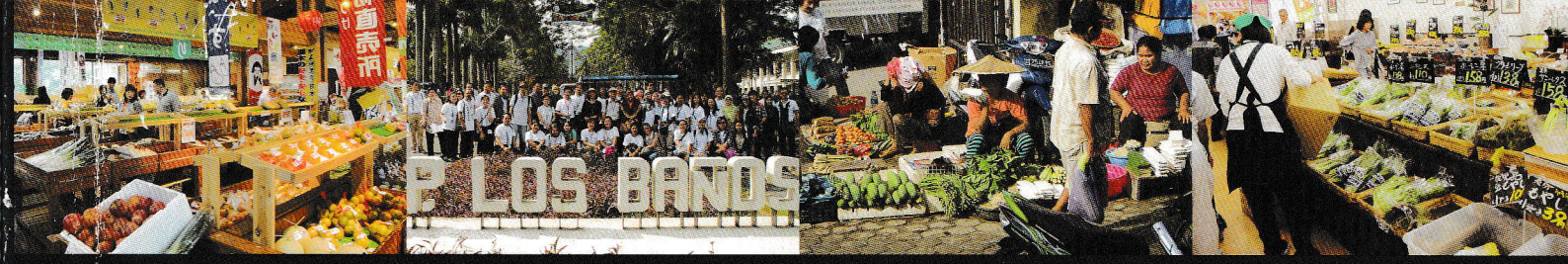


2014 ISSAAS INTERNATIONAL CONGRESS & GENERAL MEETING

Tokyo University of Agriculture
November 8-10, 2014

Agricultural Changes in Southeast Asia: Past, Present and Future

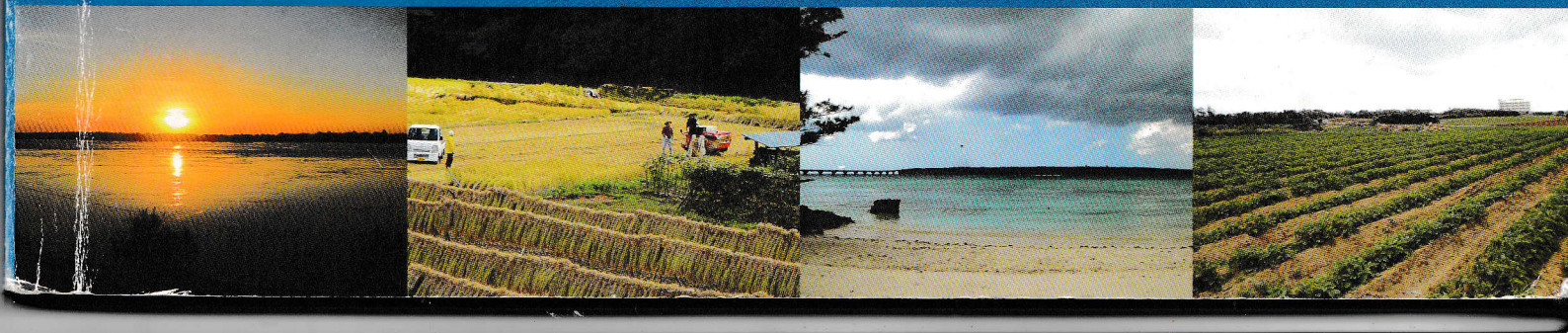
International Society for Southeast Asian Agricultural Sciences (ISSAAS)

In collaboration with

Society for Agricultural Education-Research Develolpment Abroad (SAEDA)

Tokyo University of Agriculure (TUA)

Japanese Society for Tropical Agriculture (JSTA)



The International Society for

Southeast Asian Agricultural Sciences, Inc.

(ISSAAS)

presents this

Recognition

to

Yurniwati

as RESOURCE SPEAKER

Analyzing of Comparative Bankruptcy Prediction Models to Determine The Most Accurate Predictor

Co-author: Dwinta Indriani

During the 2014 ISSAAS International Congress and General Meeting held on November 8-10, 2014 at Tokyo University of Agriculture, Setagaya, Tokyo, Japan.

Prof. Dr. Katsumi Takano
President, ISSAAS

Prof. Dr. Keiko T. Natsuaki
Head of Organizing Committee,
ISSAAS 2014 Tokyo

Comparative Analysis of Bankruptcy Prediction Models to Determine The Most Accurate Predictor

Yurniwati*1)
Department of Accounting, Andalas University
yurniwati_feunand@yahoo.co.id

Dwinta Indriani **2)
Department of Accounting, Andalas University

ABSTRACT

This study aimed to determine the predictive models are most accurate in predicting financial distress in Indonesia. This Research used models of Altman (1968), Springate (1978), Zmijewski (1983), and Internal Growth Rate, as well as to find out what companies are predicted to experience financial distress based on the most accurate predition model.

This study used secondary obtained thorugh the companies Financial statement. This research took IDX delisting data for 2011 – 2013 except financial sector as first sample and financial report 2012 of listing company in same sector with first sample. The results in this study show that model predictions of the Altman Z-Score (1968) is the best prediction model with 93,75% accuracy rate, and of the 13 companies who became the second sample of this reseacrh were seven of which is predicted to experience financial distress and one company is in the grey area.

Keywords: Financial Distress, Prediction Model Altman (1968), Springate (1978), Zmijewski (1983), and Internal Growth Rate

**1) Lecture in Department of Accounting, Faculty of Economy*

***2) Undergraduate Student of Department of Accounting, Faculty of Economy*

1. RESEARCH BACKGORUND

Company's financing tends to prefer using source of internal funds. Then with debt, and the last with the capital.Among all the forms of debt, bond becomes the first choice, because the debt value on bonds is generally in large amountand is not restricted.The other reason is easy mechanism in issuing bonds, the payment of bonds' interest can be treated as tax shield that can reduce tax payments of the firm, but It can not be applied if the company paysdividend on its shares.However, usingbonds as a source of company's financing can be a double-edged blade that can decrease company's liquidity level and can be a trigger of bankruptcy.

When the company is unable to manage its debts well, the biggest consequence is that the company will face and experience financial distress which can lead to bankruptcy. Before It's stated as a bankrupt firm, there's a period which the company experiencing financial distress, the difficulty in generating profit, or continuous declining in profit from year to year.That period is called financial distress, which occurs before the bankruptcy's period.

The availability of information about financial distress earlier, gives a chance for management, owner, investors, regulator and the other stakeholders for making relevant efforts (Platt and Platt, 2002). Management and owners have an interest in making preventive actions to avoid company's condition from getting worse, namely bankruptcy.Investor has an interest in making investment or divest decision.Regulator such as Financial Services Authority (Otoritas Jasa Keuangan) interestsis in taking decisions related to its function as institution that protects and supervisesIndonesia capital market.

Financial distress prediction model is a model that can detect the presence of financial distress in a company by evaluating various financial aspects of the firm, that is by using its financial ratios, such as liquidity ratio, ratio leverage, efficiency, profitability and market value ratio.The existence of financial distress prediction model that is able to predict company's financial condition and the quantity of existing bankruptcy prediction model, therefore this research aims to find the best bankruptcy prediction model amongAltman model (1968), Springate model (1978), Zmijewski model (1983) and internal growth rate model, that later will be used to predict companies that are experiencing financial distress.

This research is very useful for creditors and investors, because it can provide recommendations about the fittest model for financial distress prediction to be applied in indonesia that will help in making credit and investment decision. It is also useful for the firm, because it can give a description about company's financialcondition and can be used as a reference for the company to make improvement for future.

2. LITERATURE REVIEW

Financial distress is the declining stage in financial condition that is experienced by a firm, that occurs before the occurrence of bankruptcy or liquidation. In general, this condition is indicated by the presence of postponement of delivery, the decrease in product quality and postponement of bills' payment from the bank (Platt and Platt, 2002).Financial distress is the period that is the beginning of bankruptcy, but it does not mean that all the firms that are experiencing financial distress will end with bankruptcy.Financial distress is anearly warning signal for the company and its stakeholders who are concern with company's going concern.According to the bankruptcy law, No. 37of 2004,

bankruptcy is common requisitioning against all the wealth of insolvent debtor that are the management and eradication performed by a curator under supervision of the supervisory judge as it's ruled by the law. One of the indicators of public firms that suffer bankruptcy is forced delisting performed by the Indonesian Stock Exchange (IDX). It is happened because IDX is not sure about companies' going concern that can be caused by management inability in facing and solving companies' financial distress condition.

A. Financial Distress Prediction Model

1. Altman Model (1968)

Altman (1968) used step-wise multivariate discriminant anlysis (MDA) method in his study.Samples used by Altman (1968) in his study consisted of 66 companies for 20 years (1946-1965). Those samples are classified into two groups, namely 33 companies which are considered to be insolvent and 33 other companies that are not insolvent. At the beginning, Altman's research (1968)used 22 companies' financial ratio that may beuseful to predict financial distress. From those 22 ratios,several tests were done to choose which ratios will be used in generating prediction model. Tests were done by looking at the statistical significance of the ratios, correlation between the ratios, prediction ability of the ratios and judgment from the researchers. The result of the ratio tests selected five ratios that is considered as the best ratio to be used in prediction model.Those5 ratios were used in MDA analysis and generated a model as follows:

$$Z'' = 1.2A + 1.4B + 3.3C + 0.6D + 0.999E$$

Where:

A = Working capital/total assets

B = Retained earnings/total assets

C = Earnings before interest and taxes/total assets

D = Market value of equity/book value of total debt

E = Sales/total assets

Altman (1968) used cutoff value of 2.675 and 1.81. It means if the obtained Z valueis more than 2.675, the company is predicted not experienced financial distress in the future.A company whose Z value between 1.81 and 2.675 means that company is in the gray area that is, company has problems in its financialalthough it is not as serious as the problem of company experienced financial distress. And then, companies that have Z value lower than 1.81 are most likely to face financial distress.

2. Springate Model (1978)

Springate used the same method as Altman used (1968) namely Multiple Discriminant Analysis (MDA). At first, Springate (1978) usedpopuler financial ratios that might be used to predict financial distress.The total of the ratiosis originally 19 ratios. After through the same test as Altman did (1968), Springate selected 4 ratios which is believed can distinguish between financial distress firms and non financial distress firms.Samples used by Springate totaled 40 companies, which is located in Canada.

Springate (1978) generated this following model:

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

Where:

A = Working capital/total assets

B = Net profit before interest and taxes/total assets

C = Net profit before taxes/current liabilities

D = Sales/total assets

Springate (1978) state thatthe applicable cutoff value for this model is 0.862. The smaller Z value than 0.862 showed that the company is most likely to face financial distress.

3. Model Zmijewski (1984)

Zmijewski (1984) used random sampling techniques in his study.Samples used by Zmijewski (1984) totaled 840 companies, consists of 40 companies experienced financial distress and 800 companies not experienced financial distress.Data were obtained from Compustat Annual Industrial File.Data were collected from 1972 to 1978. Statistical method usedby Zmijewski (1984) is the same as Ohlson used, namely logit regression.

Zmijewski (1984) generated a model as follows:

$$X = -4{,}3 - 4{,}5X_1 + 5.7X_2 - 0{,}004X_3$$

Where:

X1 = ROA (Net income/total assets)

X2 = Leverage (Total debt/total assets)

X3 = Liquidity (Current assets/current liabilities)

Zmijewski (1984) state that the company considered as distress firm if its probability higher than 0.5, in other words, ItsX value is 0.Therefore, the applicable cutoff value in this model is 0. It means a company whose X value higher than or equivalent to 0 is predicted to face financial distress in the future.On the contrary, the company which has X value lower than 0, is predicted will not experince financial distress.

4. *Internal Growth Rate Model*

According to Ross et al (1998: 97), internal growth rate defined as "maximum growth rate a firm can achieve without external financing of any kind".

Internal growth rate mathematically can be expressed as follows:

$$\textbf{\textit{Internal growth rate (IGR)}} = \frac{\textbf{ROA x b}}{\textbf{1 – ROA x b}}$$

Where:

ROA (*Return on Assets (ROA) = Net Income/Total assets*

b = *Retention ratio*, yang merupakan *Addition Retained Earnings / Net Income*

Based on this model, analyzed companies can be classified into two groups, namely bankrupt and not bankrupt company. The applicable cutoff value in this model is -0.239.It means company whose Z value lower than or equivalent to -0,239, is predicted to experiencing financial distress in the future. Otherwise, companies that have Z value lower than -0.239, are predicted not toexperincingfinancial distress.

3. RESEARCH METHOD

Research Object

The object of this research is all the listed companies and delisted companies from the Indonesia Stock Exchange. The sample in this research are classified into two categories, namely the first sample that are tested in order to find the best bankruptcy prediction model is delisted companies from the Indonesia Stock Exchange (IDX) for the periodof 2011 to 2013, and the second sample that are tested in order to predict the company experienced financial distress based on the best prediction model, that are, still listed companies on

4. RESULTS AND DISCUSSION

The following is the comparison of bankruptcy prediction models' results, i.e. Altman model, Springate, Zmijewski and internal growth rate model, that are used in this research:

Table 2
The Comparison of Bankruptcy Prediction Models' Results

Delisting Year	Issuers' Code	Prediction Models							
		Altman		Springate		Zmijewski		*Internal Growth Rate*	
		t-1	t-2	t-1	t-2	t-1	t-2	t-1	t-2
2013	CPDW	FD	FD	FD	FD	NFD	FD	NFD	FD
	PAFI	FD	FD	FD	FD	FD	FD	NFD	NFD
	PWSI	FD	FD	NFD	NFD	FD	FD	NFD	NFD
	SAIP	FD	FD	FD	FD	NFD	NFD	NFD	NFD
2012	SIIP	FD	FD	FD	FD	NFD	NFD	NFD	NFD
	RINA	GA	FD	NFD	FD	NFD	FD	NFD	FD
	SIMM	FD	FD	FD	FD	FD	FD	NFD	FD
2011	PTRA	FD	FD	FD	FD	FD	NFD	FD	NFD
% Annual Bankrupcty		87,50%	100%	75%	87,50%	50%	62,50%	12,50%	37,50%
% Bankruptcy		93,75%		81,25%		56,25%		25%	

Source: Data processed

Explanation:

FD Financial Distress
GA Gray Area
NFD Non Financial Distress

Based on the bankruptcy levelpercentage using those fourbankruptcy prediction models, can be seen that Altman Z-score model givesthe highest percentage. It indicates that Altman model is the most accurate model in predictingfinancial distress firms, so that this model will then be used in financial distress firms' prediction.

Table 2 above also shows thatAltman Z-score model predicts that there are 93,75% of companies that are predicted experienced financial distress in

theobservation period, which PT Karina Utama Tbk for the year 2011 is categorized as a wrong prediction because it is predicted as in gray area.Springate model is able to predict the bankruptcy level as much as 81.25 %, where the difference between this model with Altman model is based on this model, PT Panca Wirasakti Tbk is predicted not experienced financial distress in two years of the observation period.

Springate model does not use MVEBVD ratio (Market Value Equity/Book Value Debt), that is the ratio that measures the value of a company in the eyes of the investors in the capital market. This PT Panca Wirasakti Tbk has low stock price and less outstanding shares, so thatthe market value of its equity is low enough. As the consequence of its low MVE, its bankruptcy index by using Altman model is also low, so that this company is predicted experienced financial distress.

Zmijewski model gives thelowest of the bankruptcy prediction level, that is 56,25%, where this model categorizes 7 out of 16 samples year not experienced financial distress.This model uses several liquidity ratios, i.e.TLTA and CACL.Eventhough the samples havelow liquidity ratios but there are no samples whose negative value, and then this model only usesa profitability ratio, that is NITA without usingthe other ratio such as evaluation ratio or activity ratio, so that this model gives the different prediction results if it is compared the other models' results.

Internal growth rate modelgives the bankruptcy prediction level as much as 25%, where this model only predicts 4 years out of 16 observation years that thesampleswill experiencefinancial distress, i.e. PT Panasia Filamen Inti Tbk, PT Panca Wirasakti Tbk, Surabaya Agung Industry Pulp & Kertas Tbk and PT

Suryainti Permata Tbk.It is so different fromthe previous model results, where all the previousprediction models predict that PTPanasia Filamen Inti Tbk experienced financial distress, but using this model, PT Panasia Filamen Inti Tbkis predicted not experienced financial distress at all before this company is stateddelisting from IDX. Internal growth rate model usesthe calculation of retained earnings addition that is not used in the computation of the three previous prediction models,so that IGR model gives the different result from the other models.

So, based on the comparison of bankruptcy prediction models used, Altman Z-score model has the highest prediction accuracy level among the others, that is 93,75%, so that this model will then be used to predict financial distress on listed companies in Indonesia Stock Exchange which reside in the same sector as the previous companies.

Based on the results obtained from the first test, the model that will be used to predict financial distress condition on the second samples is Altman Z-score model, where the formula of this model is as follows:

$$Z = 1.2\,X_1 + 1.4\,X_2 + 3.3\,X_3 + 0.6\,X_4 + 0.999\,X_5$$

Altman (1968) used cutoff value of 2.675 and 1.81. It means if the obtained Z value is more than 2.675, the company is predicted not experienced financial distress in the future. A company whose Z value between 1.81 and 2.675 means that company is in the gray area, that is, company has problems in its financial although it is not as serious as the problem of company experienced financial distress. And then, companies that have Z value lower than 1.81 are most likely to face financial distress.

The result of Altman Z-score model's computation can be seen on the following table:

Table 3
Variables' Computation on Altman Model in Predicting Financial Distress

Sectors	Issuers' Code	WCTA	RETA	EBITTA	MVEBVD	SATA	Z-Score
Mining	ATPK	0,27676	-1,32488	-0,11099	1,10226	1,20331	**-0,03**
	MYOH	-0,03975	-0,02802	0,12360	1,20950	1,38771	**2,43**
	CKRA	0,48548	-0,02587	-0,00356	32,54086	0,02021	**20,08**
	TINS	0,48678	0,68382	0,10599	5,02386	1,28218	**6,19**
Miscellaneous Industry	ARGO	-0,05812	-0,88063	-0,08012	0,24169	0,55335	**-0,87**
	MYTX	-0,23175	-0,67292	-0,08654	0,29502	0,84237	**-0,49**
	PBRX	0,17741	0,12283	0,05458	2,44431	1,34732	**3,38**
	SSTM	0,22149	-0,09677	-0,02260	0,29867	0,68430	**0,92**
Property, Real Estate& Building Constuction	ELTY	-0,04226	-0,01400	-0,04802	0,35125	0,19360	**0,18**
	OMRE	-0,07235	-0,30948	0,07530	62,67242	0,38483	**37,72**
	PLIN	0,02885	0,34253	0,08512	5,18724	0,43288	**4,34**
Infrastructure, Utilities & Transportation	APOL	-0,46884	-1,51740	-0,23374	0,07321	0,39127	**-3,02**
	SAFE	-1,78518	-18,91202	-0,29294	0,26562	0,64697	**-28,78**

Source: Data processed

Working capital to total asset ratio (X1) is used to measure the liquidity to the total of its capitalization or to measure the company's ability in fulfilling its short-term obligation.On this ratio calculation,7 out of 13 companies have negative value, that indicates that the companiesare experiencing financial distressif compared to other companies.

Retained earnings to total asset ratio (X2) is used to measure cummulative profitability. The company's age has an influence on this ratio because the longer company operates its business, it likely makes the higher accumulation of retained earnings. It means that the relatively young companies will have lower ratio in general, except the companies that have quite high profit at the beginning of their operations.Table 3 above shows that 10 out of the 13 companies have negative retained earnings, which indicate that those companies do not generate retained earnings or always have deficit accumulation.It

reflectsthat the ability of assets in generating retained earnings is very low, so thatthe revenue received is unable to cover the expenses that companies have to pay during the period.

Earnings before interest and taxes to total asset ratio (X3) is used to measure the companies' ability in generating profit from assets used. The lowerthe profitability level means that the less efficient and effective companies in using their assets in generating operating profit and so does conversely. Table 3 above shows that 5 out of 13 companies havepositive value. The lower value of X3 ratio is caused by companies have losses, where their operational expenses in that period arehigger than their gross profits, consequently companies have losses.

Market value equity to book value total debt ratio(X4)is used to measure the value of the company in the eyes of investors in active capital market.Company with the highest X4 ratiois PT Indonesia Prima Propertiwith ratio as 62.67, followed by Citra Kebun Raya Agri Tbkwith value as 32.54, where their value differences with the other companies are quite significant.

Sales to total assets ratio (X5) is used to measure the management ability in using companies' assets to make sales. Table 3 above shows that PT Samindo Resources has the highest ratio among others. It reflects that this company is able to manage its assets to generate income.

From the ratios' calculation above, those companies can be classified as in the following table:

Table 4
The Summary of Altman Model Test Result in Predicting Financial Distress

Sectors	Companies' Name	2013	
		Z-Score	Classifi-cation
Mining	ATPK Resources Tbk	**-0,03**	**FD**

	Samindo Resources Tbk	**2,43**	**GA**
	Citra Kebun Raya Agri Tbk	**20,08**	**NFD**
	Timah (Persero) Tbk	**6,19**	**NFD**
Miscellaneous Industry	Argo Pantes Tbk	**-0,87**	**FD**
	Apac Citra Centertex Tbk	**-0,49**	**FD**
	Pan Brothers Tbk	**3,38**	**NFD**
	Sunson Textile Manufacturer Tbk	**0,92**	**FD**
Property, Real Estate& Building Construction	Bakrieland Development Tbk	**0,18**	**FD**
	Indonesia Prima Properti Tbk	**37,72**	**NFD**
	Plaza Indonesia Realty Tbk	**4,34**	**NFD**
Infrastructure, Utilities and Transportation	Arpeni Pratama Ocean Pool Tbk	**-3,02**	**FD**
	Steady Safe Tbk	**-28,78**	**FD**

Source: Data processed
Explanation:

FD	Financial distress
GA	Gray Area
NFD	Non Financial distress

The calculation of Altman Z-score model (1948) shows that there are 5 non financial distress companies, 7 financial distress companies and a company in gray area. Steady Safe Tbk is the company whose the lowest Z-score among the other firms, that is -28.78, where itsRETA ratio is very low. It proves that this company alwayshas negative profit in each year that is accumulated becomes deficit on equity.While the company that has the best result isCitra Kebun Raya Agri Tbk, whereits MVEBVD ratio is high enough. It proves that its market value of equity is high enough which indicates that this company is still trustedbyits investors.

CONCLUSION, LIMITATIONAND SUGGESTION FOR FUTURE RESEACH

Conclusion

Based on thisresearch's result, the best financial distress prediction model is theAltman Z-score model (1968) with the accuracy level 93,75%, where after the next test is conducted on 13 companies inthe second samples, the result shows that there are 7 companies predicted to face financial distress and a company is inthe gray area.

Research Limitation

The limitations of this study is the observation period of the samples is relatively short, that is only 2 years before the company stated forced delisting fromIDX. This study only uses 4 bankruptcy prediction models among many existing prediction models and this study only aims tocomparethe accuracy level of prediction models, not to formulatea new prediction model.

Suggestion for Future Research

Futurestudies are suggested to use the longer observation period in order to get the more accurate result, and can widen the scope by incorporating other bankruptcy prediction models. Further research is expected not only to compare the existing bankruptcy prediction models but also to create a new financial distress prediction model.

References

Almilia, Luciana Spica dan Emanuel Kristijadi. 2003. *Analisis Rasio Keuangan Untuk Memprediksi Kondisi Financial Distress Perusahaan Manufaktur Yang Terdaftar Di Bursa Efek Jakarta.* Jurnal Akuntansi dan Auditing Indonesia (JAAI) Vol. 7 No. 2, Desember: : hal183-208.

Altman, Edward L. 1968. *Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy.* Journal of Finance.pp 589-609.

. 1983.*Corporate Financial Distress.* New York: John Wiley & Sons.

Amilia, L.S. 2003. *Analisis Faktor-Faktor yang Mempengaruhi Kondisi Financial Distress Suatu Perusahaan yang Terdaftar di Bursa Efek Jakarta.* Simposium Nasional Akuntansi VI. Surabaya, 16-17 Oktober

Beaver, William H. 1966. *Financial Ratios as Predictors of Failure.* Journal of Accounting Research, Supplement.

Bellovary, Jodi, Don Giacomino, dan Michael Akers. *Review of Bankruptcy Prediction Studies: 1930 to Present.*Journal of Financial Education. Vol.33. Winter 2007.

Brahmana, Rayendra. 2005. *Identifying Financial Distress Condition in Indonesia Manufacture Industry. Birmingham Business Schoo*l. Birmingham.

Changcarat, dkk. 2008. *Firms in Financial Distress, a Survival Model Analysis.*

Platt, H., dan M. B. Platt. 2002. *Predicting Financial Distres.* Journal of Financial Service Professionals,56: 12-15.

Ramadhani, Ayu Suci dan Niki Lukviarman.2009. *Perbandingan Analisis Prediksi Kebangkrutan Menggunakan Model Altman Pertama, Altman Revisi, Dan Altman Modifikasi Dengan Ukuran Dan Umur Perusahaan Sebagai Variabel Penjelas (Studi Pada Perusahaan Manufaktur Yang Terdaftar Di Bursa Efek Indonesia).* Jurnal Siasat Bisnis Hal.15-28

Rifqi, Muhammad.2009. *Analisis Perbandingan Model Prediksi Financial Distress Altman, Ohlson, Zmijewski , dan Springate dalam Penerapannya di Indonesia.* Universitas Indonesia.

Rismawaty. 2012. *Analisis Perbandingan Model Prediksi Financial Distress Altman, Springate, Ohlson, Dan Zmijewski (Studi empiris pada Perusahaan Manufaktur yang Terdaftar di Bursa Efek Indonesia).* Universitas Hasanuddin Makassar

Springate, Gordon L.V. 1978. *Predicting the Possibility of Failure in a Canadian Firm.* M.B.A. Research Project, Simon Fraser University.January

Widuri, Sagita. 2009. *Analisa Komparatif Prediksi Kebangkrutan Model Altman Modifikasi, Internal Growth Rate dengann Model Altman, Springate, dan*

Grover (Studi pada Perusahaan Tekstil yang Terdaftar di Bursa Efek Indonesia). Universitas Andalas.

Yuliardi. 2007. *Analisis Perbandingan Metode Memprediksi Kebangkrutan pada Perusahaan yang Terdaftar di Bursa Efek Jakarta (Studi Kasus Tiga Periode Sebelum Kebangrutan)*. Universitas Andalas.

Zmijewski, Mark. 1983. *Predicting Corporate Bankruptcy: An Empirical Comparison of the Extant Financial Distress Models.* Working paper. SUNY at Buffalo.

www.bankruptcyaction.com

www.idx.co.id