Probability of Bankruptcy of the Nonfinancial Sector: Evidence from ASEAN Developing Countries

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Abstract. Bankruptcy prediction is one of the hot issues in corporate finance since it plays an important role in the various decision-maker. However, the vast majority of these studies were conducted in developed countries rather than in developing countries. Thus, this paper aims to analyze the probability of bankruptcy of non-financial public companies in ASEAN's developing countries during 2015-2020 and its correlation with several company-specific factors. Merton's probability of default will be employed to estimate the probability of bankruptcy of each company in each country group. The result showed that on average the probability of default in Indonesia could be maintain below 50% while in Malaysia and Thailand could be maintained below 25%. This research revealed that profitability and retained earnings to total assets had a negative correlation with the probability of default while liquidity, leverage, and cash to total asset had a positive correlation with the probability of default in all representative countries. Meanwhile, firm size had a different type of correlation among representative countries. Overall, the obtained result will potentially help the practitioners and academics in seeking further exploration of bankruptcy probability prediction and its determinants in ASEAN's developing countries.

Keywords: Bankruptcy, Default Probabilities, Merton (1974) Model, Public Company, Developing Country

1 Introduction

A company's health is the conditions that are maintained and being improved by every company. It is characterized by the company's ability to pay its liabilities, the ability to generate cash, having access to the capital market, and obtain the capacity to deal with unexpected cash issues (Kumar and Ravi, cited in Pal et al. [1]). Failure to meet those aspects will result in a higher probability of bankruptcy.

Bankruptcy is mainly associated with the failure of the company. It happened when the company suffers from significant loss or when the company had more liabilities than assets [2]. Beaver, cited in Sun et al. [3] defines the company's failure as its inability to pay the liabilities or the preferred dividend that resulted in the extension of bank credit, creditor liquidation, and even bankruptcy procedure. This terminology is also explained by Carminchael, cited in Sun et al. [3] as the company's inability to fulfill its obligation that is characterized by the shortage of liquidity, equity, inability to pay debts, and lack of liquid capital.

There are numerous factors behind the cause of the company's bankruptcy. According to Veganzones and Severin [4], there are two categories of bankruptcy factors: external factor and internal factor. External factors caused by the environment that indirectly associated with business processes and can't be predicted. It can be caused by accident, natural disaster, dispute

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resolution with partner or public administration, the personal problem of the owner (death, illness), government policy that is unfavorable to the company, and implementation failure or fraud within the company. Meanwhile, the internal factor can be seen through the company's report and can be predicted. It can be caused by financial distress, losing market share, management problems, outdated technology or production process, higher operation cost, and supplier problem.

According to Global Bankruptcy Report 2019 released by Dun & Bradstreet, company bankruptcy is still happening all around the world due to the increasing economic challenges. It is happening not only in developed countries but also in developing countries with fluctuating numbers year by year. The report published by Atradius in March 2020 also revealed that global insolvencies had risen and were expected to grow by 2020. It showed that Asia-Pacific faced the highest increase in insolvencies in 2020 and the accelerated growth has already happened since 2014.

In the last 50 years, a topic related to company failure or probability of bankruptcy has been widely researched as an attempt to solve those problems [3]. The various method had been developed to identify the probability of bankruptcy that will be beneficial for the company, investor, financial institution, or even the authority to make the appropriate decision [5]. One way that could be done is by performing the probability of bankruptcy prediction so that the risk can be reduced before it happened [6].

Das et al. [7] stated that there are two methods that can be used to estimate the company's probability of bankruptcy, that is: (1) Accounting based information by using the ratio in financial statements that is introduced by Altmant, E. in 1968 and known as Altman's Z score; (2) Market-based information by analyzing the volatility of company's equity price that is pioneered by Merton, R.C. in 1974 and known as Merton probability of default. This study will employ Merton probability of default due to its accuracy compared to the accounting-based method [8]. Wang and Chiu [9] also stated that this method had flexibility in estimating the bankruptcy risk in the various market since it's only needed the information related to share price and book value stated in the financial report.

The prediction of corporate bankruptcy can be undertaken as the preventive action in mitigating the risk so that it can be handled earlier. The prediction can be obtained from various methods that have been proven by various studies. There are numerous studies about bankruptcy prediction; however, the studies still have some further investigated gaps. The literature mainly focused on the probability of public companies' bankruptcy in developed countries [10]. A public company in developing countries is no less important because of its role in economic activity, employment, and innovation in many countries.

Panjaitan [11] analyzed the probability of default company profile in the public sector using Merton's probability of default. The research found out that a developed country has a lower probability of default, lower asset volatility, and higher liability to assets ratio than a developing country.

Charalambakis and Garrett [10] analyzed the bankruptcy prediction in one of developing countries and the specific factors behind it. The research generated the result that profitability, retained earnings to total asset, company size, liquidity, leverage, export, and dividend payment are the substantial factors correlated to the bankruptcy prediction in a developing country.

Zhang et al. [12] identified the factors that could be correlated with corporate default in China. The exploration was done by using some company specific factors namely leverage, liquidity, and firm size as well as some macroeconomic variables. This research indicates that high leverage failed to decrease the corporate default risk in small companies due to financial

limitations in the amount of cash holding to prevent bankruptcies. Whereas the big company could survive because of the larger cash holding that was sufficient to mitigate the default risk.

Veganzones and Severin [4] reviewed the literature related to bankruptcy prediction in the 21st century. It concluded that the bankruptcy prediction could estimate the probability of bankruptcy with the appropriate procedure to the relevant topics.

Thus, this paper investigates the probability of bankruptcy of non-financial public companies in ASEAN's developing countries by using Merton's probability of default method since this area is not covered enough in the literature. The comparison will be made, and the determinants will be explored to get the bigger picture of the probability of bankruptcy in those countries. The determinant will be identified by some specific factors that were proven to correlate with bankruptcies in another country. The generated result will be beneficial as additional insight especially for companies in the ASEAN's developing countries.

2 Research Methods

This paper uses data from Thomson Reuters Eikon Datastream. The financial company was excluded from the research since it had widespread. This research sample is developing countries in ASEAN that are represented by Indonesia, Malaysia, and Thailand during the period 2015-2020.

In estimating the probability of bankruptcy, this paper uses Merton's Probability of Default pioneered by Merton, R.C. in 1974. This method is market-based information that employs the market value of assets and asset volatility. The equation of Merton Probability of Default can be expressed as:

$$PD = N\left(\frac{\ln L - ln\, A_t - (\mu - 0.5\sigma_A{}^2)T}{\sigma_A\sqrt{T}}\right) = N\left(\frac{\ln(\frac{A_t}{L}) + (\mu - 0.5\sigma_A{}^2)T}{\sigma_A\sqrt{T}}\right) \quad (1)$$

N is the normal distribution function, L is the book value of liabilities, μ is expected return on Asset (A), σ_A is asset volatility and T is the time horizon.

To get the value of σ_A, we need to use the iteration method as follows:

$$V_t = E_t + N(d_2)L_T e^{-r(T)}/N(d_1) \quad (2)$$

Iteration is done by applying it to the following equation for 260 trading days.

$$V_t = E_t + N(d_2)L_T e^{-r(T)}/N(d_1)$$

$$V_{t-1} = E_{t-1} + N(d_2)L_T e^{-r(T-1)}/N(d_1)$$

$$V_{t-260} = E_{t-260} + N(d_2)L_T e^{-r(T-260)}/N(d_1)$$

The iteration processes stopped until the procedure converged. Henceforth, the probability of default can be estimated.

In estimating the reason behind the probability of bankruptcy, these specific factors will be observed and correlation with the probability of default will be calculated. The correlation is used to measure the degree to which two variable moves together. The correlation coefficient magnitude is between -1 and +1. If the coefficient is -1, it means that the two variables move in the opposite direction. While, if the coefficient is +1, it means that the two variables move in the same direction. These studies investigated the correlation of probability of default with these specific factors employed from the research done by Charalambakis & Garrett [10] and Zhang et al. [13]. This research showed that these factors could be correlated with bankruptcies in developing countries.

Table 1. Estimating the specific factors

Variable	**Measurement**
Profitability	$= \frac{\text{Earning before interest, tax and depreciation}}{\text{Total assets}}$
Retained earnings to total assets	$= \frac{\text{Retained earnings}}{\text{Total asset}}$
Liquidity	$= \frac{(\text{Current assets} - \text{Current liability})}{\text{Total asset}}$
Company size	= Natural logarithm of total assets
Leverage	$= \frac{Total\ liability}{Total\ aset}$
Cash holding	$= \frac{Cash\ and\ cash\ equivalent}{Total\ aset}$

3 Result and Discussion

Employing Merton's probability of default to predict the company bankruptcy in the developing countries generated the following results. The data derived from 104 companies from 3 countries that already fulfil the qualification.

Table 2. Descriptive Statistic

	Min	Max	Mean	Med	Std. Dev
PD Indonesia	0.0000%	40.6510%	1.0151%	0.0000%	4.7653%
PD Malaysia	0.0000%	22.0412%	0.3129%	0.0000%	1.8128%
PD Thailand	0.0000%	16.9209%	0.2631%	0.0000%	1.4379%

From result presented, it can be seen that the probability of default relatively different between ASEAN's developing countries. Malaysia had showed the best result among countries since it could maintain the bankruptcy probability based on the lowest average by 0.313% for 6 years compared to the other country that could even reach up to 1.015%. All represented countries also had the similarity in the lowest percentage probability of default. Each of them had the company that its bankruptcy probability equal to 0%. The highest percentage probability

of default for every country was also in the adjacent range except for Indonesia that could reach 40.651%.

Table 3. Correlation Matrix Specific Factors in Indonesia, Malaysia and Thailand

	PD Indonesia	PD Malaysia	PD Thailand
PD	1.0000	-0.1280	-0.2677
PROF	-0.1280	1.0000	0.1781
RE_TA	-0.2677	0.1781	1.0000
LIQ	0.0021	-0.0600	0.4782
SIZE	0.1391	-0.4816	0.0236
LEV	0.2075	-0.0120	-0.5917
CASH_TA	0.0527	0.0004	0.3226

Table 3 shows the correlations of specific factors with the probability of bankruptcy in Indonesia, Malaysia, and Thailand. It reveals that profitability and the proportion of retained earnings have a negative correlation with the probability of bankruptcy in every country. It means that the higher the profitability and the proportion of retained earnings to the total assets then the bigger the probability of bankruptcy will be. The companies that can generate profits imply that they could manage their assets effectively and efficiently. It can certainly cause the company to continue growing and can reduce the probability of bankruptcy. Meanwhile, the retained earnings can help the company reserve some amount of funds for unpredictable moments so that the company can keep continue to run normally and reduce the risk of bankruptcy as well.

The table also reveals that liquidity, leverage level, and the proportion of cash to total assets have a positive correlation with the probability of default in every country. It implies the higher the liquidity, the level of leverage, and the proportion of cash to total assets then the lower the probability of bankruptcy will be. Liquidity in this study is obtained by calculating the proportion of working capital to total assets. If the company had adequate capital, it will benefit the company. However, if the proportion of working capital is fairly high, it can have an unfavorable impact on the company due to the large number of idle funds that can cause the company to lose the opportunity to manage funds effectively and efficiently. Therefore, high liquidity is correlated with a higher probability of bankruptcy. Meanwhile, the high level of leverage means that the debt owed by the company is getting higher as well. If the debt owed by the company is not managed properly, it can certainly increase the default risk. The proportion of cash owned by the company will be in line with the probability of bankruptcy as well. This can be caused by the higher amount of cash being held can make the company lose the opportunity to use these funds into a more profitable form of investment. If this happens continuously, the company can experience slow growth and it is possible to go bankrupt.

Meanwhile, the size of the company has various correlations for each country where only Indonesia has a positive correlation between this factor and the probability of bankruptcy. This shows that the larger the size of the company then the higher the probability of bankruptcy in Indonesia, while the opposite applied in Malaysia and Thailand.

The findings show a similar result with previous studies. For example, the firm that had more liquid assets will likely go default. It can be seen by its positive correlation with the probability of default in Indonesia, Malaysia, and Thailand. However, this research does not support the idea that the larger firms with greater cash holding could reduce the default risk. It can be caused by the possibility that the higher the amount of cash being held by the firm could

eliminate the opportunity to use these funds into a more profitable form of investment. If this occurs continuously, it may result in slow growth and go bankrupt gradually.

This present study extends the previous literature by measuring the specific factors correlated with the probability of bankruptcies in ASEAN's developing countries. The result showed that the companies with higher liquidity, leverage and the amount of cash held should be more cautious since these factors could lead to a higher probability of bankruptcies, especially in that region.

4 Conclusion

The bankruptcy probability estimated by Merton's probability of default was carried to the ASEAN's developing countries. The result showed the probability of bankruptcy of companies in Indonesia is on average 1.01514% with the highest score reaching 40.651%, the probability of bankruptcy of companies in Malaysia is 0.313% on average with the highest value reaching 22.0412%, while the probability of bankruptcy of companies in Thailand is 0.263% on average with the highest value reached 16,9209%.

The factors related to the probability of default had been analyzed as well. The correlation of specific factors with the probability of bankruptcy in various countries shows that profitability and retained earnings to total assets had a negative correlation with the probability of bankruptcy in all countries, liquidity, leverage, and the amount of cash held had a positive correlation with the probability of bankruptcy in all countries, while firm size had varying correlations in all countries.

Bankruptcy prediction is still one of the hot topics in corporate finance. Hence, further research could further investigate the probability of bankruptcy in another developing country. The specific factors correlated with it could also be explored to find another determinant of bankruptcy that might help the companies in some specific countries to take preventive action before they go bankrupt.

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