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ANALYZING THE LEVEL OF CREDIT FAILURE USING THE AUTOREGRESSIVE DISTRIBUTED LAG TO MAINTAIN STABILITY OF COMMERCIAL BANKS IN MALUKU PROVINCE

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ABSTRACT

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Keywords:
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Commercial banks are banks that carry out business activities conventionally and or based on sharia principles, which in their activities provide services in payment traffic. The health level of a commercial bank is the result of an assessment of the bank's condition based on risk and bank performance. Commercial Bank performance assessment can use the proxy of asset ownership, namely Return on Assets (ROA). While the risk assessment of commercial banks can use the credit risk proxy used is the Non-Performing Loan (NPL) ratio. The purpose of this study is to examine the Health Level of Commercial Banks in Maluku Province using ROA and NPL based on bank internal factors (bank specific) and macro and micro economic conditions in Maluku Province. The data used is quarterly time series data, namely in the first quarter of 2014 - first quarter of 2022. The method used is multivariate time series data analysis, namely the Autoregressive Distributed Lag (ARDL) model. The results obtained are the Health Level of Commercial Banks in Maluku Province in the first quarter of 2014 - first quarter of 2022 is classified as healthy and stable, even though the Maluku economy is experiencing the impact of the COVID-19 Pandemic. Internal (specific) bank factors are very dominant in influencing the performance and risk of Commercial Banks in Maluku Province compared to macro and micro economic factors. This means that the policies and performance of all parties related to Maluku's economic conditions need to be improved in maintaining the stability and soundness of commercial banks. In general, the performance of all parties in maintaining the health level of Commercial Banks in Maluku Province is very good, especially during the COVID-19 Pandemic.

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1. INTRODUCTION

Banks in Indonesia are categorized into Commercial Banks and Rural Banks (BPR). Commercial banks conduct business activities conventionally or based on Sharia principles, providing services in payment traffic [1]. The provision of credit in banking is the core business and primary source of bank income, so credit quality is the leading indicator of financial performance and the level of banking health [2]. Credit is a crucial factor influencing banking stability [3]. The role of banks as financial intermediaries is inseparable from credit problems. As in developed and developing countries, credit risk plays a significant role in the banking crisis [4]. Therefore, the ability of bank management to manage credit risk is needed.

Non-Performing Loan (NPL) is an indicator generally used to determine the ability of bank management to manage non-performing loans. The credit risk proxy is the ratio of NPL to total loans [5]. Some previous studies also show that NPL is the root of the banking crisis [6], a representation of credit risk at the aggregate level, and a sign of failure in the banking system [7]. This is supported by other studies which conclude that high NPL ratios impact the stability of companies and the financial system [8]. NPLs can be influenced by various variables, both from external and internal banking. From the internal banking side, variables that can affect NPLs are bank-specific factors, such as the capital adequacy ratio (CAR), as the ratio helps regulators assess whether a bank has enough capital to cover its risks, ensuring financial stability; and bank policies that are careful about the adequacy of loan loss provisions to reduce the number of NPLs [9]. According to Sheefeni [10], return on assets (ROA), return on equity (ROE), loan-to-total asset ratio, and total assets are determinants of NPLs. In addition, there is also a loan-to-deposit ratio (LDR) and net interest margin (NIM), which has a positive effect on NPL. The capital adequacy ratio (CAR) and ROA hurt NPL [11]. Studies developed independently in several countries by different scholars, such as [7], show that macroeconomic factors affect NPLs. ROA assesses how efficiently a bank uses its assets to generate profit. It is calculated as net income divided by total assets. ROA is rooted in profitability analysis and indicates operational efficiency. A higher ROA suggests the bank is better at converting its investments into earnings. On the other hands, ROE reflects profitability from shareholders' perspective, showing how well the bank utilizes investments to grow earnings. It is a key metric for investors assessing financial performance [12].

In Indonesia, the national banking condition is supported by banking performance in each province, including Maluku Province. Based on data obtained from Bank Indonesia, the asset growth of commercial banks in Maluku in the third quarter of 2021 decreased to 1.04% [13], and it is estimated to be the result of slowing asset growth in all bank groups in Maluku. In addition, credit growth at Commercial Banks in Maluku Province on an annual basis was also recorded to slow down to 18.35% or 15.07% trillion. People's economic activities are limited due to the impact of COVID-19, and their ability to pay debts (credit) is also decreasing. By investigating the impact of microeconomic and macroeconomic determinants on regional development banks' non-performing loans in Indonesia, as well as how regional development banks' risk-taking behavior reacted to the harmful shock caused by the COVID-19 [14].

This condition is reinforced by credit risk in Maluku, which is shown in the NPL ratio, which increased to 3.45%. Although the Maluku NPL value is still below 5%, which means it is within the safe limit set by Bank Indonesia, this situation must be overcome, namely efforts to reduce the rate of increase in NPLs.

This research has novelty value compared to previous research. Some things that make research different and have novelty value are using methods and case studies in the Maluku Province region. We use the time series modeling, namely Autoregressive Distributed Lag (ARDL) [15]. The process is a regression modeling that can model the relationship between the dependent variable and the independent variable, be it the present or past value, and include the lag of the dependent variable as one of the exogenous variables. In addition, the method can analyze short-term and long-term relationships between exogenous variables and the dependent variable [16].

Referring to the above description, the purpose of this research is to analyze the performance of banks in Maluku based on three related aspects, namely internal bank factors (NPL), macroeconomic conditions (inflation, GRDP, rupiah exchange rate, BI seven days repo rate), and microeconomic conditions (NPL MSME/UMKM) of the region, using the ARDL method. Research studies on the influence of these three aspects on bank performance in Maluku are needed because banks have a significant role in efforts to improve the economy and community welfare. Furthermore, banks are one of the dynamic sectors that directly drive the growth of the national and regional economies, so analyzing the aspects that affect bank performance can be a basis for consideration for the government and related parties to make other policies related to the promotion of the regional economy.

2. RESEARCH METHODS

2.1 Data and Research Variable

The data is secondary from the Financial Services Authority, Bank Indonesia, and the Central Statistics Agency. The data is monthly data from 2019 to 2022. The theoretical model that will be developed is based on Bank Indonesia Regulation Number 13/1/PBI/2011 concerning the Assessment of the Health Level of Commercial Banks. The health level of commercial banks is the result of assessing the condition of banks based on risk and bank performance [17]. This study uses two modeling schemes, shown in Figure 1 and Figure 2.

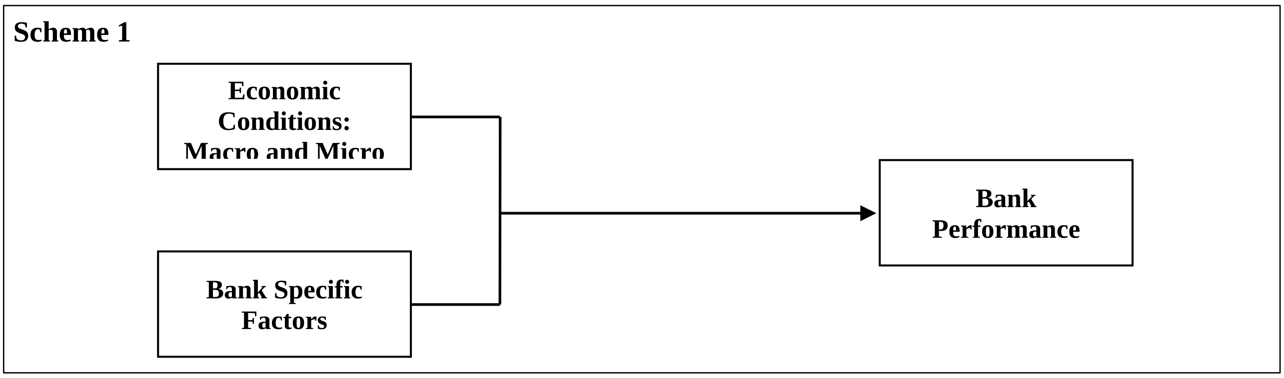

Figure 1. Theoretical Model for Analyzing Bank Performance

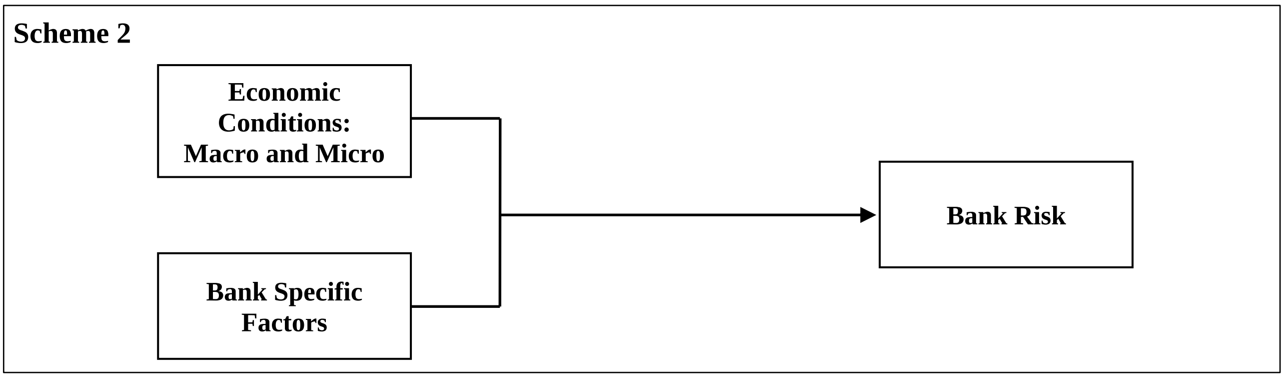

Figure 2. Theoretical Models for Bank Risk Analysis

Based on Figure 1 and Figure 2, the research variables used can be seen in Table 1.

Table 1. Research Variable

Scheme 1: analyzing bank performance	
Dependent Variable	**Independent Variable**
ROA Ratio	1. Gross regional domestic revenue (GRDP) 2. Consumer price index (CPI) 3. BI seven days repo rate 4. Exchange rate (IDR/USD) 5. MSME NPL ratio 6. NPL ratio 7. Operating Income to Operating Costs (OIOC) ratio 8. LDR
Scheme 2: bank risk analysis	
Dependent Variable	**Independent Variable**
NPL Ratio of Commercial Bank	1. Gross regional domestic revenue (GRDP) 2. Consumer price index (CPI) 3. BI seven days repo rate 4. Exchange rate (IDR/USD) 5. MSME NPL ratio 6. ROA ratio 7. OIOC Ratio 8. LDR

As per the research objective, the regression equation for Scheme 1 is given as follows:

$$ROA = f(ROA_{t-1}, \text{economic factors macro and micro, bank specific factor})$$

where ROA_{t-1} is the ROA ratio in the previous period, Macro and Micro are macroeconomic and microeconomic variables, and Bank is a bank-specific factor. Meanwhile, Scheme 2 is given as follows:

$$NPL = f(NPL_{t-1}, \text{economic factors macro and micro, bank specific factor})$$

where NPL_{t-1} is the NPL ratio in the previous period.

2.2 Research Procedures

In detail, the research procedures used are as follows:

1. Data collection and verification based on research variables.
2. Pre-modeling, namely data analysis, is used to see data characteristics based on statistical descriptions and graphs.
3. ARDL modeling based on two theoretical model schemes.
4. Analysis of the model obtained to identify factors affecting bank ROA and NPL.
5. Conclusions and recommendations.

The software used to analyze data and perform ARDL modeling in this study is EViews.

3. RESULTS AND DISCUSSION

3.1 Data Characteristic

The data used in this study are quarterly time series data, namely data in the first quarter of 2014 - the first quarter of 2022. Statistically, all variables used in this study are described in **Table 2**.

Table 2. Statistical description of each variable

Variable	Measures of Centre and Dispersion				Normality Test	
	Mean	Max	Min	Std. Dev	Jarque-Bera Stat.	*p*-value
BANK NPL	2.3982	3.6000	1.3000	0.8154	3.9620	0.1379
ROA	3.3309	5.6300	0.0100	0.8711	51.922	0.0000
OIOC	71.652	99.560	62.190	6.0195	253.54	0.0000
LDR	72.351	94.980	58.190	11.407	3.4926	0.1744
GRDP	4.6755	9.7700	-3.42	2.8767	19.3165	0.0001
INFLATION	3.6476	9.0700	-0.59	2.9225	2.4174	0.2986
BI RATE	5.3182	7.7500	3.5000	1.5198	3.0054	0.2225
RUPIAH EXCHANGE RATE	13669.88	14733.00	11611.00	850.3083	8.4010	0.0150
UMKM NPL	3.4642	5.0300	2.0800	0.7950	1.5448	0.4619

The spread of the Inflation variable is relatively large because the standard deviation value is quite significant near the mean value. **Table 2** also shows the results of the normality test for each variable, where the Bank NPL, LDR, Inflation, BI Rate, and UMKM NPL variables are generally distributed at the 95% confidence level because the p-value of the Jarque-Bera test statistics of these variables is more than 5%. MSMEs are usually distributed at the 95% confidence level because the p-value of the Jarque-Bera test statistics of these variables is more than 5%. Visually, the characteristics of each variable can be analyzed using a line plot, as shown in **Figure 3**, which shows that each variable is quite varied.

Based on **Figure 3**, variables that contain trends are Bank NPL, GRDP, Inflation, BI rate, Exchange Rate, and MSME NPL. The exchange rate variable forms a positive or increasing trend, while GRDP, inflation, BI rate, and MSME NPL form a negative or decreasing trend. Meanwhile, the Bank NPL variable experienced fluctuations caused by a decrease in the trend in the first quarter of 2014 - the second quarter of 2018, then experienced an increasing trend in the following quarter. The variables that do not contain trends are ROA, OIOC, and LDR. At the same time, ROA and OIOC have relatively small variations and tend to be stationary in the mean, while the LDR variable varies relatively and forms a repeating pattern.

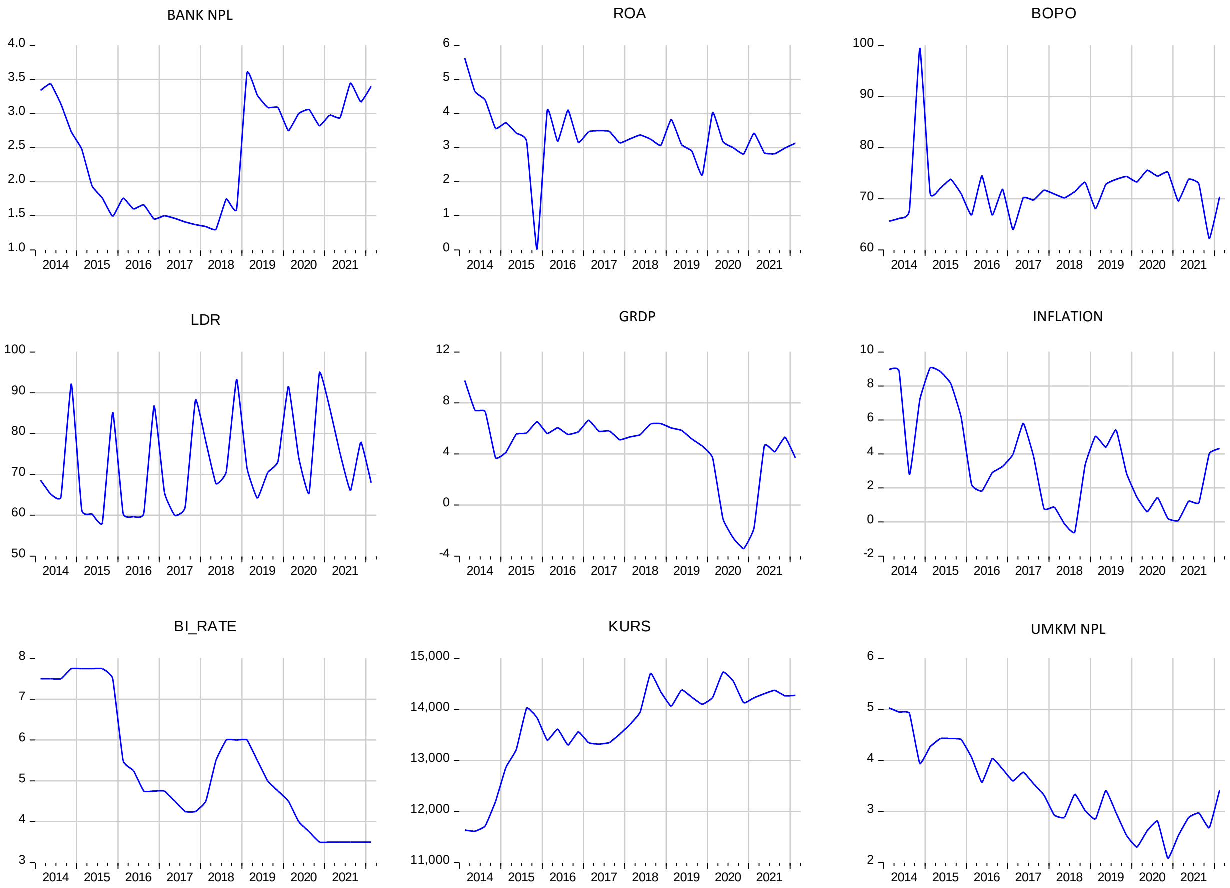

Figure 3. Line Plot of Research Variable
Source: EViews Output

3.2 Stationarity

The initial assumption the ARDL model must meet is that each variable must be stationary in level, namely I(0), or stationary in differential I(1). One way to detect the order of integration of each variable is through a unit root test using the Augmented Dickey-Fuller (ADF) test. The null hypothesis (H_0) is that the data contains unit roots, while the alternative hypothesis (H_1) is that the data does not contain unit roots, namely stationary data.

Table 3. Results of ADF test

Variable	Intercept				Trend and Intercept			
	Level		Differences I		Level		Differences I	
	t-stat	*p* value	t-stat	*p*-value	t-stat	*p* value	t-stat	*p*-value
BANK NPL	-1.5032	0.5192	-6.3871	0.0000	-2.1910	0.4782	-6.9086	0.0000
ROA	-5.6316	0.0001	-	-	-5.7647	0.0002	-	-
OIOC	-5.8688	0.0000	-	-	-9.5559	0.0000	-	-
LDR	-1.3321	0.6009	-2.9213	0.0576	-2.6485	0.2639	-10.777	0.0000
PDRB	-1.5121	0.5124	-5.4501	0.0001	-2.6069	0.2802	-5.3493	0.0009
INFLASI	-2.8985	0.0570	-5.1305	0.0003	-3.5972	0.0477	-	-
BI RATE	-1.4754	0.5325	-4.5564	0.0016	-4.3098	0.0111	-	-
RUPIAH EXCHANGE RATE	-2.4981	0.1253	-4.9900	0.0003	-2.2453	0.4500	-5.2974	0.0008
UMKM NPL	-2.1868	0.2147	-5.9420	0.0000	-2.5700	0.2954	-6.7112	0.0000

The ADF test results summarized in Table 3 are the test results of each variable individually, whether it involves only the intercept or the trend and intercept. At the 95% confidence level, the ADF test results on the intercept state that the ROA and OIOC variables are stationary in level, which means that both variables have a degree of integration I(0). Then, the Bank NPL, GRDP, INFLATION, BI RATE, RUPIAH EXCHANGE RATE, and NPL UMKM variables are stationary in the first differential or integrated at the I(1) degree. In comparison, the LDR variable is stationary in the I or I(0) differential at the 90% confidence level. The results of the ADF test involving trend and intercept at the 95% confidence level state that the variables ROA, OIOC, INFLATION, and BI Rate are stationary at level or I(0). In contrast, the variables of BANK NPL, LDR, GRDP, RUPIAH EXCHANGE RATE, and UMKM NPL are stationary at differentiation I or I(1). Thus, all variables meet the I(0) or (1) assumptions for ARDL modeling.

3.3 ARDL Modeling

The Autoregressive Distributed Lag (ARDL) Model is a versatile econometric tool used to examine both short- and long-term relationships between variables in time series data. The method is particularly useful when dealing with mixed-order integration (I(0) and I(1)) of variables, making it ideal for cases where some series are stationary and others are non-stationary. The lag length selection in the ARDL model is a critical step because the chosen lag structure determines the model's ability to capture dynamic relationships and the accuracy of its inferences [16]. ARDL modeling is carried out based on the scheme in Figure 1 and Figure 2 so that four models are obtained.

Scheme 1: Analysis of Commercial Bank Performance in Maluku Province

Bank Health Level is the result of an assessment of the bank's condition, which is carried out on the risks and performance of the bank. Bank performance can be seen from its financial performance. This is reflected by Return on Assets (ROA). The high ROA of a bank can indicate the bank's high level of profit and asset utilization. This section uses ROA as an indicator of bank performance, where ROA is the dependent variable.

1. Initial Assumptions

The first step in the analysis process is to test the multicollinearity assumption on each independent variable in each model. A multicollinearity-free model is one of the assumptions that must be met by the Ordinary Least Square (OLS) model. Multicollinearity causes the model coefficients obtained to be invalid because of the linear correlation between independent variables. One of the tools used to detect multicollinearity is the variance inflation factor (VIF). The value of VIF =1 indicates that the independent variables are not correlated to each other. If the value of VIF is 1< VIF < 5, it specifies that the variables are moderately correlated to each other [18]. Multicollinearity among predictors in a regression if VIF ≥ 5 to 10. If VIF > 10 indicates the regression coefficients are weakly estimated, as the presence of multicollinearity [19]. Table 4 presents the VIF results of the four models.

Table 4. VIF value of four models

Scheme/Model	Variable			VIF
	Name	Type	Notation	
Scheme 1/Model 1	ROA	Dependent	ROA_t	-
	NPL BANK	Independent	$NPLB_t$	1.003009
	LDR	Independent	LDR_t	1.167588
	OIOC	Independent	$BOPO_t$	1.170579
Scheme 1/Model 2	ROA	Dependent	ROA_t	-
	PDRB	Independent	$PDRB_t$	1.655677
	INFLASI	Independent	INF_t	2.328779
	BI REPO RATE	Independent	$BIRR_t$	2.961693
	EXCHANGE RATE	Independent	$KURS_t$	2.647199
	NPL UMKM	Independent	$NPLU_t$	4.831797
Scheme 2/Model 3	NPL BANK	Dependent	$NPLB_t$	-
	ROA	Independent	ROA_t	1.106393
	LDR	Independent	LDR_t	1.238679

Scheme/Model	Variable			VIF
	Name	**Type**	**Notation**	
Scheme 2/Model 3	OIOC	Independent	$BOPO_t$	1.180200
Scheme 2/Model 4	NPL BANK	Dependent	$NPLB_t$	-
	PDRB	Independent	$PDRB_t$	1.655677
	INFLASI	Independent	INF_t	2.328779
	BI REPO RATE	Independent	$BIRR_t$	2.961693
	EXCHANGE RATE	Independent	$KURS_t$	2.647199
	NPL UMKM	Independent	$NPLU_t$	4.831797

The results obtained in **Table 4** show that the VIF values of all independent variables of the four models are less than 10. That means that there is no multicollinearity in the three independent variables.

2. Selection and Model Estimation

The next step is to select a model based on the value of the information criterion, AIC. A good ARDL model is one that has the smallest AIC value. The results of the AIC analysis for ARDL model selection are shown in **Figure 4**, which shows 20 models with the smallest AIC. Therefore, the ARDL(3,0,4,4) model (or Model 1) is suitable.

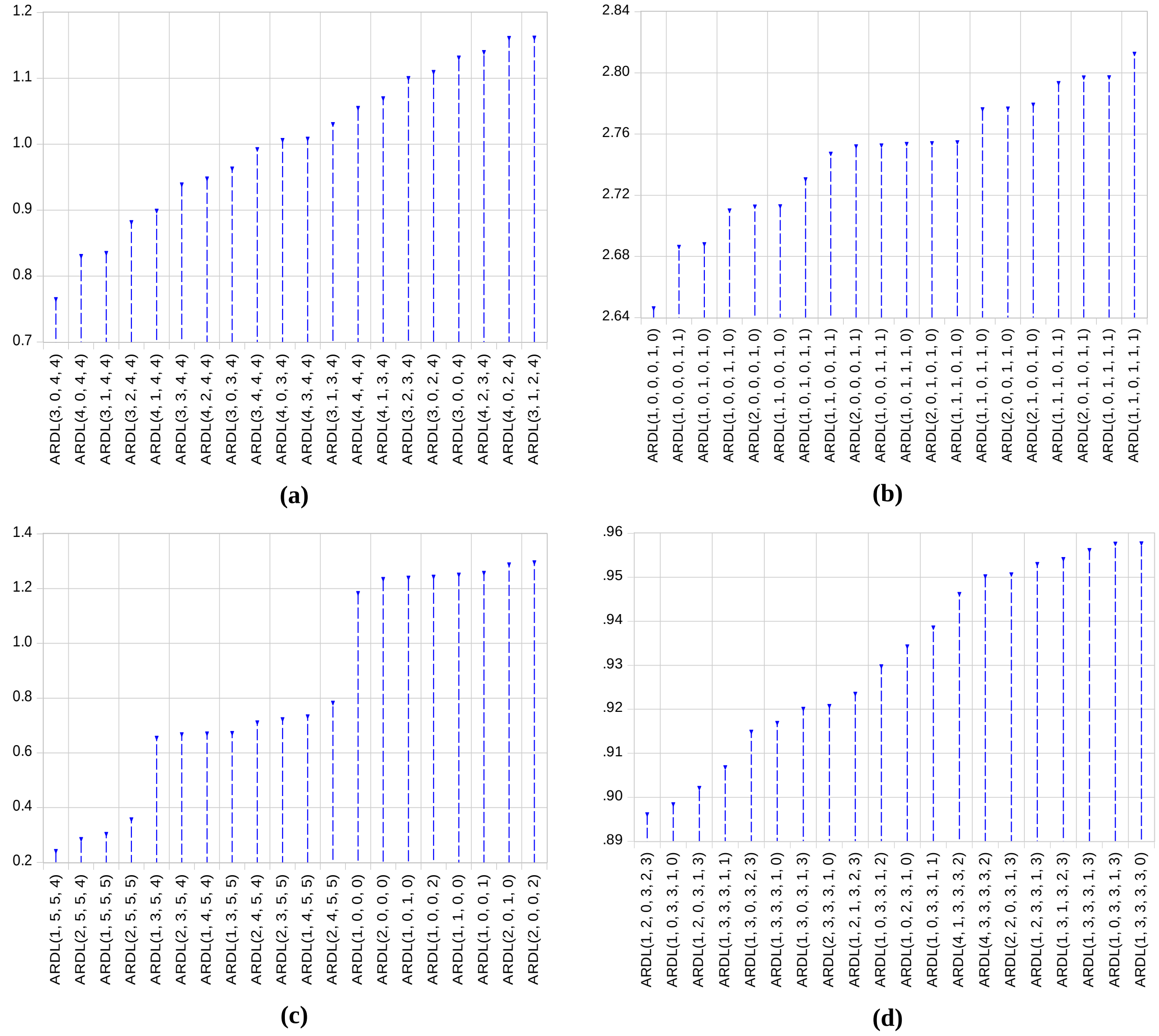

Figure 4. Graph of the Smallest AIC
(a) Model Selection 1, (b) Model Selection 2, (c) Model Selection 3, (d) Model Selection 4
Source: EViews Output

Figure 4 (a) shows the ARDL(3,0,4,4) model has optimum lags. Thus, no lag from the BANK NPL variable that affects ROA. The estimation results of model 1, ARDL(3,0,4,4), are shown in Table 5.

Table 5. Results of Model Estimation 1: ARDL(3,0,4,4)

Variable	Coefficient	Standard Error	t-Statistic	*p*-value
ROA_{t-1}	-0.352465	0.113070	-3.117230	0.0082*
ROA_{t-2}	-0.078916	0.093116	-0.847505	0.4120
ROA_{t-3}	-0.387053	0.098889	-3.914007	0.0018*
$\Delta NPLB_t$	0.405403	0.173951	2.330562	0.0365*
ΔLDR_t	0.028470	0.009035	3.151035	0.0077*
ΔLDR_{t-1}	0.028105	0.011309	2.485135	0.0273*
ΔLDR_{t-2}	0.039211	0.011970	3.275793	0.0060*
ΔLDR_{t-3}	0.031981	0.011199	2.855731	0.0135*
ΔLDR_{t-4}	0.017340	0.008650	2.004639	0.0663**
$BOPO_t$	-0.055723	0.022869	-2.436618	0.0300*
$BOPO_{t-1}$	-0.049134	0.026303	-1.867983	0.0845**
$BOPO_{t-2}$	0.025711	0.013688	1.878367	0.0829**
$BOPO_{t-3}$	0.019465	0.014160	1.374682	0.1925
$BOPO_{t-4}$	-0.096201	0.012653	-7.603041	0.0000*
C	16.86385	2.203918	7.651762	0.0000*

R-squared = 0.918986; Adjusted R-squared = 0.831741
Wald of short-run relationship: F-statistic = 10.53335; p-value = 0.000066

*Significant at α = 5%; **Significant at α = 10%

Table 5 shows that most exogenous variables that make up the ARDL(3,0,4,4) model significantly affect ROA at the 5% and 10% significance levels. The two variables that do not considerably affect ROA are the second lag of the ROA variable and the third lag of the first differential of the OIOC variable. The Wald test results show that all short-run coefficients significantly affect ROA. The adjusted R-squared shows that the ability of exogenous variables formed in the ARDL(3,0,4,4) model can explain the ROA variable by 83.17%.

Using the same method in this step, the results for model 2, ARDL(1,0,0,0,1,0) are shown in Table 6.

Table 6. Results of Model Estimation 2: ARDL(1,0,0,0,1,0)

Variable	Coefficient	Standard Error	t-Statistic	*p*-value
ΔROA_{t-1}	-0.664593	0.153066	-4.341872	0.0002*
$\Delta PDRB_t$	0.023557	0.087596	0.268926	0.7904
ΔINF_t	0.086572	0.073655	1.175372	0.2519
$\Delta BIRR_t$	-0.660364	0.395350	-1.670328	0.1084
$\Delta KURS_t$	0.000364	0.000542	0.670178	0.5094
$\Delta PDRB_{t-1}$	-0.001607	0.000491	-3.270688	0.0034*
$\Delta NPLU_t$	0.125536	0.397239	0.316020	0.7548
C	-0.063851	0.172858	-0.369384	0.7152

R-squared = 0.605682; Adjusted R-squared = 0.485672
Wald of short-run relationship: F-statistic = 5.046935; p-value = 0.001404

* Significant at α = 5%; ** Significant at α = 10%

Table 6 shows that only the lag of the first differential results of ROA and GRDP variables significantly affect ROA at the 5% significance level. Meanwhile, the other variables have a negligible effect. The Wald test results show that all short-run coefficients significantly affect ROA. The Adjusted R-squared shows that the ability of exogenous variables formed in the ARDL(1,0,0,0,1,0) model can only explain the ROA variable by 48.57%. The following are the estimation results of the ARDL(1,5,5,4) model shown in Table 7.

Table 7. Results of Model Estimation 3: ARDL(1,5,5,4)

Variable	Coefficient	Standard Error	t-Statistic	*p*-value
$\Delta NPLB_{t-1}$	0.251415	0.167472	1.501235	0.1717
ΔROA_t	0.918158	0.192901	4.759746	0.0014*
ΔROA_{t-1}	0.373131	0.110349	3.381365	0.0096*
ΔROA_{t-2}	-0.051288	0.097357	-0.526802	0.6126

Variable	Coefficient	Standard Error	t-Statistic	p-value
ΔROA_{t-3}	0.300963	0.118992	2.529262	0.0353*
ΔROA_{t-4}	-0.136694	0.080436	-1.699418	0.1277
ΔROA_{t-5}	-0.214681	0.093798	-2.288769	0.0514**
ΔLDR_{t}	-0.051793	0.008351	-6.201873	0.0003*
ΔLDR_{t-1}	-0.003096	0.010209	-0.303247	0.7694
ΔLDR_{t-2}	-0.004700	0.011832	-0.397244	0.7016
ΔLDR_{t-3}	0.025142	0.012375	2.031631	0.0767**
ΔLDR_{t-4}	0.032039	0.010681	2.999682	0.0171*
ΔLDR_{t-5}	0.039998	0.007925	5.047254	0.0010*
$\Delta BOPO_{t}$	0.085191	0.026525	3.211674	0.0124*
$\Delta BOPO_{t-1}$	0.079781	0.026104	3.056286	0.0157*
$\Delta BOPO_{t-2}$	0.011111	0.026399	0.420904	0.6849
$\Delta BOPO_{t-3}$	-0.019441	0.017397	-1.117540	0.2962
$\Delta BOPO_{t-4}$	0.105541	0.022374	4.717040	0.0015*
C	0.027079	0.057264	0.472881	0.6489

R-squared = 0.905417; Adjusted R-squared = 0.692604
Wald of short-run relationship: F-statistic = 4.254532; p-value = 0.021281

*Significant at α = 5%; **Significant at α = 10%

Table 7 shows that there are exogenous variables that make up the ARDL(1,5,5,4) model significantly affect BANK's NPL at the 5% and 10% significance levels, including long-term variables such as ΔROA_t, ΔLDR_t, dan $\Delta BOPO_t$. The Wald test results show that all short-run coefficients have a significant effect on BANK NPL. Adjusted R-squared shows that the ability of exogenous variables formed in the ARDL(1,5,5,4) model is able to explain the NPL BANK variable by 69.26%.

Furthermore, the estimation results of model 4, ARDL(1,2,0,3,2,3) are shown in **Table 8**.

Table 8. Results of Model Estimation 4: ARDL(1,2,0,3,2,3)

Variable	Coefficient	Standard Error	t-Statistic	p-value
$\Delta NPLB_{t-1}$	-0.368603	0.179432	-2.054275	0.0624**
$\Delta PDRB_{t}$	-0.009771	0.042107	-0.232042	0.8204
$\Delta PDRB_{t-1}$	-0.016146	0.041513	-0.388947	0.7041
$\Delta PDRB_{t-2}$	0.095026	0.045214	2.101708	0.0574**
ΔINF_{t}	-0.003809	0.045960	-0.082872	0.9353
$\Delta BIRR_{t}$	0.234170	0.181078	1.293203	0.2203
$\Delta BIRR_{t-1}$	0.193775	0.182473	1.061936	0.3092
$\Delta BIRR_{t-2}$	0.137329	0.193503	0.709701	0.4915
$\Delta BIRR_{t-3}$	0.457734	0.168174	2.721796	0.0185*
$\Delta KURS_{t}$	-0.000967	0.000327	-2.955194	0.0120*
$\Delta KURS_{t-1}$	-0.001095	0.000256	-4.284475	0.0011*
$\Delta KURS_{t-2}$	0.000251	0.000254	0.989416	0.3420
$\Delta NPLU_{t}$	0.483112	0.241728	1.998577	0.0688**
$\Delta NPLU_{t-1}$	-0.243323	0.311084	-0.782179	0.4493
$\Delta NPLU_{t-2}$	-0.550398	0.295688	-1.861412	0.0874**
$\Delta NPLU_{t-3}$	-0.765405	0.291696	-2.623981	0.0222*
C	0.213132	0.099584	2.140230	0.0536**

R-squared = 0.787400; Adjusted R-squared = 0.503934
Wald of short-run relationship: F-statistic = 2.777755; p-value = 0.039661

* Significant at α = 5%; **Significant at α = 10%

Table 8 shows that the INFLATION variable does not significantly affect BANK NPLs. In contrast, the GRDP variable influences BANK NPLs at the 10% significance level. The Wald test results show that all short-run coefficients significantly affect BANK NPLs. The Adjusted R-squared shows that the ability of exogenous variables formed in the ARDL (1,2,0,3,2,3) model can only explain the BANK NPL variable by 50.39%.

3. Bounds Test

The Bounds test aims to detect the presence of a long-run relationship in each model. The test statistic used in this test is the F test statistic.

Model 1: Bounds test results of ARDL(3,0,4,4) (model 1) based on F test statistics are shown in **Table 9**.

Table 9. Bound Test for Model 1

Test Statistic	Value	Significance	Lower limit I(0)	Upper limit I(1)
F-statistic	24.62851	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Table 9 shows that the F-statistic value is 24.63, more than the upper bound critical value of I(1) at 10%, 5%, 2.5%, and 1% significance levels. This means rejecting the H_0 hypothesis that there is a long-run cointegration relationship between exogenous variables in the ARDL(3,0,4,4) model. The results of the long-run relationship coefficient estimation are shown in **Table 10**.

Table 10. Model 1 Long-Run Coefficient

Variable	Coefficient	Standard Error	t-Statistic	Prob.
$\Delta NPLB_t$	0.222941	0.096130	2.319156	0.0373*
ΔLDR_t	0.079798	0.023747	3.360299	0.0051*
$BOPO_t$	-0.085723	0.017835	-4.806424	0.0003*
C	9.273831	1.274816	7.274642	0.0000*

*Significant at α = 5%; **Significant at α = 10%

These results show that all these variables have a significant long-term effect on ROA at the 5% significance level. Based on the long-term relationship coefficients, the error correction model (ECM) is obtained as shown in **Table 11**.

Table 11. Error Correction: Model 1

Variable	Coefficient	Standard Error	t-Statistic	Prob.
ΔROA_{t-1}	0.465969	0.105076	4.434594	0.0007*
ΔROA_{t-2}	0.387053	0.081937	4.723806	0.0004*
$\Delta^2 LDR_t$	0.028470	0.005396	5.276586	0.0001*
$\Delta^2 LDR_{t-1}$	-0.088532	0.009400	-9.418135	0.0000*
$\Delta^2 LDR_{t-2}$	-0.049320	0.007320	-6.737983	0.0000*
$\Delta^2 LDR_{t-3}$	-0.017340	0.005287	-3.279448	0.0060*
$\Delta BOPO_t$	-0.055723	0.017136	-3.251848	0.0063*
$\Delta BOPO_{t-1}$	0.051025	0.016465	3.099053	0.0085*
$\Delta BOPO_{t-2}$	0.076736	0.012847	5.973081	0.0000*
$\Delta BOPO_{t-3}$	0.096201	0.010543	9.124397	0.0000*
ECT_{t-1}	-1.818435	0.143298	-12.68986	0.0000*
R-squared	0.967097	Adjusted R-squared		0.947742

*Significant at α = 5%; **Significant at α = 10%

The results shown in **Table 11** are the combined results of the short-run and long-run coefficients. The results show that all short-run coefficients significantly affect ROA at the 5% significance level. Furthermore, the corrected equilibrium coefficient (ECT_{t-1}) is significant with the right sign (negative). This implies that there is an adjustment after the shock where there is a high speed towards the equilibrium point. This means that, the speed of the process from an imbalance in the previous quarter to a balanced condition in the following quarter is 181%. Based on the adjusted R-squared, the ability of ECM in explaining ROA is very good at 94.77%.

Model 2: Bounds test results of ARDL(1,0,0,0,1,0) (model 2) based on F test statistics shown in **Table 12**.

Table 12. Bound Test for Model 2

Test Statistic	Value	Significance	Lower limit I(0)	Upper limit I(1)
F-statistic	21.68508	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Table 12 shows that the F-statistic value is 21.69, more than the upper bound critical value of I(1) at 10%, 5%, 2.5%, and 1% significance levels. It rejects the H_0 hypothesis that there is a long-run cointegration relationship between exogenous variables in the ARDL(1,0,0,0,1,0) model.

Table 13. Model 2 Long-Run Coefficient

Variable	Coefficient	Standard Error	t-Statistic	Prob.
$\Delta PDRB_t$	0.014152	0.052594	0.269076	0.7903
ΔINF_t	0.052008	0.043638	1.191794	0.2455
$\Delta BIRR_t$	-0.396712	0.247293	-1.604221	0.1223
$\Delta KURS_t$	-0.000747	0.000418	-1.786189	0.0873**
$\Delta NPLU_t$	0.075415	0.238822	0.315780	0.7550
C	-0.038358	0.103941	-0.369039	0.7155

*Significant at α = 5%; **Significant at α = 10%

The results of the estimation of the long-term relationship coefficients are shown in **Table 13**, which shows that only the first differential variable of RUPIAH EXCHANGE RATE has a significant long-term effect on ROA at the 10% significance level. The ECM is obtained based on the long-term relationship coefficient, shown in **Table 14**.

Table 14. Error Correction: Model 2

Variable	Coefficient	Standard Error	t-Statistic	Prob.
$\Delta^2 KURS_t$	0.000364	0.000305	1.190114	0.2461
ECT_{t-1}	-1.664593	0.120322	-13.83454	0.0000*
R-squared	0.875673	Adjusted R-squared		0.871386

*Significant at α = 5%; **Significant at α = 10%

The results shown in **Table 14** are the combined results of the short-run and long-run coefficients. Only one short-run coefficient does not affect ROA significantly at either a 5% or 10% significance level. Then the corrected equilibrium coefficient (ECT_{t-1}) is significant with the right sign (negative). This implies an adjustment after the shock where there is a high speed towards the equilibrium point. This means that the speed of the process from an imbalance in the previous quarter to a balanced condition in the following quarter is 166%. Based on the adjusted R-squared, the ability of ECM to explain ROA is relatively good at 87.14%.

Model 3: Bounds test results of ARDL(1,5,5,4) (model 3) based on F-test statistics are shown in **Table 15**.

Table 15. Bound Test for Model 3

Test Statistic	Value	Significance	Lower Limit	Upper Limit
			I(0)	I(1)
F-statistic	13.46084	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Table 15 shows that the F-statistic value is 13.46, more than the upper bound critical value of I(1) at 10%, 5%, 2.5%, and 1% significance levels. This means that we reject the H_0 hypothesis, which states a long-run cointegration relationship exists between exogenous variables in the ARDL(1,5,5,4) model.

Tabel 16. Model 3 Long-Run Coefficient

Variable	Coefficient	Standard Error	t-Statistic	Prob.
ΔROA_t	1.589119	0.808471	1.965587	0.0849**
ΔLDR_t	0.050214	0.065684	0.764471	0.4665
$\Delta BOPO_t$	0.350239	0.138208	2.534134	0.0350*
C	0.036173	0.075554	0.478773	0.6449

*Significant at α = 5%; **Significant at α = 10%

The results of estimating the coefficients of the long-term relationship are shown in **Table 16**. The results show that the ROA variable significantly exerts a long-term influence on BANK NPL at the 10% significance level, and the OIOC variable significantly exerts a long-term influence on BANK NPL at the 5% significance level. While the ROA variable, in the long term, does not have a significant effect. The ECM is obtained based on the long-term relationship coefficient, as shown in **Table 17**.

Table 17. Error Correction: Model 3

Variable	Coefficient	Standard Error	t-Statistic	Prob.
$\Delta^2 ROA_t$	0.918158	0.097876	9.380814	0.0000*
$\Delta^2 ROA_{t-1}$	0.101700	0.104890	0.969579	0.3607
$\Delta^2 ROA_{t-2}$	0.050412	0.097478	0.517166	0.6190
$\Delta^2 ROA_{t-3}$	0.351375	0.089406	3.930124	0.0044*
$\Delta^2 ROA_{t-4}$	0.214681	0.066198	3.243001	0.0118*
$\Delta^2 LDR_t$	-0.051793	0.004987	-10.38640	0.0000*
$\Delta^2 LDR_{t-1}$	-0.092478	0.010279	-8.996465	0.0000*
$\Delta^2 LDR_{t-2}$	-0.097179	0.010290	-9.443908	0.0000*
$\Delta^2 LDR_{t-3}$	-0.072037	0.008619	-8.357542	0.0000*
$\Delta^2 LDR_{t-4}$	-0.039998	0.005151	-7.765176	0.0001*
$\Delta^2 BOPO_t$	0.085191	0.015468	5.507580	0.0006*
$\Delta^2 BOPO_{t-1}$	-0.097211	0.023721	-4.098106	0.0034*
$\Delta^2 BOPO_{t-2}$	-0.086100	0.015613	-5.514652	0.0006*
$\Delta^2 BOPO_{t-3}$	-0.105541	0.011969	-8.817550	0.0000*
ECT_{t-1}	-0.748585	0.074503	-10.04770	0.0000*
R-squared	0.963441	Adjusted R-squared		0.920790

*Significant at α = 5%

The results shown in **Table 17** are the combined results of short-run and long-run coefficients. The results show that most of the short-run coefficients significantly affect BANK NPLs at the 5% significance level; only the variables $\Delta^2 ROA_{t-1}$ and $\Delta^2 ROA_{t-2}$ do not have a significant effect. Then the corrected equilibrium coefficient (ECT_{t-1}) is significant with the right sign (negative). There is an adjustment after the shock where there is a high speed towards the equilibrium point. The process's speed from an imbalance in the previous quarter to a balanced condition in the following quarter is 74.86%. Based on the adjusted R-squared, the ability of ECM to explain ROA is very good at 92.08%.

Model 4: Bounds test results of ARDL(1,2,0,3,2,3) (model 4) based on F test statistics are shown in **Table 18**.

Table 18. Bound Test for Model 4

Test Statistic	Value	Significance	Lower Limit I(0)	Upper Limit I(1)
F-statistic	10.25892	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Table 18 shows that the F-statistic value is 10.26, more than the upper bound critical value of I(1) at 10%, 5%, 2.5%, and 1% significance levels. It rejects the H_0 hypothesis that there is a long-run cointegration relationship between exogenous variables in the ARDL(1,2,0,3,2,3) model.

Table 19. Model 4 Long-Run Coefficient

Variable	Coefficient	Standard Error	t-Statistic	Prob.
$\Delta PDRB_t$	0.050496	0.051982	0.971414	0.3505
ΔINF_t	-0.002783	0.033591	-0.082850	0.9353
$\Delta BIRR_t$	0.747484	0.207579	3.600958	0.0036*
$\Delta KURS_t$	-0.001323	0.000354	-3.741943	0.0028*
$\Delta NPLU_t$	-0.786213	0.621973	-1.264063	0.2302
C	0.155730	0.066191	2.352723	0.0365*

* Significant at α = 5%; **Significant at α = 10%

The results of the estimation of the long-term relationship coefficient are shown in **Table 19**. The results show that only the first differential variables of the BI Repo rate and RUPIAH EXCHANGE RATE have a significant long-term effect on BANK NPLs at the 5% significance level. The ECM is obtained based on the long-term relationship coefficient, as shown in **Table 20**.

Table 20. Error Correction: Model 4

Variable	Coefficient	Standard Error	t-Statistic	Prob.
$\Delta^2 PDRB_t$	-0.009771	0.026844	-0.363977	0.7222
$\Delta^2 PDRB_{t-1}$	-0.095026	0.028414	-3.344303	0.0058*
$\Delta^2 BIRR_t$	0.234170	0.120208	1.948034	0.0752**
$\Delta^2 BIRR_{t-1}$	-0.595063	0.139844	-4.255195	0.0011*
$\Delta^2 BIRR_{t-2}$	-0.457734	0.119578	-3.827928	0.0024*
$\Delta^2 KURS_t$	-0.000967	0.000166	-5.841281	0.0001*
$\Delta^2 KURS_{t-1}$	-0.000251	0.000175	-1.438661	0.1758
$\Delta^2 NPLU_t$	0.483112	0.157223	3.072780	0.0097*
$\Delta^2 NPLU_{t-1}$	1.315803	0.193101	6.814059	0.0000*
$\Delta^2 NPLU_{t-2}$	0.765405	0.129133	5.927243	0.0001*
ECT_{t-1}	-1.368603	0.131866	-10.37876	0.0000*
R-squared	0.912004	Adjusted R-squared		0.863117

* Significant at α = 5%; **Significant at α = 10%

The results shown in **Table 20** are the combined results of short-run and long-run coefficients. Based on the table, there is one short-term coefficient, the variable coefficient $\Delta^2 KURS_{t-1}$ which does not affect BANK NPL. In contrast, the coefficient $\Delta^2 PDRB_t$ can influence BANK NPL at the 10% significance level. Then, the corrected equilibrium coefficient (ECT_{t-1}) is significant with the correct sign (negative value). There is an adjustment after the shock where there is a high speed towards the equilibrium point. The speed of the process from an imbalance in the previous quarter to a balanced condition in the following quarter is 137%. Based on the adjusted R-squared, the ability of ECM to explain ROA is relatively good at 86.31%.

4. Assumption Test for Residuals Model

The ARDL model is an OLS-based model. Therefore, OLS assumptions must be met by the ARDL model to obtain a stable model. The results of the assumption test based on the residuals of Model 1 are shown in **Table 21**. We examined whether residuals are normally distributed by testing skewness and kurtosis by using the Jarque-Bera Test **[20]**. Normally distributed residuals indicate model reliability for hypothesis testing. Then, we assessed whether residual variance is constant across observations. Heteroscedasticity can distort standard errors and inference.

The results show that Model 1 fulfills the OLS assumptions, namely normal distribution (p-value JB statistic more than 5%), no serial correlation (p-value BGLM statistic more than 5%), and no heteroscedasticity (p-value BPG statistic more than 5%).

Table 21. Assumption test for residuals model 1

Test	Statistical Test	Statistical Value	p-value
Normality	Jarque-Bera (JB)	0.1184	0.9425
Serial Correlation	Breusch-Godfrey LM (BGLM)	3.9327	0.1400
Heteroscedasticity	Breusch-Pagan-Godfrey (BPG)	11.836	0.6195

The stability of Model 1 can be seen in the cumulative sum (CUSUM) plot and the CUSUM of squares plot (**Figure 5**). The plots show that the values of CUSUM and CUSUM of squares (blue line) are between the red 5% significance boundary line. It means that Model 1 is stable.

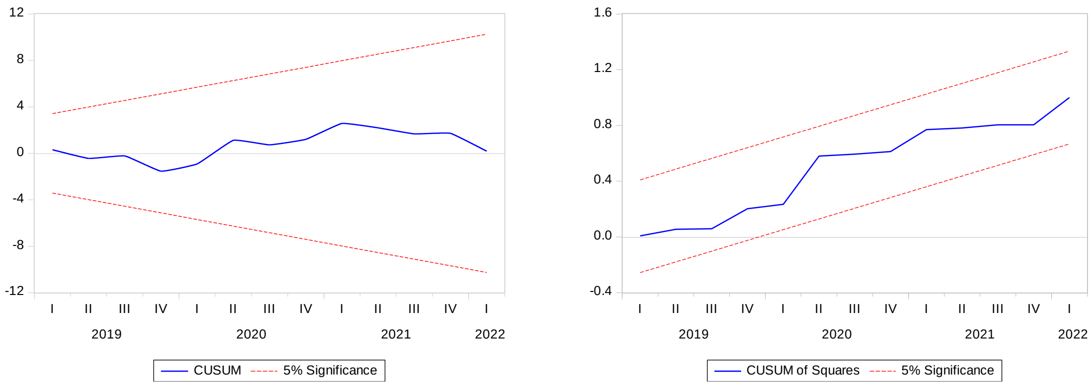

Figure 5. CUSUM and CUSUM Square Graph Model 1
Source: EViews Output

The results of the assumption test based on the residuals of model 2 are shown in Table 22. The results show that Model 1 meets the OLS assumptions at the 5% significance level, namely normally distributed (*p*-value JB statistic more than 5%), no serial correlation (*p*-value BGLM statistic more than 5%), and no heteroscedasticity (*p*-value BPG statistic more than 5%.

Table 22. Assumption Test for Residuals Model 2

Test	Statistical Test	Statistical Value	*p*-value
Normality	Jarque-Bera (JB)	0.8929	0.6399
Serial Correlation	Breusch-Godfrey LM (BGLM)	4.9848	0.0827
Heteroscedasticity	Breusch-Pagan-Godfrey (BPG)	6.3456	0.5000

The plot in Figure 6 shows that the values of CUSUM and CUSUM of squares (blue line) are between the red 5% significance boundary line. It means that Model 2 is stable.

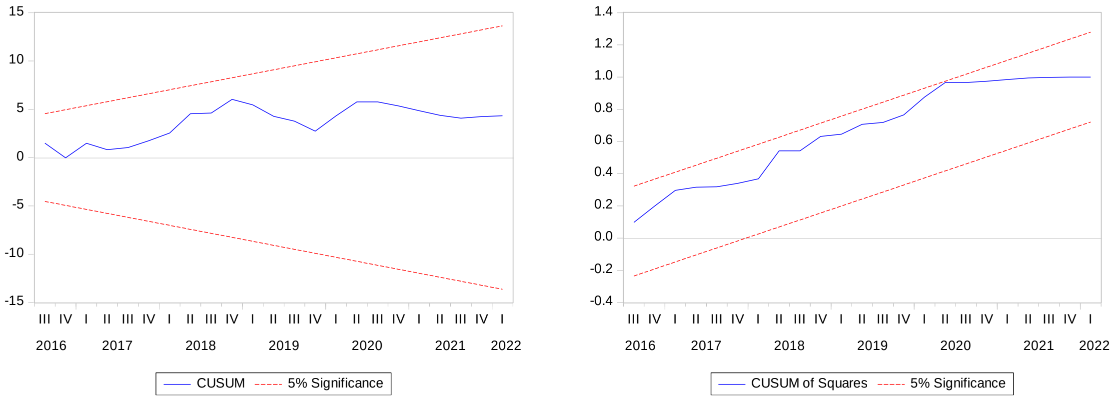

Figure 6. CUSUM and CUSUM Square Graph of Model 2
Source: EViews Output

The results of the assumption test based on the residuals of Model 3 are shown in Table 23. The results show that Model 3 fulfills the OLS assumptions, namely normal distribution (*p*-value JB statistic more than 5%), no serial correlation (*p*-value BGLM statistic more than 5%), and no heteroscedasticity (*p*-value BPG statistic more than 5%).

Table 23. Assumption test for residuals Model 3

Test	Statistical Test	Statistical Value	*p*-value
Normality	Jarque-Bera (JB)	1.2325	0.5400
Serial Correlation	Breusch-Godfrey LM (BGLM)	1.0797	0.5828
Heteroscedasticity	Breusch-Pagan-Godfrey (BPG)	13.077	0.7870

Figure 7 shows that the values of CUSUM and CUSUM of squares (blue line) are between the red 5% significance boundary line. It means that Model 3 is stable.

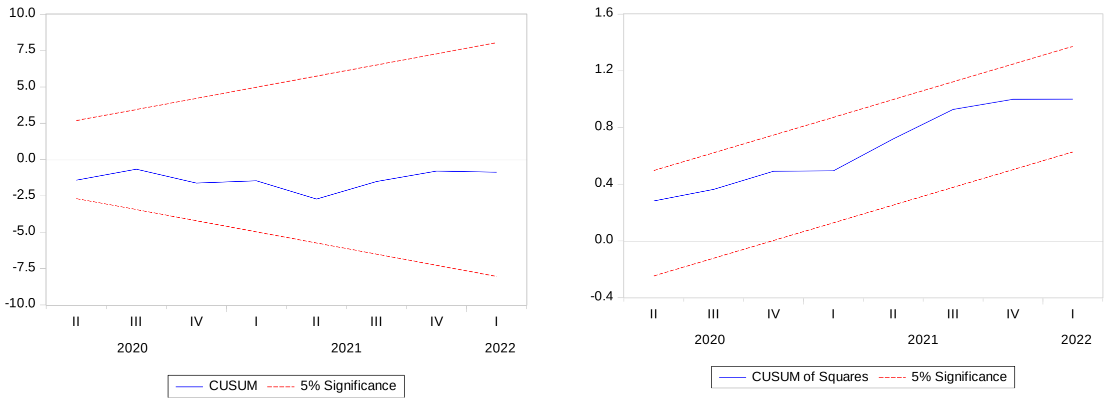

Figure 7. CUSUM and CUSUM Square Graph of Model 3
Source: EViews Output

The results of the assumption test based on the residuals of Model 2 are shown in **Table 24**. The results show that Model 1 meets the OLS assumptions at the 5% significance level, i.e. normally distributed (p-value JB statistic more than 5%), no serial correlation (p-value BGLM statistic more than 5%), and no heteroscedasticity (p-value BPG statistic more than 5%).

Table 24. Assumption test for residuals model 3

Test	Statistical Test	Statistical Value	p-value
Normality	Jarque-Bera (JB)	0.5429	0.7623
Serial Correlation	Breusch-Godfrey LM (BGLM)	3.9374	0.1396
Heteroscedasticity	Breusch-Pagan-Godfrey (BPG)	20.462	0.2001

Figure 8 shows that the values of CUSUM and CUSUM of squares (blue line) are between the red 5% significance boundary line. It means that Model 4 is stable.

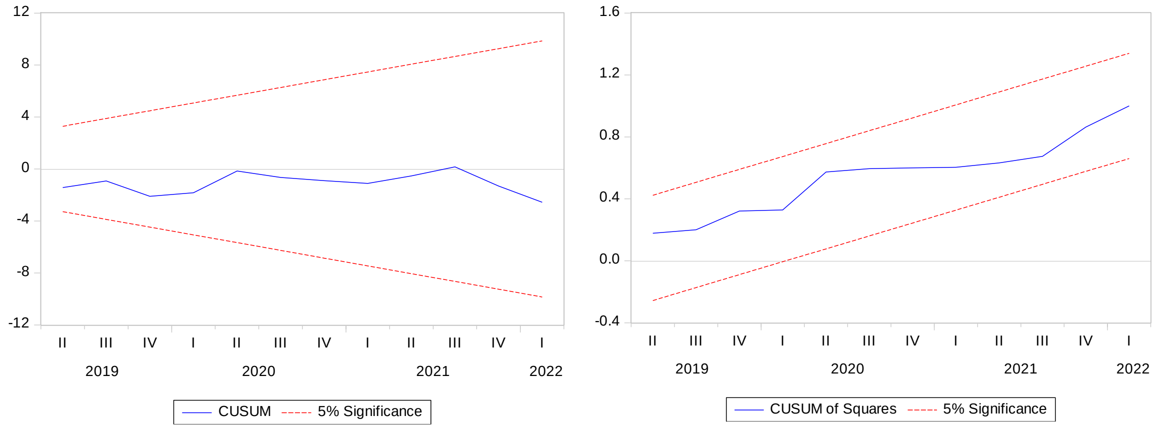

Figure 8. CUSUM and CUSUM Square Graph of Model 4
Source: EViews Output

3.4 Discussion

One of the proxies to assess good bank performance is ROA. Based on the results of data analysis in the previous section, the ROA of commercial banks in Maluku Province in the first quarter of 2014 - the first quarter of 2022 tends to be stable because it is stationary, with an average of 3.33%. The average value is more than the limit set by BI, which is 1.5%. It means that the average performance of commercial banks in Maluku is very good. One indicator to assess commercial banks' credit failure level is the NPL ratio. The NPL ratio of commercial banks in Maluku Province in the first quarter of 2014 - first quarter of 2022 fluctuated between 1.3% - 3.6%, with an average of 2.4%. The average value is still in the category of healthy banks by BI regulations. Based on ROA and NPL data from the first quarter of 2014 to the first quarter of 2022, the condition of commercial banks in Maluku during that period is classified as healthy.

GRDP is one of the essential indicators to determine the economic conditions in a region in a certain period, both at current and constant prices. Based on GRDP in the first quarter of 2014 - first quarter of 2022, the economic level in Maluku Province experienced a downward trend, although the average was 4.68%. The financial condition in Maluku Province had experienced a decline, with a GRDP of -3.42%. It happened during the COVID-19 Pandemic, which occurred throughout Indonesia, including in Maluku Province.

The modeling results of Scheme 1 are used to analyze the performance of commercial banks in Maluku Province based on bank-specific factors. The results show that all bank-specific factors have a significant effect on ROA. The NPL and LDR variables positively affect increasing ROA, while the OIOC variable has a negative impact. In the long term, only OIOC hurts ROA, while in the short term, only LDR hurts ROA. The speed after the shock to the equilibrium condition is breakneck, above 150%. This means that the policies and performance of related parties in maintaining the health level of commercial banks (by the model) in the first quarter 2014 - first quarter 2022 period are very good, despite shocks such as the COVID-19 Pandemic, the condition of commercial banks in Maluku Province remains stable.

In addition, Scheme 1 also analyze the performance of commercial banks in Maluku Province based on macro and micro economic factors. The modeling results of scheme 1 show that GRDP negatively influences the increase in ROA in the first quarter of 2014 - the first quarter of 2022. In the long term, there are no macro and microeconomic variables that have a significant effect on ROA. In contrast, in the short term, the CURR variable hurts ROA. After the shock to the equilibrium condition, the speed is relatively fast, between 80%-100%. It means that the policies and performance of all parties related to Maluku's economic conditions must be improved to maintain the stability and soundness of commercial banks. Based on the adjusted R square, commercial bank-specific factors are more dominant in influencing the performance of commercial banks than macro and micro economic factors.

The results of modeling Scheme 2 to analyze the level of credit risk of commercial banks in Maluku Province based on bank-specific factors. The results show that all bank-specific factors affect NPL BANK. Each bank-specific factor has a positive and negative effect according to the lag. In the long term, ROA and OIOC positively influence the increase in BANK NPL. In contrast, all variables significantly affect the short term, while LDR and OIOC (lag variables) negatively influence Bank NPL. The speed after the shock to equilibrium conditions is breakneck, above 150%. It means that the policies and performance of related parties in maintaining the level of credit risk of commercial banks (by the model) in the first quarter period 2014 - first quarter of 2022 is very good, despite shocks such as the COVID-19 Pandemic, the condition of commercial banks in Maluku Province remains stable.

In addition, Scheme 2 also analyze the credit risk of commercial banks in Maluku Province based on macro and micro economic factors. The modeling results of scheme 2 show that GRDP, BI Repo Rate, Exchange Rate, and SME NPL significantly influence the increase in Commercial Bank NPLs in the first quarter of 2014 - the first quarter of 2022. In the long term, the BI Repo Rate and Exchange Rate significantly affect Commercial Bank NPLs, where the BI Repo Rate has a positive effect. In contrast, the Exchange Rate has a negative impact. All macro and micro economic variables affect Bank NPLs in the short term. All GRDP and RUPIAH EXCHANGE RATE variables have a significant adverse effect. The speed after the occurrence of shocks to equilibrium conditions is relatively fast, at between 80%-100%. It means that the policies and performance of all parties related to Maluku's economic conditions must be improved to maintain commercial banks' stability and health level. Based on the adjusted R square, commercial bank-specific factors are more dominant in influencing commercial bank risk than macro and micro economic factors. These findings were significant with [14], which their examining the influence of the macroeconomic and microeconomic factors on regional development banks' NPL in Indonesia.

4. CONCLUSIONS

Based on the results and discussion in the previous section, we can conclude the following essential points:

1. The proxies used for the performance and risk of commercial banks, namely ROA and NPL in the first quarter of 2014 - first quarter of 2022, show that the condition of commercial banks in Maluku during this period is relatively healthy, despite extraordinary events such as the COVID-19 pandemic.

2. GRDP is an essential indicator for determining a region's economic conditions in a certain period. The average economic level in Maluku Province is quite good, despite the decline in GRDP due to the COVID-19 Pandemic throughout Indonesia, including in Maluku Province.
3. The influence of banking-specific factors on the performance of commercial banks in Maluku Province is more dominant than macro and microeconomic factors.
4. The influence of banking-specific factors on the risk of commercial banks in Maluku Province is more dominant than macro and microeconomic factors.
5. The performance of all parties in maintaining the health level of commercial banks in Maluku Province is very good, especially during the COVID-19 Pandemic, where Commercial Banks in Maluku Province remained stable.

Future research could focus on exploring regional variations by comparing banking health dynamics in Maluku with other provinces, integrating microeconomic and macroeconomic factors to uncover their combined influence on banking stability, and developing innovative financial indicators beyond traditional metrics like ROA and NPL to enhance assessments of banking performance and resilience.

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