

## INDONESIAN BANKS RISK-TAKING: THE EFFECT OF LIQUIDITY RISK, CAPITAL BUFFER AND BOPO: Z-SCORE MEASURE ASPPROACH

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### ABSTRACT

*This study was aimed to examine the effect of liquidity risk, capital buffer and BOPO on banks risk-taking in Indonesia. This study used loan to deposit ratio, non-performing loan, liquidity gap, capital buffer and BOPO as independent variable and banks risk-taking proxied by Z-Score as dependent variable.*

*This study used secondary data retrieved from banking companies' annual reports listed on Indonesia Stock Exchange Index (IDX) in 2013-2017. Sample used in this study were 110 samples consist of 22 Indonesian banks taken using purposive sampling method. This study used multiple linear regression as analysis method.*

*The results of this study indicate that non-performing loan and BOPO have a positive and significant effect on banks risk-taking. Capital buffer has a negative and significant effect on bank risk-taking, while loan to deposit ratio has a positive and insignificant effect on banks risk-taking and liquidity gap has a negative and insignificant effect on banks risk-taking.*

*Keywords: Bank Risk-Taking, Liquidity Risk, Capital Buffer, BOPO, Z-Score*

### INTRODUCTION

Banking sector has a strategic position as a prominent financial institution, such as supporting operations of the payment system, implementing monetary policy and achieving financial system stability, therefore, banking sector has a great role in country's economy that is to support the economy by lending money to other parties that can make a better use of it. In other words bank indirectly helped generate new business that also developed the country. However, bank is also one form of business that also profit oriented.

Bank as a business is oriented to gain profits, which can be obtained from various ways including interest, transaction fees and financial advice. But normally, the most prominent method is by charging interest on funds/capital it lends out to customers (credit). Bank obtains profit from the difference between the level of interest the bank pays for deposits or other source of funds and the level of interest that bank charges in its lending activity. When banks lend money to customers mostly it is in form of credit, in this case banks have a system to define the creditworthiness of customer so banks can decide whether to lend them the money (credit) or not.

Credit that is given to customer can gives profit to banks due to the interest it puts on credit, however if the customer can't give back the credit then the cash flow within the

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bank would be disturbed and raise the possibility of bank going bankrupt thus having net performing loans and this is one crucial risk that is vulnerable to bank. So this risk would exist as long as bank gave more credit to customer, hence there are risks in every form of banks activity. If the banks cannot manage their risk well then banks can possibly fail and eventually go bankrupt which also could affect the economic stability of a country.

There are various types of risk that banks face, but these are several main risks that faced by banks (Bank Indonesia Regulation No. 5/8/PBI/2003) such as credit risk, liquidity risk, market risk, operational risk, reputational risk, legal risk, strategic risk and compliance risk. Banks have shown some tendencies In facing various risks that could happen in banking industry, these tendencies are called risk-taking. Banks risk-taking refers to which extent bank is willing to take risks, whether it is more risk-taking or less risk-taking in determining managerial decisions. A high risk-taking of a bank can lead to the bank being insolvent. Insolvency is a condition when an organization can no longer meet its financial obligations to its lenders as debts become due and ultimately could result into a bank failure. Therefore bank's probability of insolvency is highly related with bank risk, which is if the bank with high potential risk will tend to take more risk and the bank with low potential risk will tend to take lower risk.

Risk-taking happens during periods of low interest in which banks think, overconfident, that the climate will remain at favorable rates, and can also lead to excessive tendency to take risk. Consequently, Banks could not adapt enough to their expectations regarding the level of interest rates and hence, banks would likely give too many loans to less creditworthy borrowers. Understanding bank risk taking behavior is important for various reasons. The excessive risk-taking by banks is often associated with bank failures that lead to bankruptcy and costly undermine the government.

Apart from other risks and determinants, liquidity risk has long been acknowledged as a significant threat to financial institutions management and financial system stability (Khan et al. 2016). Normally banks are suggested to maintain their liquidity buffer to manage the liquidity risk and also to ensure towards small liquidity shocks. Hong et al. (2014) showed that systematic liquidity risk was an important contributor to bank failures occurring over 2009–2010 in the aftermath of the 2007–2008 Global Financial Crisis (GFC). They revealed that liquidity risk could lead to bank failures through systematic and idiosyncratic channels. Maintaining and managing liquidity risk was proven important for a company especially banks in order to maintain their business activities.

To observe and examine the liquidity risk in a bank, there are several instruments that are highly accurate; they are loan to deposit ratio, non-performing loan and liquidity gap. LDR is used to measure bank's ability to pay its obligations to depositors and can fulfil the proposed credit request. The higher the Loan to Deposit Ratio (LDR), the higher the bank's tendency to avoid taking risk (assuming the bank is able to channel credit effectively). NPL represents the state of bad credit that is experienced by bank, indicating its state of liquidity. Liquidity gap refers to a maturity mismatch of assets and liabilities, referring the higher the gap would result in a liquidity risk.

Banks core activity was about the allocation of collected funds, thus liquidity of bank or how much capital/fund a bank was required to hold would be a key driver in banks profitability, thus inflicting the bank's manager in making decisions regarding risk-taking. Regulations regarding bank risk and capital adequacy are regulated by an international committee called the Basel Committee. Inefficiency is another factor that presumably can affect bank risk taking since the inefficiency (BOPO) can lead banks in taking more risky decisions. Berger & De Young (1997) and Kwan & Eisenbeis (1997) suggest that efficiency is a key factor influencing bank behavior and should be included in multivariate analysis of the determinants of banks risk.

Down to date, the study of risk-taking has been a widely discussed topic in recent years (Laeven & Levine, 2009), (Bhattacharyya & Purnanandam, 2010), (Naqvi & Acharya, 2010). A large literature has sought to identify the determinants of risk-taking in banks : regulation (Laeven & Levine, 2009), Black & Hazelwood (2012) and Duchin & Sosyura (2014). Literature of bank risk-taking with determinant of banking capital has also been conducted (Bouheni & Rachdi, 2015), (Tracey et. al, 2017) and (Maji & Hazarika, 2018).

Based on the above problem formulation, it can be formulated research questions as follows: (1) Does loan to deposit ratio (liquidity risk) have an effect on bank risk-taking? (2) Does non-performing loan (liquidity risk) have an effect on bank risk-taking? (3) Does liquidity gap (liquidity risk) have an effect on bank risk-taking? (4) Does capital buffer have an effect on bank risk-taking? (5) Does inefficiency (BOPO) have an effect on bank risk-taking?

## **THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT**

### **Effect of Independent variables on Dependent Variable**

#### **Loan to Deposit Ratio (LDR) to Bank Risk-Taking**

One of the bank's core activities is providing credit, but this activity has a high risk. This of course will affect the bank's liquidity. High or excessive LDR (large loans) can cause banks liquidity to be low, because most of the funds collected are channelled back in the form of loans whose returns cannot be ascertained thus making it risky. This is in align with the agency theory, where it states that difference priorities of shareholder and agents would bring issues or problems in a company, in this case manager (agent) would likely increase the lending rate (LDR) of the bank which would result in banks having a high increase in risk. Therefore high LDR can inflict the bank into excessive risk taking. This is in line with the research conducted by Köhler (2015) and Khoury (2018) who found that loan to deposit ratio has a positive effect to bank risk-taking.

**H<sub>1</sub>: There is a positive effect of loan to deposit ratio (LDR) to Indonesian banks risk-taking.**

#### **Non-Performing Loan (LDR) to Bank Risk-Taking**

NPL is the number of non-performing loans that cannot be collected. The greater the value of Non-Performing Loans, the worse the bank's performance is. The increasing value of NPL shows banks are increasingly exposed to credit risk which can cause losses and making the bank less liquid and risky. This is in align with agency theory which focused on difference priorities of shareholder and agents would induce problems for the company, the manager (agent) will increase the loan into the customer in order to achieve a great compensation form the company, but on the other hand the increase of loan would also be followed by an increase in NPL which may induce the banks being riskier than before. This also reflects the backfire of anticipated loan theory, where the banks having a miscalculation in deciding a trustworthy customer which resulting with the banks having more bad credit (NPL) instead of return. Therefore an increase of NPL can affect an increase in bank risk taking especially in lending term of loans, this is in line with research conducted by , Zhang et al. (2016) who found that non-performing loan has a positive effect to bank risk-taking.

**H<sub>2</sub>: There is a positive effect of non-performing loan (NPL) to Indonesian banks risk-taking.**

### Liquidity Gap to Bank Risk-Taking

In banking, some assets are funded by deposits which may be disbursed at any time (Arif & Anees, 2012). This will result in a mismatch between assets and liabilities. The greater the mismatch between assets and liabilities, the liquidity gap will arise. Liquidity gap reflects a poor asset and liability management (ALMA), hence indicating that the bank is not handling its' risk well enough. The liquidity gap will affect liquidity risk. The higher the liquidity gap, the higher the liquidity risk thus making the bank riskier. This is in line with research conducted by (Arif & Anees, 2012) who found that a large liquidity gap will decrease the banking system's performance thus making the bank riskier.

**H<sub>3</sub>: There is a positive effect of liquidity gap to Indonesian banks risk-taking.**

### Capital Buffer to Bank Risk-Taking

To cover bank capital from risk of loss, banks have to meet the level of capital adequacy in facing future risk. The Basel Committee has issued Basel III regulations where banks are required to prepare capital buffers in the crisis period (capital conservation buffer), based on short-run relationship of capital buffer theory, the banks with decent capital buffer that is close to its minimum required capital will increase their capital and maintain their risk-taking behaviour to the minimum, indicating a negative relationship between capital buffer and risk. This is also supported by research conducted by Khan et al. (2016) and Lindquist (2004), who found a negative effect of capital buffer on risk-taking, which imply that when bank have a high or sufficient capital buffer the bank would tend to keep their risk exposure to minimum.

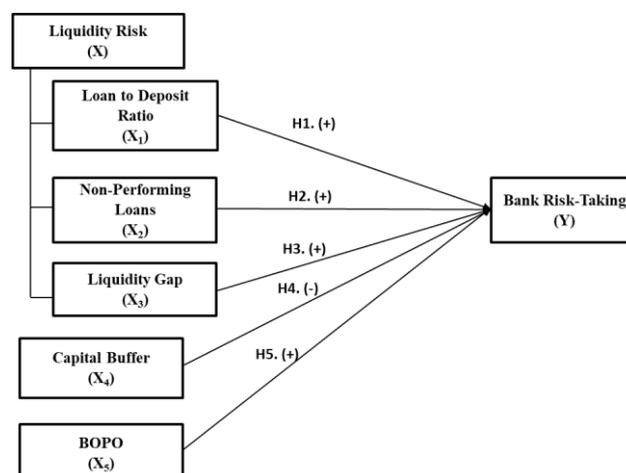
**H<sub>4</sub>: There is a negative effect of capital buffer to Indonesian banks risk-taking.**

### BOPO to Bank Risk-Taking

Bank's efficiency refers to its ability in utilizing its activities, in this case, the main activity of bank, which is lending money (credit/loan). Indonesian banking sector still rely on its interest income from credits, this means that the more efficient the bank in lending its money and operating all of their activities then the bank is stable and sound thus far from being risky. However, if the bank is inefficient in giving credit and does not manage their activity well then it can endanger the bank. This is in line with research conducted by Isshaq et al. (2015) and Khoury (2018) who found that inefficiency has a significant and positive effect on bank risk taking.

**H<sub>4</sub>: There is a positive effect of BOPO to Indonesian banks risk-taking.**

**Figure 1**  
**Theoretical Framework**



**RESEARCH METHODS**

**Variables Operational Definition**

**Table 1**  
**Summary of Variables Operational Definition**

No.	Dependent Variable (Y)	Definition	Measurement	Scale
1.	Z-Score Index (Bank Risk-Taking)	The measurement of bank's risk-taking that has the potential to cause the bank to become insolvent	$\frac{ROA + Eq/TA}{SDROA}$	Ratio
	<b>Independent Variable (X)</b>			
2.	LDR (Loan to Deposit Ratio)	The ratio total credit given by the bank and deposits or third party funds received by the bank	$\frac{Total\ Loans}{Total\ Deposits}$	Ratio
3.	NPL(Non-Performing Loan)	The ratio that shows the level of non-performing loans in a bank	$\frac{Total\ Non\ Performing\ Loans}{Total\ Loans}$	Ratio
4.	Liquidity Gap	The difference between the assets and liabilities that are due for a certain period	Natural Logarithm of Liquidity Gap	Ratio
5.	Capital Buffer	The difference between the CAR ratio (bank capital adequacy ratio) and the regulated CAR(8%)	Banks' CAR – CAR (8%)	Ratio
6.	Inefficiency (BOPO)	The measurement that defines banks' ability to efficiently managed its resources to achieve higher profit	$\frac{Operating\ Expense}{Operating\ Income}$	Ratio

**Sample**

Sample used in this study were 22 go-public and conventional banking companies in Indonesia enlisted in Indonesia Stock Exchange (IDX) during 2013 – 2017 periods. This research used panel data which resulting the whole sample of 145 (29x5 years of observation). After data processing using IBM SPSS 23, there were 35 outlier data, so the final sample used in this study were 110.

**Analysis Method**

The analysis method used in this study is by conducting quantitative analysis which is expressed by the numbers in the calculation using statistical methods which are assisted by the IBM SPSS statistical data processing program. Therefore, methods used in this study are descriptive statistics test, classical assumption test, multiple linear regression analysis, and hypothesis testing.

Multiple linear regression analysis is conducted in this study for the purpose of measuring and finding out the effect of independent variables on dependent variable (bank risk taking with Z-Score Index as its proxy). The equation for multiple linear regression is presented as follows:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + \varepsilon$$

Notes :

- Y = Z-Score Index'
- b<sub>0</sub> = Constant
- b<sub>1</sub>-b<sub>5</sub> = Regression coefficient of independent variables
- X<sub>1</sub> = LDR (Loan to Deposit Ratio)
- X<sub>2</sub> = NPL (Non-Performing Loan)
- X<sub>3</sub> = Liquidity Gap
- X<sub>4</sub> = Capital Buffer
- X<sub>5</sub> = BOPO (Inefficiency)
- e = Error term

**RESEARCH RESULT AND DISCUSSION**

**Descriptive statistics**

**Table 2**  
**Descriptive Statistics Test Result**

	N	Minimum	Maximum	Mean	Std. Deviation
LDR	110	.4202	1.0235	.8329	.1309
NPL	110	.0016	.0854	.0222	.0140
LG	110	9.7125	18.9837	15.1193	2.1350
BUFFER	110	.0244	.2712	.1138	.0484
BOPO	110	.5413	1.0082	.8360	.1050
ZI_1	110	.1803	.4360	.2795	.0519
Valid N (listwise)	110				

Source: Secondary data processed using IBM SPSS 23

Based on descriptive statistics, it is showed that the amount of data used in this study is 110 samples of data taken from 22 banking companies in Indonesia within period 2013-2017. Z-Score Index' (ZI') has the highest value of 0,4360 at Bank BukopinTbk in 2017 while the lowest value is 0,1803 at Bank Central Asia Tbk in 2017. Average value (mean) of ZI' is 0,2795 and the standard deviation value is 0,0519. High ZI' Value, that is above zero indicates that the bank has high risk or undergoing an excessive risk-taking.

Loan to Deposit Ratio (LDR) has the highest value of 1,0235 at Bank Mestika Dharma Tbk in 2013 while the lowest value is 0,4202 at Bank MitraniagaTbk in 2017. Average value (mean) of LDR is 0,8329 and the standard deviation value is 0,1309. Higher LDR implies low or shortage in liquidity thus making the bank riskier and inflict the bank to take high or excessive risk-taking.

Non-Performing Loan (NPL) has the highest value of 0,0854 at Bank BukopinTbk in 2017 while the lowest value is 0,0016 at Bank MitraniagaTbk in 2014. Average value (mean) of NPL is 0,0222 and the standard deviation value is 0,0140. Higher NPL implies low liquidity, because of the high bad loans, thus making the bank riskier and inflict the bank to take high or excessive risk-taking.

Liquidity Gap (LG) has the highest value of 18,9837 at Bank Central Asia Tbk in 2017 while the lowest value is 9,7125 at Bank Yudha Bhakti Tbk in 2013. Average value (mean) of LG is 15,1193 and the standard deviation value is 2,1350. A high liquidity gap indicates a high liquidity risk which implies a bad or low liquidity that can affect the bank to be riskier and tend to take a high or excessive risk-taking.

Capital Buffer (BUFFER) has the highest value of 0,2712 at Bank Mestika Dharma Tbk in 2016 while the lowest value is 0,0244 at Bank Mayapada International Tbk in 2014. Average value (mean) of BUFFER is 0,1138 and the standard deviation is 0,0484. A companies or banks with high capital buffer tend to raise their exposure to risk, thus leading them to take more risk which can induce them to having a high or excessive risk taking.

Inefficiency (BOPO) has the highest value of 1,0082 at Bank Agris Tbk in 2017 while the lowest value is 0,5413 at Bank Mestika Dharma Tbk in 2013. Average Value (mean) of BOPO is 0,8360 and the standard deviation is 0,1050. A high value of BOPO indicates a low level of efficiency, thus the higher the BOPO can imply on high or excessive risk-taking that is taken by the banks and can't be covered.

### Discussion

In this research the classical assumption test was conducted before conducting multiple linear regression analysis, namely normality test, multicollinearity test, heteroscedasticity test, and autocorrelation test on the data used. The results of the classic assumption test that is on all the data used proved all passed the classic assumption test.

### Hypothesis Testing Result

#### Adjusted R<sup>2</sup>

The coefficient of determination test (adjusted R<sup>2</sup>) in this study was conducted to measure the ability of a model in explaining the variation of the dependent variable. The results of the adjusted R<sup>2</sup> coefficient in this study are shown in Table 3 as follows:

**Tabel 3**  
**Adjusted R<sup>2</sup> Result**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.557 <sup>a</sup>	.310	.277	.15919

Source: Secondary data processed using IBM SPSS 23

Based on Table 4.15, the value of the Standard Error of the Estimate is 0,15919 so the regression model used is feasible to explain the effect on the dependent variable on this study. Meanwhile, the coefficient of determination (Adjusted R Square) in this study was 0,277. These results indicate that 27,7% of the ZI' (Z-Score Index') can be explained by LDR (Loan to Deposit Ratio), NPL (Non-Performing Loan), LG (Liquidity Gap), BUFFER (Capital Buffer) and BOPO (Inefficiency). Meanwhile, the remaining 72,3% of the ZI (Z-Score Index) is explained by other variables that are outside of this study.

### F-Test

The F-Test in this study was conducted to test the overall significance of a regression model that was observed or estimated. The results of the F statistical test in this study are shown in Table 4 as follows:

**Tabel 4**  
**F-Test Result**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.184	5	.237	9.348	.000 <sup>b</sup>
	Residual	2.635	104	.025		
	Total	3.820	109			

Source: Secondary data processed using IBM SPSS 23

The F-Test is accepted if the calculated F value is greater than the F table value. Based on Table 4.16, the calculated F value in this study is 9,348. F table values can be calculated with F (k; N-k), so that in this study the F table value is equal to 2,30. The F value calculated in this study is greater than the value of F table, so H0 is rejected and Ha is accepted.

In F-Test, decision making of the independent variable has a significant effect on the dependent variable is determined by the significance value. In this study, the significance value was set at 0.05. Based on Table 4, the significance value in this study is 0,000. These results are smaller than the significance value set at 0.05, so the results of this F statistical test are H0 rejected and Ha accepted. The conclusion in this study is that all independent variables significantly affect the dependent variable.

**T-Test**

The t statistical test in this study was conducted to show how influential the independent variables individually were in explaining the variation of the dependent variable. In this study has a t table value of 1,98304. The results of the t statistical test in this study are shown in Table 5 as follows:

**Table 5**  
**T-Test Result**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.796	.328		-2.427	.017
	LDR	.036	.093	.034	.389	.698
	NPL	.052	.020	.222	2.558	.012
	LG	-.150	.125	-.118	-1.198	.234
	BUFFER	-.092	.037	-.220	-2.469	.015
	BOPO	.428	.148	.307	2.891	.005

Source: Secondary data processed using IBM SPSS 23

Based on Table 5, then in this study an equation of regression can be written as follows:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + e$$

$$ZI = -0,796 + 0,036 \text{ LDR} + 0,052 \text{ NPL} + (-0,150 \text{ LG}) + (-0,092 \text{ BUFFER} + 0,428 \text{ BOPO})$$

In the results of the regression equation, if the independent variable is considered constant, then the value of ZI' (Z-Score Index') is -0,522.

#### **Effect of Loan to Deposit Ratio (LDR) to Risk-Taking**

LDR (Loan to Deposit Ratio) has a positive coefficient value towards ZI' (Z-Score Index') of 0,036. LDR has a value of t count (0,389) < t value of table (1,98304) with a significance level of more than 0,05; which is 0,698; thus indicates that LDR has a positive and insignificant effect on ZI'. Accordingly, there is a positive and insignificant effect of LDR (Loan to Deposit Ratio) to bank risk-taking (ZI') and therefore the first hypothesis (H1) is rejected. The result of this study is in accordance with the previous researches conducted by Soedarmono & Prasetyantoko (2008) who found that LDR has an insignificant effect on bank risk-taking.

#### **Effect of Non-Performing Loan (NPL) to Risk-Taking**

NPL (Non-Performing Loan) has a positive coefficient value towards ZI' (Z-Score Index') of 0,052. NPL has a value of t count (2,558) > t value of table (1,98304) with a significance level of less than 0,05; which is 0,012; thus indicates that NPL has a positive and significant effect on ZI'. Accordingly, there is a positive and significant effect of NPL (Non-Performing Loan) to bank risk-taking (ZI') and therefore the second hypothesis (H2) is accepted. The result of this study is in accordance with the previous researches conducted by Zhang et al. (2016) who found that NPL has positive and significant effect on bank risk-taking.

#### **Effect of Liquidity Gap to Risk-Taking**

Liquidity Gap has a negative coefficient value towards ZI' (Z-Score Index) of 0,150. LG has a value of t count (1,198) < t value of table (1,98304) with a significance level of more than 0,05; which is 0,234; thus indicates that LG has a negative and insignificant effect on ZI. Accordingly, there is a negative and insignificant effect of LG (Liquidity Gap) to bank risk-taking (ZI') and therefore the third hypothesis (H3) is rejected. Due to minimum research conducted related to effect of liquidity gap on bank risk-taking, the results of this study can be related to researched conducted by Arif & Anees, (2012), Ferrero et al. (2018), and which research studied about effect of liquidity gap on banks profitability (ROA) whose results have an insignificant effect.

#### **Effect of Capital Buffer to Risk-Taking**

Capital Buffer has a negative coefficient value towards ZI' (Z-Score Index') of 0,092. BUFFER has a value of t count (2,469) > t value of table (1,98304) with a significance level of less than 0,05; which is 0,015; thus indicates that BUFFER has a negative and significant effect on ZI'. Accordingly, there is a negative and significant effect of BUFFER (Capital Buffer) to bank risk-taking (ZI') and therefore the fourth hypothesis (H4) is accepted. The result of this study is in accordance with the previous researches conducted by Khan et al. (2016) and Lindquist (2004) who found that capital buffer has negative and significant effect on bank risk-taking.

### Effect of BOPO to Risk-Taking

BOPO (Inefficiency) has a positive coefficient value towards ZI' (Z-Score Index') of 0,428. BOPO has a value of t count (2,891) > t value of table (1,98304) with a significance level of less than 0,05; which is 0,005; thus indicates that BOPO has a positive and significant effect on ZI'. Accordingly, there is a positive and significant effect of BOPO to bank risk-taking and therefore the first hypothesis (H5) is accepted. The result of this study is in accordance with the previous researches conducted by Khoury (2018) and Isshaq et al. (2015) who found that inefficiency has a positive and significant effect to bank risk-taking.

### CONCLUSION

Based on the discussion in previous chapters and data analysis that has been done in this study regarding the analysis of the effect of liquidity risk, capital buffer and BOPO to risk-taking of banking companies in Indonesia in 2013-2017, conclusions can be drawn from the results of this study as follows:

1. LDR variable (Loan to Deposit Ratio) has a positive and insignificant effect on the Bank Risk-Taking variable. So the first hypothesis (H1) which states that Loan to Deposit Ratio has a positive effect on risk-taking of banking companies in Indonesia is rejected.
2. NPL variable (Non-Performing Loan) has a positive and significant effect on the Bank Risk-Taking variable. So the second hypothesis (H2) which states that Non-Performing Ratio has a positive effect on risk-taking of banking companies in Indonesia is accepted.
3. LG variable (Liquidity Gap) has a negative and insignificant effect on the Bank Risk-Taking variable. So the third hypothesis (H3) which states that Liquidity Gap has a positive effect on risk-taking of banking companies in Indonesia is rejected.
4. BUFFER variable (Capital Buffer) has a negative and significant effect on the Bank Risk-Taking variable. So the fourth hypothesis (H4) which states that Capital Buffer has a negative effect on risk-taking of banking companies in Indonesia is accepted.
5. BOPO variable (Inefficiency) has a positive and significant effect on the Bank Risk-Taking variable. So that the fifth hypothesis (H5) which states that BOPO has a positive effect on risk-taking of banking companies in Indonesia is accepted.

Therefore it can be concluded that liquidity risk using NPL as its proxy have a positive and significant effect on banks risk-taking, except for LDR and liquidity gap which respectively has a positive and negative insignificant effect, as for capital buffer, it has a negative and significant effect on banks risk-taking and finally BOPO has a positive and significant effect on banks risk-taking

### Research Limitation

This study still has limitations that can be used as consideration for further research that wants to examine the risk-taking behaviour of Indonesian banks or related fields. Limitations in this study are as follows:

1. The population of conventional and go-public bank in Indonesia is approximately 43, but the one used in this study only comes down to 22.
2. This study only used Z-Score Index which indicates bank overall risk as a proxy for banks risk-taking.
3. This study only examines the effect of liquidity risk (LDR, NPL, liquidity gap), capital buffer, and BOPO as its independent variable to bank risk-taking as dependent variable.

4. The coefficient of determination (Adjusted R Square) in this study was 0,277; which indicates that there is only 27,7% of independent variables ability to interpret dependent variable, thus making the remaining 72,3% is from other variables outside of this study.

### Suggestion

Based on the conclusions obtained from this study, there are several suggestions that can be proposed. The variables which have a significant effect on risk-taking such as BOPO (Inefficiency), Capital Buffer and NPL could be used as a reference for both banking companies and investors. For the future research, it is expected that the results of this study can be used as a reference for other similar studies and are expected to add other variables, years and model of research that can affect the bank's risk-taking behaviour, so that it can get better results or other new findings compared to current research.

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