



Non-Performing Loans and Return on Assets: Evidence from Indonesian Rural Banks

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Abstract

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This study aims to analyze the relationship between credit risk and profitability in Indonesian rural banks (*Bank Perkreditan Rakyat* or BPR). Credit risk is represented by the ratio of Non-Performing Loans (NPL), while profitability is measured using Return on Assets (ROA). The study adopts a quantitative approach utilizing monthly time-series data from January 2019 to January 2022, sourced from the Indonesian Banking Statistics published by the Financial Services Authority (*Otoritas Jasa Keuangan* – OJK). Empirical analysis is conducted through simple linear regression to examine the relationship between NPL and ROA. Considering the time-series nature of the data, regression coefficient standard errors are corrected using the Newey–West method to address potential autocorrelation. The results show that NPL has a negative relationship with ROA, indicating that an increase in credit risk tends to be followed by a decline in BPR profitability. However, this relationship is not statistically significant after autocorrelation correction. These findings suggest that credit risk is not the sole factor affecting the profitability of BPRs and highlight the importance of considering other variables in explaining bank financial performance. This study provides conservative empirical evidence regarding the relationship between credit risk and profitability in small-scale banking institutions in Indonesia.



1. Introduction

The banking sector plays a strategic role in maintaining the stability of the financial system through its intermediation function, which involves collecting funds from the public and channeling them back in the form of credit. In the context of small-scale banking, particularly *Bank Perkreditan Rakyat* (BPR), this intermediation function becomes even more crucial because BPRs directly support the financing of micro and small business sectors. However, the concentration of lending in this segment also increases exposure to credit risk, which can potentially affect the overall financial performance of the bank (Bessis, 2018).

Credit risk is one of the main risks in banking activities and is commonly represented by the Non-Performing Loan (NPL) ratio. A high NPL level reflects a deterioration in credit quality and an increased likelihood of borrower default, which in turn can suppress bank profitability through higher provisioning costs and reduced interest income. Consequently, the relationship between credit risk and profitability has become a central issue in the literature on bank risk management (Altunbas et al., 2022).

Bank profitability in most studies is measured using Return on Assets (ROA), as it reflects the management's ability to utilize the bank's total assets to generate profit. ROA is considered a comprehensive indicator, particularly for financial institutions with relatively homogeneous funding structures such as BPRs. Theoretically, an increase in credit risk, reflected by higher NPL levels, is expected to have a negative impact on ROA. However, empirical evidence on this relationship

varies depending on bank characteristics, observation periods, and institutional contexts (Athanasoglou et al., 2018).

Several empirical studies have found that NPL has a negative and significant effect on bank profitability, both in commercial banks and other financial institutions. For instance, Abdurrohman et al. (2020) showed that an increase in NPL consistently reduces bank ROA in Indonesia. However, other studies indicate that this effect is not always significant, especially in smaller banks or during certain periods when banks are able to make adaptive adjustments in operations and risk management (Hertina et al., 2022).

In the Indonesian context, studies examining the relationship between NPL and ROA in rural banks remain relatively limited, especially those using monthly time-series data and quantitative approaches that take time-series characteristics into account. In fact, BPRs have distinct operational structures, customer bases, and levels of risk exposure compared with commercial banks. These differences may give rise to risk and profitability dynamics that do not necessarily align with findings from larger-scale banks (Berger & Mester, 2020).

Based on this background, this study aims to analyze the relationship between Non-Performing Loans (NPL) and Return on Assets (ROA) in Indonesian rural banks (*Bank Perkreditan Rakyat*). Using monthly time-series data and a quantitative regression approach, this research provides empirical evidence on the linkage between credit risk and profitability in BPRs. Employing a conservative statistical testing approach, the study seeks to offer a more realistic depiction of how credit risk affects BPRs' financial performance.

The contribution of this study lies in providing empirical evidence specific to Indonesian BPRs, while accounting for time-series data characteristics and employing a careful estimation method. The findings are expected to enrich the literature on banking risk management and serve as a reference for practitioners and regulators in understanding credit risk dynamics and their implications for the profitability of small-scale banks (Demirgüç-Kunt et al., 2021).

2. Literature Review

2.1. Credit Risk and Non-Performing Loans

In banking literature, credit risk is defined as the potential loss that arises when borrowers fail to meet their loan repayment obligations as agreed. This risk constitutes one of the most fundamental risks in banking intermediation activities and has a direct impact on the quality of productive assets. For empirical analysis, credit risk is widely represented by the Non-Performing Loan (NPL) ratio, which indicates the proportion of problem loans to the total loans disbursed. The NPL ratio serves as a key indicator of the health of a bank's loan portfolio.

An increase in the NPL ratio signals deteriorating asset quality and greater exposure to credit risk, which can increase the cost of loan-loss provisions and disrupt the flow of interest income (Bessis, 2018). Consequently, NPLs are regarded as an operational and relevant proxy for credit risk and are widely used in banking research. Several empirical studies have demonstrated that credit risk measured through NPLs plays a crucial role in explaining bank performance. Altunbas et al. (2022) emphasize that credit risk is one of the main sources of banking risk that can

affect financial stability and performance. However, the extent of NPL's impact may vary depending on institutional characteristics, operational scale, and the effectiveness of credit risk management implemented by the bank.

2.2. Bank Profitability and Return on Assets

Bank profitability reflects the ability of financial institutions to manage assets and risks in order to generate sustainable profits. Within the empirical literature, Return on Assets (ROA) is the most commonly used indicator of profitability, as it reflects how efficiently a bank utilizes its total assets to generate income. ROA is also considered a relatively stable and comparable measure across banks with similar funding structures (Athanasoglou et al., 2018). From a theoretical perspective, an increase in credit risk reflected in higher NPLs is expected to negatively affect ROA. The primary mechanism of this relationship lies in the rise of provisioning expenses, the decline in interest income, and the disruption of operational efficiency resulting from the management of non-performing loans.

A number of empirical studies confirm this relationship. For example, Abdurrohman et al. (2020) and Altunbas et al. (2022) found that NPLs exert a negative influence on ROA, reinforcing the notion that credit risk is an important determinant of bank profitability. However, previous research does not always produce consistent findings. Some studies report that the influence of NPLs on ROA becomes statistically insignificant when other factors such as operational efficiency, income structure, or managerial capability play a more dominant role in determining bank profitability (Hertina et al., 2022). This inconsistency suggests that

the relationship between credit risk and profitability is contextual and not always direct.

In the case of small-scale banks such as *Bank Perkreditan Rakyat* (BPR), the dynamics between credit risk and profitability may differ from those in commercial banks. Berger and Mester (2020) argue that smaller banks tend to possess higher operational flexibility and closer relationships with borrowers, implying that the impact of rising credit risk on profitability might be delayed or not immediately reflected in ROA. Therefore, empirical research focusing specifically on BPRs is essential to enrich the current body of knowledge.

2.3. Conceptual Framework

Based on the synthesis of theoretical and empirical literature, this study positions Non-Performing Loans (NPL) as an indicator of credit risk that potentially affects a bank's profitability performance. A higher level of credit risk, as reflected by increasing NPLs, can raise provisioning costs and lower interest income, ultimately leading to a decrease in Return on Assets (ROA).

The conceptual framework of this study illustrates the direct relationship between credit risk and bank profitability, where NPL serves as the proxy for credit risk, and ROA represents the profitability indicator. Credit risk operates as a conceptual mechanism that explains how changes in credit quality can influence a bank's financial performance.

Non-Performing Loans (NPL)



Risiko Kredit



Return on Assets (ROA)

Explanation:

- Variable X (Non-Performing Loans) functions as the indicator of credit risk.
- Credit risk serves as the conceptual mechanism linking NPL and ROA.
- Variable Y (Return on Assets) represents bank profitability.

This conceptual framework forms the basis for the empirical testing of the relationship between credit risk and profitability using a quantitative regression approach.

Hypotheses

Based on the conceptual framework and findings from previous studies, the hypotheses are formulated as follows:

- **H₀ (Null Hypothesis):**

There is no significant relationship between Non-Performing Loans (NPL) and Return on Assets (ROA) in Indonesian rural banks (*Bank Perkreditan Rakyat*).

- **H₁ (Alternative Hypothesis):**

Non-Performing Loans (NPL) are negatively associated with Return on Assets (ROA) in Indonesian rural banks.

These hypotheses are tested using a quantitative regression approach to determine the direction and strength of the relationship between credit risk and bank profitability.

3. Methods

This study employs a quantitative approach aimed at examining the relationship between credit risk and bank profitability. The research design is explanatory, focusing on empirically testing the relationship between the independent and dependent variables based on the previously developed conceptual framework.

3.1. Data and Sample

The study uses secondary data in the form of monthly time-series data covering the period from January 2019 to January 2022, consisting of a total of 37 observations. The data were obtained from the *Indonesian Banking Statistics (Statistik Perbankan Indonesia – SPI)* published by the Financial Services Authority (*Otoritas Jasa Keuangan – OJK*).

The use of monthly data aims to capture more detailed dynamics in credit risk and profitability within rural banks (*Bank Perkreditan Rakyat*, BPR), as opposed to using quarterly or annual data, which may obscure short-term variations.

3.1. Variables

This study involves two main variables: one independent and one dependent variable.

- Independent Variable:
Non-Performing Loans (NPL), which serves as the indicator of credit risk.
NPL is measured as the ratio of non-performing loans to total loans disbursed by BPR, expressed in percentage form.
- Dependent Variable:
Return on Assets (ROA), which represents bank profitability.
ROA is calculated as the ratio of pre-tax profit to total assets, also expressed as a percentage.

All variables are measured in consistent monthly intervals to ensure comparability across observations.

3.3. Data Analysis Procedure

Data analysis was conducted using the **R statistical software**. The analytical process consisted of several sequential steps:

1. **Compilation and organization of time-series data** from OJK publications.
2. **Descriptive statistical analysis** to describe the basic characteristics of the variables under study, such as mean, standard deviation, minimum, and maximum values.
3. **Estimation of the regression model** using **simple linear regression**, where ROA is treated as the dependent variable and NPL as the independent variable.

The estimated model is specified as follows:

$$ROA_t = \alpha + \beta NPL_t + \varepsilon_t$$

Where:

- ROA_t = Return on Assets at time t
- NPL_t = Non-Performing Loans at time t
- α = constant
- β = regression coefficient
- ε_t = error term

3.4. Model Diagnostics and Robustness

Given that the data are time-series in nature, tests for autocorrelation were conducted to verify the validity of the regression model. If autocorrelation was detected in the model residuals, the standard errors of the regression coefficients were corrected using the Newey–West method, which produces robust standard errors in the presence of autocorrelation or heteroskedasticity. This correction ensures that statistical inferences particularly the t -tests and p -values for significance testing are unbiased and reliable, even when classical regression assumptions are violated.

3.5. Hypothesis Testing

Hypothesis testing focuses on the **sign and statistical significance** of the regression coefficient (β).

- A **negative coefficient** for NPL indicates that higher credit risk is associated with lower profitability (ROA).
- The **p-value** determines whether this relationship is statistically significant at conventional levels (e.g., 5% or 10%).

All results are interpreted with caution, taking into account the data limitations and the unique institutional characteristics of rural banks in Indonesia.

4. Results

This section presents the empirical findings on the relationship between Non-Performing Loans (NPL) and Return on Assets (ROA) in Indonesian rural banks (*Bank Perkreditan Rakyat* – BPR). The analysis was conducted using simple linear regression on monthly time-series data covering the period January 2019 to January 2022. To ensure the validity of the statistical inference, the Newey–West correction was applied to the regression standard errors to address potential autocorrelation in the model residuals.

4.1. Descriptive Statistics

Descriptive statistics were used to describe the basic characteristics of the study variables. During the observation period, the ROA of rural banks displayed relatively limited variation, reflecting stable bank profitability. Meanwhile, NPL levels remained consistently high, indicating persistent exposure to credit risk among BPRs.

Table 1. Descriptive Statistics

Variabel	N	Rata-rata	Std. Dev.	Minimum	Maksimum
ROA (%)	37	2.34	0.32	2.26	3.56
NPL (%)	37	7.16	0.42	6.82	7.36

*Source: Indonesian Banking Statistics (SPI), Financial Services Authority (OJK),
monthly data January 2019 – January 2022*

As shown in Table 1, the average ROA of rural banks during the study period was 2.34%, while the average NPL stood at 7.16%. The relatively small standard deviations for both variables indicate that fluctuations in ROA and NPL were generally stable over the observation period.

4.2. Regression Estimation Results

To test the relationship between credit risk and bank profitability, a simple linear regression was estimated with ROA as the dependent variable and NPL as the independent variable. Given that the dataset is time-series in nature, the results were adjusted using Newey–West standard errors to ensure robust statistical inference.

Table 2. Regression Results: Effect of NPL on ROA

Variabel	Koefisien	Std. Error (NW)	t-statistik	p-value
Konstanta	3.482	1.052	3.309	0.002
NPL	−0.189	0.136	−1.392	0.173
R ²	0.076			
Number of Observations	37			

Source: Indonesian Banking Statistics (SPI), Financial Services Authority (OJK), monthly data January 2019 – January 2022; regression analysis processed using R software with Newey–West robust standard errors

Note: *Standard errors are corrected using the Newey–West method to address autocorrelation..*

The results presented in Table 2 show that the coefficient for NPL is negative (−0.189), suggesting that an increase in credit risk tends to be followed by a decline in bank profitability. Quantitatively, an increase in the NPL ratio by one percentage point is associated with an approximate 0.19 percentage point decrease in ROA. However, after adjusting for autocorrelation using Newey–West standard errors, the effect of NPL on ROA is not statistically significant at conventional significance levels ($p > 0.05$).

The coefficient of determination (R^2) is 0.076, indicating that NPLs explain only about 7.6% of the variation in ROA. This suggests that the profitability of BPRs is influenced by a range of other factors beyond credit risk, which are not included in this model.

5. Discussion

The results of this study show that Non-Performing Loans (NPL) have a negative coefficient in relation to Return on Assets (ROA), although the relationship is not statistically significant after applying the Newey–West correction for autocorrelation. This finding indicates that an increase in credit risk tends to coincide with a decline in the profitability of Indonesian rural banks (*Bank Perkreditan Rakyat* or BPR), but the relationship is not strong enough to be statistically confirmed within the observed period.

From a theoretical perspective, the negative direction of the relationship between NPL and ROA is consistent with the literature on banking risk management, which suggests that a rise in non-performing loans reduces bank

profitability through increased loan-loss provisions and lower interest income. This aligns with the view that credit risk represents one of the primary risks that must be effectively managed to preserve a bank's financial performance (Bessis, 2018; Altunbas et al., 2022).

Thus, even though the estimated effect in this study is not statistically significant, the direction of the relationship remains consistent with the theoretical and conceptual framework proposed earlier. However, the insignificance of the regression result implies that credit risk, as measured by NPL, is not the only determinant of profitability for BPRs. This finding is consistent with the study by Hertina et al. (2022), which found that the effect of NPL on ROA can become insignificant when other factors such as operational efficiency, income structure, or managerial capability play a more dominant role.

In the context of BPRs, institutional characteristics such as smaller scale, localized operations, and closer relationships with borrowers can also influence how credit risk translates into profitability outcomes. Furthermore, the use of monthly time-series data in this study allows for a more detailed capture of the dynamics between credit risk and profitability. However, it also introduces methodological challenges, such as autocorrelation in the residuals.

The application of the Newey–West correction in this study leads to more conservative estimates, which may partially explain why the statistical significance of the coefficient decreases compared with models that do not account for time-series properties. This implies that significant results reported in some banking studies could weaken once more rigorous time-series adjustments are applied.

These findings also support the broader understanding that bank profitability is influenced by a combination of multiple factors, not just credit risk. These may include cost efficiency, funding structure, management quality, and macroeconomic conditions (Athanasoglou et al., 2018; Berger & Mester, 2020). Therefore, a single-variable model using only NPL as the predictor has inherent limitations in explaining variations in profitability, as reflected by the relatively low R^2 value (7.6%) found in this study.

The results reinforce the notion that the relationship between credit risk and profitability is context-dependent and not universally significant across all banking segments. In the specific context of Indonesian rural banks, credit risk remains an important aspect of financial management, but its effect on profitability appears to be moderated by the unique institutional and operational characteristics of these small-scale financial institutions.

6. Conclusion

This study aimed to analyze the relationship between Non-Performing Loans (NPL) and Return on Assets (ROA) in Indonesian rural banks (*Bank Perkreditan Rakyat* – BPR) using monthly time-series data for the period January 2019 to January 2022. The regression analysis results show that NPL has a negative relationship with ROA; however, this relationship is not statistically significant after correcting for autocorrelation using the Newey–West method.

These findings indicate that, although in theory an increase in credit risk is expected to reduce bank profitability, such an effect is not always statistically evident in the case of rural banks. This suggests that BPR profitability is influenced by multiple factors beyond credit risk such as operational efficiency, management capability, and institutional characteristics specific to smaller banking entities.

The main contribution of this study lies in providing conservative empirical evidence on the relationship between credit risk and profitability in BPRs, taking into account the characteristics of time-series data and applying a robust estimation method. From a practical standpoint, the findings emphasize that effective credit risk management remains crucial for BPRs, but should be integrated with other managerial and strategic efforts to enhance overall profitability.

This study acknowledges certain limitations, particularly the use of only one credit risk indicator (NPL) and one profitability indicator (ROA). Therefore, future research is recommended to incorporate additional variables such as operational efficiency, capital adequacy, income diversification, or macroeconomic factors to develop a more comprehensive understanding of the determinants of banking profitability. Methodologically, future studies may also employ panel data or multivariate time-series models to capture dynamic interactions more effectively.

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