

Granger Causality Test of Net Interest Margin and Liquidity

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Abstract

Keywords: Net Interest Margin; Legal Reserve Requirement; Loan to Deposit Ratio; Granger

The study aims to compute the Granger test on Net Interest Margin (NIM) and liquidity bank listed in Indonesia Stock Exchange for 2014-2018. Variable of liquidity uses proxies Legal Reserve Requirement (LRR) and Loan to Deposit Ratio (LDR). The statistics tool is E-Views 8th with the Granger Causality test. The Data research is financial statement Bank in IDX. The study found a relationship between NIM, LRR, and liquidity ratio Bank. We found the Granger causality NIM and LRR, NIM and Loan to Deposit Ratio (liquidity), and Reserve Requirement and LDR. The study helps management bank make policy in net interest margin and liquidity, for future research to develop empirical literature in net interest margin, Legal Reserve Requirement, and Loan to Deposit Ratio.

Abstrak

Kata kunci: Net Interest Margin; Giro Wajib Minimum; Loan to Deposit Ratio; Granger

Penelitian bertujuan untuk menguji kausalitas Granger hubungan Net Interest Margin (NIM), dan likuiditas Bank. Variabel likuiditas menggunakan proksi Giro Wajib Minimum (GWM) dan Loan to deposit ratio (LDR). Alat statistik yang digunakan adalah E-Views 8th dengan uji metode kausalitas Granger. Penelitian menggunakan data laporan keuangan Bank yang terdaftar di Bursa Efek Indonesia (BEI) tahun 2014-2018. Hasil menunjukkan bahwa variable NIM, GWM dan LDR signifikan memiliki hubungan kausalitas Granger. Penelitian ini bermanfaat bagi manajemen bank untuk membuat keputusan penetapan margin bank dan likuiditas, bagi pemerintah untuk bahan kajian dan pemetaan terkait dengan net interest margin dan likuiditas, bagi penelitian selanjutnya adalah untuk bahan referensi terkait dengan net interest margin (NIM), BI Rate, Giro Wajib Minimum (GWM) dan Loan to Deposit Ratio (LDR).

1. Introduction

Interest margin becomes valuable income for the bank because it plays an intermediary in credit distribution and deposits. The net interest margin in Indonesia is relatively high (Trinugroho, 2014). The high NIM value in Indonesia's banks is caused by many small, micro, and medium business loans. Micro, small, and medium business loans can increase the number of NIMs because micro and small business loans have high risks. The high NIM in Indonesia can threaten bank liquidity and reduce opportunities for access to bank capital loans for the public. Limited access to bank credit can hamper business growth for the community. The micro, small, and medium business sectors can directly drive the people's economy and impact a country's economic growth. The amount of NIM determined by the bank can affect bank lending, thus impacting the number of deposits of Commercial Banks in Bank Indonesia. The number of Commercial Bank Current Accounts deposits at Bank Indonesia and bank lending affect the Bank's liquidity. Chowdhury & Zaman (2018) found that liquidity can be caused by inefficient banks, imbalances in cash inflows and cash outflows, imbalances between credit and deposits. Empirical studies have

found that NIM influences bank liquidity (Parinsi, 2013; Wibowo, Wiyono & Rinofah, 2020).

Granger Causality Test is a test of causal relations between variables. Granger causality test serves to test the direction or two-way relationship between two variables. The Granger causality test is used by using the E-Views statistical tool. This study will examine the causality relationship between net interest margin and liquidity variables proxy with the legal reserve requirement (LRR) and Loan to Deposit Ratio (LDR). Net interest margin (NIM) can impact the condition of bank liquidity as measured by the size of the statutory reserve requirement of commercial banks at Bank Indonesia and the ratio of bank loans and deposits. Thus, NIM can have a causal relationship with bank liquidity.

Bank interest margin can affect the level of bank liquidity. Lowering bank margins can affect the level of profitability, so that it can have an impact on bank liquidity. Low bank liquidity can affect the level of bank lending. Low bank liquidity can prevent banks from channeling credit to the public.

Liquidity is the state of the bank to be able to pay short-term obligations. Bank liquidity significantly affects the soundness of banks. Liquidity risk for banks can make banks unable to pay debts and become bankrupt. Bank liquidity can be measured by Loan to Deposit Ratio (LDR) and legal reserve requirement (LRR). Mousa (2015) uses two liquidity measurements, including current assets divided by total assets and total loans divided by total deposits, and found that financial performance, GDP, inflation have a significant effect on liquidity. In contrast, the size of the company has no significant impact on liquidity. Valla, Saer Escorbia & Tiesset (2006) found that profitability, credit growth, GDP, monetary policy, interest rates negatively affect bank liquidity. Vodová (2011) shows that specific bank and macro factors have a significant effect on liquidity. Rouch, Steffen, Hackethal & Tyrell (2010) found that company size, profitability, interest rates harmed liquidity. Meanwhile, Mustika & Kusumastuti (2015) found that the Capital Adequacy Ratio (CAR) has a positive effect on liquidity.

The legal reserve requirement (LRR) is a mandatory bank deposit at Bank Indonesia. The amount of Statutory Reserves for each Bank in Indonesia is 8% of the Bank's total assets. Meanwhile, LDR is the ratio of bank credit loans to deposits from the public. The size of the bank's interest rate affects credit interest receipts and deposit interest payments. The greater the NIM, the more liquidity the bank has. Thus, the amount of NIM affects the funds channeled to the public in the form of credit and attracts the public to deposit funds in the bank so that this condition reflects the level of bank liquidity.

To support previous findings, interest rate has a negative impact in liquidity bank; thus, this study reinvestigates the relationship between net interest margin and liquidity that consists of loan to deposit ratio and legal reserves requirement. This study supported the critical role of bank liquidity and net interest margin on banks listed in the Indonesia Stock Exchange by using the Granger causality test.

The benefit of this research ismap be a mapping of the level of NIM and liquidity of commercial banks in Indonesia. Academics can be used to develop scientific literature

related to banks in NIM and bank liquidity. For the government to be material for mapping the level of liquidity and banking NIM in Indonesia.

This study's originality is the use of the Granger causality test to investigate empirical studies of the influence of NIMs on bank liquidity. The literature on the Granger causality test is also still limited, so it is hoped that this study's results can develop literature on testing empirical studies.

2. Literature Review and Hypothesis Development

2.1 Liquidity

According to [Budisantosa & Nuritomo \(2017\)](#), liquidity is the banks' ability to pay short-term obligations. Liquidity plays an important role in the success of bank management. Bank liquidity can be measured by the LDR (Loan to deposit ratio) ratio. Bank Indonesia regulations relating to the safe limit of bank liquidity are 78-92%. The amount of safe liquidity limit decreased compared to last year of 78-100%.

Banks require liquidity needs for various purposes, including withdrawal of deposits by customers, withdrawal of funds by depositors, provision of funds for credit facilities, the fulfillment of reserve requirements or minimum mandatory reserves, etc. A bank is considered liquid if the bank has liquid assets to meet liquidity needs and has additional liquid assets such as the sale of shares and stock deposits ([Romli & Alie, 2017](#)).

Bank liquidity management is the ability of bank management to provide sufficient funds to meet all obligations that have been issued to bank customers. Liabilities from the asset side are loan withdrawals by customers, while liabilities from the liability side are withdrawals of deposits or savings by customers. Liquidity management includes the management of reserve requirements (RR) or legal reserve requirements (LRR) and secondary reserves ([Kuncoro & Suhardjono, 2011](#)). The function of liquidity management is predicting future funding needs, finding sources of funds for operational needs, structuring cash inflows, and outflows.

Indicators or measuring instruments include the ratio of liquid assets to third party funds, the ratio of credit to third party funds (LDR), the ratio of short-term securities to total securities. Some liquidity measurement tools are the legal reserve requirement (LRR), basic surplus (the difference between current assets and current liabilities), liquidity ratios (comparison of the weight of liabilities and asset weights), and loan to deposit ratio (LDR).

The evaluation of quantitative and qualitative approaches to liquidity factors, among others, is done through an evaluation of the components including ([Budisantosa & Nuritomo, 2017](#)):

- a) Liquid assets are less than one month compared to liquid liabilities
- b) 1-month maturity mismatch ratio
- c) Loan to third party fund (LDR) ratio
- d) Current projections for the next three months
- e) Dependence on interbank funds and core depositors
- f) Liability policy and management (ALMA)

- g) Banks' ability to manage access to money markets, capital markets, or other sources of funding.
- h) Stability of third-party funds.

2.2 Net Interest Margin

Bank margin is the difference between credit interest and deposit interest (Trinugroho, Risfandy, & Ariefianto, 2018). Net Interest Margin (NIM) is also called the intermediation fee. The greater the NIM, the greater the profit earned by the bank. The amount of NIM can increase the level of liquidity and lending. Hermuningsih & Wardani (2011) state that interest credit influences performance. Interest credit determines the net interest margin.

2.3 Hypothesis Development

NIM And Liquidity

Net interest margin is the level of profitability of banks that come from interest rates. The high NIM indicates that the specified bank interest rate is large. Valla et al. (2006) and Rouch et al. (2010) find that credit growth and interest rates harm bank liquidity. NIM influences bank liquidity (Parinsi, 2013). Thus, the hypothesis as follows:

H1: NIM has a Granger causality relationship with LDR

NIM and Statutory Reserve requirement

NIM measured the profitability of banks from interest income. The higher interest income, the higher NIM that it strengthens statutory reserve bank. Statutory bank measured liquidity ratio. Valla et al. (2006) found that the interest rate has a significant impact on liquidity. Thus, the hypothesis as follows:

H2: NIM has a Granger causality relationship with the reserve requirement

Liquidity and Statutory Reserve Requirement

Budisantosa & Nuritomo (2017) showed a liquidity bank measured by the statutory reserve. The higher the statutory reserve bank in Central Bank, the higher the liquidity bank. Some credit and deposit ratios have an impact on the liquidity bank. The higher LDR means that the lack of liquidity ratio in banks was reducing reserve requirement. Irawati & Puspitasari (2020) found a one-way causality granger between liquidity and capital adequacy. Thus, the hypothesis as follows:

H3: LDR has a Granger causality relationship with the reserve requirement.

Conceptual framework of this research is presented in Figure 1.

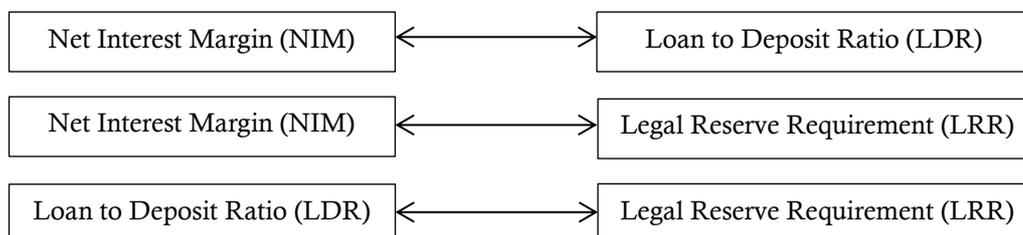


Figure 1. Conceptual framework

3. Method

The study design uses quantitative research because it is in the form of numbers from bank financial statements. The research sample is banks listed on the Indonesia Stock Exchange in 2013-2018. The sampling technique uses a purposive sampling method. The purposive sampling method is a method of sampling with a specific purpose. The sampling criteria are commercial banks on the Indonesia Stock Exchange, which publish complete financial statements for 2013-2018.

Net Interest Margin

Net Interest Margin (Trinugroho, 2014) is the difference between credit interest and savings interest, as presented in Eq.(1)

$$NIM = (\text{interest income}) / (\text{total assets}) \quad (1)$$

Liquidity

Liquidity is the ability of a bank's liquid assets that can be used to pay short-term liabilities.

Liquidity (LDR) = percentage of loans against bank deposits.

Statutory Reserves

The minimum reserve requirement is determined by Bank Indonesia at least 8%. The value of the reserve requirement is found in the bank's financial statements.

Analysis Techniques

Data management in this study will be processed using the E-Views 8th program. The analysis technique used is the granger causality test (Sarwono, 2011) and multiple linear regression analysis.

4. Results and Discussion

Table 1 shows that the number of observational data was 96 of 16 banks listed on the Indonesia Stock Exchange during 2013-2018. The bank's average values are LDR 86, NIM 5.4, and GWM 8.03. This LDR and GWM ratio shows the safe limit of Indonesian government regulations, while the NIM value is still relatively high. The government requires NIMs in number 4.

Table 1. Statistic descriptive

	LDR	NIM	GWM
Mean	86.29396	5.480833	8.034479
Median	87.04500	4.855000	7.550000
Maximum	108.8600	12.70000	19.70000
Minimum	68.38000	1.530000	0.020000
Std. Dev.	7.607191	2.280202	2.764735
Skewness	-0.052987	1.188698	2.676814
Kurtosis	3.076458	4.493345	12.02333
Jarque-Bera	0.068306	31.52837	440.3273
Probability	0.966424	0.000000	0.000000
Sum	8284.220	526.1600	771.3100
Sum Sq. Dev.	5497.589	493.9355	726.1570
Observations	96	96	96

Table 2 shows the results of the correlation of NIM, LDR, and GWM. The results mean that variables NIM, LDR, and GWM do not correlate with each other.

Table 2. Result of correlations

	LDR	GWM	NIM
LDR	1.000000	0.118557	0.396375
GWM	0.118557	1.000000	0.195124
NIM	0.396375	0.195124	1.000000

Table 3 shows the stationary test results using the root test. Based on the results of the Augmented Fuller root test that the NIM value has a significant value of 0.000, and the t-statistic is -7.85, which means that the NIM data is stationary data.

Table 3. Stasioner test

Null Hypothesis: NIM has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on SIC, maxlag=2)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-7.858953	0.0000
Test critical values:		
1% level	-3.501445	
5% level	-2.892536	
10% level	-2.583371	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(NIM)

Method: Least Squares

Date: 05/03/20 Time: 12:52

Sample (adjusted): 3 96

Included observations: 94 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NIM(-1)	-0.984688	0.125295	-7.858953	0.0000
D(NIM(-1))	0.275173	0.100961	2.725541	0.0077
C	5.409445	0.723253	7.479329	0.0000
R-squared	0.432389	F-statistic		34.66057
Adjusted R-squared	0.419914	Prob(F-statistic)		0.000000

Table 4 shows the stationary test results using the root test. Based on the results of the Augmented Fuller root test that the GWM value has a significant value of 0,000, and the t-statistic is 9.5, which means that the GWM data is stationary. Then, **Table 5** shows the LDR root test results that the LDR variable has a significance value of 0.000, and the t statistic is -8.3, meaning that the LDR data is stationary.

Table 4. GWM root test

Null Hypothesis: GWM has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=2)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-9.509123	0.0000
Test critical values:		
1% level	-3.500669	
5% level	-2.892200	
10% level	-2.583192	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GWM)

Method: Least Squares

Sample (adjusted): 2 96

Included observations: 95 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GWM(-1)	-0.984588	0.103541	-9.509123	0.0000
C	7.925689	0.879499	9.011600	0.0000
R-squared	0.492976	F-statistic		90.42341
Adjusted R-squared	0.487525	Prob(F-statistic)		0.000000

Table 5. Root test LDR

Null Hypothesis: LDR has a unit root

Exogenous: Constant

Lag Length: 2 (Automatic - based on SIC, maxlag=2)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-8.356134	0.0000
Test critical values:		
1% level	-3.502238	
5% level	-2.892879	
10% level	-2.583553	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LDR)

Method: Least Squares

Sample (adjusted): 4 96

Included observations: 93 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LDR(-1)	-1.254073	0.150078	-8.356134	0.0000
D(LDR(-1))	0.316036	0.128777	2.454129	0.0161
D(LDR(-2))	0.489081	0.093178	5.248912	0.0000
C	108.0708	12.97942	8.326318	0.0000
R-squared	0.630388	Mean dependent var		-0.208387
Adjusted R-squared	0.617930	S.D. dependent var		10.75019
S.E. of regression	6.644889	Akaike info criterion		6.667631
Sum squared resid	3929.755	Schwarz criterion		6.776560
Log-likelihood	-306.0449	Hannan-Quinn criter.		6.711614
F-statistic	50.59779	Durbin-Watson stat		2.115339
Prob(F-statistic)	0.000000			

Table 6 shows that the Bayesian VAR estimate Granger causality test is lag 2. The significance value is 0.004 for LDR, NIM, and GWM.

Table 6. Bayesian VAR

Bayesian VAR Estimates
 Sample (adjusted): 3 96
 Included observations: 94 after adjustments
 Prior type: Litterman/Minnesota
 Initial residual covariance: Univariate AR
 Hyper-parameters: Mu: 0, L1: 0.1, L2: 0.99, L3: 1
 Standard errors in () & t-statistics in []

	GWM	LDR	NIM
GWM(-1)	-0.019542 (0.07440) [-0.26267]	-0.229329 (0.19876) [-1.15378]	0.021720 (0.05728) [0.37920]
GWM(-2)	-0.009125 (0.04524) [-0.20171]	-0.062306 (0.12054) [-0.51687]	-0.002390 (0.03473) [-0.06882]
LDR(-1)	0.027307 (0.02730) [1.00039]	-6.96E-05 (0.07373) [-0.00094]	0.061333 (0.02113) [2.90282]
LDR(-2)	0.000934 (0.01685) [0.05545]	0.038660 (0.04566) [0.84676]	0.008516 (0.01304) [0.65283]
NIM(-1)	0.399103 (0.09332) [4.27686]	0.101858 (0.25078) [0.40617]	0.070581 (0.07261) [0.97212]
NIM(-2)	-0.034520 (0.05865) [-0.58856]	-0.151700 (0.15753) [-0.96297]	-0.053558 (0.04577) [-1.17025]
C	3.853881 (2.78760) [1.38251]	85.40785 (7.53003) [11.3423]	-0.787055 (2.15685) [-0.36491]
R-squared	0.362959	0.065500	0.190267
Adj. R-squared	0.319026	0.001052	0.134424
Sum sq. resids	460.4639	5011.183	398.8525
S.E. equation	2.300584	7.589454	2.141147
F-statistic	8.261501	1.016318	3.407147
Mean dependent	8.061489	86.12245	5.492766
S.D. dependent	2.787872	7.593447	2.301409

Table 7 granger causality tests are NIM and GWM. NIM significantly influences GWM 0.002, and GWM has a significant effect on NIM (1E-14). LDR and GWM have a two-way reciprocal relationship. GWM has a significant effect on the LDR of 0.0069, and LDR significantly impacts the GWM of 0.0147. LDR and NIM have a two-way reciprocal

relationship. LDR has a significant effect on NIM 0.0012, and NIM affects the GWM 5E-06.

Table 7. Pairwise granger causality tests

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
NIM does not Granger Cause GWM	94	47.0932	1.E-14
GWM does not Granger Cause NIM		3.98614	0.0220
LDR does not Granger Cause GWM	94	5.26449	0.0069
GWM does not Granger Cause LDR		4.42517	0.0147
LDR does not Granger Cause NIM	94	14.1322	5.E-06
NIM does not Granger Cause LDR		7.23119	0.0012

Table 8 shows that the t-test shows that the loan to deposit ratio significantly affects net interest margin (significance value 0.0001 and coefficient 0.113). The statutory reserve does not significantly affect net interest margin (significance value 0.1157 and coefficient 0.07). The F test shows that liquidity with LDR and GWM proxies significantly affects net interest margin (F value of 10.1 and a significance value of 0.0001). These findings are linear with Putri & Wahyudi (2016) and Muslim (2014) that LDR positively impacts NIM. The higher LDR was, the higher NIM. Thus, the statutory reserve has no significant impact on NIM, but LDR has a significant impact on NIM.

Table 8. F Test

Dependent Variable: NIM
Method: Least Squares
Included observations: 96

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.306627	2.462217	-2.155223	0.0337
LDR	0.113471	0.028357	4.001574	0.0001
GWM	0.123912	0.078024	1.588129	0.1157
R-squared	0.179368	F-statistic		10.16367
Adjusted R-squared	0.161720	Prob(F-statistic)		0.000102

Based on the analysis above, the NIM variable has a two-way reciprocal relationship to the LDR. NIM and GWM or statutory reserve values have a two-way relationship. The reserve requirement and the LDR affect the mutual relationship. LDR regression test results affect the net interest margin, but the statutory reserve does not significantly affect the NIM. The ratio of loans and bank deposits affect the acquisition of bank NIMs, but the statutory reserve requirement has no significantly affected the NIM. The amount of bank lending affects the amount of net interest margin obtained by banks, but the minimum reserve requirement fund size does not affect the amount of NIM. These findings have similar results

with Irawati & Puspitasari (2020) that Liquidity dan adequacy ratio have significant causality granger but in one-way causality. Thus, all three research hypotheses were accepted.

The results mean that for gaining profitability, a bank can improve credit distribution. It because credit distribution collected high interest from credit. The high-interest margin can determine liquidity banks on statutory reserves. Liquidity on Credit distribution and deposit can determine statutory reserves. The study has implications for Banks to manage the liquidity ratio, especially the LDR ratio and statutory reserve, increasing NIM. For reference to the investor in investment on the liquid bank. It is better to develop other variables such as macroeconomic variables on net interest margin for further research. Research in the granger causality relationship provided limitation references; thus, this study explored in limitation scope for samples. Then, this study collected small samples that impacted simple research for developing learning on banks' scope. We used six years of time observation that concluded short time research for the more considerable findings.

5. Conclusions

The study revealed a strong relationship between Net interest margin (NIM), Loan to Deposit Ratio (LDR), and Statutory Reserves. To be specific, NIM correlated with LDR, NIM associated with Statutory Reserves, and LDR linked with Statutory Reserves. Additionally, the finding of the study can be baseline data to encourage the bank to develop economic policies pertaining to interest margin and liquidity. Further research is needed to investigate the impact of macroeconomic variables on the net interest margin.

Authors' Declaration

Authors' contributions and responsibilities

The authors made substantial contributions to the conception and design of the study. The authors took responsibility for data analysis, interpretation, and discussion of results. The authors read and approved the final manuscript.

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Availability of data and materials

All data are available from the authors.

Competing interests

The authors declare no competing interest.

Additional information

No additional information from the authors.

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