Bankruptcy Prediction Model of Banks in Indonesia Based on Capital Adequacy Ratio

by Lis Sintha

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ABSTRACT

Objective - The purpose of this study is to examine the influence of capital to bankruptcy bank. The hypothesis of this research is that capital has an effect on Bankruptcy of Bank.

Methodology/Technique – Tis research examines financial report between 2005-2014. Econometric model with logistic regression analysis technique. In this study capital is measured by CAR by taking into account credit risk; CAR by taking into account market risk; Ratio of Obligation to Provide Minimum Capital for Credit Risk and Operational Risk; Ratio of Minimum Capital Adequacy Ratio for Credit Risk, Operational Risk and Market Risk; Capital Adequacy Requirement (CAR).

Findings -The results found that the capital adequacy ratio for market ratio and capital adequacy ratio for credit ratio and operational ratio support the research hypothesis and can form a logit model. Test results of CAR by taking into account credit risk, Minimum Capital Requirement Ratio for Credit Risk, Operational Risk and Market Risk and Minimum Capital Provision Obligations do not support the research hypothesis.

Novelty – This paper contribute to bankruptcy prediction models based on time dimension and bank groups using financial ratios which are expected can influence bank in bankrupt condition.

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1. Introduction

   Banking as an institution that functions to collect and channel public funds has an important role to support national development, therefore new breakthroughs are needed in the banking sector to drive the wheels of the national economy. "That is why the assessment of bank soundness is very necessary for the continuity of its business, so analysis is needed to assess the bank's financial statements. Health conditions and bank performance can be analyzed through financial statements.

In assessing the health of banks, they can be assessed in various ways or methods. Since 2011, a tool to measure bank health is by the RGEC method (Risk Profile, GCG, Earning, Capital). The bank's health assessment model is loaded with risk management. Risk Profile is an assessment of inherent risk and the quality of the application of Risk Management in the Bank's operational activities including 8 (eight) types of Risk, Assessment for other factors, namely Good Corporate Government, Earning, and Capital, in general just like the previous CAMELS assessment.

   The bank's capital aspect in this study is the Capital Adequacy Ratio (CAR). There are many factors that can affect changes in company profitability, one of which is the Capital Adequacy Ratio (CAR). Capital Adequacy Ratio (CAR) is a ratio that shows the level of capital adequacy, which means the amount of own

capital needed to cover the risk of losses caused from planting assets at risk. The higher the CAR ratio will be on the increase in ROE. CAR shows the level of bank compliance with regulations that serve and protect the public interest, (Supriyatna, et.al, 2007). In addition, the magnitude of the CAR indicates the bank's sensitivity to public interest. The higher the value of CAR, the more sensitive the bank is to the public interest. However, if the CAR value is low, it indicates that the bank's sensitivity to the public is low.

Research to examine the effect of Capital Adequacy Ratio (CAR) on bank conditions has been carried out by many previous studies. In the previous study there were inconsistencies in the results of the study, namely: CAR has a significant negative effect on the soundness of the bank (Suharman, 2007) while the research of Santoso, 1996 and Sinkey, 1975 states significant positive CAR. On the other hand, (Haryati's, 2006) study gives a not significant CAR result.

In this study, capital is measured by CAR by calculating credit risk; CAR by calculating market risk; Obligation Ratio Providing Minimum Capital for Credit Risk and Operational Risk (Capital Adequacy Ratio For Credit Risk and Operational risk); Minimum Capital Requirement Ratio for Credit Risk, Operational Risk and Market Risk (Capital Adequacy Ratio for Credit Risk, Operational Risk); Minimum Capital Adequacy Ratio (CAR).

Based on the discussion above, the following questina are posed:

1. How does the Capital Adequacy Ratio prediction model effect the healt of Bank?
2. How accuracy is the Capital Adequacy Ratio in predicting the bankruptcy of a bank?

2. Literature Review

2.1 Bank Health

Bank health is the ability of banks to carry out banking operations normally and are able to fulfill obligations properly and in ways that comply with applicable banking regulations (Santoso, 2006: 51). The soundness of the bank is the financial condition and management of the bank measured by calculating of ratios. The soundness of the bank is in the interest of all parties involved, namely the owner and manager of the bank, the community using the services of the bank, and the Indonesian bank as the supervisor and supervisor of the banks in Indonesia (Sunarti, 2011: 144).

Almilia and Herdiningtyas, 2005 have conducted empirical research on the level of business failure and bank bankruptcy using financial ratios of the CAMELS model. The results show that Capital Adequacy Ratio (CAR) is significantly negatively related to problematic conditions.

Santoso and Triandaru, 2006 argue that bank health is the ability of a bank to carry out banking operations normally and is able to fulfill all of its obligations properly in ways that comply with applicable regulations. If the bank's CAR increases, the risk will decrease and profits will increase (Yuliani, 2007).

In calculating capital, banks must refer to Bank Indonesia regulations governing Minimum Capital Requirements for commercial banks. In addition, in assessing capital adequacy, banks must also link capital adequacy with the bank's risk profile. The higher the bank's risk, the more capital must be provided to anticipate the risk.

2.2 Capital

In regulating the capital of banks in Indonesia, Bank Indonesia adopted the capital provisions issued by the International Settlement Bank (BIS) in requiring that the amount of bank capital be at least 8% of the total assets of banks at risk which are called WAAR (Weighted Assets According to Risk).

In terms of assets, a high level of capital adequacy will provide an opportunity for diversifying assets for banks and can expand so that they can improve the ability of bank profitability or bank financial performance, (Rose, 2002).

Adequate bank capital covers the level of asset risk so that the bank's performance will improve. This is due to an increase in the level of trust of depositors to deposit their funds even though the interest rates of third party funds are lower.

During the market crisis and banking crisis that occur in the world, especially in the United States, the results of Berger and Bownmen, 2009 show that the level of bank capital in small banks is able to survive. While for medium and large banks, the capital level is only able to survive when the banking crisis occurs. This shows that there is a relationship between bank capital and the banking performance.

The results of research in Indonesia conducted by Sudiyatno and Soroso, 2010 show that capital adequacy ratio (CAR) has a significant positive relationship with banking performance. Whereas the opposite results of research conducted by (Sudiyatno and Setyowati, 2012, Rusdini, 2012 and Amalia, 2010) show that CAR does not affect the performance of banks.

Assessment of capital (capital) factors includes an assessment of the level of capital adequacy and capital management. The indicators used in the aspect of capital, namely Capital Adequacy Ratio (CAR) is a capital adequacy ratio, is an important factor for banks in business development and accommodates the risk of losses caused by bank operations. CAR shows the extent to which a decrease in bank assets can still be covered by available equity banks, the higher the CAR the better the condition of a bank (Tarmidzi Achmad, 2003).

Capital Adequacy Ratio is a capital ratio that shows the ability of banks to provide funds for business development needs and to accommodate the possible risk of losses caused by bank operations. The greater the ratio, the better the position of capital (Achmad and Kusuno, 2003).

Minimum Capital Liability Calculation according to risk profile, (SE No. 14/37 / DPNP, 27 December 2012) Banks are required to provide minimum capital in accordance with risk profiles, both individually and on a consolidated basis. Meeting the needs of the Bank's Minimum Capital Ratio or known CAR is determined by BIS (Bank for International Settlement) of 8%.

CAR ratio is obtained by using the formula: (Capital: WAAR) x 100%. Capital consists of Core Capital (Tier 1) and Complementary Capital (Tier 2), where the amount of Supplementary Capital is calculated to be a maximum of 100% of the amount of Core Capital. If credit risk, market risk and operational risk are included, these risks will add WAAR.

CAR by taking into account Credit Risk is the bank's performance ratio to measure the capital adequacy of the bank in supporting assets that contain or produce risks, for example loans given. The greater the percentage of CAR by taking into account Credit Risk of a bank shows the greater endurance of a bank in the face of shrinking the value of bank assets arising from the existence of troubled assets. Based on Bank Indonesia regulations", banks that are declared as healthy banks must have a CAR of at least 8%.

The bank health level relationship diagram with the capital rating factor measured by credit risk, market risk and operational risk in predicting bankruptcy of the bank is shown in the figure below:
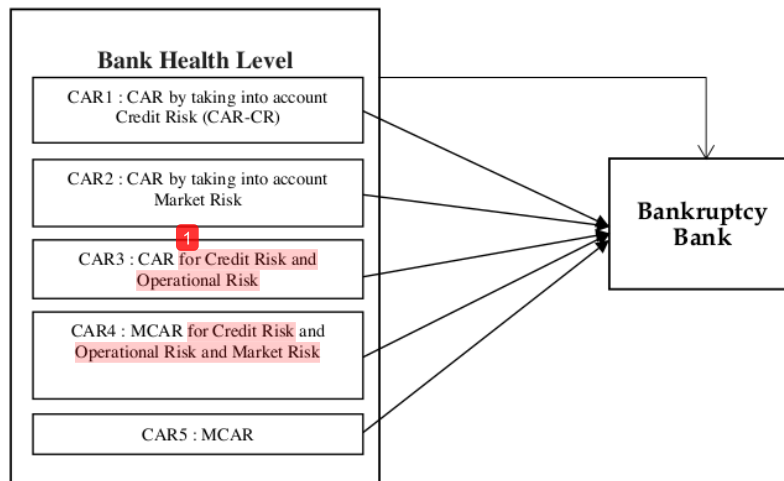
Figure 1. Relationship of Capital Variables

3. Research Methodology

The population in this study are all Banks in Indonesia listed in the Indonesian Banking Directory Book . Sampel were taken from population by purposive sampling. Based on the above criteria, 74 bank samples were obtained from 2005 - 2014 as a design model consisting of 13 troubled / bankrupt banks and 61 non-bankrupt banks. This study uses a Logit model that is useful as a predictor of bankruptcy model with a relatively small 3

3.1 Variable Operationalization

The Capital Parameters / Indicators matrix in this study are:

CAR by calculating credit risk
CAR by calculating market risk
Ratio of Capital Adequacy Ratio to Credit Risk and Operational Risk (Capital Adequacy Ratio for Credit Risk and Operational Risk).
Minimum Capital Requirement Ratio for Credit Risk, Operational Risk and Market Risk (Capital Adequacy Ratio for Credit Risk, Operational Risk)
Minimum Capital Requirement (CAR)

Logit analysis will form a model that is expected to answer the probability problem bankruptcy bank. Bankruptcy status of the bank: The bankruptcy status of the bank is dichotomous, where Y = 1, states bankruptcy bank and Y = 0, declares the bank is healthy (not bankrupt) .

Table 1 , Operationalization of Research Variables

Variable	Dimension	Formula	Scale
Capital	1. CAR_1 : CAR taking into account credit risk	CAR_1 = (bank capital - credit risk) / (weighted asset by credit risk) x 100%	Ratio
	2. CAR_2 : CAR by taking into account market risk	CAR_2 = (bank capital - market risk) / (weighted assets by market risk) x 100%	Ratio
	3. CAR_3 : Insurance Capital Expenditure Ratio for Capital Risk and Operational Risk	CAR_3 = (bank capital - credit risk-operational risk) / (risk-weighted assets - credit risk-operational risk) x 100%	Ratio
	4. CAR_4 : Ratio of Minimum Capital Adequacy Ratio for Credit Risk, Operational Risk	CAR_4 = (bank capital - credit risk-operational risk) / (risk-weighted assets - market risk-risk-operational risk) x 100%	Ratio
	5. CAR_5 : Minimum Capital Adequacy Requirement.	CAR_5 = (bank capital) / (risk-weighted assets) x 100%	Ratio

4. Results

The description of capital variables in table 2 shows that there are differences in average rating of the Capital Adequacy Ratio by taking into account "Credit Risk (CAR_1), Capital Adequacy Ratio Market Risk (CAR_2), Capital Adequacy Ratio for Credit Risk and Operational Risk (CAR_3), Capital Adequacy Ratio of Credit Risk, Market Risk and Operational Risk (CAR_4) and Capital Adequacy Ratio (CAR_5) in healthy banks is smaller than the average value in unhealthy banks.

Capital Adequacy Ratio by taking into account Credit Risk (CAR_1) and Capital Adequacy Ratio Market Risk (CAR_2), the difference is reinforced by t test results that yield probability significance below 0.05. So it can be concluded that the average CAR_1 and CAR_2 on banks that experienced bankruptcy and non bankrupt differ significantly.

Capital Adequacy Ratio for Credit Risk and Operational Risk (CAR_3), Capital Adequacy Ratio of Credit Risk, Market Risk and Operational Risk (CAR_4) and Capital Adequacy Ratio (CAR_5), result of t test show probability significance above 0.05. So it can be concluded that the average CAR_3, CAR_4 and CAR_5 on bank that experienced bankruptcy and non-bankrupt different not significant .

Table 2, Description of *Capital*

Variables	Panel A			Panel B			P-value
	Non Bankruptcy = 1.850			Bankruptcy = 70			T_{test}
	Mean	Max	Min	Mean	Max	Min	
CAR_1	11,720	166.03	-39.62	45.351	372.59	0.16	0.000
CAR_2	20464	144.63	-22.29	56.912	372.59	0	0.000
CAR_3	20365	166.03	-39.62	147.791	6231	10.58	0.154
CAR_4	19874	144.63	-22.29	145.216	6227	0	0.161
CAR_5	13.830	94.61	0	21.636	349.41	8	0.149

Source: BI data processed, 2017

Effect of *Capital* on Bank Bankruptcy Predictions

Logit (y) = - 5.953 + 0.093 (CAR_1) - 0.062 (CAR_2) - 0.043 ($CARCROR_3$) + 0.07 (CAR_4) + 0.115 (CAR_5)

Table 3, Hypothesis Testing Results Capital Models

Variabel	Prediction	Koefisien	Wald	Exp (B)	Result
Constants		-5.953	289.33	0.003	
CAR_1	Negatif (-)	0.093	15.87	1.098	Not Supported
CAR_2	Negatif (-)	-0.062	5.64	0.940	Supported
CAR_3	Negatif (-)	-0.043	1.74	0.958	Supported
CAR_4	Negatif (-)	0.070	4.22	1.072	Not Supported
CAR_5	Negatif (-)	0.115	16.68	1.122	Not Supported
Negelkerke R^2		29.70%			
Chi-Square		160.00			

Source: Processed Data 2017*** Supported statistically on alpha 1%, ** at alpha 5%, and * at alpha 10%.
The table above summarizes the results of tests of *capital* influ- ence in terms of *capital adequacy ratio credit ratio (CAR_1), capital adequacy ratio market ratio (CAR_2). capital adequacy ratio of credit ratio* and *operational ratio (CAR_3), capital adequacy ratio of credit ratio, market ratio* and *operational ratio (CAR_4)* and *capital adequacy ratio (CAR_5)* to bank insolvency.

The initial hypothesis predicts that the capital adequacy ratio of credit ratio (CAR_1) negatively affects Bankruptcy of the Bank. Based on the results of output in table above, obtained the coefficient of capital adequacy ratio credit ratio (CAR_1) of 0.093 which means will increase the value of odds ratio or bankruptcy probability of exp (0.093). The logit model does not support the hypothesis that the capital adequacy ratio of credit ratio (CAR_1) does not negatively affect bank insolvency, so the capital adequacy ratio credit ratio (CAR_1) is not able to form logit model.

Value of variable capital adequacy ratio (CAR_2) is equal to -0.062, meaning that the result of logit model research supports the hypothesis that capital adequacy ratio market ratio (CAR_2) negatively affects Bankruptcy of Bank at 5% significance level. The higher the capital adequacy ratio market ratio (CAR_2), the bankruptcy probability of the Bank will decrease and vice versa, so that the capital adequacy ratio market ratio (CAR_2) variable can form the logit regression model equation.

The coefficient of capital adequacy ratio of credit ratio and operational ratio (CAR_3) is -0.043 meaning that each increase of CAR_3 will decrease the value of bank odds ratio or probability of bankruptcy by exp (-0.043) or equal to 0.958. The result of the logit model research supports the hypothesis that the capital adequacy ratio of credit ratio and operational ratio (CAR_3) negatively affects Bankruptcy of Bank at 5% significance level. The higher the capital adequacy ratio of credit ratio and operational ratio (CAR_3) , the bankruptcy probability of Bank will decrease and vice versa, so that the variable of capital adequacy ratio of credit ratio and operational ratio (CAR_3) can form logit regression model equation.

The value of coefficient of capital adequacy ratio of credit ratio, market ratio and operational ratio (CAR_4) is 0.070 which means result of the logit model does not support the hypothesis that the capital adequacy ratio of credit ratio, market ratio and operational ratio (CAR_4) does not negatively affect bank insolvency so that the variable of capital adequacy ratio of credit ratio, market ratio and operational ratio (CAR_4) cannot form equation of regression model logit.

The value of capital adequacy ratio (CAR_5) coefficient is 0.115, which means the result of logit model does not support the hypothesis that capital adequacy ratio (CAR_5) does not negatively affect bank insolvency so that variable capital adequacy ratio (CAR_5) cannot form logit regression model equation.

It can be concluded that from the five indicators of capital variables , only capital adequacy ratio market ratio (CAR_2) and capital adequacy ratio credit ratio and operational ratio (CAR_3) supporting the research hypothesis and can form variable logit variable capital. While CAR_1, CAR_3 and CAR_5 test results do not support the research hypothesis.

The results of this study are consistent with the Haryati (2006) study showing CAR_5 has no significant effect on the probability of bankruptcy of the bank. The absence of significant influence between the CAR_5 on

bankruptcy probability of banks is due to the fact that the whole bank already has a high CAR. This is indicated by the descriptive statistic in Table 3 where the minimum value of CAR_5 for bankrupt bank is 8% and non-bankrupt bank is 0%.

CAR is one indicator of bank capital health. Capital Assessment is an assessment of the adequacy of bank capital to cover current risk exposure and anticipate future risk exposure. CAR_1 is a bank performance ratio to measure the capital adequacy of a bank in supporting assets that contain or generate risks, such as loans. The greater the percentage of a bank's CAR_1 indicates the greater the endurance of a bank in the face of the depreciation of bank property value arising from the presence of troubled assets. Based on the provisions of Bank Indonesia", banks declared as healthy banks must have a CAR of at least 8%.

The results did not support the research of Almilia and Herdiningtyas, (2005) which stated that CAR had a significant negative effect on the prediction of troubled condition in the banking sector and Santoso (1996) that the bigger the ratio, the less probability of a bank going bankrupt. Capital Adequacy Ratio (CAR) is a capital adequacy ratio that is an important factor for banks in the framework of business development and accommodates the risk of losses caused by bank operations. The higher the coefficient the more positive Capital probability of default or the higher the risk of bankruptcy of the bank. The results of this study support research conducted by Sudiyatno and Setyowati (2012), Rusdini (2012) and Amalia (2010) that the CAR does not affect bank performance and reject the results of Rose's research (2002) that a high level of capital adequacy will provide the opportunity of diversification asset for the bank and can expand to improve the bank profitability or bank's financial performance.

5. Discussion

The model test results support the hypothesis that Capital effect on bank insolvency. Based on the results of hypothesis test is then obtained the findings of the model as follows:

$$Logit\ P\ (y = 1 \mid x_1) = -5.953 - 0.062\ (CAR_2) - 0.043\ (CAR_3)$$

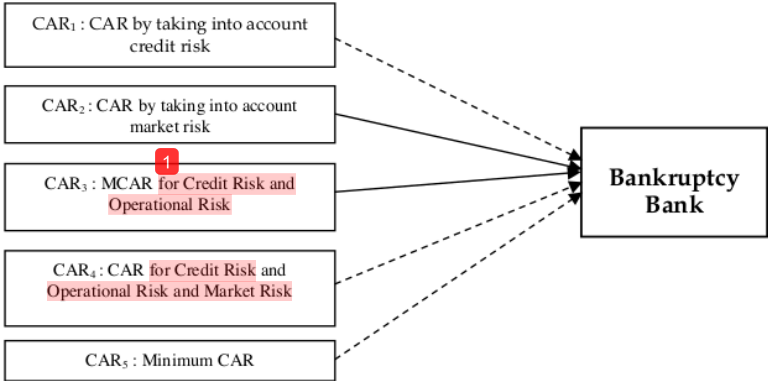The model diagram is shown in the picture below :

Figure 2 . Novelty Research Model *Capital*

The above model states that bank insolvency in Indonesia is determined by capital that is capitalized by capital adequacy ratio market ratio (CAR_2) and capital adequacy ratio of credit ratio and operational ratio (CAR_3). Capital valuation is an assessment of the adequacy of bank capital to cover current risk exposures and

anticipate future risk exposures. The greater the percentage of the capital adequacy of a bank shows the greater the endurance of a bank in the face of the depreciation of the bank's property values arising from the existence of troubled assets.

Overall, both with estimation data and validation data, the results of this study proved to support Pantalone & Platt (1987) and Ou & Penman (1989) statements, that bank failures can be accurately predicted despite the publication of information as a basis for limited predictions, and financial ratios can be used to predict future events by linking financial ratios with economic phenomena.

6. Conclusion

It can be concluded that from the five variable capital indicators, only the capital adequacy ratio market ratio (CAR$_2$) and the capital adequacy ratio credit ratio and operational ratio (CAR$_3$) that support the research hypothesis and can form a variable capital logit model. While the results of testing CAR$_1$, CAR$_4$ and CAR$_5$ do not support the research hypothesis.

This study is limited by relatively low adjusted R2 value of 29.70%. Therefore, future research may wish to add other variab. Future research should also examine a longer study period, to ensure that the results can be generalizable.

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