

Capital Adequacy Requirement, the Cost of Financial Intermediation and Risk Taking Behavior of the Indonesia Banking Sector

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Abstract—Basel I, II and III are strictly applied after the financial crisis in 1997 / 1998 and 2008 to ensure financial stability, among others by applying the minimum capital adequacy requirements that must be met by the bank in accordance with the risk profile. However, whether the impact of these requirements contributes positively to the Indonesian banking sector is still questionable, because some previous empirical studies have shown that strict capital requirements can force banks to increase their financial intermediation costs due to the rising capital cost. This study examines the relationship between minimum capital adequacy, the cost of financial intermediation and the risk-taking behavior of the Indonesia banking sector by using panel data from 45 commercial banks from 2012 to 2017. Using the Generalized Least Square (GLS) panel data regression, we find that the bank's capital ratio has a negative and significant relationship to the financial intermediation costs and risk-taking behavior of the Indonesia banking sector. We also find that the average return on equity of the Indonesia banking sector decreased during the observation period which shows that an increase in capital regulation position did not increase the cost of the banks' equity capital.

Index Terms—Capital requirement; the cost of financial intermediation; risk-taking

I. INTRODUCTION

Ensuring financial stability as an aftermath of the 1997/1998 and 2008 crisis, Banking Committee and Banking Supervision (BCBS) issued Basel I, II, III as macroprudential regulatory references and recommendation for many central banks in the world. One of the regulation requires banks to maintain a capital ratio at a certain level to absorb the risk of loss as a proxy by risk-weighted assets (RWA) which reduce the potential of systemic risk especially in times of crisis. During the implementation, some empirical results showed the controversial effect of capital regulation on the cost of financial intermediation and bank risk-taking. Angelini et al state that capital regulations have negative consequences in the form of high financial intermediation costs and capital regulation do not always reduce risk [1]. Rahman et al., find that capital regulation has a positive relationship with the cost of financial intermediation but has a negative relationship with bank risk-

taking behavior; banks increase financial intermediation cost in order to make up that higher capital adequacy ratio, but capital regulation has demotivated the banks to take excessive risk [2].

On a contradictory viewpoint, [3] mentions that a large portion of equity in the capital structure will decrease the bankruptcy cost, thereby reducing the rate of return required by shareholders, therefore high capital does not always increase the cost of capital. In addition, capital buffers also tend to reduce the impact of high equity on the cost of financial intermediation. Banks generally maintain capital buffers above the defined minimum level of capital adequacy requirements, and further, increase in minimum capital adequacy regulation will not necessarily increase bank equity. Slovik & Cournead suggests that banks may cut off some of the capital buffers in response to a rise in minimum regulatory capital adequacy requirements [4].

Kahane, through the mean-variance approach of selecting a portfolio model, show that minimum capital regulation increases the risk of banking assets [5]. This is because an increase in capital will reduce the expected profit so the bank will invest more in high-risk assets to cover such losses; it is called the Expected Income effect. Blum using the dynamic framework concludes that if the cost to meet the future capital ratio standard is high, then the bank will increase their investment risk in the present to meet the standard of future capital ratio [6]. In contrast, Huang et al. (2005) by simplifying Blum's (1999) model into one stage model and using static frameworks found that increasing capital requirement will lower bank risk.

Therefore, based on the conflicting empirical results showed in some countries, the aim of this paper is to examine the impact of the capital regulation on financial intermediation cost and risk-taking behavior of Indonesia banking sector. Overall, our empirical results support the capital regulation objectives to ensure financial stability by reducing bank risk and to support economic growth by lowering financial intermediation cost, this result can be a literature and contribute a

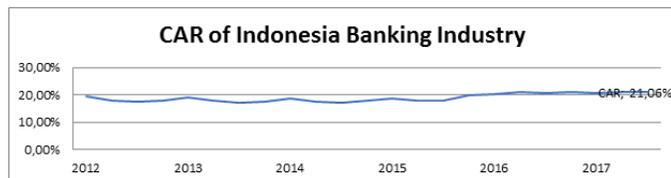


Fig. 1. CAR Position of Indonesia Banking Industry

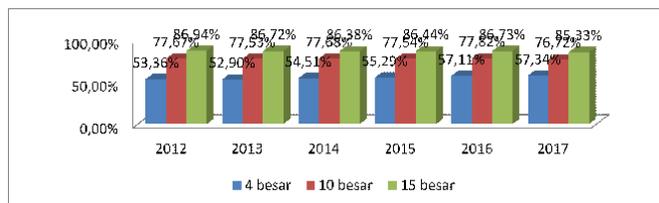


Fig. 2. Level of Asset Concentration

better insight for the regulators to create decisions.

II. LITERATURE REVIEW

A. Capital Regulation in Indonesia

Since the issuance of Basel I in 1988, followed by Basel II in 2004 and Basel III in 2010, dramatically the definition of bank capital has grown in order to improve the stability of financial system especially of the banking system and improve the harmonization gap that caused the financial crisis [7]. Capital is used as a tool to avoid future financial crises and as a security mechanism to absorb or reduce systemic risk (contagion effect). The capital structure of the Indonesia banking sector consists of (1) Tier 1 which include core capital at least 6% of risk-weighted assets, (2) Tier 2 as a complementary capital and (3) Tier 3 as an additional supplementary capital, both Tier 2 and Tier 3 are set as maximal 100% of Tier 1 [8]. The average CAR of Indonesia commercial banks from the sample data has an upward trend during the observation period as shown in Figure 1. The increase in CAR shows that the bank capital adequacy ratio is quite high as it is well above the capital regulation of at least 8% to 14% according to the bank risk profile [8]. An increase of the CAR was seen in 2016, with the fulfillment of The Capital Surcharge and The Countercyclical Capital Buffer required in Basel III, which has been implemented gradually from 2015 and will be fully implemented in 2019, the minimum capital requirement plus the capital buffer will at least be 10,5% [8].

B. Capital Regulation, Net Interest Margin, and Bank Risk-Taking Behavior

Naceur and Kandil state that higher capital requirement increases the cost of intermediation in the Egyptian banking industry to support higher return on equity and return on assets because capital requirement internalizes the risk for shareholders, which indicate that high capitalized banks face a lower bank risk in accordance with the lower cost of funding [9]. In line with this result are [2], Miles et al. (2013) and [10] who suggest that equity is an expensive source of financing compared to deposit and debt, and an increase in capital regulation would enhance the weighted cost of capital. Baker & Wurgler in Rahman et al. [2] [3] argues that a large share of equity will decrease bank risk-taking, then ultimately lower the return on equity (ROE). In addition, Zarruk and Madura [12], as well as Saunders and Schumacher (2000) [13], state that an increase in the capital adequacy ratio will decrease net interest margin if there is no increase in risk aversion level.

In a highly concentrated market, the financial intermediation cost could be lower because the new entrance players will increase the bank's competition which can reduce the loan interest for borrowers (Martinez-Miera & Repullo, 2010 in [11]). According to the sample data shown in Figure 2., the market concentration of the 4 largest banks increased during the observation period, but the market concentration of the 10 largest banks and the 15 largest banks decreased. This suggests that other groups of banks outside the largest bank group with relatively smaller asset values are able to compete to maintain or even accumulate the value of their assets than their asset share increases. Bustaman et al found a the decreasing trend in the banks' net interest margin in the ASEAN-4 banking industry followed by an increasing market power that can increase concerns of banking stability [11].

III. RESEARCH METHODOLOGY

A. Data & Research Framework

The data used in this study are panel data from 45 Indonesia commercial banks from 2012 to 2017, consisting of the quarterly financial statements of 45 conventional banks from the Financial Services Authority (OJK), Indonesia Central Bank (BI), websites of each of the banks, and macroeconomic data was obtained from BI and Central Bureau of Statistics (BPS). The sample data are based on the availability of the data through the observation period, including 4 biggest banks in BUKU 4 category, the total asset of the sample data is over 75% of the total asset of Indonesia commercial banks in 2016 (Indonesia Banking Statistics, 2017). The variables used for this research is summarized in the table below:

The dependent variables consist of financial intermediation cost proxied by net interest margin over average total assets, and risk-taking behavior proxied by Z-score which reflecting the stability of income obtained by the banks. The greater the standard deviation of ROA, the greater the unstable returns obtained by the banks and increase risk-taking by the banks (excess risk-taking).

The independent variables consist of capital requirement (CAR), the bank level variables (management efficiency, income diversification, risk-weighted ratio, leverage, and financial intermediation), the industry variables (market concentration) and the macroeconomic variable (GDP). The capital requirement can be met by increasing equity capital or decreasing risk-weighted asset in bank's portfolios. The higher ratio indicates the idle money or liquidity shortage and the lower ratio indicate the excessive risk-taking in bank's portfolio,

TABLE I
VARIABLE SUMMARY

Variable	Symbol	Description	Sources of variable
Dependent Variable			
Cost of intermediation	NITA	the ratio of net interest income over average total assets	Aysen Doyran (2013), Naceur and Kandil (2009)
Risk taking	zscore	$[\log \{(\text{roa} + \text{car})/\alpha(\text{roa})\}]$, where $\alpha(\text{roa})$ is the standard deviation of return on average assets before tax.	Ashraf (2017b)
Independent Variable			
Capital Requirement	CAR	the ratio of capital over risk weighted assets	Soedarmono and Tarazi (2015)
Management efficiency	Manef	the ratio earning assets over total assets	Naceur and Kandil (2009)
RWA ratio	Rwata	the ratio of risk weighted assets to total assets	Rahman et al., (2017)
Income Diversification	Nopi	the ratio of noninterest income over total operating income	Rahman et al., (2017)
Leverage	Lev	the ratio of total liabilities to total assets	Gonzales (2005)
Financial intermediation	LDR	the ratio of total loan to total deposit	Islam and Nishiyama (2015)
Market concentration	Marcons	the size of bank's asset in the three largest bank to total asset	Islam and Nishiyama (2015)
GDP	GDP	quarterly growth in gross domestic product	Islam and Nishiyama (2015)

thus it is important to maintain the optimum of the capital requirement.

The management efficiency shows that the higher portion of productive assets, the higher the value of risk-based assets in RWA. Income diversification reflects how much revenue is derived from non-interest income; a higher ratio is expected to lower the financial intermediation cost due to the pressure on interest income has decreased. RWATA ratio as a control variable reflects how much risk-weighted assets are assumed in total bank assets; it is expected that the higher the ratio, the higher the risk-taking by the bank. Leverage reflects the level of debt portion in the capital structure of the bank; the higher the leverage ratio, the higher the bank risk. Financial intermediation as a proxy to the ratio of total loan to total deposits reflect bank liquidity; the higher the ratio, the higher the bank risk.

The industry-specific variables in this study include market concentration proxied by the ratio of the total of three largest bank assets to total bank assets in the sample research. The greater the market concentration shows the lower competition that can increase the monopoly power in the banking system, in which, with monopoly power, the bank can increase the intermediation cost. The macroeconomic variable used is GDP or economic growth proxied by the ratio of gross domestic product (GDP). The intuition of this variable is that when the economic condition of good growth is high, it is expected the financial intermediation cost becomes low because of low risk (Demircuc Kunt & Huizinga, 1999, Tarus et al, 2012 in [2]).

B. Methodology

The methodology used is multiple panel data regression with the static framework ([7], Haldane, 2012, Anginer & Demircuc-Kunt, 2014). We used the Fixed Effect Model (FE) to estimate the parameters in the panel data regression model. Two empirical model specification are as follows: Equation of Model 1: $NITA_{ij,t} = C + \beta_1 CAR_{ij,t} + \beta_2 Manef_{ij,t} + \beta_3 Nopi_{ij,t} + \beta_4 LDR_{ij,t} + \beta_5 Marcons_{j,t} + \beta_6 GDP_{growth_{j,t}} + \epsilon_{it}$ Equation Model 2: $Zscore_{ij,t} =$

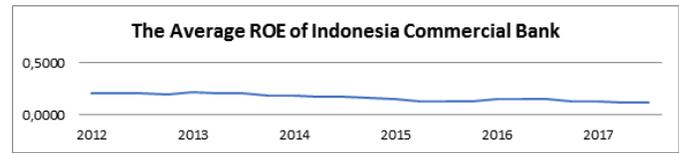


Fig. 3. The Average ROE of Indonesia Commercial Banks

$C + \gamma_1 CAR_{ij,t} + \gamma_2 Lev_{ij,t} + \gamma_3 Rwata_{ij,t} + \gamma_4 LDR_{ij,t} + \gamma_5 Marcons_{j,t} + \gamma_6 GDP_{growth_{j,t}} + \epsilon_{it}$ To overcome the autocorrelation and heteroscedasticity problem and to answer the robustness of the model, we used Generalized Least Square (GLS) with the cross section weight and white period estimation coefficient on both equation models

IV. EMPIRICAL RESULTS

Table 2. Matrix Correlation shows that there is no strong relationship between the variables used because there is no correlation coefficient value greater than 0.8 (Gujarati, 2007) and this also indicates the absence of multicollinearity in the data sample. In general, according to the results of GLS for both models in Table III & IV, we can conclude that the model is worth explaining the influence of the independent variable to the dependent variable with significance levels 1%, 5%, and 10%.

Table 3. The Determinant of The Cost of Financial Intermediation shows that the capital requirement negatively and significantly influences the cost of financial intermediation with a 99% confidence level. In other words, any 1% increase (or decrease) in CAR will lower (or increase) the financial intermediation cost of conventional commercial banks by 5.51%. This contrasts with [2], with samples from 32 commercial banks in Bangladesh period 2000-2014, who showed that the capital requirement positively and significantly affected the financial intermediation cost. We suggest that a large share of equity in the capital structure will decrease bankruptcy costs that will ultimately lower the cost of bank capital (ROE), thus lower the cost of intermediation [3]. Figure 3 shows that from the sample data, the average ROE of Indonesia commercial banks has decreased about 8,53% during the observation period.

The ratio of management efficiency positively and significantly affects the cost of intermediation. With an increasing portion of productive assets in total assets, the risk-weighted assets becomes higher. Thus if the capital does not increase then CAR will decrease, indicating excessive risk-taking by the bank which also will increase the intermediation cost [9]. This contrasts with [2] who found a negative relationship between the ratio of total productive assets to total assets and the intermediation cost.

Income diversification negatively and significantly affects the financial intermediation cost. The increase in the amount of income generated from the traditional banks' activities will decrease the cost of financial intermediation caused by the lower pressure on income from interest; this is in line with [2].

TABLE II
MATRIX CORRELATION

	CAR	MANEF	NOPI	LDR	LEV	RWATA	MARCONS	GDP	NITA	ZSCORE
CAR	1									
MANEF	-0.07229	1								
NOPI	-0.056881	0.219367	1							
LDR	-0.100561	0.433113	0.498251	1						
LEV	-0.170478	-0.060558	-0.302964	-0.258972	1					
RWATA	0.229579	0.034501	-0.011701	0.035262	-0.244639	1				
MARCONS	-0.088353	-0.157728	0.046739	-0.070849	0.120365	-0.555818	1			
GDP	-0.024915	0.376666	0.420152	0.34381	-0.348306	0.043342	-0.052379	1		
NITA	0.19419	-0.06193	-0.237549	-0.124922	-0.038653	0.109488	0.023079	-0.175818	1	
ZSCORE	0.323648	0.084246	0.056007	0.055492	-0.098077	0.074043	-0.028574	-0.1715	-0.0555	1

TABLE III
THE DETERMINANT OF THE COST OF FINANCIAL INTERMEDIATION

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$NITA_{ij,t} = C + \beta_1 CAR_{ij,t} + \beta_2 Manef_{ij,t} + \beta_3 Nopi_{ij,t} + \beta_4 LDR_{ij,t} + \beta_5 Marcons_{j,t} + \beta_6 GDP\ growth_{j,t} + \epsilon_{it}$				
CAR	-0.055073	0.00951	-5.791252	0,00000***
MANEF	0.027836	0.011497	2.421137	0,01570**
NOPI	-0.010102	0.005227	-1.932697	0,05360*
LDR	0.030876	0.008721	3.540555	0,00040***
MARCONS	0.311156	0.029219	10.64905	0,00000***
GDP	0.780663	0.088917	8.779695	0,00000***
C	-0.18686	0.021333	-8.759371	0,00000***
R-squared	0.453543			
Adjusted R-squared	0.425052			
F-statistic	15.91884			
Prob(F-statistic)	0			
* significance level 10%, ** significance level 5% *** significance level 1%				

Loan to deposit ratio positively and significantly affects the cost of financial intermediation. The high lending activities will increase the bank's tendency to increase the cost of financial intermediation due to the high cost of monitoring [14] related to the increased credit risk from the increase in lending activity. The results of this study are in line with [2] and [3].

Market concentration, as an industrial proxy for assessing monopoly levels in the banking system, positively and significantly affects the cost of financial intermediation. Naceur and Kandil describes the relationship between market structure and bank profitability which can be studied in three hypotheses included efficient-structure (ES), structure-behavior-performance (SCP), and relative-market-power hypothesis (RMP) [3]. The ES hypothesis states that the difference in interest spread may be due to the differences in operating efficiency at the bank and leads to a negative relationship between interest margin and operational efficiency. Meanwhile, the positive relationship between interest margin and market structure is due to non-competitive price behavior in more concentrated markets as showed by the SCP hypothesis. However, the RMP hypothesis confirms that only firms with high market forces and product differentiation from competitors are able to extract non-competitive benefits.

GDP positively and significantly affects the cost of financial intermediation; changes in economic growth are expected to

change business opportunities for banks. However, the sign of the relationship between economic growth and intermediation costs is unclear, as it depends on the bank's expertise in handling changes in the business cycle [14]. Bustaman in [11] found that the economic growth projected by GDP growth was in line with the increase in the company's profit margins projected by net interest margin. Different results documented in [15] revealed that the negative correlation occurred because of the high economic growth in the region has increased the franchise value of the debtor company, so that the risk of failure is reduced and the risk reduction is responded by banks by decreasing the interest rate margin. None of the market concentration variables, nor GDP can explain the financial intermediation cost significantly in [11].

Table 4. shows that the capital requirement affects the bank risk-taking behavior positively and significantly with a 99% confidence level, CAR can reduce risk and it is a positive contribution to the banking industry. Zong-yi et al (2008), through his research on 12 commercial banks in China with an observation period of 2004-2006, found that capital adequacy requirement lower risk-taking behavior of China's banking sector. This is in line with [2] and [14], but in the contrast with Bichsel & Blum (2004) and Bitai et al., (2017).

The coefficient of risk-weighted assets ratio has a negative relationship, but cannot explain the bank risk-taking behavior significantly, while in [2], the risk-weighted assets to total

TABLE IV
THE DETERMINANT OF RISK-TAKING BEHAVIOR

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$Zscore_{ij,t} = C + \gamma_1 CAR_{ij,t} + \gamma_1 Lev_{ij,t} + \gamma_2 Rwata_{ij,t} + \gamma_3 LDR_{ij,t} + \gamma_4 Market\ Power\ j, t + \gamma_5 GDP\ growth\ j, t + \epsilon_{it}$				
CAR	1.940144	0.047548	40.80423	0,00000***
LEV	0.044069	0.032334	1.362918	0.17320
RWATA	-0.006719	0.012196	-0.550941	0.58180
LDR	-0.005097	0.004299	-1.185502	0.23610
MARKETPOW	-0.144238	0.064934	-2.221318	0.02660**
GDP	0.08807	0.183492	0.479966	0.63140
C	1.133332	0.05168	21.92971	0,00000***
R-squared	0.997578			
Adjusted R-squared	0.997452			
F-statistic	7901.192			
Prob(F-statistic)	0			
* significance level 10%, ** significance level 5% *** significance level 1%				

assets ratio has a positive significant effect on the bank risk-taking behavior. In line with [2], the coefficients LDR, Lev, and GDP have no significant effect on risk-taking behavior.

Market concentration shows a negative and significant effect on the risk-taking behavior with a 5% significance level. The increase in market concentration depicted by monopolistic competition will increase risk-taking behavior. Susanto & Rokhim (2011) in his research of 115 commercial banks in the period 2003-2008, which measures the influence of foreign ownership on the level of bank competition, found that high competition lowers bank risk.

V. CONCLUSION & SUGGESTION

This paper examines the impact of the capital requirement to the financial intermediation cost and bank risk-taking behavior in Indonesia using panel data of 45 commercial banks from period 2012 to 2017. Based on the results we find that the capital requirement has a negative and significant effect on financial intermediation and bank risk-taking behavior. A large portion of equity in the capital structure encourages banks to have sufficient capital to absorb the potential risk of losses from the banks' activities, thereby reducing bank risk-taking or bankruptcy cost faced by the bank. The lower the bankruptcy cost the lower the cost of equity capital are required by shareholders, which have been shown by the decrease on return on equity (ROE) over the observation period and the lower cost of financial intermediation.

Another factor affecting the cost of financial intermediation is the ratio of management efficiency, which positively and significantly affects the cost of financial intermediation; the higher portion of productive assets the higher the value of risk-based assets in RWA. Income diversification is negatively and significantly affects the cost of financial intermediation; the higher the amount of income generated from other activities outside the interest, the lower the cost of financial intermediation caused by the lower pressure on earnings arising from interest. The loan to deposit ratio positively and significantly affects the financial intermediation costs; the higher the lend-

ing activities, the higher the financial intermediation cost due to the higher cost of monitoring. Market concentration has a positive and significant effect on financial intermediation cost; the higher the market concentration, the higher the financial intermediation cost because the bank with big market power can determine the price or interest rate of their deposit and lending. GDP has a positive and significant impact on the cost of financial intermediation where changes in economic growth are expected to change business opportunities for banks.

Another factor affecting bank risk-taking behavior is market concentration ratio, which negatively and significantly affects the bank risk-taking behavior. The higher the market concentration, the higher the risk faced by the bank, because of the lower competition in the market.

Overall, our empirical results show the positive contribution of the capital regulation on the financial intermediation cost to support the economic growth of the country and on bank risk-taking behavior to support financial stability. These empirical results can be a literature and a better insight for the regulators to determine the optimum capital requirement regulation for each bank BUKU category because maintaining the capital ratio on a certain level is important to balance the function of the banks as financial intermediaries in the financial system.

Further research can be done using dynamic framework assumptions with the Generalized Method of Moment (GMM) method and deed for each category of BUKU in order to see the impact of CAR for each category of BUKU. Another idea for future research is finding the optimum level of the capital ratio in each bank BUKU category.

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