which should be corrected by changing the size of the operation or the structure of the company. Luciana Spica, and Emanuel Kristijadi (2003) argue that financial distress occurs when the company experiences a net operating profit (net income operation) being negative for several years and they did not pay dividends or eliminate the payment of dividends, and layoffs. Furthermore, Luciana Spica Almilia (2006) also stated that a financial distress experienced by companies are delisted as a result of net income and book value of negative equity in a row as well as the company has in-merger.

The emerging bankruptcy prediction model is the anticipation and early warning system against financial distress because the model can be used as a means to identify even improve the condition

prior to the crisis or bankruptcy. In addition, the financial statements can be used as a basis for measuring the financial distress of a company through the analysis of financial statements using financial ratios that exist.

### **Research Framework**

As based on the background and description of the literatures as well as some references for this study viewed previously, the model of research framework can be drawn as in Figure 3.

### **The Development of Financial Distress Prediction Technique**

#### **Altman Model**

Altman (1968) applies the Multiple Discriminate Analysis. The discriminant analysis is a statistical technique that identifies some financial ratios that are considered the most important in influencing the value of an event, and then it develops it into a model with a view of making it easier to draw conclusions from an event. The use of Altman model as one of the bankruptcy of performance measurement is not fixed or stagnant, but it even evolves from time to time. The testing and discovery of Altman model continues to be expanded by up to its application not only in the public manufacturing companies alone but already includes manufacturing companies, non-public, non-manufacturing companies, and corporate bonds company. The model developed by Altman bankruptcy experienced some improvement or revision. Some revisions were made by Altman aiming to adapt to the existing models. Thus, the bankruptcy prediction model is more flexible. Not only for manufacturing companies which are going public, but this model even can also be applied to other companies such as which are in the private sector.

Several studies using this model can be noted. For example a research and Atika Anggraeni Syamsul Hadi (2008), in which, they were looking for the delisted best predictor among the models of Altman, Springate, and Zmijewski. They concluded that the prediction model of Altman was the best predictor for predicting the conditions delisted companies. Other study was conducted by Mila Fatmawati (2012), using the Zmijewski model, the Altman model, and the Springate model as predictors of delisting of the manufacturing company. Altman model develops more competitively in financial distress. Based on previous research, Altman model can be used for prediction of financial distress events. For that reason, this study proposes hypothesis as follows:

H1 = Altman model can be used to predict financial distress.

#### **Springate Model**

Springate model was the first model to be introduced by Gordon LV Springate (1978). Basically, this model is a revolution of the Altman model developed by Multiple Discriminant Analysis (MDA). Springate model development process initially used 19 financial ratios that have been frequently used. However, after testing, Springate finally chose four financial ratios to be used to determine whether the company is said to be either a healthy company or potentially insolvent. Springate test shows that the model has an accuracy rate of 92.5%. Springate used 40 companies as the sample for this research.

A study by Adriana (2011) analyzed the bankruptcy prediction using Springate for the foods and beverages sector companies listed in Indonesia Stock Exchange in the period of 2006-2010. The study mentions that Springate method can be used as a means of evaluating the condition and performance of a company for the parties concerned. Furthermore, Springate is found to be a method for predicting bankruptcy of the company in the future. Springate is also a model that can be used as an early warning system of bankruptcy. In this study, relevant Springate used to test the prediction model of financial distress. As such, the hypothesis is proposed as the following:

H2 = Springate model can be used to predict financial distress.

#### **Model Zmijewski**

Zmijewski, ME, (1984) used financial ratio analysis that measures the performance of debt or leverage and liquidity of a company. In his analysis, Zmijewski used probit analysis as applied to 40 companies in a state of bankruptcy and 800 companies that are still operating at the time, and then develop a model by using ROA, leverage, and liquidity ratios. Hodgins, Robert F, and Roberto Marchesini (2011) investigated the presence of criticism sample-bias in the model of financial distress by Zmijewski. The study used a sample of high-leverage the companies as the indicators of bad loans, the results raise doubts criticism sample-bias.

Another research conducted by Fatmawati (2012), compared the three prediction models of delisting such as the Zmijewski, Altman, and Springate models. The analysis showed that of the three models of the delisting predictor, Zmijewski was more accurate model for predicting the com-

pany delisting compared with Altman and Springate models. Based on previous research, the proposed hypothesis is as follows:

H3 = Zmijewski model can be used to predict financial distress.

#### Grover Model

Grover Model is a model created by restoration or redesigns of the model of the Altman Z-Score. It takes X1 and X3 of the Altman model and then adds profitability ratios which are indicated by ROA. The next is Evi, Ni Made et al. (2013) also conducted a study using a model of bankruptcy prediction analysis Grover, Altman Z-Score, Springate and Zmijewski the food and beverage sector companies listed on the Indonesia Stock Exchange (IDX).

The result, Grover models are most appropriate predictive models applied to companies in the food and beverage sector. The study shows that the model Grover has the highest degree of accuracy that is equal to 100%. On the contrary, Altman model of Z-Score has an accuracy rate of 80%, 90% Springate models and models Zmijewski by 90%. Based on their previous research, the proposed hypothesis is as the following:

H4 = Grover model can be used to predict financial distress.

This study also attempts to test which model is found to be the best for predicting financial distress among some of the models used. Therefore, the research hypothesis can be formulated as follows:

H5 = Altman Model predicts financial distress better than Springate, Zmijewski, and Grover.

H6 = Springate model predicts financial distress better than Altman, Zmijewski, and Grover.

H7 = Model Zmijewski predicts financial distress better than the Altman, Springate, and Grover.

H8 = Model Grover predicts financial distress better than Altman, Springate, and Zmijewski.

### 3. RESEARCH METHOD

#### Research Type

This study uses a concept of non-parametric statistics that is statistical interpretation which does not depend on the population matched by any normal distribution. Based on the characteristics of the problem, this study can be also a historical research because it uses financial statement data from 2009 to 2013. It is also considered a descriptive study that is the study of phenomena or certain populations obtained by researchers of the subject in the form of individual, organizational, industry or any other perspective. Descriptive research aims to pre-

sent an overview of financial distress used by describing a number of models of financial distress.

#### Population and Sample

The population consists of companies listed in the List of Islamic Securities (DES). List of Islamic Securities (DES) is a collection of effects that do not conflict with the principles of Sharia in the capital market, which is set by *Bapepam-LK* or approved the *Bapepam-LK*. Sharia stock index is incorporated in the List of Islamic Securities (DES) belonging to the new index, the level of liquidity of stocks that is still questionable, Akbar, Aldiansyah. et al. (2014).

Sampling method used is non-probability with purposive sampling or with certain criteria. The sample was taken by means of pooled technique, which combines the data cross-section with time series. This is done because of the limited data that can be in the aggregation. Criteria for sample consist of general and specific criteria. The general criteria are criteria that must be met by all samples such as the following:

1. The Companies have the financial statements (income statement, balance sheet, and cash flow) during the study.
2. Companies are not a company engaged in the banking and financial sectors (banks, insurance companies, credit agents, securities).

The specific criteria are used to determine whether a company experiencing financial distress or not. There is no consistent definition for companies experiencing financial distress or decline stage. The identification of financial distress can be as long as 2 years experience operating net income (net operating income) and negative for more than one year which have not paid dividends, Almlia, Luciana Spica, and Kristijadi (2003). Sheikhi, Maryam et al. (2012) identify the financial distress on companies that have lost at least half of their capital in 2 consecutive years. In this study, the researcher tries to get the companies experiencing financial distress with a return on equity (ROE) under the BI Rate, in terms of positive equity. Conversely, companies that are not experiencing financial distress have return on equity (ROE) above the BI Rate. ROE describe the ability of management companies in using capital entrusted by shareholders.

According to Sri Hermuningsih (2013), the greater the ROE is, the better the performance of the company is. It can be seen by investors as a positive signal of the company. Thus, it can increase the confidence of investors and facilitate the management of the company to attract capital in

the form of shares. If ROE is under the BI rate, it is better company to sell all of its assets and invest in government bonds or bank deposits. That is, companies with ROE above BI rate cannot be a good investment alternative.

Based on the above criteria, the pooled techniques took 66 companies experiencing financial distress during 2009-2010. Furthermore, the companies are paired based on the amount of assets owned by the same or nearly the same as a comparison. Total assets of companies included in the sample are not limited because it is only as an indication of the couple alone.

### Source of the Data

This study uses secondary data which were taken by the researchers indirectly or through an intermediary. Secondary data are generally in the form of notes or past reports contained in the documents both whether published or unpublished. The data types include pooled data categories, namely the combination of time series data (time series data) and slices of latitude (cross section).

### Data Collection Technique

A non participant observation was applied for collecting the data. The observation data are not directly involved in these activities. The data observed in the form of financial statements of the company in 2009-2013, obtained indirectly from related sources. The financial statements were used as the data obtained from the website IDX through the Website Indonesian Stock Exchange [www.idx.co.id](http://www.idx.co.id) and ICMD (Indonesia Capital Market Directory).

### Definition of Operating Variables

The dependent variable is a dummy variable. Obviously, the dependent variable is a qualitative variable. Financial distress has diverse definitions as described earlier. Dummy variable is used to provide attributes on the dependent variable. Attribute 0 for companies experiencing financial distress and attributes 1 to companies that are not experiencing financial distress. On the contrary, the independent variable is the score of each bankruptcy prediction model. The prediction model used is a model of financial distress prediction models that have been developed, namely the model of Altman Z-Score, Springate, Zmijewski, and Grover. The formula used is as follows:

### Altman Model

The equation proposed by Altman models are:

**Table 1**  
**Criteria of Hypothesis Testing**

| Probability Values | Classification       |
|--------------------|----------------------|
| P < 1%             | Strong Significant   |
| 1% > P < 5%        | Moderate Significant |
| 5% > P < 10%       | Weak Significant     |
| P > 10%            | Not Significant      |

$$Z' = 0.717X_1 + 0.847X_2 + 3.108X_3 + 0.42X_4 + 0.988X_5$$

Description:

Z' = bankruptcy index

X<sub>1</sub> = working capital or total assets

X<sub>2</sub> = retained earnings or total assets

X<sub>3</sub> = earnings before interest and taxes or total assets

X<sub>4</sub> = book value of equity or book value of total debt

X<sub>5</sub> = sales or total assets.

### Springate Model

Equation models proposed by Springate are:

$$Z = 1.03A + 3.07B + 0.66C + 0.4D$$

Description:

A = Working Capital or Total Assets

B = Net Profit before Interest and Taxes or Total Assets

C = Net Profit before Taxes or Current Liabilities

D = Sales or Total Assets

### Zmijewski Model

The model equations are:

$$X = -4.3 - 4.5 + 5.7 X_1 X_2 - 0.004X_3$$

Description:

X<sub>1</sub> = after-tax earnings or/total assets

X<sub>2</sub> = total debt or total assets

X<sub>3</sub> = current assets or current liabilities

### Grover Model

Equation in this is as follows:

$$Score = 1.650X_1 + 3.404X_2 - 0.016ROA + 0.057$$

Description:

X<sub>1</sub> = Working capital or Total assets

X<sub>2</sub> = Earnings before interest and taxes or total assets

ROA = net income or total assets

### Data Analysis Techniques

All the hypothesis are tested for determining which one is the most accurate model of financial distress using logistic regression analysis. Logistic regression was used when the dependent variable in the form of dummy variables, to see if there is the effect of the independent variables on the dependent variable in the form of dichotomous variables or binary variables. This analysis uses statistical program of Microsoft Excel. The model used is the following:

**Table 2**  
**Results of Descriptive Statistics**

|                    | Z-Score | S-Score | X-Score   | G-Score |
|--------------------|---------|---------|-----------|---------|
| Mean               | 1.6857  | 0.7834  | -23.1913  | 0.3807  |
| Median             | 1.7254  | 0.7497  | -14.0435  | 0.3093  |
| Standard Deviation | 1.5126  | 0.9626  | 44.0717   | 0.5081  |
| Kurtosis           | 1.8968  | 1.4394  | 2.1052    | 0.3357  |
| Skewness           | -0.7226 | -0.1984 | 0.2349    | 0.1623  |
| Range              | 8.4411  | 6.2577  | 304.2011  | 2.7473  |
| Minimum            | -3.5092 | -2.9110 | -138.1612 | -1.0181 |
| Maximum            | 4.9319  | 3.3466  | 166.0398  | 1.7292  |

$$Y = a + bX + \varepsilon \quad (1)$$

Description:

$Y$  = Dummy variable, 1: distress and 0: non-distress

$a, b$  = constants

$X$  = Score models

$\varepsilon$  = Error

Such above formula is applied to each model in order to see the level of significance or accuracy of each model. To identify the most accurate model requires testing criteria as presented in Table 1.

#### 4. DATA ANALYSIS AND DISCUSSION

##### Descriptive Statistics

When applying descriptive statistics, the researcher collect, process, and then presents the data of observation so that others can easily obtain an overview of the nature or characteristics of such data. It was processed using Microsoft Office Excel 2007. The important point of this descriptive statistics is the homogeneity or heterogeneity and normality of the data.

Such a test is to find the data distribution. The shape of the data distribution can be seen from the skewness and kurtosis. The size of skewness is a quantity used to determine the degree of inclination of a frequency distribution of a set of data. The skewness function indicates where the highest position of a distribution of data to a data group. A perfect data is data that have the skewness being equal to 0 (zero), or called they also have a perfect normal distribution.

The larger the value of skewness means the more skewed distribution. In such a condition, the data are more concentrated on one side of the distribution. The skewness value of the models of Altman, Springate, Zmijewski, and Grover respectively is -0.7226, -0.1984, 0.2349, and 0.1623 (see Table 2). The skewness is positive; showing the top of the data distribution skewness overhung the positive values (the cure tail of the right side is longer). While the negative skewness indicates end of data distribution skewness overhung the nega-

tive value (curve tails left longer).

Kurtosis is a tool to show the fineness of a distribution of data. It shows the form of distribution; tapered (leptokurtic), blunt (mesokurtic), and very blunt (platikurtic). The finer the distribution of data indicates that the data are increasingly collected or concentrated in one particular point (homogeneous) and conversely the blunter the more widespread distribution of data which means heterogeneous. Kurtosis  $< 3$  is platikurtic,  $= 3$  is mesokurtic, and  $> 3$  is leptokurtic (Syamsul Hadi 2007). Kurtosis value for the models of Altman, Springate, Zmijewski, and Grover respectively are 1.8968, 1.4394, 2.1052, and 0.3357.

Based on the kurtosis value of each model, it can be concluded that the shape of the data distribution is quite blunt- platikurtic or because the value of kurtosis  $< 3$ . Therefore, the data were heterogeneous or spreading. The standard deviation is a tool used to determine the rate of spread of the distribution of the data. The smaller the standard deviation is, the data will be even better (Abdul Hakim 2010). The standard deviation values of the models for Altman, Springate, Zmijewski, and Grover respectively are 1.5126, 0.7497, 44.0717, and 0.5081. The standard deviation of Zmijewski model is higher than the other models. However, in the logistic regression test, it does not require the assumption of normality.

##### Hypothesis Testing

The hypotheses are tested by using logistic regression with a dummy variable. Regression test is done by using statistical program of Microsoft Excel 2007.

The first hypothesis (H1) states that the Altman model can be used to predict financial distress of a company in the future. As shown in Table 3, it can be seen that the value of significance F (Sig. F) of the Z-Score of 3, 3347E-18. The significance value indicates an error model or the model error rate to be paid attention by the researcher. As based on the



appropriate testing criteria, the significance value that is owned by the model is  $< 1\%$ , showing significantly stronger.

The coefficient of determination or R Square is of 0.4424 or 44.24%. This value indicates the ability of Altman model in explaining financial distress, while 55.76% is explained by other variables which may not be included in the equation. Significance of constant value that is equal to  $0.0102 > 1\%$  showed moderate significantly. This value indicates a missing variable borne by Altman model. For that reason, it is said to fail in rejecting H1 regression.

The second hypothesis (H2) states that Springate model can be used to predict financial distress of a company in the future. From the results of the regression test (Table 4) can be seen that the value of significance F (Sig F) of the S-Score for 1, 7847E-21. P-value/Sig-F  $< 1\%$ , shows a strong significance. Coefficient of determination or R Square of 0.5030 or 50.30%, demonstrating the ability of the model in explaining financial distress Springate, while 49.70% is explained by other variables not included in the equation.

The significance of constant value is equal to 5, 5655E-07  $< 1\%$  showing strong significant, i.e. missing variable borne by Springate models. Nevertheless, the model is more significant p value compared with constants. Thus, it can be concluded that the results of the regression failed to reject H2.

The third hypothesis (H3) states that Zmijewski model can be used to predict financial distress of a company in the future. The result of regression test (Table 5) states that the significance of F (Sig F) of the X-Score for 1, 5020E-24. P-value/Sig-F of S-Score  $< 1\%$  shows a strong significance. The coefficient of determination or R Square of 0.5539 or 55.39%, demonstrating the ability of the model in explaining financial distress Zmijewski, while 44.61% is explained by other variables not included in the equation.

The significance of constant value is equal to 9, 5963E-16  $< 1\%$  showing strong significant. This means that a missing variable of Springate model is high, but it has more significant p-value compared with the model constants. The conclusion is the result also failed to reject H3 regression.

The fourth hypothesis (H4) states that Grover model can be used to predict financial distress of a company in the future. Significance F (Sig F) owned by 1.0359E G-Score-15. P-value/Sig-F owned by G-Score  $< 1\%$  shows a strong significance. The coefficient of determination or R Square is 0.3915 or 39.15%. This value indicates

**Table 3**  
**The Test of Logistic Regression for Altman Model**

|                         | Z-Score    |
|-------------------------|------------|
| Sig. F                  | 3.3347E-18 |
| Determinant coefficient | 0.4424     |
| Const                   | 0.1279     |
| P Value of Cons         | 0.0102     |
| B                       | 0.2207     |
| P Value                 | 3.3347E-18 |

**Table 4**  
**The Test of Logistic Regression for Springate Model**

|                         | S-Score    |
|-------------------------|------------|
| Sig. F                  | 1.7847E-21 |
| Determinant Coefficient | 0.5030     |
| Const                   | 0.2102     |
| P Value of Cons         | 5.5655E-07 |
| B                       | 0.3697     |
| P Value                 | 1.7847E-21 |

**Table 5**  
**The Test of Logistic Regression for Zmijewski Model**

|                         | Z-Score    |
|-------------------------|------------|
| Sig. F                  | 1.5020E-24 |
| Determinant Coefficient | 0.5539     |
| Const                   | 0.3034     |
| P Value of Cons         | 9.5963E-16 |
| B                       | -0.0084    |
| P Value                 | 1.5020E-24 |

**Table 6**  
**The Test of Logistic Regression for Grover Model**

|                         | G-Score    |
|-------------------------|------------|
| Sig. F                  | 1.0359E-15 |
| Determinant coefficient | 0.3915     |
| Const                   | 0.2646     |
| P Value of Cons         | 7.5267E-09 |
| B                       | 0.6180     |
| P Value                 | 1.0359E-15 |

the ability of the model in explaining financial distress Grover, while 60.85% is explained by other variables which may not be included in the equation (see Table 6).

The significance of the constant value of 7, 5267E-09  $< 1\%$  indicates a missing variable borne by high Springate models. However, the significance of the model Zmijewski is considered stronger than the significance of the constants. Thus, it can be concluded that the result of the regression also failed to reject H4.

**Table 7**  
**Comparison of Regression Results**

|                         | Z-Score    | S-Score    | X-Score    | G-Score    |
|-------------------------|------------|------------|------------|------------|
| Sig. F                  | 3.3347E-18 | 1.7847E-21 | 1.5020E-24 | 1.0359E-15 |
| Determinant Coefficient | 0.4424     | 0.5030     | 0.5539     | 0.3915     |
| Const                   | 0.1279     | 0.2102     | 0.3034     | 0.2646     |
| P Value of Cons         | 0.0102     | 5.5655E-07 | 9.5963E-16 | 7.5267E-09 |
| B                       | 0.2207     | 0.3697     | -0.0084    | 0.6180     |
| P Value                 | 3.3347E-18 | 1.7847E-21 | 1.5020E-24 | 1.0359E-15 |

### The Accuracy Analysis of All Models for Financial Distress Prediction

The results of the accuracy analysis for all models can be seen in Table 7. Based on the results of the comparison in Table 7, the regression of the models for Altman, Springate, Zmijewski, and Grover, it shows that the model has a significance level for Zmijewski which is the most powerful among other models. It is of 1.5020E-24. The determination coefficient or the ability of the model in explaining financial distress for Zmijewski is at 55.39%. It is higher than the other models. The missing variable that must be paid attention by the model of Zmijewski is also higher than other models.

The Zmijewski model accuracy is shown by two factors: the level of significance and determination coefficient. Thus, it rejected H5, H6, and H8 but failed to reject H7. It indicates that Zmijewski model is considered the most appropriate one for predicting the potential financial distress in the future. For the overall, the results of this study support the evidence by Mila Fatmawati (2012), which indicates that the Zmijewski model is more accurate in predicting companies delisting compared to the revised Altman model and Springate model. The study uses logic-regression with 60 sample companies on the Stock Exchange in 2003-2009, 30 companies that have been delisted and 30 others listed. The significance of the resulting models in research Mila Fatmawati Zmijewski at 0.061, the value of which is smaller than other models with a significance level of 10%.

However, the result of this study is on the contrary with that by Atika Anggraeni and Syamsul Hadi (2008). The result of Zmijewski model with the significance of the X-Score shows inaccurate. For that reason, it cannot be used to predict the delisting. The coefficient of determination has value which is very low that is at only 1.4%. This value indicates the ability of the model to explain the delisting Zmijewski, while the other of 88.6% is explained by the variables which are not included in the equation.

Some evidences should be noted in this study. For example, the condition of the sample also determines the results for obtaining the best prediction model of financial distress. Yet, this study uses a sample of companies that exist in the List of Islamic Securities during 2009-2012. It can be questioned such as the selection of the sample. With different samples, the model of Zmijewski tends to be inappropriately used. That is, the model is only appropriate for Zmijewski used to predict financial distress at such companies as the samples. It need considering the existing companies in the sample which are not the entity engaged in the banking and financial sectors (such as banks, insurance companies, credit agents and, securities).

### 5. CONCLUSION, IMPLICATION, SUGGESTION, AND LIMITATION

The models used are those of Altman, Springate, Zmijewski, and Grover models which can be used to predict financial distress in the future. However, the Zmijewski model has a stronger significance than other models. For that reason, it can be said that the most appropriate model used for financial distress prediction model is Zmijewski. This also indicates that the variable-existing variables in the model are more appropriate for predicting financial distress, the profitability ratio (earnings after tax or total assets), the solvency ratio (total debt or total assets), and liquidity ratio (current assets or current liabilities).

It is now obvious that Zmijewski model emphasizes the magnitude of the debt in predicting financial distress condition of the company. Among the three variables in the model there are two variables leverage. The bigger the amount of debt is, the more accurate predictions of the model to the possibility of companies experiencing financial distress. It also indicates that the sample categories of companies that experience financial distress tend to have a leverage problem.

The stocks that are incorporated in the list of Islamic securities may experience financial difficul-

ties in terms of leverage. The stability of the financial performance of these stocks can be disrupted if the company bears too many obligations while they do not have optimal profitability to be generated. ROE decreases so that it can result in a decreased level of return on shareholders' equity. As such, it can continue at the level of more severe financial difficulties, until the company experienced delisted from the Stock Exchange and led to bankruptcy. This research can also refer to more references that can support Zmijewski model for the prediction of financial distress of companies belonging to the List of Islamic Securities.

The paired sample was based only on the amount of certain assets of the company in the same approach with the partners but there is no limit to the number of assets. Yet, partner companies do not pay attention to the business sector.

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