EQUITY DURATION MODELS AS THE MEASUREMENT TOOLS ON POTENTIAL DEFAULT RISK OF COMPANIES IN THE ECONOMIC RECESSION AS THE IMPACT OF PANDEMIC COVID-19 IN INDONESIA

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ABSTRACT

Default risk is the uncertainty surrounding the ability of a firm to fulfill its debts and obligations. Potential default risk happens to the company when the country where that company operated is in the economic crisis. Indonesia have been attacked by economic crisis since February 2020 for the second time after 1998's biggest economic crisis. To measure the potential default on companies, Almant Z-Score commonly used by analyst or risk management team in economic crisis. But for the crisis caused by the pandemic is different than the crisis caused by the monetary factor. To find another alternative of measurement where the accuracy as the first priority, in this research, the researcher proposed to test the Equity Duration Models. This models result "predicted" can be the right tools and give the more accurate result. The proposed tools used to measure the potential default of the samples, selected from the stock listed in LQ45 (the most active stocks and have a strong financial capability) and the stocks classified as the Suspension for Debt Payment Obligation in 2019 - 2020. We selected the stocks during 2019 to reflect the condition before pandemic Covid-19 and selected from 2020 to reflect the stocks in pandemic Covid-19 era. The result shows that both of methods showed us the same results. The first group (LQ 45) was mostly on Non-Distress or normal duration, and the second group (the stocks in Suspension for Debt Payment Obligation) was mostly on Distress or extended duration. Therefore, the investor might not perceive using only one method because its accuracy might vary.

Keyword: Default risk, Equity Duration, Altman Z - Score, Stock Performance

BACKGROUND OF THE STUDY

According to (Crosbie & Bohn, 2003), default risk is the possibilities surrounding the ability of a firm to fulfill its liabilities. On the other hand, there is no approach to determining the stocks that are going default and those that are not. Consequently, the firms pay a spread over the default-free interest rate equal to their default likelihood to compensate lenders for this uncertainty.

The forecasting of financial difficulties in the firms has piqued such a particular interest in researchers, scholars, business owners, and the governments. Though the methodological approach of the financial ratio still dominated this kind of research. (Fitzpatrick, 1932), Earlier before the invention of quantitative metrics to determine the firm's solvency rate, This research had concluded that the inadequate firms had substantially different financial ratios. (Altman E. , 1968).

Equity Duration has also been used by academia to understand better how investors price default risk. (Alagarsamy, 2019) conclude that firms with higher equity duration have a higher default risk because of their ability to generate their cash flow to cover their liabilities. Therefore, firms with high default risk will take a relatively longer period to generate their cash flows for their shareholder (Alagarsamy, 2019). Thus,

another empirical finding that because of the correlated duration effect, the firm with high default risk is earning lower future returns than firms with low default risk.

Following the background of the study, which has already been explained above about Altman Z – Score and Equity Duration in predicting the default risk. Due to the limited access to data and time limitation, the researcher focuses on researching the stock's default risk from 2015 until 2019. Based on the background explained above, the author decided to conduct further research with the title *"***Equity Duration Models as the measurement tools on Potential Default Risk of companies in the Economic Recession as the impact of pandemic Covid-19***."*

LITERATURE REVIEW

a. Default Risk

Default risk is the potential that surrounds the firms' ability to meet the obligations under agreed terms. Before default, there was no option to discriminate between the firms that will become default and those that will not. Default Risk is the most considerable risk most banks face and arises from the possibility that loans or bonds held by a bank will not be recompensed either partially or fully. (Apostolik, Donohue, & Went, 2009).

In general, the default risk prediction model's prediction falls into one of the accounting, market, or hazard models. Meanwhile, the hazard models are the most accurate model, measured with non-parametric statistical tests such as receiver operating characteristics, accuracy ratio, and Kolmogorov- Smirnov tests.

(Shumway, 2001) predicted the default probability using the hazard model to U.S. non-financial firms trading on the New York Stock Exchange (NYSE) and AMEX between 1962 and 1992. The model is a multi-period logit estimation program that calculates maximum likelihood estimates for the likelihood that a firm will default within the next year. The logit model can be expressed as:

$$p_{i,t} = \frac{e^{\alpha+\beta x_{i,t}}}{1+e^{\alpha-\beta x_i t}} = \frac{1}{1+e^{-\alpha-\beta x_{1;}t}} \quad \ldots\ldots\ldots\ldots\ldots (1)$$

Where:

Pi,t is the one-year ex-ante probability of default for firm *i* at time *t*,

α and β are regression coefficients in the logit regression,

Xi,t is a vector of independent variables used in the logit model.

(Shumway, 2001) applies net income to total assets (NITA), total liabilities to total assets (TLTA), market capitalization to the total size of CRSP NYSE/AMEX index (RSIZE), excess rate of return in comparison to the market (EXRET), and annualized standard deviation of monthly residual returns (obtained from regressing firm monthly returns on CRSP NYSE/AMEX index) over the past 12 months (SIGMA) as independent variables. The dependent variable is an indicator variable, *Indicator i,t*, that takes the value one if the firm *i* defaults in year *t* and takes the value 0 if the firm *i* survives in year *t*. No observations exist for firms beyond the year in which they default. In 2008, the Shumway model was extended by including lagged information on profitability and excess stock returns over the S&P 500 by (Campbell, Hilscher, & Szilagyi, 2008)

b. Altman Z – Score

Altman Z - Score is the first multivariate credit scoring model that combines several financial statements and measures the market's value. The resulting score was used to classify the firm into two categories: the Distressed (bankrupt potentially) and non-distressed category.

By developing the Altman Z-Score, they have opted to use the Multiple Discriminant Analysis (MDA) as the proper statistical technique. MDA itself is a method

used to identify the observation as one of many suitable groups depending on the characteristics of the observation. (Altman E. , 1983).

Altman Z-Score	Meaning of the cut-off points
Z > 2.67	Non-distressed zone
1.81 < Z < 2.67	Grey zone
Z < 1.81	Distressed zone

Altman Z-Score will differentiate between firms that are financially troubled and those that are not. The model used financial data from the financial statements and divided them into five separate analytical variables. These ratios or independent variables are used to estimate the risk of a business going bankrupt for a period of two years. (Maccarthy, 2017).

The model uses the formula below to detect the financial distress related to these weights assigned to X1, X2, X3, X4, and X_5.

$$Z - Score = 1.2\,X1 + 1.4\,X2 + 3.3X3 + 0.4X4 + 1.0X5 \ldots\ldots (2)$$

Source: *Adapted from "Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy" by Altman, 1968, p. 189-209.*

Where:

$X_1 = \frac{Net\ Working\ Capital}{Total\ Assets}$

$X_4 = \frac{Market\ Value\ of\ Equity}{Total\ Liabilities}$

$X_2 = \frac{Retained\ Earnings}{Total\ Assets}$

$X_5 = \frac{Sales}{Total\ Assets}$

$X_3 = \frac{Earning\ before\ Taxes}{Total\ Assets}$

The independent variables for the model are X_1, X_2, X_3, X_4, X_5, which are used to calculate the dependent variable, which is the Z-score. Altman Z - Score has a high degree of precision in forecasting corporate financial distress in both the USA as well as in the emerging markets (Altman, Hartzell, & Peck, 1998)

Source: *Adapted from "Business Bankruptcy Prediction Models" by Anjum, 2012, p. 216.*

In practice itself, (Singhal & Zhu, 2013) , used the Altman Z - Score as a measurement of financial distress in order to check the bankruptcy risk and bankruptcy cost in the case of focused and diversified non-financial firms in the U.S. from the period January 1991 to December 2007. As a result, the diversified firms represented a lower risk of bankruptcy, contrary to their inefficient segment investment and higher bankruptcy costs because the time needed for bankruptcy procedure is longer. (Piotroski, 2000) implemented the Altman Z - Score is a measurement of financial distress and applied a simple accounting-based fundamental analysis as a tool for the comprehensive portfolio management of high Book market firms. The sample is 14,043 firms with high book to market value from 1976 to 1996 in COMPUSTAT. The conclusion is that firms with lower financial distress levels highly potential future returns than highly distressed firms.

c. Equity Duration

Duration is a standard and universal measurement of the sensitivity of a bond price to the changes in the interest rate in fixed income analytics. Then, Equity Duration measures equity prices' sensitivity to changes in rate (Blitzer, Dash, Murphy, & S&P, 2009). Alternatively, Equity Duration is the cashflow weighted average time at which shareholders obtain the cash flows from their investment in a company's share. (Leibowitz & Kogelman, 1993).

Equity Duration has also been used by academia to understand better how investors price default risk. (Alagarsamy, 2019) conclude that firms with higher Equity duration to have a higher default risk

because of the ability of the firms to generate their cash flow to cover their liabilities. Therefore, firms with high default risk will take a relatively longer period to generate their cash flows for their shareholder (Alagarsamy, 2019). Thus, another empirical finding that because of the correlated duration effect, the firm with high default risk are earning lower future returns than firms with low default risk.

This measurement of Equity Duration was developed by (Dechow, Sloan, & Soliman, 2004) and refined by (Weber, 2018). This measurement proceeds into two distinct steps. First, the estimation of future cash flow. Second, using the estimated cash flow will be generated into the standard bond formula to generate the Equity Duration. As a result, the formula for measuring the Equity Duration is:

$$\text{Duration: } \frac{\Sigma_{t=1}^{T} t * CF_t/(1+r)^t}{ME_0} + \left(T + \frac{1+r}{r}\right) * \frac{ME_0 - \Sigma_{t=1}^{T} CF_t/(1+r)^t}{MEo} \quad \ldots\ldots. (3)$$

Source: *Adapted from "Equity Duration: A new measure of Equity Risk" by Dechow, P., Sloan, R., Soliman, M., (2004), p 197-228*

Where:
C.F. is Cash flow at time t
R is the return on equity
M.E. is Market Capitalization

(Fullana & Toscano, 2013) calculated the duration of the Equity for the 80 non-financial firms listed in the Spanish stock exchange on December 31, 2011, As a result, the duration of Spanish Equity is slightly higher due to the different expected return on equity used in each context. This analysis shows a substantial relationship regarding the equity duration and the earnings to price ratio, the book to market ratio, and the sales growth rate, but not to capitalization, thereby, excluding the presence of the firm size effect. The results support the relationship of the equity duration with the high minus low factor, thereby indicating that the latter is subsumed in this measure.

METHODOLOGY

This research uses secondary data that was collected from the Infovesta Database System originally comes from Indonesia Stock Exchange and also the Company's Annual Financial Report as the comparison. The required data for this research are Sales, Total Liabilities, Total Equity, Return on Equity (ROE), Current Assets, Current Liabilities, Total Assets, Total Liabilities, Market Capitalization, Net Income, Earnings before Taxes, Working Capital, Sales Growth, Retained Earnings and Cash Flow which gives a total of 1,067 data recorded from 2015-2019. The data then used by the researcher to be calculated based on these methods, such as Equity Duration and Altman Z- Score.

Company Code	Company Name
AALI	Astra Agro Lestari Tbk
ADRO	Adaro Energy Tbk
CPIN	Charoen Pokphand Indonesia Tbk
ASII	Astra International Tbk
HMSP	Hanjaya Mandala Sampoerna Tbk
PWON	Pakuwon Jati Tbk
TLKM	Telekomunikasi Indonesia Tbk
UNVR	Unilever Indonesia Tbk

Also, for other stocks, there are four companies' stocks that file the Suspension of Debt Payment Obligation.

Company Code	Company Name
ARII	Atlas Resources Tbk
EMDE	Megapolitan Development Tbk

TAXI	Express Transindo Utama Tbk
POOL	Pool Advista Indonesia Tbk

RESULT AND DISCUSSION

a. Data Analysis

After the stocks are chosen based on the requirement. The researcher computes the cash flow of the company yearly. The researcher uses the formula from (Brennan & Xia, 2006) as follow:

$$CF = Bv_{t-1}\left(\frac{E_t}{Bv_{t-1}} - \frac{\Delta Bv}{BV_{t-1}}\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Source: *Adapted from "Risk and Valuation Under an Intertemporal Capital Asset Pricing", by Brennan and Xia, (2006)*

In which:

C.F. is the cashflow of the year

BV_{t-1} is lagged book value of equity

Et is Earning of the year

Delta BV is Current Book Value of Equity – Lagged Book Value of Equity.

In this section, the researcher reveals the default risk calculation and prediction from the sample selected from 2015-2019. Started from Altman Z - Score to Equity Duration.

1. Altman Z – Score

The results presented for the first group (LQ45):

Code Name	Date	Zeta	Conclusion
AALI	31/12/2015	3.01	Non-Distress
	31/12/2016	4.52	Non-Distress
	31/12/2017	4.29	Non-Distress
	31/12/2018	3.62	Non-Distress
	31/12/2019	3.67	Non-Distress
ADRO	31/12/2015	1.33	Distress
	31/12/2016	2.07	Grey
	31/12/2017	2.43	Grey
	31/12/2018	2.04	Grey
	31/12/2019	2.06	Grey
CPIN	31/12/2015	4.64	Non-Distress
	31/12/2016	6.28	Non-Distress
	31/12/2017	7.01	Non-Distress
	31/12/2018	12.65	Non-Distress
	31/12/2019	11.57	Non-Distress
ASII	31/12/2015	2.91	Non-Distress
	31/12/2016	3.24	Non-Distress
	31/12/2017	3.10	Non-Distress
	31/12/2018	2.78	Non-Distress
	31/12/2019	2.70	Non-Distress
HMSP	31/12/2015	48.51	Non-Distress
	31/12/2016	36.83	Non-Distress
	31/12/2017	41.33	Non-Distress
	31/12/2018	27.75	Non-Distress
	31/12/2019	13.96	Non-Distress
PWON	31/12/2015	2.52	Grey
	31/12/2016	2.77	Non-Distress
	31/12/2017	3.12	Non-Distress

	31/12/2018	3.38	Non-Distress
	31/12/2019	6.24	Non-Distress
TLKM	31/12/2015	4.50	Non-Distress
	31/12/2016	5.25	Non-Distress
	31/12/2017	5.08	Non-Distress
	31/12/2018	4.32	Non-Distress
	31/12/2019	3.99	Non-Distress
UNVR	31/12/2015	19.65	Non-Distress
	31/12/2016	18.90	Non-Distress
	31/12/2017	22.53	Non-Distress
	31/12/2018	21.96	Non-Distress
	31/12/2019	16.25	Non-Distress

The results for the first group (LQ45), ADRO or Adaro Energy is dominated with Grey Status and the rest is on Non-Distress Situation. This group score ranges from 0.98 – 48.51.

Below are the results presented for the second group (Suspension for Debt Payment Obligation):

Code Name	Date	Zeta	Conclusion
ARII	1/12/2015	(0.76)	Distress
	1/12/2016	(0.89)	Distress
	1/12/2017	(0.49)	Distress
	1/12/2018	(0.64)	Distress
	1/12/2019	(0.70)	Distress
EMDE	1/12/2015	1.36	Distress
	1/12/2016	1.39	Distress
	1/12/2017	1.66	Distress
	1/12/2018	1.31	Distress
	31/12/2019	1.20	Distress
TAXI	31/12/2015	1.34	Distress
	31/12/2016	0.43	Distress
	31/12/2017	(0.97)	Distress
	31/12/2018	(4.30)	Distress
	31/12/2019	(6.27)	Distress
POOL	31/12/2015	18.11	Non-Distress
	31/12/2016	37.60	Non-Distress
	31/12/2017	166.12	Non-Distress
	31/12/2018	21.43	Non-Distress
	31/12/2019	2.39	Grey

This group score ranges from (-6.27)–166.12). Meanwhile, the sample in this group was dominated by "Distress"status.

b. Equity Duration

The results presented for the first group (LQ45):

CodeName	Duration
AALI	14.64
ADRO	15.42
CPIN	14.39
ASII	14.60
HMSP	13.93
PWON	14.41
TLKM	14.53
UNVR	13.45

Max	15.42
Min	13.45
Average	14.41

For the first group, the duration of the stocks is quite average; the duration lies between 13.45–15.42 with an average of 14.41

The results presented for the second group (Suspension for Debt Payment Obligation):

CodeName	Duration
ARII	-60.67

EMDE	13.24
TAXI	13.79
POOL	-1.05

Max	13.79
Min	-60.67
Average	-8.74

For the second group, the duration of the stocks is abnormal because the duration is negative and in the extended period. The duration lies between (-60.67) – 13.52 with an average of (-8.74). The negative value for the Equity Duration is that the stock is underpriced, or the model incorrectly assumes that past profitability will continue in the future. (Fullana & Toscano, 2013). An explanation for POOL score is that the characteristic of financial sector regarding interest rates that separate the financial and non-financial firms, thus giving conclude that the financial firms are more vulnerable of financial firms to interest rate movements. (Ballester, Ferrer, & Gonzalez, 2011).

CONCLUSION

The findings are summarized in the following points:

1. Both the two methods, Altman Z-Score and Equity Duration, generate different results, in the LQ45 group, there are 2 (two) stocks that on the Grey Status, and 1(one) stock on Distress status, meanwhile the rest is on Non-Distress. In the Suspension for Debt Payment Obligation group, there are three stocks on Distress status and 2 (two) in grey status. In the Equity Duration model, the results for the first group are relatively low duration stocks; however, in Suspension for Debt Payment Obligation Stocks, the results are very abnormal.
2. The level of the accuracy based on the results shows that both Altman Z-Score and Equity Duration's results concludes that the firms that file for Suspension for Debt Payment Obligation are mostly on Distress status or in extended or negative duration. For the firms on LQ45, both of the method concludes that the firms are mostly on Non Distress status or in normal duration.
3. What are the strengths and weaknesses of each method?
   a. The Altman Z-Score method is easier to use because the data can be traced easily in the financial statement of the company. The model itself is very applicable for the new investor to predict the solvency of the company. However, the weaknesses are the forecasting only for two years; the model itself fails to incorporate the benefit of cash flow management. Also, it does not work well with new or emerging companies because the earnings are too low and will generate distress scores.
   b. The Equity Duration method is more stable, useful as a metric to predict the risk of the company. The Equity Duration itself also provides the easiness in forecasting the default risk for 2 (two) years or more. However, the data requirement is not always to be able to be found in the financial statement of the company; also, the formula is not very easy to be applied to the new investor.

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