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MERTON MODEL OF DEFAULT RISK AND STOCK RETURN: EVIDENCE FROM INDONESIAN STOCK MARKET

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ABSTRACT

The main objective of this study is to evaluate the effect of default risk on stock return. Balanced panel data at the firm level from non-financial firms listed on the Indonesia Stock Exchange (IDX) during 2008-2017 (ten years) period was used in this research. This study uses Merton's (1974) model as done by Vassalou & Xing (2004) to build a proxy for the risk of default. The advantage of this model is that it considers the volatility of firms' assets in estimating default risk. This study also investigates whether the size and book-to-market factors are also proxies for default risk or not. Panel data regression analysis was used as the method of analysis. The empirical results suggest that default risk has a positive and significant effect on equity returns. Adding the size and B/M ratio into the estimation model, the results show that the size, B/M ratio, and default risk are still significant factors to explain stock returns. This shows that size and book-to-market cannot represent default risk, and default risk has certain explanatory power for stock returns

Keywords: *default risk, probability of default, stock return, and Merton model*

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INTRODUCTION

Default risk is uncertainty surrounding the firm's ability to service its debts and obligations (Crosbie and Bohn, 2003). A company is default if it cannot provide sufficient funds to meet its debt obligations. Therefore, the default risk would be to encourage shareholders to demand a premium in the form of a stock return difference above the risk-free interest rate as compensation for the risk of default. The higher the default risk, the higher the default risk premium demanded, and it should be reflected in the higher rate of return (Wibowo & Ham, 2016). Companies with high risk mean the market will expect a high return (Fama & French, 1995).

Several studies in the corporate finance literature have tested whether the default risk has an influence on the company's stock returns, but the results often vary and become conflicts. Denis and Denis (1995) show that default risk is relevant to macroeconomic factors and the business cycle, so it is a systematic risk. If the default risk is a systematic risk, there is expected to be a positive relationship between the default risk and subsequent realized returns (Dichev, 1998). Similar findings are also generated by empirical studies conducted by Griffin and Lemmon (2002), Vassalou and Xing (2004) and Lin, Chang & Yeh (2012) which show that default risk has a significant effect on equity returns. In contrast, Opler and Titman (1994) and Asquith et al., (1994) show that default risk is an idiosyncratic factor so that it is a non-systematic risk, arguing that default risk is not related to systematic risk. This is supported by empirical studies conducted by Dichev (1998) and Ghargori et al., (2007) who found that bankruptcy risk was not marked by a higher return. Meanwhile, Chiao and Chen's (2005) research on Japanese equity markets found that different default risks measurement has a more varied portfolio explanatory power. So that the default risk has an influence on return or not depends on the method used to measure the risk of default. Lin, Chang & Yeh (2012) concluded that different researchers obtained varied empirical results refers to different default risk indicators and sampling data from different equity markets. The results of the study do not present consistent conclusions about whether the default risk has an influence on return or not.

The most classical bankruptcy prediction model is the Altman Z-score model (1968). Altman (1968) used a multi-discriminant analysis method for companies in the United States. By analyzing the data of 66 companies divided into two groups equally for companies that went bankrupt and did not go bankrupt during the period 1946-1965, Altman produced a linear equation of the company's financial ratios that could predict the bankruptcy of a company. The discriminant linear equation which contains five financial ratios will then produce a value known as Altman Z-score. The higher the Z-score, the lower the possibility of the company experiencing bankruptcy. If the Z-score is less than 1.80, the company is expected to experience bankruptcy.

This Z-score method has often been used in research on bankruptcy and it is accurate enough to predict bankruptcy (Lumondang, 2008). However, there are weaknesses in this method, namely the use of financial statement data that measures past performance so that it could not be applied to future performance. Another disadvantage to this method is the use of financial statements that cannot capture the calculation of asset volatility which provides important information in estimating bankruptcy (Vassalou and Xing, 2004). Criticism of the Altman model is mainly in the selection of arbitrary financial ratios and lacks an adequate financial logic framework (Martin, 1996; Wibowo, 2017).

The other default risk measurement model is a linear probability model such as the Logit model that was first used by Ohlson (1980) to predict non-financial firms. The selection of the Logit model in this method is done to complete the Z-score. The Z-score results are values with a small forecast interpretation because multiple discriminant analysis is basically a rating tool. With the use of conditional logit analysis, problems arising from the use of multiple discriminant analysis can be overcome. The Ohlsons score provides the probability of bankruptcy in a given time and it is expressed as a percentage of bankruptcy (Lumondang. 2008). The higher Ohlson score means the higher possibility of the company experiencing bankruptcy. But there are criticisms of the use of the Logit model as a bankruptcy prediction model that is almost similar to the critique of discriminant analysis, namely the development of models that do not have an adequate basis of intuition and financial theory and are highly dependent on ex-post data and questionable generalization for other companies (Wibowo, 2017).

Merton (1974) introduces a new approach to default risk modeling that is using the Black-Scholes option pricing formula. This model is built on a market-based approach. Merton's (1974) model defines the default event as a condition where the market value of company assets is lower than the market value of liabilities and equity (Wibowo & Ham, 2016). The Merton model uses the market value of firm's assets that reflect the prospects and business value of the company in the future and its value changes over time depending on the external and internal situation of the company so that it is assumed to move on a random walk (Wibowo 2017). So that it will contain information that is forward-looking which is more suitable for calculating the possibility of a company going through default in the future (Vassalou & Xing, 2004). The advantage of this model is to consider the volatility of the company's assets in estimating the risk of default. Accounting models such as Altman Z-score and Ohlson score imply that companies with similar financial ratios will have similar default probabilities. Unlike the Merton (1974) model where companies can have similar levels of equity and debt, but have a very different default probability. This is because clearly, the volatility of assets provides important information about the default probability of the company (Vassalou & Xing, 2004). The firm's volatility is the key input on the Black-Scholes option pricing formula.

Merton Model (1974) assesses corporate liabilities as a contingent claim for a firm's assets (Lin et al., 2012). A firm's debt can be valued as a put option on the firm's assets with a strike price equal to the principal value of the debt and the selling option is due to the due date of the debt (Wibowo, 2017). Meanwhile, the company's equity value can be seen as a call option from the company's assets because the equity holders are residual claimants from the company's assets after all obligations have been settled. The strike price of a call option is the book value of a company's liability. When the value of a company's assets is less than the strike price, the value of equity is zero (Vassalou & Xing, 2004). If the market asset value is lower than the principal debt that should be paid on the due date, then the company is in a default condition and unable to pay the debt fully. The debtholder will only get a return equal to the value of the asset and suffer losses equal to the principal value of the debt less the value of the firm's assets.

The probability of default is measured using distance to default, which is the difference between the value of the company's assets estimated by the Merton model (1974) on the face value of corporate debt which is then scaled by the standard deviation of the market value of assets. This distance to default measurement method has the advantage of being able to be calculated with more frequent frequencies and shorter periods of time so that the default estimation can be known at a certain point of time needed. This is because audited financial statement information is available once a year or at the latest once a month for unaudited, while stock exchange information is available on a daily basis. The bankruptcy probability prediction model that has the strongest financial theory base is the Merton (1974) model (Wibowo, 2017).

Varied empirical results not only refer to different default risk indicators but also due to data sampling from different equity markets. Research in this area has been carried out in the United States (Dichev, 1998; Griffin & Lemmon, 2002; Vassalou & Xing, 2004) which is a developed country with more stable capital market conditions than in developing countries. Meanwhile, stock market volatility in emerging markets such as in Indonesia is generally much higher than in developed markets (Bekaert & Harvey, 1997; Wang, 2007). So the data characteristics between developed and developing countries will certainly be different and further research is needed to examine the relationship between default risk and stock returns in developing countries such as Indonesia.

Research on measuring default risk using accounting models in estimating firm's default risk has been done in Indonesia (Utama & Lumondang, 2009; Purnomo, 2014), but research on default risk by using a market-based approach by considering the volatility in company assets in estimating default risk still very limited. Therefore, this study will examine the default risk as one of the factors that can affect stock returns. Default risk will be calculated using the same approach in the study of Vassalou and Xing (2004) which uses the Merton (1974) model as described in Crosbie and Bohn (2003). In addition, size and the book-to-market ratio will also be taken into account in this study as a control variable commonly used in many previous studies to analyze stock returns. The default risk, size, and book-to-market are examined for their effect together on stock returns. The result found that the higher the default risk, the higher rate of return. When adding the size and B/M ratio into the estimation model, the results show that the size, B/M ratio, and default risk are still significant factors to explain stock returns.

LITERATURE REVIEW

Default Risk & Stock Return

Dichev (1998) conducted research in the United States for the period 1981 to 1995. This study used two bankruptcy prediction models called Altman Z-score (1968) and Ohlson-score (1980) to investigate whether the risk of bankruptcy is a systematic risk that is valued in subsequent return from securities. The main result of this test is that the risk of bankruptcy is not marked by a higher return. It was found that companies with high bankruptcy risk produced returns that were significantly lower than average returns since 1980. According to Dichev (1998) this is in accordance with the assumption of inefficient markets where insolvent companies have low systematic risk and the market does not absorb financial information the distress is so insolvent companies have low subsequent returns.

Griffin and Lemmon (2002) examined the relationship between book-to-market ratio, bankruptcy risk, and stock returns by using Ohlson-score (1980) as a proxy for bankruptcy risk. This research was also conducted in the United States in the period July 1965 to June 1996. Companies with a high risk of bankruptcy (Ohlson-high score) showed a high return around earnings announcements.

Research by Vassalou and Xing (2004) which was also conducted in the United States in the period 1971 to 1999, used the Black-Scholes method, Merton to calculate distances to bankruptcy (distance to default). This study is the first study to use the Merton (1974) option pricing model as a measure of default risk for individual companies and assess the effect of default risk on equity returns. Vassalou and Xing (2004) found a positive influence between bankruptcy risk as measured by distance to default with stock returns. The smaller the distance to default, the greater the yield of the stock

Studies in Australia conducted by Ghargori, Chan & Faff (2007) examine whether default risk is valued in equity returns. By running the Merton (1974) model as in the study of Vassalou and Xing (2004), this study found contradictory results. Default risk is not valued by equity returns.

Research in Japan by Chiao and Chen (2005) uses a default risk model developed by Altman (1968) and Shirata (1998) to evaluate the financial crisis of Japanese companies. They found that if the risk was assessed using the Altman Z-score, the default risk in the Japanese equity market was part of a systematic risk that was marked by its positive influence on return. However, the default risk model designed by Shirata (1998) cannot determine whether the default risk in Japanese equity markets is part of systematic risk. So Chiao and Chen (2005) draw the conclusion that the measurement of different default risks has varying explanatory power against systematic risk.

Lin, Chang & Yeh (2012) conducted a study on the Taiwan Stock Exchange for the period 1996 to 2007. This study used two default probability measurements, which are Merton (1974) option pricing model and the compound option model which is an extension of the Merton (1974) model concept conducted by Geske (1977,1979). Both models are to build a proxy of default risk and evaluate the relationship between default risk and equity return. Lin, Chang & Yeh (2012) found that the higher the default risk calculated using the Merton and Compound Option models, the higher rate of return on the equity market. This means that default risk is part of systematic risk.

Research conducted in Indonesia by Utama and Lumondang (2009) in the period 2000 to 2004 investigated the effect of bankruptcy risk, size, and book-to-market on stock returns. Bankruptcy risk is measured using Altman Z-score and Ohlson score. The results of this study state that stock returns are not influenced by bankruptcy risk either by measuring the Z-score or Ohlson-score, size and book-to-market of the company.

Another study conducted by Purnomo (2014), examined the effect of financial distress on stock returns in the mining sector on the Indonesia Stock Exchange in the period 2009-2013. Using the Altman Z-score model as a proxy for financial distress produces findings that contrast with Utama & Lumondang (2009). Bankruptcy risk was found to have a significant relationship to variable stock returns in mining sector companies. Z-score variable in mining companies proved to have a positive and significant relationship with returns, which means that companies with lower bankruptcy risk will produce higher average returns. Conversely, a company with a higher risk of bankruptcy will produce a lower average return.

To find out the effect of default risk on stock returns, this study uses the references of Vassalou and Xing (2004) and Lin, Chang & Yeh (2012) which show that default risk has a significant positive effect on equity returns. The decision to select the article as the basis for hypothesis formation is due to the default risk indicator equation that will be used in this study. Vassalou & Xing (2004) and Lin, Chang & Yeh (2012) found a positive influence between bankruptcy risk as measured by distance to default with stock returns. The smaller the distance to default, the greater the yield of the stock. So that the relationship between the risk of default and return is as follows:

H1: Default risk has a positive effect on stock returns

Default Risk, Size, Book to Market Ratio & Stock Return

Fama & French (1993) states that size and book-to-market are two additional factors that are better at explaining returns. Fama and French (1993,1995) also argued that size and book-to-market factors are proxies for default risk. But research by Lin, Chang & Yeh (2012) states contradictions to the argument. Lin, Chang, and Yeh (2012) show that size, book-to-market (B/M) and default risk remain significant factors. This shows that size and book-to-market cannot represent default risk, and default risk has certain explanatory power for stock returns. Hence, to find out the effect of default risk, size and book-to-market simultaneously on returns, the hypothesis is formulated as follows:

H2 : Default risk, size, and book-to-market simultaneously affect the stock return.

METHODOLOGY

Sample Selection and Data Sources

The selection of samples in this study uses a purposive sampling method, which is sampling based on certain criteria that have been determined. This study uses a sample of non-financial companies listed on the Indonesia Composite Index (IDX Composite) in Indonesia from 2008 until 2017. Financial companies are not included in the study as samples tested because financial companies have a different capital structure from other companies. The data used in this study is secondary data where the data is previously published data. The data source of this study comes from the Data Stream. The data used for this study include daily stock return data, company size, book-to-market ratio (negative B / M ratio are excluded from the sample), long-term debt, short-term debt, the book value of equity (short-term debt plus a half from long-term debt), market returns use the return of the IDX Composite (Indeks Harga Saham Gabungan /IHSG) and risk-free interest rates using the 1-month SBI interest rate.

Variables and Measurement

Dependent Variable

Stock return is used as the dependent variable. Return is the monthly return at month t+1 from the measurement period of default risk, size, and book to market. Return is used as a proxy of expected return. Stock return is obtained by the formula

$$R_t = \frac{P_t - P_{t-1}}{P_{t-1}} \times 100\% \qquad (1)$$

Where :

$R_{i,t}$: Stock return *i* at periode t

$P_{i,t}$: Stock price *i* at the end periode t

$P_{i,t-1}$: Stock price *i* at the beginning periode t

Independent Variables

Default Risk

The measurement of default risk for individual companies in this study is estimated using the Default Likelihood Indicators (DLI) introduced by Vassalou and Xing (2004). DLI is a non-linear function of the default probability of individual companies. DLI is calculated using the Merton (1974) model similar to that described in Crosbie & Bohn (1999).

In the Merton (1974) model, firm's equity can be seen as a call option for firm's assets. This is because the shareholders are residual claimants from the firm's assets after all the firm's obligations have been fulfilled. The strike price of a call option is the book value of a firm's liability. When a firm's asset value is less than the strike price, the equity value is zero.

In this study it is assumed that the capital structure of the company consists of equity and debt. The market value of the company's underlying assets follows the geometric Brownian Motion (GBM) with the form:

$$dV_A = \mu V_A dt + \sigma_A V_A dW \qquad (2)$$

Where :

V_A : Firm's asset value

μ : Drift from V_A

σ_A : Firm's asset volatility

The equity market value will be obtained from the call option Black & Scholes (1973) formula as follows:

$$V_E = V_A N(d_1) - Xe^{-rT} N(d_2), \qquad (3)$$

Where :

$$d_1 = \frac{\ln(V_A/X) + (r + \frac{1}{2}\sigma_A^2)T}{\sigma_A \sqrt{T}}, \qquad d_2 = d_1 - \sigma_A \sqrt{T} \qquad (4)$$

Where :

X_t : Book value of the debt at time *t*, that has maturity equal to T

r : Risk-free rate

N : Cumulative density function of the standard normal distribution

To calculate V_A and σ_A, which is unobservable, this study following Vassalou and Xing (2004) adopted an iterative procedure. This study uses daily data from the last 12 months to obtain estimates of equity volatility σ_E, which is then used as initial values of σ_A estimation. Using the Black-Scholes formula, and for each trading day from the last 12 months, this study calculates V_A using V_E as the market value of equity for that day. In this way, the daily value of V_A is obtained. Then the standard deviation of V_A will be calculated, which is used as the value of σ_A, for the next iteration. This procedure continues to be repeated until the values of σ_A of the two sequential iteration converge. The tolerance level for convergence is 10E-4. Once the convergence value of σ_A is obtained, then the value is used to back out to V_A through equation (3).

The above process is repeated at the end of each month, to produce an estimate of the monthly value of σ_A. The estimation window always kept equal to 12 months. The risk free rate used for the iteration process every month is the 1-year SBI interest rate observed at the end of the month. Once the daily value of V_A estimated, then the direction of μ can be calculated, by calculating the average change from $\ln V_A$.

Default probability is the probability that the firm's assets will be less than the book value of the firm's liabilities. In other words,

$$P_{def,t} = \text{Prob}\ (V_{A,t-T} \leq X_t |\ V_{A,t}) = \text{Prob}\ (\ln(V_{A,t-T}) \leq \ln(X_t)\ |\ V_{A,t}) \tag{5}$$

Because the value of assets follows the GBM of equation (1), the value of assets at each time t is obtained from:

$$\ln(V_{A,t-T}) = \ln(V_{A,t}) + \left(\mu - \frac{\sigma_A^2}{2}\right) \text{T} + \sigma_A\sqrt{T}\varepsilon_{t+T}, \tag{6}$$

$$\varepsilon_{t+T} = \frac{W\ (t+T) - W\ (t)}{\sqrt{T}}, \text{ and } \varepsilon_{t+T} \sim \text{N}\ (0,1) \tag{7}$$

Therefore the default probability can be rewritten as follows:

$$P_{def,t} = \text{Prob}\left(\ln(V_{A,t}) - \ln(X_t) + \left(\mu - \frac{\sigma_A^2}{2}\right)T + \sigma_A\sqrt{T}\varepsilon_{t-T} \leq 0\right) \tag{8}$$

$$P_{def,t} = Prob\left(-\frac{\ln\left(\frac{V_{A,t}}{X_t}\right) + \left(\mu - \frac{\sigma_A^2}{2}\right)T}{\sigma_A\sqrt{T}}\right) \geq \varepsilon_{t-T} \tag{9}$$

Distance to default (DD) defined as follows:

$$DD_t = \frac{\ln(V_{A,t}/X_t) + \left(\mu - \frac{1}{2}\sigma_A^2\right)T}{\sigma_A\sqrt{T}} \tag{10}$$

Default occurs when the ratio of asset value to debt is less than 1, or the log is negative. DD tells us how much the standard deviation of this log ratio needs to deviate from the average to make the default occur. Although the value of the call option in equation (2) does not depend on μ, DD depends on μ. This is because DD depends on the future value of the asset obtained from equation (4).

This study uses a theoretical distribution that is implied by the Merton model, the normal distribution. In that case, the theoretical default probability will be obtained by:

$$P_{def} = \text{N (-DD)} = \text{N}\left(-\frac{\ln(V_{A,t}/X_t) + \left(\mu - \frac{1}{2}\sigma_A^2\right)T}{\sigma_A\sqrt{T}}\right) \tag{11}$$

Control Variable

There are two control variables used in this study, size and book-to-market ratio commonly used in previous research to analyze stock returns. Firm size variables use log (market capitalization) and book to market ratio is the inverse of the market to book ratio value available in Datastream.

Model Specification

This study use panel data analysis to explain the relationship between the default risk, size and book-to-market toward stock returns. The research model built to answer the two research objectives is as follows:

- **Model 1 :** $\boldsymbol{R_{i,t+1} = \beta_{i,0} + \beta_1\ \text{DEF}_{i,t} + \varepsilon_{i,t}}$
- **Model 2 :** $\boldsymbol{R_{i,t+1} = \beta_{i,0} + \beta_1\ \text{DEF}_{i,t} + \beta_2\ \text{Size}_{i,t} + \beta_3\ \text{B/M}_{i,t} + \varepsilon_{i,t}}$

Where :

$R_{i,t+1}$ = Stock return of firm *i* at time *t + 1*

$DEF_{i,t}$ = Probability of default of firm i at time t
$SIZE_{i,t}$ = Firm size i at time t
$B/M_{i,t}$ = Book to market of firm i at time t
β = Parameter estimated
$\varepsilon_{i,t}$ = Error term

RESULT AND DISCUSSION

Descriptive Statistics

Table 1 summarizes the descriptive statistics of all variables used in this study. With a sample of 102 companies with a total period of 120 months, total data entries were generated are 12240 firm-years observations. Table 1 describes the empirical distribution of the variables tested. Based on the results of the descriptive analysis, it was concluded that the average return of the sample was positive, that is 0.6%, which means that the average company experiences capital gain. Meanwhile, the average default probability is relatively low at 15%. Observations of the size of the company state that the average size of the company in the sample is 19.4 billion Rupiah. Furthermore, the average B/M ratio is 0.884 which is smaller than 1 (one), which means that the rate of return from the company's shares is greater than expected because the market expects that the company's performance prospects in the future will be good which is appreciated by the market price of the stock which is higher than its book value.

Table 1. Statistic Descriptive

Variable	Mean	Median	Maximum	Minimum	Std. Dev	Observation
RETURN	0.006818	0.000000	1,458957	-1,205971	0.140121	12240
PROBABILITY OF DEFAULT	0.154581	0,014014	0.888384	0.0000000	0.226033	12240
SIZE	1.94E+10	2.57E+09	5.50E+11	15931080	5.45E+10	12240
BOOK TO MARKET	0.884905	0.581395	14.28571	6.37E-11	0.957716	12240

Table 2. Pearson Correlation Matrix

VARIABLE	RETURN	PROBABILITY OF DEFAULT	SIZE	B/M
RETURN	1 -----			
PROBABILITY OF DEFAULT	0.042257 0.0000 ***	1 -----		
SIZE	0.017199 0.0571 *	-0.216393 0.0000 ***	1 -----	
B/M	0.056915 0.0000 ***	0.426944 0.0000 ***	-0.221371 0.0000 ***	1 -----

* Significance at the 10% level; ** Significance at the 5% level; *** Significance at the 1% level

Table 2 displays the Pearson correlation coefficient, which offers preliminary evidence about the relationship between the variables tested. As already hypothesized, the probability of default, size, and B/M ratio has a significant correlation with stock returns. The direction of the correlation of all variables is positive. It is showns that the correlation between the default probability, B/M ratio and stock return is consistent with the book-to-market effect which is the firm with high B/M ratio means the market expect that the company's prospect is worse than the company with a low B/M ratio, so the market will expect a high return. One well-known argument of book-to-market equity premiums for returns is that companies with high book-to-market are charged a higher risk premium because of the greater risk of distress (Griffin & Lemmon, 2002). The correlation between size and return is not consistent with the size effect because of its positive relationship. However, a negative relationship is found between the default probability and size, which means that small companies have a high default risk.

Regression Analysis

The data in this study are panel data so regression analysis with Ordinary Least Square (OLS) does not regard the difference between individuals and between time, because it is assumed the intercept and the slope of the model are the same. Therefore, to overcome the weakness of the regression analysis (OLS), the test of Fixed Effect Model (FEM) and Random Effect Model (REM) are conducted. OLS, FEM and REM models testing were carried out by Chow Test, Hausman Test and Pagan Breusch (Gujarati, 2006). Table 3 summarizes the results of the FEM and REM tests for models 1 and 2.

Table 3. Regression Model Determination

Regression Model	*Chow Test*	*Hausman Test*	Conclusion
	Prob. F-Stat		
Model 1	0.2269	0.000 ***	*Common Effect*
Model 2	0.000 ***	0.000 ***	*Fixed Effect*

* Significance at the 10% level; ** Significance at the 5% level; *** Significance at the 1% level

The Chow Test results for Model 1 in Table 3 show that the p-value for Cross-section F = 0.2269, It conclude that Common Effect Model are better than FEM. Then, the Hausman Test results show p-value for Random Cross-section = 0.000 which states that FEM is better than REM. Hence, the conclusion is Common Effect Model will be used to interpret the regression results for Model 1. Furthermore, The Chow Test results for Model 2 in Table 3 show that the p-value for Cross-section F = 0.000. It concludes that Fixed Effect Model are better than Common Effect Model. Then the Hausman Test results show p-value for Random Cross-section = 0.000 which states that FEM is better than REM. According to the both tests, Fixed Effect Model will be used to interpret the regression results for Model 2.

Table 4. Main Regression Analysis

Variable	Coefficient of Regression	
	Panel A (Model 1)	Panel B (Model 2)
Probability of Default	0.026196 *** (0.000)	0.126102 *** (0.000)
Size	-	0.041006 *** (0.000)
Book to Market	-	0.027904 *** (0.000)
Constant	0.002769 * (0.071)	-0.924889 *** (0.000)
Period	120	

Cross-Section	102	
Observation	12240	
Method	*Common Effect Model*	*Fixed Effect Model*
R-squared	0.001786	0.052167
Adj R-squared	0.001704	0.044044
Prob. (F-Statistic)	0.000003 ***	0.000 ***

* Significance at the 10% level; ** Significance at the 5% level; *** Significance at the 1% level

Table 4 shows the results of regression analysis for sample in this study. Panel A displays the results of regression testing for hypothesis 1 which examines the effect of default risk on stock returns. The results presented in Panel A show that the default risk which is proxied by default probability has a positive ($\beta = 0.026$) and significant ($p < 0.01$) effect on stock returns. So that the first hypothesis of this research is proven. The higher the default risk, the higher the demand for default risk premiums and the higher rate of return. This finding also supports previous research of Denis & Denis (1995), Griffin & Lemmon (2002), Vassalou & Xing (2004), Lin, Chang & Yeh (2012).

Panel B on Table 4 displays the results of testing for hypothesis 2, which adds the control variable size and B/M ratio to see the effect of default risk on stock returns. The results show that the risk of default ($\beta = 0.126$), size ($\beta = 0.041$) and B/M ratio ($\beta = 0.027$) has a positive and significant ($p < 0.01$) effect both partially and simultaneously (*F-Stat* < 0.01) on stock returns. The addition of these two control variables also increases the adjusted R-square by 4.23% from 0.17% to 4.40%, which means that the addition of these two control variables makes the estimation model better to explain stock returns. The empirical findings also support the research of Vassalou & Xing (2004), Lin, Chang & Yeh (2012) where default risk, size and B/M ratio, each of them is a significant factor that has certain explanatory power for stock returns.

Robustness Check

We designed the robustness check to validate our findings by examining the influence of our independent and control variables on stock return during the crisis 2008 and the post-Crisis period (2009-2017). Table 5 divide the regression period into 2, the crisis and post-crisis period. An interesting stuff was found when dividing the two periods. During the crisis, it suggests the effect of the risk of default on stock returns. This is reflected in the positive ($\beta = 0.326$), and significant ($p < 0.01$) coefficient values. Adding two control variables of size and B/M ratio, the result remain supports the main analysis of this study. The results suggest that the risk of default ($\beta = 0.201$), size ($\beta = 0.136$) and B/M ratio ($\beta = 0.036$) has a positive and significant ($p < 0.01$) effects on stock returns. The effect of default risk on stock returns during the crisis confirmed the main analysis. Meanwhile, when tested in the post-crisis period it's also shows a positive ($\beta = 0.131$) and significant ($p < 0.01$) effect of the risk of default on stock returns. Adding two control variables of size and B/M ratio, the result remains confirm the main analysis of this study. The results suggest that the risk of default ($\beta = 0.162$), size ($\beta = 0.043$) and B/M ratio ($\beta = 0.023$) has a positive and significant ($p < 0.01$) effects on stock returns. Thus, it is concluded that the default risk had an effect on stock returns regardless of the crisis and post-crisis periods.

Tabel 5. Crisis and Post-Crisis Analysis

Variable	Crisis Period (2008)		Post-Crisis Period (2009-2017)	
	Model 1	Model 2	Model 1	Model 2
Probability of Default **Prob. t-statistic**	0.326530 *** (0.000)	0.201063 *** (0.000)	0.131791 *** (0.000)	0.162431 *** (0.000)
Size **Prob. t-statistic**		0.136905 *** (0.000)		0.043002 *** (0.000)

Book to Market **Prob. t-statistic**		0.036704 *** (0.000)		0.022743 *** (0.000)
Constant **Prob. t-statistic**	-0.069946 *** (0.000)	-2.917498 *** (0.000)	0.001797 (0.4321)	-0.961743 *** (0.000)
Period	24		96	
Cross-Section	102		102	
Observation	2448		9792	
Method	*Fixed Effect Model*	*Fixed Effect Model*	*Fixed Effect Model*	*Fixed Effect Model*
R-squared	0.053592	0.145555	0.017193	0.035988
Adj R-squared	0.012427	0.107629	0.006846	0.025639
Prob. (F-Statistic)	0.024791 **	0.0000 ***	0.000035 ***	0.000000 ***

* Significance at the 10% level; ** Significance at the 5% level; *** Significance at the 1% level

CONCLUSION

This study uses the Merton (1974) model to calculate the monthly probability of default for individual firm, and examine the effect of probability of default on stock return. This study also examines the effect of size, B/M ratio, and the risk of default on stock returns. Sample data of this research are non-financial companies listed on the Indonesian Stock Exchange (IDX) during the period 2008-2017. The result found that the higher default risk, the higher rate of return. When adding the size and B/M ratio into the estimation model, the results show that the size, B/M ratio and default risk are still significant factors to explain stock returns.

When the research period is divided into periods of crisis and post-crisis, the results remain support the main analysis. During the crisis and post-crisis period reveal a positive effect of the risk of default on stock returns. This study has limitations, which is the data used in this sample is a small sample of non-financial companies in Indonesia so the results cannot be generalized for all companies on the Indonesia Stock Exchange. Therefore, further research in this area is needed by using larger samples and longer periods, so that the validity of the default risk proxy toward stock returns can be increased.

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