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Risk Management and Bank Profitability: Moderating Effects on Lending and Credit Risk in Indonesia

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ABSTRACT

Banks face credit and liquidity risks that affect profitability and financial stability. This study examines the effects of the Loan-to-Deposit Ratio (LDR) and Non-Performing Loans (NPL) on Return on Assets (ROA) in Indonesian banking, as well as the moderating role of risk management and the mediating role of NPL in the relationship between LDR and ROA. This study employed a quantitative approach using panel data from 30 commercial banks, resulting in 300 bank-year observations. The data were analyzed using Moderated Regression Analysis (MRA) with SPSS. The findings show that LDR positively affects ROA (β = 0.020; p = 0.035), while NPL negatively affects ROA (β = −0.340; p = 0.009). Risk management does not directly affect ROA (β = 0.375; p = 0.486), but it significantly moderates the relationship between LDR and NPL (β = 0.007, p = 0.039) and reduces the negative effect of NPL on ROA (β = −0.098; p = 0.024). NPL does not mediate the relationship between LDR and ROA. This study contributes to the development of agency theory and risk management. The research implication is to raise awareness of the importance of risk management for banks, helping them reduce risks and increase profits.

Keywords: Agency Theory; Loan to Deposit Ratio; Non-Performing Loan; Return on Assets; Risk Management

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INTRODUCTION

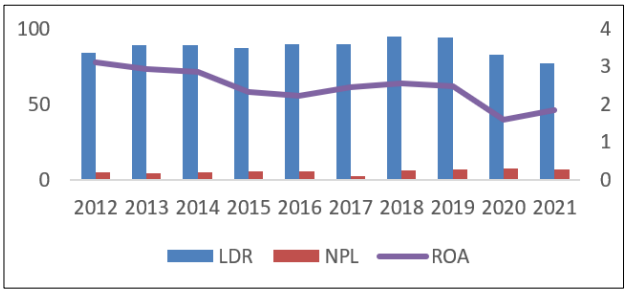
Banks, as the financial intermediary, play an important part in economic growth, which is supported by financial stability. The financial system stability of a country is influenced by the banks' performance; therefore, banks must be professionally managed. However, banks confront many risks; therefore, they are obligated to manage risks to stay financially stable and keep the public's trust. Good risk management helps to minimize risk events and financial loss as well as to maintain financial performance (Bayubahe et al., 2026; Ogundele & Nzama, 2025). Financial performance can be shown by earning ratios (such as Return on Assets or ROA) and liquidity ratios, which can be reflected from the number of credits measured by the Loan-to-Deposit Ratio (LDR). Additionally, the quality of loans is indicated by Non-Performing Loans (NPLs).

A substantial body of research indicates that LDR and NPL have a significant impact on ROA. Ali (2025) and Chun & Ardaaragchaa (2024) posited that an elevated level of credit (LDR) is conducive to enhanced profitability. The bank will earn interest on the loans that it disburses, thereby increasing its profits. However, should the loan become bad, the bank will not receive interest on the loan, which will consequently affect the bank's income. This is also supported by Sarker et al. (2025) and Wu et al. (2022), who revealed that the amount of credit will support an increase in profitability, but losses due to bad credit will reduce profitability. In order to mitigate the potential for financial loss in banking operations, the employment of a risk management strategy is crucial. By mitigating risks, the potential for significant impacts on bank profits will be reduced. Bhowmik & Sarker (2021) and Chand et al. (2024) posited that risk management strategy is able to mitigate the occurrence of bad debts effectively and consequently enhance the profitability of banking institutions.

In response to systemic vulnerabilities exposed during catastrophes such as the 1997 financial crisis in Asia and the 2020 pandemic, Indonesian regulators (Bank of Indonesia and OJK) have mandated comprehensive risk management frameworks covering credit, liquidity, operational, and reputational risks (OJK, 2016). While risk management is theoretically expected to offset the adverse effects of credit risk on profitability, empirical evidence remains inconclusive, particularly regarding whether risk management moderates the pathways from LDR to NPL and then affects ROA. This research answered the gaps by empirically testing the moderating role of risk management in the LDR–NPL–ROA nexus within the Indonesian banking context.

The 2019 SARS-CoV-2 pandemic had a big effect on the economy and business continuity across the country. The pandemic led to the closure of many businesses. This has made it harder for people to repay their debts, which affects the banks. Figure 1 shows that Indonesian banks had a lower LDR and ROA and more NPL during 2019-2020. It would be useful to see if there is a link between LDR, NPL, and ROA, and if risk management can reduce NPL and increase ROA.

Figure 1. Trend of LDR, NPL, and ROA banks in Indonesia



Banks in Indonesia faced the biggest risk of all: credit risk. This is a major issue for the banking industry. Credit risk is the potential of losing money because borrowers cannot repay what they owe. If banks do not manage credit properly, they will face problems with NPLs. This occurs when a borrower cannot repay a loan on time. Banks lend money, so there is always a risk that borrowers will default or struggle to repay, which could affect the bank's stability. The NPL ratio shows the extent of credit business risk and is a key indicator in a bank's financial statements. A lower NPL ratio means fewer bad loans, which is beneficial for the bank. Many factors affect the ratio of NPLs. External factors include economic events at the global and national levels, while internal factors relate to the bank's credit policies.

A study conducted by Estevão et al. (2024) found that NPL affects profitability (ROA) with a negative sign, while LDR significantly influences ROA positively. Lalon et al. (2023) posit that an increase in credit availability will not automatically lead to enhanced profitability and that not all elevated NPLs are detrimental to a banking institution's financial performance. This conclusion is also supported by Rusli & Fitriana (2023) and Taofiqurrochman et al. (2026), who found that there is no discernible impact of LDR and NPL on profitability.

On 29 September 2003, the Bank of Indonesia issued Bank of Indonesia Circular Letter Number 5/21/DPNP regarding risk management implementation for commercial banks, and it was amended on October 25, 2011, by Circular Letter Number 13/23/DPNP (OJK, 2011). This was intended to provide guidance to commercial banks regarding the management of credit risks arising in banking operations. It was expected that commercial banks would be able to minimize credit losses caused by NPLs, thus ensuring the continued viability of banks as intermediary institutions and assure public funds. Management risk significantly affects ROA due to a lower risk of default, or NPL, which will increase ROA. In addition, Kwashie et al. (2022) mentioned that bad debts give a negative influence on ROA.

Risk management as a moderating variable supports the financial performance of banks better. Its relationship with financial performance lies in its objective to improve financial outcomes, because minimizing risk reduces losses and allows financial performance to improve optimally. In the previous study, risk management was measured by bad credit financing risk (NPL), liquidity risk, and market risk. Soraya and Khairi (2024) stated that the implementation of risk management will reduce NPL. Almaskati (2022) emphasized that risk management is instrumental in reducing risk and increasing profits. Nevertheless, there are still many factors that affect bank risk and profitability, such as government or central bank regulations, market forces, and the level of financial development in a country.

Isayas (2022) added that liquidity influences profitability with a positive sign, while a negative effect can be caused by inflation. Despite regulatory emphasis on risk management, the literature offers limited consensus on the risk management effectiveness in moderating the relationship between credit exposure (LDR), asset quality (NPL), and profitability (ROA). Additionally, it is not entirely clear whether risk management directly enhances profitability or merely mitigates losses, especially in emerging economies like Indonesia, where macroeconomic volatility and institutional factors shape banking performance.

The aims of this research are to test the influence of LDR and NPL on ROA at banks in Indonesia; to investigate the potential of risk management in contributing to increasing profitability; and to investigate the potential of NPL as the intervening variable on the

influence of LDR on ROA. This research contributes to the literature on bank performance by offering a clarifying perspective on the role of risk management to moderate the link between those variables. This is not merely a control system in the credit risk–profitability link. It thoughtfully examines a range of theoretical perspectives and provides valuable insights through empirical validation in an understudied emerging market context. This contributes to the enrichment of agency theory and the risk-return trade-off framework in financial intermediation.

LITERATURE REVIEW

Loan-to-Deposit Ratio (LDR)

LDR is a formula to quantify bank liquidity by calculating the total of third-party source funds divided by total loans. When the number of deposits is high, then the bank becomes spendable with excess capacity of money and ready to be distributed as loans. The higher LDR ratio indicates that the bank distributes all of its sources of funds, so the bank is relatively illiquid. By lending loans, the bank will receive interest and support profit. Corroborating with agency theory, management (agents) tend to pursue high LDR targets to maximize short-term bonuses (apparent ROA), even though this creates systemic risks (high NPLs) that are detrimental to shareholders (principals) in the long term. Therefore, banking regulators set a maximum LDR limit not only for liquidity reasons, but also as a control mechanism to mitigate agency problems and maintain financial system stability. This condition relates to agency theory.

Non-Performing Loan (NPL)

Risk of credit is an inherent risk arising when debtors are unable to repay their loans or default on their obligations to the bank. The ratio measurement for testing bad debts is NPL, which is calculated by dividing the amount of NPLs by total loans. Regulation No. 06/10/PBI/2004 issued by Bank Indonesia (2004) sets the standards for bank health levels as follows: Very Healthy: NPL < 2%; Healthy: 2% ≤ NPL < 5%; Fairly Healthy: 5% ≤ NPL < 8%; Less Healthy: 8% ≤ NPL < 12%; Unhealthy: NPL ≥ 12%. Every increase in NPL requires banks to form reserves, which become a non-cash operational expense that directly reduces net profit. If banks aggressively distribute loans without prudential measures, bank risks and bad debts (NPL) as consequences, and finally impact their profit (Wu et al., 2022). It is in line with Bhowmik and Sarker (2021), who asserted that high risk is induced by loan growth and reduces profit.

Risk Management

Risk management refers to activities aimed at reducing or mitigating the possibility of unwanted events arising from business activities that could potentially cause losses. The steps in risk management include identifying, measuring, monitoring, controlling, and evaluating risks. Risk identification involves a comprehensive analysis of potential sources of risk within the bank's business processes. This analysis should also include an assessment of the inherent risks associated with new products and activities, ensuring that they undergo a proper risk management process before implementation. Risk analysis is a systematic process used to determine the probability and impact of risk events and their potential consequences. The risk evaluation process aims to help banks make decisions based on the results of risk analysis and to compare them with predetermined risk criteria (Sari, 2024).

Regulation No. 18/POJK.03/2016 issued by the OJK identifies eight risk categories that must be handled, namely credit risk, market risk, liquidity risk, operational risk, legal risk, strategic risk, compliance risk, and reputation risk (OJK, 2016). The assessment of risk management implementation is conducted through an evaluation of the inherent risk

profile, which classifies risk levels into five ratings: Rating 1 = low; Rating 2 = low to moderate; Rating 3 = moderate; Rating 4 = moderate to high; Rating 5 = high. By implementing sound risk management and prudent lending (LDR), banks can reduce NPLs and increase profit (ROA) (Gunawan & Prasetio, 2025). This supports agency theory, which suggests that prudential risk management and credit policies are not only about regulatory compliance but also about building governance that can reduce agency conflicts, suppress credit losses, and optimize asset returns, thereby reducing agency costs.

Return on Assets (ROA)

ROA is a profitability ratio to calculate the ability of banks to generate revenue from their assets. ROA is used to evaluate whether management has effectively utilized the company's assets to generate returns. According to Clark's research on profitability theory, society and the business environment are dynamic, leading to uncertainty and risk. Profit, therefore, represents a reward for the company's ability to manage uncertainty and risk. Effective risk management contributes to higher profitability (Li et al., 2024). By contrast, bad debts (NPL) influence ROA significantly with a negative sign (Kwashie et al., 2022).

Hypotheses Development

Banks gather funds from investors or creditors and subsequently lend them as loans to generate profit. However, when these institutions extend loans, they assume financial risk, as there is a possibility of loss. The likelihood of financial institutions incurring losses increases in proportion to the number of loans they extend. This phenomenon, known as the leverage effect, is a hallmark of unstable financial health. In the event of financial loss, the amount of interest earned is reduced, thereby negatively affecting profits and ROA. It can be summarized that there is a significant impact of high LDR on the increase in NPL, as evidenced by the findings of Koten (2021) and Wahyuni et al. (2023). Jallali and Zoghlami (2021) posited that the implementation of management risk strategies by banking institutions can effectively mitigate the incidence of NPLs, thereby enhancing profitability.

Risk management practices have a significant effect on LDR and NPL with respect to ROA. Therefore, effective risk management is essential for banks to mitigate potential risks. Banks must implement robust procedures and governance structures to identify, measure, monitor, and control risks associated with their business activities. Effective risk management in banks helps mitigate risks and enhance performance. The findings of Syrová and Špička (2023) mentioned that risk management is an indirect variable in the link of financial performance. In addition, Hidayat et al. (2025) indicated that the relationship between LDR and NPL, moderated by risk management, and it can improve banking performance in terms of profitability.

The Influence of LDR on NPL

The LDR is a ratio to measure how much banks distribute loans from third-party funds. An elevated LDR indicates increased exposure to credit risk. In accordance with liquidity and credit risk management theory, an increase in credit distribution may lead to a rise in NPLs if it is not balanced by rigorous credit assessment and adequate risk mitigation. Wahyuni et al. (2023) found a positive effect of LDR on NPL, suggesting that increased credit distribution may increase the probability of adverse credit outcomes. This relationship is not always linear but depends on the effectiveness of risk management and prevailing macroeconomic conditions. Accordingly, the hypothesis proposed is as follows:

H1: LDR is expected to affect NPL.

The Influence of NPL on ROA

NPL measures the percentage of bad loans that do not give interest income for banks. According to profitability theory, an increase in NPLs reduces operating profit because banks must establish provisions for productive asset write-offs (PPAP), thereby lowering net profit. Consequently, NPL is expected to negatively influence ROA. Estevão et al. (2024), Kwashie et al. (2022), and Wahyuni et al. (2023) found that NPL significantly influences ROA negatively. Hence, the hypothesis is:

H2: NPL is expected to negatively affect ROA.

The Influence of LDR on ROA

According to financial intermediation theory, banks primarily generate revenue through the interest margin between loans and deposits. A higher LDR is associated with increased interest income and higher profitability (ROA), provided that credit quality is maintained. As mentioned by Wu et al. (2022), a high LDR positively influences bank profitability. Therefore, the supposed hypothesis is:

H3: LDR is expected to positively affect ROA.

Risk Management Moderates the Effect of LDR on NPL

Risk management is an activity that aims to identify, measure, monitor, and control potential risks to loans. When risk management is effective, banks can extend credit with a high LDR without significantly increasing NPLs, as debtor quality and risk-mitigation processes are strengthened. Research by Almaskati (2022) and Soraya & Khairi (2024) indicated that effective risk management strategies are associated with reduced NPLs. Jallali and Zoghlami (2021) posit that implementing risk management strategies enhances overall performance by mitigating credit risk. Thus, the hypothesis is:

H4: Risk management is expected to moderate the effect of LDR on NPL.

Risk Management Moderates the Influence of NPL on ROA

Financial institutions that implement comprehensive risk management can minimize the impact of NPLs by diversifying portfolios, improving fund-allocation efficiency, and strengthening credit monitoring. As a result, the decline in ROA due to NPL is less severe in institutions with strong risk management. Ogundele and Nzama (2025) stated that risk management can mitigate the adverse impact of NPL on financial performance. In addition, Chun and Ardaaragchaa (2024) demonstrated that effective risk management enhances profitability by reducing credit losses. The hypothesis proposed is:

H5: Risk management is expected to moderate the effect of NPL on ROA.

NPL Mediates the Effect of LDR on ROA

In principle, an incline of LDR may lead to leverage NPL, which in turn may decrease ROA. If NPL acts as a mediator variable, the effect of LDR on ROA is expected to weaken or change direction when NPL is included in the model. Several studies, including Estevão et al. (2024), have proposed a chain relationship among LDR, NPL, and ROA. However, empirical evidence supporting the intervening role of NPL remains inconclusive. NPL is a moderating variable rather than an intervening variable. The proposed hypothesis is:

H6: NPL is expected to mediate the effect of LDR on ROA.

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The Influence of Risk Management on ROA

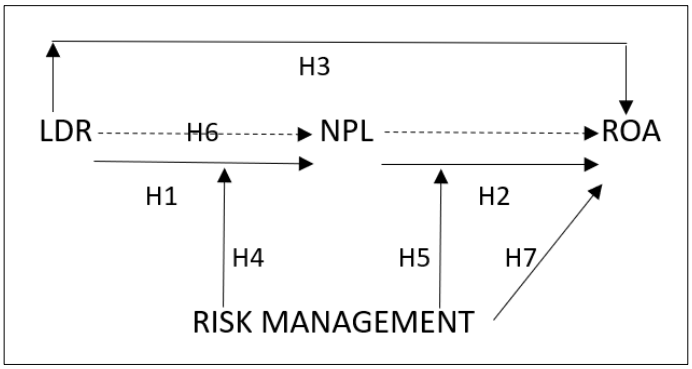
According to Gunawan and Prasetio (2025), risk management will help increase earnings. Although risk management is expected to improve profitability by reducing losses, it should be noted that risk management is a cost center rather than a direct revenue-generating activity. Its impact on ROA may not be immediate but may appear over the long term. According to Almaskati (2022), risk management improves profitability, although the effect is not always significant in the short term. Lalon et al. (2023) emphasize that bank profitability is more strongly affected by external factors (such as inflation, interest rates, and exchange rates) than by internal variables, such as risk management. The proposed hypothesis is:

H7: Risk management is expected to affect ROA.

Conceptual Framework

This paper's conceptual framework examines the effects of LDR on NPL and ROA, and the moderating influence of Management of risk on the associations between LDR and NPL, and between NPL and ROA. The theoretical framework is shown in Figure 2.

Figure 2. Research Framework



RESEARCH METHOD

Research Approach

A quantitative research approach is employed in this research, also conducted to explain, test, and analyze the influence among variables as well as to examine the proposed theory. The LDR, NPL, and Risk Management are employed as independent variables, while ROA is the dependent variable. The moderating variable is Risk management, while the intervening variable is NPL.

Population and Sample

The population consists of national banks (excluding foreign banks) listed on the OJK website in Indonesia (www.ojk.go.id), totaling 99 banks. These comprised four state-owned banks, 68 private banks, and 27 regional development banks. Using simple random sampling, 30 banks were selected as the research sample. Gay et al. (2012) and Ross (2014) argued that, based on the Central Limit Theorem, a sample size of at least 30 is generally considered adequate for parametric tests, such as the t-test, regression, and ANOVA. Therefore, the selection of 30 banks was considered plausible and representative for this study. To clarify the sampling process and the final observations, the sample mapping is presented in Table 1.

Table 1. Sample Mapping of Banks in Indonesia

No.	Description	Number of Banks
1	Population: national commercial banks in Indonesia listed on the OJK website (excluding foreign banks)	99
2	State-owned banks	4
3	Private banks	68
4	Regional development banks	27
5	Final sample	30
6	Period of annual reports analyzed	2014–2023
7	Total observations	300

As shown in Table 1, the sample mapping presents the population composition and the final observations used in this study. Based on annual reports published from 2014 to 2023, the study obtained 300 bank-year observations. The complete population list and sample selection are presented in Appendix 1.

Data Collection

The data were acquired from the annual reports published on the official websites of the 30 randomly selected banks for the period 2014–2023, resulting in a total of 300 data. The risk management variable comprises the implementation of management activities by banks to mitigate eight types of risk: credit, market, liquidity, operational, legal, strategic, compliance, and reputation. Banks conduct risk management and assess their own risk by employing the Risk-Based Bank Rating approach, focusing on the risk profile as the inherent risk.

Data Testing and Analysis

The data were processed using SPSS. The t-test was used to examine the effect of variables, while Moderated Regression Analysis (MRA) was employed to test the moderating role of risk management in H4 and H5. The data and statistical test results were statistically analyzed to answer the hypotheses.

RESULTS

Description of Statistic Results

Table 2 presents the descriptive statistics for the variables employed in this research. The mean value of LDR is 89.9202, which falls within the normal range (70%–90%) based on OJK standards. The average NPL is 2.4972, indicating a relatively low credit risk level (below 5%). Meanwhile, the mean ROA is 2.5225, suggesting that banks generally have good profitability performance. The risk management variable shows an average value of 2.0767, indicating a low to moderate risk profile. However, the maximum values reveal that some banks experience extreme conditions, such as a very high LDR (295.76), high NPL (15.03), and high-risk levels.

Table 2. Statistics of Research Variables

Variable		LDR	NPL	ROA	RISK
N	Valid	300	300	300	300
	Missing	1	1	1	1
Mean		89.9202	2.4972	2.5225	2.0767
Std. Deviation		23.26289	1.72878	3.76510	0.41396
Skewness		4.336	2.882	6.533	1.380
Std. Error of Skewness		0.141	0.141	0.141	0.141
Minimum		38.33	0.06	0.02	1.00
Maximum		295.76	15.03	34.10	4.00

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Description of Statistical Tests

Table 3 summarizes the results of the t-test and MRA. The findings show that LDR has a positive and significant effect on ROA (β = 0.020; p = 0.035), indicating that higher credit distribution is associated with higher profitability. In contrast, NPL has a negative and significant effect on ROA (β = −0.340; p = 0.009), suggesting that higher credit risk reduces bank profitability. Risk management does not have a significant direct effect on ROA (β = 0.375; p = 0.486).

Table 3. Summary of T Test and MRA results

Hypothesis		Unstandardized		Standardized Coefficients	t	Sig.	VIF
		Beta	Coeff. Std. Error	Beta			
Constant		0.835	1.372		0.609	0.543	1.004
H3	LDR-ROA	0.020	0.009	0.121	2.116	0.035	1.004
H2	NPL-ROA	-0.340	0.129	-0.156	-2.640	0.009	1.078
H7	RISK-ROA	0.375	0.537	0.041	0.698	0.486	1.074
R Square		0.040					
F Stat		4.079 sig = 0.007					
H1	LDR-NPL	-0.005	0.004	-0.061	-1.062	0.289	1
H4	LDR*RISK–NPL	0.007	0.003	-0.122	2.073	0.039	1.049
H5	NPL*RISK-ROA	-0.098	0.043	-0.133	-2.273	0.024	1.049
R Square (MRA)		0.054					
F Stat		3.362 sig = 0.006					

Based on the effect of the moderating variable, the relationship between LDR and risk management significantly affects NPL (β = 0.007; p = 0.039), indicating that risk management significantly moderates the relationship between LDR and NPL. Similarly, the interaction between NPL and risk management significantly affects ROA (β = −0.098; p = 0.024), suggesting that risk management mitigates the negative impact of NPL on profitability. However, LDR does not affect NPL significantly (β = −0.005; p = 0.289). Furthermore, NPL is not proven as the mediator in the association between LDR and ROA, as the indirect effect (0.0009516) is smaller than the direct effect (0.121).

The model shows an R-square value of 0.040 for the main regression and 0.054 for the moderated model, indicating a modest explanatory power. The main regression model showed an R-square value of 0.040, meaning that about 4% of the variation in the dependent variable (ROA) is supported by the independent variables (LDR, NPL, Risk), which are parts of the model. After adding interaction variables to test for moderating effects, the R-square value increased to 0.054. Although this R-square value is relatively small, it is reasonable in the context of the banking industry, where bank performance is influenced by many external factors (such as inflation, interest rates, and foreign exchange rates) that are not fully captured by the model. More importantly, most of the statistically significant relationships are consistent with the theoretical expectations proposed in this study. The increase in R-square in the moderated model, although small, indicates that the moderating variable provides additional explanation of the relationship among LDR, NPL, and ROA, as evidenced by its significance. This indicates that effective risk management is important in reducing NPL and increasing profits.

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DISCUSSION

H1: LDR is Expected to Affect NPL

The results indicate that LDR does not significantly affect NPL (p = 0.289), suggesting that higher credit distribution does not necessarily increase credit risk; therefore, H1 is rejected. This reflects the effectiveness of credit governance and risk mitigation frameworks implemented by Indonesian banks. Financial institutions have established guidelines and procedures to manage credit risk, including thorough credit analysis conducted by account officers. As a result, even when LDR is relatively high, credit quality remains stable, and NPL levels are maintained at a low level.

This condition may also be influenced by macroeconomic factors. As highlighted by Ozili & Delgado (2026) and Wu et al. (2022), NPL is a sensitive factor influenced by external conditions such as GDP growth, unemployment, and moral hazard, COVID-19 Pandemic (Umar & Kespo, 2024). Indonesian banks also implement strict underwriting standards and comply with regulations issued by OJK, such as POJK No. 18/POJK.03/2016, which further strengthens risk control mechanisms (OJK, 2016). These practices weaken the direct relationship between LDR and NPL. Moreover, an insignificant relationship between LDR and NPL according to (Ozili & Delgado, 2026), due to many factors influencing NPL, such as inflation, lending rate, exchange rate, not merely LDR.

The results are in line with prior studies. Koten (2021) emphasized which the relationship between LDR and NPL is not always linear and depends on credit management quality. Similarly, Wahyuni et al. (2023) found that Indonesian banks can maintain low NPL levels even when LDR exceeds 85%, provided that strong monitoring systems are in place. Therefore, aggressive lending does not automatically increase credit risk when supported by prudent underwriting and effective risk management practices. This finding is proven by the hypothesis (H4) where LDR should be moderated by risk management in order to influence NPL with a negative sign, finally, risk management contributes to the effect LDR on NPL.

H2: NPL is Expected to Negatively Affect ROA

The findings confirm that NPL significantly affects ROA in a negative direction (p = 0.009), indicating that poor credit quality reduces bank profitability; therefore, H2 is accepted. NPL represents non-performing assets that do not generate interest income and require loss provisions, thereby directly lowering net income and ROA.

This finding aligns with credit risk theory and signaling theory, which suggest that asset quality reflects financial stability and a bad signal of institutional credibility. Empirical studies also supported this result. According to Kwashie et al. (2022), NPL affects bank performance in a negative sign. Furthermore, Chand et al. (2024) also reported a relationship between NPL and profit in a negative direction. Bad loans mean that the bank will not receive interest income, and banks must add more capital to cover the loss, and increase agency costs, such as collecting debts, monitoring, and restructuring costs.

From a practical perspective, effective management of risks has proven to have a pivotal role in mitigating the potential negative effects. By improving credit allocation, prudential, diversifying loan portfolios, and strengthening monitoring systems, banks can reduce credit risk and maintain stable income streams. Therefore, banks need to enhance underwriting standards, credit monitoring, and recovery strategies to prevent the NPLs ratio. NPLs are not simply a business risk, but rather a manifestation of the failure of agency mechanisms that directly impact a bank's efficiency. High NPLs reflect two main problems among the principal (owner/depositor) and the management as the agent.

When NPL is high, stakeholders ask the manager to monitor and audit oversight, which increases costs and reduces profit, therefore influence ROA.

H3: LDR is Expected to Positively Affect ROA
The results show that LDR significantly and positively affects ROA (p = 0.035), indicating that higher credit distribution contributes to increased profitability. Accordingly, H3 is accepted. This suggests that banks are able to distribute third-party funds effectively to generate interest income. The main profit of banks is from loans, by generating interest income. Therefore, banks need to balance credit expansion with the maintenance of asset quality to ensure sustainable profitability (Li et al., 2024).

A high LDR reflects efficient intermediation, where banks successfully channel deposits into productive loans (Anh, 2024). This result supports the risk-return trade-off theory, which states that higher returns are achieved through increased risk-taking, provided that risks are properly managed. Previous studies also confirm this relationship. Wahyuni et al. (2023) and Wu et al. (2022) argued that higher loan distribution banks will earn interest income and improve profitability, although the effect may weaken when credit quality deteriorates (Ogundele & Nzama, 2025).

H4: Risk Management is Expected to Moderate the Effect of LDR on NPL
The results indicate that risk management significantly moderates the relationship between LDR and NPL (p = 0.039). This suggests that although higher LDR increases exposure to credit risk, effective risk management can reduce the likelihood of rising NPLs. This means that H4 is accepted.

Risk management improves fund allocation, strengthens liquidity control, and enhances portfolio diversification. Through prudent credit assessment and strict monitoring, banks can maintain asset quality even during credit expansion. The implementation of the 5C principles (Character, Capacity, Capital, Collateral, and Condition) and robust credit scoring systems plays a key role in mitigating default risk. A high LDR indicates that the bank is very aggressive in disbursing its credit. This expansion often ignores prudence, ultimately resulting in NPLs. However, implementing risk management certainly reduces the risk of bad debts. This is in accordance with agency theory. Risk management, as an early warning system, can reduce information asymmetry. This will also reduce agency costs.

This finding is consistent with risk-based lending theory and supported by previous studies. Soraya and Khairi (2024) found that risk management reduces NPL despite increased lending, while Jallali and Zoghlami (2021) demonstrated that risk management strengthens the relationship between credit expansion and asset quality. Therefore, investment in risk management infrastructure is essential to sustain healthy credit growth.

H5: Risk Management is Expected to Moderate the Effect of NPL on ROA
Based on the findings of this study, risk management significantly moderates the relationship between NPL and ROA (p = 0.024), indicating that it reduces the adverse impact of credit risk on profitability. Along with that, H5 is accepted. This suggests that banks with strong risk management systems are more resilient to credit shocks.

Effective risk management helps mitigate the adverse effects of NPL through portfolio diversification, proactive recovery strategies, and efficient capital allocation. This supports resilience theory, which emphasizes the ability of financial institutions to withstand risk without significantly affecting performance. In line with agency theory, this

moderation function represents the effectiveness of the governance mechanisms implemented by banks in controlling agency conflicts before more severe bad debts occur.

Empirical evidence also supports this finding. Almaskati (2022) showed that strong risk management enhances profitability resilience. Therefore, risk management should be viewed not only as a regulatory requirement but also as a strategic tool to sustain profitability under risk conditions. These findings notice the notion that risk management is not solely a compliance function, however rather a form of agency governance that safeguards assets to generate profit (ROA) despite facing bad debts. This is achieved by reducing agency costs and minimizing residual loss.

H6: NPL is Expected to Mediate the Effect of LDR on ROA
The results indicate that NPL does not mediate the relationship between LDR and ROA. The indirect impact (0.0009516) is substantially smaller than the direct effect (0.121), suggesting that LDR influences profitability directly rather than through NPL. Therefore, H6 is rejected.

This finding implies that bank profitability is not merely determined by credit quality but also affected by other factors, namely macroeconomic conditions, digitalization, and operational efficiency (Ali, 2025; Jeris, 2021). In this context, NPL is better interpreted as an outcome of lending policies rather than a mediating mechanism.

The results are consistent with Bakır et al. (2025), who emphasized the role of macroeconomic variables in determining NPL, such as inflation, interest rate, foreign exchange rate, foreign direct investment, and the COVID-19 pandemic (Umar & Kespo, 2024); and Koten (2021), who reported a non-linear relationship between LDR and NPL. Therefore, improving profitability requires a broader strategy beyond managing NPL, including enhancing operational efficiency, diversifying income sources, and strengthening risk management. This makes sense, given that banks have independent risk committees, robust credit distribution, and effective internal audits, all of which can reduce fraudulent behavior. LDR expansion does not necessarily lower credit standards in order to maintain profit.

H7: Risk Management is Expected to Affect ROA
The findings show that risk management does not significantly affect ROA ($p = 0.486$), indicating that it is not an immediate profit-generating factor. Therefore, H7 is rejected. Instead, risk management functions as a preventive and control mechanism, contributing to long-term financial stability.

This result aligns with agency theory, which views risk management as a tool to reduce agency costs and limit excessive risk-taking rather than directly increasing profitability (Febriany et al., 2025). Risk management operates indirectly by controlling credit risk, reducing NPL, and preventing financial losses. Risk management is a non-revenue-generating measure that reduces risk. Risk management is indirect, acting more as a moderating tool in reducing fraud, thereby reducing losses and increasing revenue. Risk management can reduce information asymmetry, suppress moral hazard, and protect the principal's wealth from loss. Risk management is able to reduce information asymmetry, suppress moral hazard, and protect the principal's wealth from loss. Risk management is a compliance driver in agency theory, not a profit center.

Empirical studies also support this interpretation. Lalon et al. (2023) found that profitability is influenced by multiple factors, including macroeconomic conditions and

operational efficiency, and the stabilizing risk management role. Therefore, the risk management of effectiveness should be evaluated based on long-term sustainability rather than short-term financial performance.

CONCLUSION

The findings show that LDR has a significant positive effect on ROA, indicating that credit expansion within prudent limits contributes to higher profitability. In contrast, NPL has a significant negative effect on ROA, confirming that deteriorating loan quality reduces bank performance. The moderating analysis demonstrates that risk management weakens the effect of LDR on NPL (H4 accepted) and reduces the negative impact of NPL on ROA (H5 accepted), hence risk management matters as the moderating variable. Nevertheless, risk management does not directly influence ROA (H7 rejected), which suggests that its contribution to profitability operates indirectly through credit risk control rather than through immediate financial gains. In addition, NPL does not act as a mediator variable in the relationship between LDR and ROA, indicating that lending activity affects profitability directly rather than through increased problem loans. Overall, effective risk management strengthens banking stability, particularly in managing credit risk, although it does not automatically generate short-term profit growth.

In the context of theory, these research results contribute to the development of the theory of agency. It found that risk management does not directly affect ROA but moderates the links between LDR and NPL, and between NPL and ROA. This research reinforces the importance of risk management in the banking system. Risk management is not a profit center, but rather a form of governance that can reduce information asymmetry, suppress moral hazard, and minimize losses. Furthermore, NPLs are not solely caused by credit expansion, but are caused by many factors. This study adds to the evidence that bank profitability is not solely determined by credit volume or quality but can also be due to the effectiveness of risk management in reducing NPLs. Another contribution provides evidence that risk management in developing countries like Indonesia matters and is needed to anticipate risks caused by volatility and other macroeconomic factors.

The findings of this research give practical implications for financial intermediary companies, particularly boards of commissioners, managers, and stakeholders. Banks must have a risk management culture paradigm, starting from work planning and performance evaluation. Risk management has been proven to support NPL reduction. Strengthening risk management as a strategic investment increases bank resilience, as it has been proven to reduce NPLs, thereby maintaining bank profits. Banks are advised to implement an early warning system to minimize risk. Increased transparency in risk reporting and a risk culture must function optimally to protect shareholder value and maintain sustainable profitability.

LIMITATION

This research has several limitations. First, the analysis is restricted to 30 banks in Indonesia during the years 2014–2023; therefore, the findings should not be generalized to other countries or non-bank financial institutions without caution. Second, risk management was measured using self-assessment inherent risk profile scores reported by banks, which may not fully capture the actual quality of implementation. Third, macroeconomic factors, for example, inflation, interest rates, growth of GDP, and pandemic-related effects, were not directly controlled, even though prior studies indicate their influence on NPL and ROA. Fourth, the use of a purely quantitative design does not allow for deeper exploration of how risk management practices are applied in practice.

Finally, although the study covers ten years of data, the long-term effect of risk management on profitability may require a longer observation period to be fully understood.

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