




# “Determinants of bankruptcy probability in Indonesian rural banks”

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# DETERMINANTS OF BANKRUPTCY PROBABILITY IN INDONESIAN RURAL BANKS

## Abstract

This study investigates the key factors influencing the probability of bankruptcy among rural banks in Indonesia, concentrating on internal, industry-specific, and external factors. The study analyzes 1,391 conventional rural banks in Indonesia from 2019 to 2023, resulting in 6,919 bank-year observations. This study uses financial and regional macroeconomic data and applies a population-averaged logistic regression model on a balanced panel dataset. The results indicate that internal factors play a significant role in determining the probability of bankruptcy. In contrast, industry characteristics, which are competition and regulation, and external factors, such as economic growth, do not exhibit a substantial impact. Rural banks characterized by inadequate capital and low profitability are at a heightened risk of insolvency, exacerbated by a significant proportion of non-performing loans. Excessive liquidity paradoxically leads to insolvency, as it indicates the presence of underutilized assets, increasing the chance of failure. These findings confirm that policies encouraging underperforming rural banks to merge with solid rural banks are suitable. These strategies promote a more robust rural banking ecosystem and effective regulatory control by decreasing the number of rural banks.

## Keywords

bank failure, capital adequacy, profitability, loan quality, liquidity, regulation

## JEL Classification

G21, G28, G33

## INTRODUCTION

Banks are fundamental drivers of economic activity, providing the foundation for investments, consumption, and human capital development. In Indonesia, rural banks – often referred to as People's Economy Banks (BPRs) – serve a unique function in the financial sector. These institutions operate in more localized settings, particularly in rural and suburban areas, where they focus on supporting smaller-scale enterprises and individual borrowers. Their operations are confined to narrow geographic areas, typically within a province. Most of their clients belong to microeconomic segments, accessing loans that range from IDR 1 million to IDR 100 million. With total assets generally below IDR 1 billion, rural banks align with internationally recognized definitions of Microfinance Institutions (MFIs) and community-focused banks, which aim to extend financial services to individuals underserved by larger financial entities.

Although small in scale, rural banks play a pivotal role in advancing financial inclusion and supporting regional economic growth. Studies indicate that the credit provided by these banks strengthens local economies, helping stabilize communities in underserved areas. Collaborations with financial technology platforms, such as peer-to-peer lending systems, have enhanced rural banks' ability to distribute credit effectively. These partnerships show how cooperation between

financial organizations can improve access to services for marginalized populations. Furthermore, rural banks adopting technologies like branchless banking contribute to financial accessibility and advance sustainability objectives in Indonesia.

However, growing concerns about the health of rural banks have emerged in recent years. The number of these institutions has significantly dropped, from 1,633 in 2016 to 1,405 in 2023, illustrating a notable contraction. At the same time, the proportion of non-performing loans has risen sharply, increasing from 5.83% in 2015 to 9.87% in 2023. These patterns indicate declining institutional resilience and emphasize the importance of understanding the underlying reasons for this downward trend. Alongside operational challenges, rural banks are under pressure from tighter regulatory requirements and increased competition, both of which threaten their long-term survival.

These difficulties point to systemic issues that require detailed investigation. Rural banks play a crucial role in Indonesia's financial architecture, enabling economic growth and inclusion in areas often neglected by larger financial institutions. The reduction in their numbers and performance raises significant concerns about their ability to remain viable. Exploring the root causes of these challenges is vital to devising strategies that will strengthen rural banks and ensure their continued contribution to Indonesia's economic progress.

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## 1. LITERATURE REVIEW AND HYPOTHESES

The probability of bankruptcy among MFIs can be attributed to three main categories of causes, namely internal factors inherent to the MFIs, industry dynamics within the microfinance sector, and external influences beyond the control of the institutions. The first cause is bank-specific factors, such as mismanagement, a lack of managerial competence, and strategic failures. These factors are isolated and do not trigger crises in other MFIs (Mendelson & Rozas, 2024). In Nigeria, only 39 out of 300 MFIs operating in 1993 remained active by 2020, with significant risks such as reliance on subsidies and governance issues (Maichanou & Daouda, 2021). Other studies show that internal factors such as low capital and profitability contribute to high bankruptcy (Kang et al., 2022). Meanwhile, Basterretxea et al. (2022) show that a significant weakness lies within the cooperative's governance structure, which is overly complex and hinders swift decision-making. Suryandari et al. (2023) highlight the significant potential for fraud in rural banks in Indonesia, indicating weaknesses within their internal structures.

Internal factors contributing to bankruptcy can be explained using the CAMELS framework (Capital adequacy, Asset quality, Management, Earnings, Liquidity, and Sensitivity to market risk). The

CAMELS framework systematically assesses how specific bank conditions influence their failure. Researchers utilize ratios and other indicators representing these six elements to identify the most impactful factors contributing to bank failures. This framework underscores that banking failures often result from a combination of weak fundamentals across these interconnected dimensions.

Despite skepticism about the use of the CAMELS framework as a tool for predicting bank failures (Citterio, 2024), its indicators are still frequently used to identify the causes of such failures (Paule-Vianez et al., 2020). Wang et al. (2024) explain the widespread use of the CAMELS framework as it is well-known among various stakeholders for assessing bank distress and efficiency levels. Additionally, there is a consensus that many regulators utilize CAMELS to evaluate the soundness of banks (Gaul & Jones, 2021). This study utilizes the CAMELS framework to analyze the impact of internal factors on the probability of bankruptcy in rural banks.

The next factor contributing to the high probability of bankruptcy among MFIs is the dynamics occurring within the MFI industry. This condition includes regulatory factors explicitly targeting rural banks and the relatively rapid growth of the industry. The Too-Big-to-Fail Theory and the Regulatory Approach are theoretical frameworks

that can explain this condition. Both theories highlight similar dynamics, emphasizing the influence of lobbying by large banks on policymakers. This lobbying often drives decisions that benefit these significant institutions, undermining efforts to reduce their size or address the underlying risks they pose (Ioannou et al., 2019). These theories elucidate how systemic banking risks arise from individual bank failures and structural and institutional factors that enable and reinforce risky behaviors. This integrated framework provides a lens for analyzing why specific regulatory and policy measures fail to mitigate banking crises and how these dynamics contribute to the broader phenomenon of financial instability.

Competition is also a dynamic within the MFI industry that often affects the probability of MFI bankruptcy. Amanda (2023) emphasizes the intense competition among rural banks, negatively impacting their stability. Amiquero et al. (2023) also concluded that the primary factor in cooperatives' failure is their inability to compete with the strategies employed by successful cooperatives. The debate over the necessity of competition is divided into two perspectives: competition stability and competition fragility. The competition-fragility perspective suggests that competition reduces banks' charter value, incentivizing them to take on more significant risks (Das & Pati, 2024). Furthermore, increased competition leads to a decline in bank stability, which can ultimately result in bankruptcy (González, 2023). On the other hand, the competition-stability perspective argues that banking competition enhances stability by lowering interest rates, thereby reducing borrowing costs. This, in turn, improves borrowers' success in repaying loans, ultimately enhancing bank stability (Tran & Nguyen, 2024).

The Financial Services Authority (FSA), as the regulator overseeing rural banks in Indonesia, aims to foster the development of strong and healthy rural banks (Otoritas Jasa Keuangan, 2024). To achieve this, the FSA issued regulations stipulating that rural banks must have a minimum core capital of IDR 3 billion by December 2019, increasing to IDR 6 billion by December 2024. Failure to comply with these requirements will result in sanctions, including restrictions on opening new branches and mandatory actions such as mergers, acqui-

sitions, or securing new investors. Meanwhile, competition often has a negative impact on the sustainability of MFIs. High levels of competition frequently drive MFIs to extend loans to high-risk borrowers, which diminishes their performance (Hossain et al., 2020). This study observes regulatory and competitive factors as key influences on the probability of bankruptcy among rural banks in Indonesia, examining the broader dynamics within the rural banking industry.

Another contributing factor to the increased probability of bankruptcy among rural banks is external conditions beyond their control, such as the macroeconomic environment. Many scholars highlight the impact of macroeconomic uncertainty on bank failure (Wu & Cole, 2024). There are two opposing theories related to macroeconomic impact (Vuong et al., 2024). The first theory argues that heightened macroeconomic uncertainty increases systemic risks as banks face challenges in managing credit, market, and liquidity risks. This uncertainty can lead to conservative lending practices, reduced profitability, and financial instability. Conversely, the second theory, known as the "real options" theory, suggests that uncertainty creates opportunities for banks to optimize their strategies. Banks can enhance their resilience and adapt more effectively to volatile macroeconomic conditions by delaying decisions or adjusting investments in response to new information.

Adverse external conditions, such as economic slowdown, often increase the likelihood of rural banks facing bankruptcy. This is primarily due to rising non-performing loans as borrowers' incomes decline. Additionally, the potential for systemic risk tends to escalate during unfavorable macroeconomic conditions. This research includes macroeconomic conditions as a factor influencing the probability of bankruptcy among rural banks.

Based on the literature review, this study constructs a conceptual landscape of the key factors contributing to bank failure. This landscape includes internal characteristics, industry-specific dynamics, and broader macroeconomic conditions. Drawing from this framework, the study develops hypotheses to examine their influence on the probability of bankruptcy in rural banks.

- $H_1$ : *Capital adequacy enhances the ability of rural banks to survive.*
- $H_2$ : *High asset quality improves the resilience of rural banks.*
- $H_3$ : *The ability to generate profitability strengthens the survival capacity of rural banks.*
- $H_4$ : *Low liquidity weakens the ability of rural banks to sustain their operations.*
- $H_5$ : *Regulatory compliance enhances the ability of rural banks to survive.*
- $H_6$ : *High competition reduces the ability of rural banks to survive.*
- $H_7$ : *A deteriorating economic condition increases the likelihood of rural banks facing bankruptcy.*

## 2. METHOD

### 2.1. Data

This study investigates the factors contributing to the bankruptcy of rural banks in Indonesia. The analysis encompasses all rural banks with complete data, which refers to those with five years of data from 2019 to 2023 (Nisa, 2025). The data for rural banks that were declared bankrupt during the observation period include only the years before liquidation. For those that were declared bankrupt in 2024, complete data from 2019 to 2023 are included in the analysis. Observations focus on rural banks that failed between 2020 and 2024, while those that were declared bankrupt in 2019 are excluded due to the unavailability of financial statement data. Based on this categorization, 25 rural banks were declared bankrupt during the observation period. Information on bankrupt banks is sourced from liquidated rural banks obtained from the Indonesia Deposit Insurance Corporation as of September 30, 2024, at the latest.

This study applies both dependent and independent variables. The dependent variable in this study is a binary variable with values of 1 and 0. A value of 1 indicates that the rural bank experi-

enced bankruptcy, while 0 signifies that it was not liquidated during the observation period. The use of a binary variable with values of 1 and 0 has been adopted, among others, by Gaul and Jones (2021).

The independent variables used in this study include the following data: Bank-specific variables are based on the CAMEL framework. For the measurement of capital, this study uses the Capital Adequacy Ratio (CAR) as a proxy (Stewart & Chowdhury, 2021). The asset quality of rural banks is proxied using the non-performing loan (NPL) ratio (Zamore et al., 2023). Similar to CAR, NPL is also a key element in bank supervision. Earnings are measured using the proxy Return on Assets (ROA) (Agustin et al., 2018). ROA is one of the primary metrics for evaluating the performance of rural banks specifically and MFIs in general. ROA is preferred because many MFIs operate with non-profit objectives, making shareholder returns a less relevant measure of success (Banto & Monsia, 2021). Liquidity is measured using the cash ratio (CR) as a proxy (Uddin et al., 2022). The cash ratio is a widely used indicator for assessing liquidity management in banks (Rashid et al., 2020). A high cash ratio indicates that a rural bank holds a more significant proportion of liquid assets.

Industry factors expected to contribute to rural bank failures include competition and regulations set by the regulator. Competition among rural banks is proxied using the Herfindahl-Hirschman Index (HHI) (Caballero-Montes, 2022), a metric frequently employed by researchers to assess competition levels in MFIs (Al-Azzam & Parmeter, 2021). Hikouatcha et al. (2023) explain that the HHI considers all firms within the industry, not just the largest ones. Additionally, the index penalizes firms with significant market shares by applying a squared calculation, providing a more comprehensive view of market concentration. Several studies indicate that competition among MFIs often leads to declining performance. The regulator establishes regulations, among other objectives, to strengthen the financial industry (Otoritas Jasa Keuangan, 2024). Regulation is proxied using a dummy variable, where a value of 1 is assigned to rural banks that comply with the regulations before the specified deadline, and a value of 0 is assigned to those that fail to meet the requirements.

**Table 1.** Variable definitions, source, and expected sign

Variables	Definition	Data Source	Expected Sign
CAR	The ratio of a bank's capital to its risk-weighted assets	Financial Services Authority	–
NPL	The proportion of non-performing loans relative to the total loan portfolio	Financial Services Authority	+
ROA	The ratio of net income to total assets	Financial Services Authority	–
CR	The proportion of cash and cash equivalents relative to total assets	Financial Services Authority	–
HHI	The sum of the squared market shares of rural banks' assets	Financial Services Authority, Author's calculation	–
REG	The ability to comply with regulations set by the regulator	Financial Services Authority, Author's calculation	–
GDPG	The real GDP per capita growth rate is calculated using constant 2010 prices	Statistics Indonesia	–

External factors that are anticipated to contribute to rural bank failures include macroeconomic conditions. In this study, macroeconomic factors are proxied by Gross Domestic Product (GDP) growth (Al-Azzam, 2019). High GDP growth encourages greater financial access among the public. Table 1 outlines the independent variables used in this study, their definitions, data sources, and expected signs. A positive value indicates that an increase in the variable's value raises the likelihood of rural bank failure.

## 2.2. Methodology

This study uses a binary variable as a dependent variable, where a value of 0 indicates that a rural bank did not experience bankruptcy, and a value of 1 indicates that the bank went bankrupt. The model employed in this study is as follows:

$$\begin{aligned} \text{Logit Pr}(Y_{i,t} = 1 | X_{i,t}) = & \beta_0 + \beta_1 \text{CAR}_{i,t} \\ & + \beta_2 \text{NPL}_{i,t} + \beta_3 \text{ROA}_{i,t} + \beta_4 \text{CR}_{i,t} + \beta_5 \text{HHI}_{i,t} \quad (1) \\ & + \beta_6 \text{REG}_{i,t} + \beta_7 \text{GDPG}_{i,t} + \varepsilon_{i,t}. \end{aligned}$$

In this model, the dependent variable equals 1 if the rural bank goes bankrupt and 0 if it does not. CAR represents the capital adequacy ratio for rural bank  $i$  in year  $t$ . Following this, NPL measures asset quality, ROA indicates profitability, and CR reflects the liquidity ratio for rural bank  $i$  in year  $t$ .

Regarding industry variables, HHI denotes the level of competition faced by rural bank  $i$  in year  $t$ . A higher HHI value implies lower competition in the province where the rural bank operates. REG captures regulatory compliance,

where REG equals 1 if the rural bank satisfies regulatory requirements and 0 if it does not. Lastly, GDPG refers to the GDP growth in the province where rural bank  $i$  is located in year  $t$ .

Following Ruiz et al. (2024), this study adopts the Population-Averaged model for panel data analysis. The Population-Averaged model measures changes in the logit of the average response across all institutions due to variations in the independent variables. This approach allows using the Huber/White/Sandwich variance estimator, which minimizes the influence of outliers and produces valid standard errors. Additionally, the Population-Averaged model in this study employs the Generalized Estimating Equation (GEE) approach, which provides robust standard errors.

## 3. RESULT

The data collection identifies 1,391 rural banks, with 25 banks classified as bankrupt. The data are winsorized at 1% and 99% to minimize outliers (Vuong et al., 2024). Table 2 presents the descriptive statistics for all rural banks included in the sample for this study. Descriptive statistics help understand the characteristics of the data used in this study. Based on Table 2, the average CAR of rural banks is relatively high, at 47, indicating a secure capital adequacy level given that the regulatory requirement typically ranges between 8 and 12. Meanwhile, the average NPL is 8.6, within an acceptable range, with a variability of 8.3. This suggests that there are no significant differences in NPL across rural banks.

**Table 2.** Descriptive statistics

Variables	Obs.	Mean	Std. Dev.	Min	Max
BANKRUPT	6,919	0.013	0.113	0	1
CAR (%)	6,919	47.996	36.190	0	209.23
NPL (%)	6,919	8.593	8.322	0	44.76
ROA (%)	6,919	1.972	4.854	-23.2	17.36
CR (%)	6,919	30.361	41.218	2.06	333.61
HHI (%)	6,919	8.775	13.728	1.378	100
REG	6,919	0.883	0.321	0	1
GDPG (%)	6,919	3.133	3.507	-15.74	22.94

The average ROA, although positive, is relatively low at 1.972, with high variability at 4.854. This is further reflected in the wide range between the minimum and maximum ROA values. The average HHI is 8.775, indicating a relatively high level of competition, with the lowest HHI value of 1.378 reflecting intense competition among rural banks in some regions. Lastly, the average economic growth rate in the provinces where rural banks operate is 3.133, with values ranging from -15.74 to 22.94. The moderate average growth rate can be attributed to the study period coinciding with the COVID-19 pandemic, which significantly impacted many regions in Indonesia.

Table 3 presents the mean differences between rural banks that go bankrupt and those that remain operational. The variables CAR, NPL,

ROA, CR, and REG exhibit significant mean differences between the two groups. CAR, ROA, and REG values are higher in rural banks that remain operational. Thus, rural banks that remain operational have higher average CAR and ROA values and better regulatory compliance. On the other hand, the average NPL of rural banks that remain operational is significantly lower. Meanwhile, the average CR of rural bankrupt banks is significantly higher than those that remain operational.

Table 4 presents the correlation matrix for all independent variables. The results indicate no evidence of multicollinearity, as the correlation values are below 0.8. The highest correlation, at 0.4802, occurs between CR and CAR. The absence of multicollinearity provides a foundation for proceeding with the regression analysis.

**Table 3.** Means comparison

Variables	Bankrupt	Not Bankrupt	t-test
CAR	22.321%	48.331%	6.759***
NPL	16.124%	8.495%	-8.637***
ROA	-4.957%	2.063%	13.738***
CR	42.625%	30.201%	-2.827***
HHI	9.471%	8.766%	-0.481
REG	0.674	0.886	6.182***
GDPG	3.136%	2.881%	0.683

Note: \*\*\*, \*\*, and \* for 99%, 95%, and 90% confidence levels.

**Table 4.** Correlation matrix

Variables	CAR	NPL	ROA	CR	HHI	REG	GDPG
CAR	1	-	-	-	-	-	-
NPL	0.0800	1	-	-	-	-	-
ROA	0.0502	-0.3206	1	-	-	-	-
CR	0.4802	0.0685	-0.0605	1	-	-	-
HHI	0.0654	-0.0039	-0.0009	0.0789	1	-	-
REG	-0.0265	-0.1258	0.1966	-0.1595	-0.0138	1	-
GDPG	-0.0026	-0.0282	0.0422	0.0113	0.0032	0.0039	1

This study implements a Population-Averaged Logistic Panel Regression to estimate the hypothesis. This model also employs the independent correlation since it provides a robust standard error. In this model, changes reflect variations across the entire study population. Thus, a one-unit change in an independent variable represents the corresponding change for all rural banks included in the analysis or the marginal effect on population (Ruiz et al., 2024). This aligns with the population-average model in the GEE approach, which captures the average effect of independent variables on the dependent variable across the entire population of rural banks under study. Table 5 shows the main results of this regression.

**Table 5.** Main regression results

Independent Variables	Dependent Variables		
	Bankrupt		
	Coef.	Std. Error	P> z
CAR	-0.0445***	0.0149	0.003
NPL	0.0329***	0.0106	0.002
ROA	-0.0839***	0.0173	0.000
CR	0.0084***	0.0033	0.014
HHI	-0.0054	0.0209	0.796
REG	-0.3995	0.4855	0.411
GDPG	-0.0257	0.0179	0.152
CONS	-3.0747	0.6158	0.000
Obs.	6,919	-	-
Groups	1,391	-	-
Wald Chi <sup>2</sup>	233.17	-	-
Prob > chi2	0.0000	-	-

Note: \*\*\*, \*\*, and \* for 99%, 95%, and 90% confidence levels.

Table 5 presents the regression results from the population-averaged logistic models used to assess the probability of rural bank bankruptcy. The findings show that four internal bank-specific variables, CAR, NPL, ROA, and CR, are statistically significant at 5% and 1%. CAR shows negative coefficients, indicating that more substantial capital positions reduce the likelihood of bankruptcy. A one percentage point increase in CAR is associated with a 0.0445 decrease in the log-odds of bankruptcy. This corresponds to a multiplicative change in the odds of approximately 0.956, meaning the odds of bankruptcy decrease by about 4.4% for each additional point in CAR (Pampel, 2020).

The positive and statistically significant coefficient for NPL indicates that higher levels of non-performing loans increase the likelihood of bankruptcy. A one

percentage point increase in NPL is associated with a 0.0329 increase in the log-odds of bankruptcy. This translates to a multiplicative increase in the predicted odds of bankruptcy by a factor of approximately 1.033, meaning the odds of bankruptcy rise by about 3.3% for each additional percentage point in NPL.

The negative and statistically significant coefficient for ROA suggests that higher profitability reduces the likelihood of bankruptcy. A one percentage point increase in ROA is associated with a 0.0839 decrease in the log-odds of bankruptcy. This corresponds to a multiplicative change in the predicted odds by a factor of approximately 0.920, meaning the odds of bankruptcy decrease by about 8.0% for each additional percentage point in ROA. The coefficient for CR is positive and statistically significant, indicating that higher liquidity, as measured by the cash ratio, is associated with a greater likelihood of bankruptcy. A one percentage point increase in CR is associated with a 0.0084 increase in the log-odds of bankruptcy. This results in a multiplicative increase in the predicted odds by a factor of approximately 1.008, meaning the odds of bankruptcy rise by about 0.8% for each additional point in the cash ratio.

The findings are consistent with hypotheses 1, 2, and 3. The hypotheses suggest that an increase in CAR and ROA decreases the likelihood of bankruptcy for rural banks, whereas an increase in NPL elevates the probability of bankruptcy. The findings for the CR variable are inconsistent with hypothesis 4. The hypothesis suggests that an increase in the current ratio (CR) would reduce bankruptcy risk; however, the findings reveal that a higher CR correlates with an increased average likelihood of bankruptcy among rural banks.

At the same time, the coefficients for HHI, REG, and GDPG do not show statistical significance. Nevertheless, all three variables exhibit coefficient signs that align with the proposed hypotheses. A rise in HHI, serving as an indicator of competition, diminishes the probability of bankruptcy for average rural banks. This suggests that heightened competition raises the likelihood of rural banks facing bankruptcy. The average chance of rural banks going bankrupt is also decreased by their capacity to comply with regulations and increased economic growth.

**Table 6.** Robustness check

Independent Variables	Dependent Variables					
	Bankrupt (HHI loan)			Bankrupt (HHI fund)		
	Coef.	Std. Error	P> z	Coef.	Std. Error	P> z
CAR	-0.0445***	0.0149	0.003	-0.0445***	0.0149	0.003
NPL	0.0329***	0.0106	0.002	0.0329***	0.0106	0.002
ROA	-0.0329***	0.0173	0.000	-0.0836***	0.0173	0.000
CR	0.0083***	0.0034	0.014	0.0083***	0.0034	0.014
HHI	-0.0042	0.0193	0.826	-0.0042	0.0206	0.837
REG	-0.4005	0.4867	0.411	-0.4000	0.4864	0.411
GDPG	-0.0250	0.0176	0.155	-0.0254	0.0177	0.153
CONS	-3.0841	0.6101	0.000	-3.0822	0.6191	0.000
Obs.	6,919	–	–	6,919	–	–
Groups	1,391	–	–	1,391	–	–
Wald Chi <sup>2</sup>	231.80	–	–	232.74	–	–
Prob > chi2	0.0000	–	–	0.0000	–	–

Note: \*\*\*, \*\*, and \* for 99%, 95%, and 90% confidence levels.

This study employs the HHI measurement not only based on assets but also on the amount of loans disbursed and third-party funds as a robustness check. Table 6 presents the regression results using these alternative calculations. The estimation results are consistent with the regression based on assets, indicating that competition does not significantly affect the probability of bankruptcy. However, increased competition tends to raise the odds of banks experiencing bankruptcy.

## 4. DISCUSSION

Bankruptcy is a condition that all parties seek to avoid, particularly financial institutions such as banks, as it can diminish public trust in banking services. This is particularly important for rural banks due to the extra work needed to educate rural people about banking services and to enhance financial inclusion. The results of this study indicate that financial ratios within the CAMEL framework still contribute significantly to the probability of rural banks experiencing bankruptcy. The study finds that a higher CAR significantly reduces the probability of rural bank bankruptcy. This result aligns with Barajas et al. (2023), who highlight that robust capitalization is crucial for maintaining operational stability and resilience. The findings are also consistent with Oduro (2024). However, Oduro (2024) emphasizes an additional factor,

specifically dividend payments to shareholders, which play a significant role in enhancing the ability of capital to maintain the financial stability of rural banks.

The results of this study indicate that higher NPL significantly increases the probability of bankruptcy risk among rural banks. This finding is consistent with Foley et al. (2023). However, Cebula et al. (2024) report contrasting results, potentially due to differences in sample characteristics. Their sample, which consists of small banks in the United States, can compensate for income losses resulting from defaulted loans through alternative revenue sources. Despite these differing findings, the current study underscores the critical importance of stringent loan monitoring to prevent asset quality deterioration and minimize bankruptcy risk.

This study confirms the role of profitability as a critical determinant in reducing the probability of bankruptcy, supporting findings from Bostandzic et al. (2022). Paule-Vianez et al. (2020) emphasize that profitability plays a fundamental role in enhancing banks' financial performance. These findings exhibit that higher profitability signals stronger charter value and discourages risky practices.

The finding exhibits that holding a high proportion of liquid assets increases bankruptcy probability among rural banks. This aligns with

Konovalova (2019), who argues that excessive liquidity incurs high opportunity costs. In contrast, Barajas et al. (2023) propose that liquidity buffers protect against failure, suggesting differences possibly attributable to varied regulatory frameworks or market environments.

This study has two key limitations that indicate future research opportunities. First, it relies on data from rural banks liquidated by the Indonesia Deposit Insurance Corporation, de-

spite the significantly higher number of rural banks undergoing consolidation (Otoritas Jasa Keuangan, 2024). Future studies should expand their scope to include bankrupt and acquired rural banks. Second, the population-average logistic regression model overlooks subject-specific variations, focusing instead on average changes across the sample. While this is valuable for policy-making, future research could adopt alternative methodologies to capture individual-level impacts more comprehensively.

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## CONCLUSIONS

The aim of this research is to explore the underlying drivers that contribute to bankruptcy risk in rural banks across Indonesia. This study investigates factors determining the probability of bankruptcy among rural banks in Indonesia by examining bank-specific, industry-specific, and external determinants. The findings reveal that internal bank-specific factors significantly increase the probability of bankruptcy, reinforcing the continued importance of the CAMEL framework as a predictive tool for bank sustainability. Specifically, rural banks with inadequate capital, low profitability, high non-performing loans, and excessive liquidity exhibit a higher probability of insolvency.

These results indicate that regulatory policies promoting the consolidation or merger of weaker rural banks with financially healthier institutions are necessary to mitigate bankruptcy risk. Additionally, the timely liquidation of rural banks showing persistent deficiencies within the CAMEL criteria is justified to prevent increased systemic costs. Such policy actions would ultimately contribute to a more stable and efficient rural banking environment in Indonesia.

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## REFERENCES

1. Agustin, H., Indrastuti, S., Tanjung, A. R., & Said, M. (2018). Ownership structure and bank performance. *Banks and Bank Systems*, 13(1), 80-87. [https://doi.org/10.21511/bbs.13\(1\).2018.08](https://doi.org/10.21511/bbs.13(1).2018.08)
2. Al-Azzam, M. (2019). Financing microfinance institutions: subsidies or deposit mobilisation. *Applied Economics*, 51(15), 1621-1633. <https://doi.org/10.1080/00036846.2018.1527467>
3. Al-Azzam, M., & Parmeter, C. (2021). Competition and micro-credit interest rates: international evidence. *Empirical Economics*, 60, 829-868. <https://doi.org/10.1007/s00181-019-01766-6>
4. Amanda, C. (2023). Rural banking spatial competition and stability. *Economic Analysis and Policy*, 78, 492-504. <https://doi.org/10.1016/j.eap.2023.03.021>
5. Amiquero, K. S., Wubben, E. F. M., van Dam, Y. K., & Trienekens, J. H. (2023). Success and failure factors in agricultural cooperatives. *International Journal on Food System Dynamics*, 14(1), 1-21. <https://doi.org/10.18461/ijfsd.v14i1.E1>
6. Banto, J. M., & Monsia, A. F. (2021). Microfinance institutions, banking, growth and transmission channel: A GMM panel data analysis from developing countries. *Quarterly Review of Economics and Finance*, 79, 126-150. <https://doi.org/10.1016/j.qref.2020.06.004>
7. Barajas, A., Krakovich, V., & López-Iturriaga, F. J. (2023). Survival of Russian banks: how efficient are the control measures? *European Journal of Management and Business Economics*, 32(3), 320-341. <https://doi.org/10.1108/EJMBE-12-2021-0329>
8. Basterretxea, I., Cornforth, C., & Heras-Saizarbitoria, I. (2022). Corporate governance as a key aspect in the failure of worker cooperatives. *Economic and Industrial Democracy*, 43(1), 362-387. <https://doi.org/10.1177/0143831X19899474>
9. Bostandzic, D., Irresberger, F., Juelsrud, R. E., & Wei, G. (2022). Do Capital Requirements Make Banks Safer? Evidence from a Quasinatural Experiment. *Journal of Financial and Quantitative Analysis*, 57(5), 1805-1833. <https://doi.org/10.1017/S0022109021000612>
10. Caballero-Montes, T. (2022). Integrating market conditions into regulatory decisions on microfinance interest rates: does competition matter? *Annals of Finance*, 19(2), 201-232. <https://doi.org/10.1007/s10436-022-00417-8>
11. Cebula, R. J., Foley, M., Downs, J., & Johansen, D. (2024). Examining small bank failures in the United States: an analysis using (coarsened exact matching) CEM. *Journal of Financial Economic Policy*, 16(2), 162-175. <https://doi.org/10.1108/JFEP-09-2023-0280>
12. Citterio, A. (2024). Bank failure prediction models: Review and outlook. *Socio-Economic Planning Sciences*, 92, 101818. <https://doi.org/10.1016/j.seps.2024.101818>
13. Das, S., & Pati, A. P. (2024). Market power and bank risks: insights from India and Bangladesh. *Journal of Financial Regulation and Compliance*, 32(4), 462-478. <https://doi.org/10.1108/JFRC-12-2023-0196>
14. Foley, M., Cebula, R. J., Downs, J., & Liu, X. (2023). Examining small bank failures in the United States: an application of the random effects parametric survival model. *Journal of Financial Economic Policy*, 15(2), 104-122. <https://doi.org/10.1108/JFEP-12-2022-0297>
15. Gaul, L., & Jones, J. (2021). CAM-ELS Ratings and Their Information Content. In *Office of the Comptroller of Currency*.
16. González, F. (2023). Creditor rights, bank competition, and stability: International evidence. *Journal of International Financial Markets, Institutions and Money*, 82, 101711. <https://doi.org/10.1016/j.intfin.2022.101711>
17. Hikouatcha, P., Djabatang, T., Njangang, H., & Nzongang, J. (2023). Effect of non-structural competition on the performance of microfinance institutions in sub-Saharan Africa. *SN Business & Economics*, 3(11), 1-23. <https://doi.org/10.1007/s43546-023-00583-5>
18. Hossain, S., Galbreath, J., Hasan, M. M., & Randøy, T. (2020). Does competition enhance the double-bottom-line performance of microfinance institutions? *Journal of Banking and Finance*, 113, 105765. <https://doi.org/10.1016/j.jbankfin.2020.105765>
19. Ioannou, S., Wójcik, D., & Dymski, G. (2019). Too-Big-To-Fail: Why Megabanks Have Not Become Smaller Since the Global Financial Crisis? *Review of Political Economy*, 31(3), 356-381. <https://doi.org/10.1080/09538259.2019.1674001>
20. Kang, C.-M., Wang, M.-C., & Lin, L. (2022). Financial Distress Prediction of Cooperative Financial Institutions – Evidence for Taiwan Credit Unions. *International Journal of Financial Studies*, 10(2), 30. <https://doi.org/10.3390/ijfs10020030>
21. Konovalova, N. (2019). Management of Liquidity and Profitability in Commercial Banks. In Kabashkin, I., Yatskiv, I., & Prentkovskis, O. (Eds.), *Reliability and Statistics in Transportation and Communication* (pp. 725-735). Cham: Springer. [https://doi.org/10.1007/978-3-030-12450-2\\_70](https://doi.org/10.1007/978-3-030-12450-2_70)
22. Maichanou, A., & Daouda, Y. H. (2021). Les faillites des institutions mutualistes ou coopératives d'épargne et de crédit au Niger [Bankruptcies of mutual or cooperative savings and credit institutions in Niger]. *RECMA*, 362(4), 98-116. (In French). <https://doi.org/10.3917/recma.362.0098>
23. Mendelson, S., & Rozas, D. (2024). Selected microfinance crises: past, present, and future. *Oxford Review of Economic Policy*, 40(1), 30-43. <https://doi.org/10.1093/oxrep/grad053>
24. Nisa, C. (2025). *Rural Banks in Indonesia*. <https://doi.org/10.5281/zenodo.15072813>

25. Oduro, R. (2024). Impact of re-capitalisation and dividend payout policies on financial sustainability of rural and community banks in Ghana. *Future Business Journal*, 10(1). <https://doi.org/10.1186/s43093-023-00292-3>
26. Otoritas Jasa Keuangan. (2024). *Roadmap Pengembangan dan Penguatan Industri BPR-BPRS 2024–2027 [Roadmap for Development and Strengthening of BPR-BPRS Industry 2024–2027]*. (In Indonesian). Retrieved from [https://www.perbarindo.or.id/wp-content/uploads/2024/05/Roadmap-Pengembangan-dan-Penguatan-Industri-BPR-da\\_240520\\_155717.pdf](https://www.perbarindo.or.id/wp-content/uploads/2024/05/Roadmap-Pengembangan-dan-Penguatan-Industri-BPR-da_240520_155717.pdf)
27. Pampel, F. C. (2020). *Logistic Regression: A Primer* (2nd ed.). SAGE Publications.
28. Paule-Vianez, J., Gutiérrez-Fernández, M., & Coca-Pérez, J. L. (2020). Prediction of financial distress in the Spanish banking system: An application using artificial neural networks. *Applied Economic Analysis*, 28(82), 69-87. <https://doi.org/10.1108/AEA-10-2019-0039>
29. Rashid, A., Hassan, M. K., Abdul, M., & Shah, R. (2020). On the role of Islamic and conventional banks in the monetary policy transmission in Malaysia: Do size and liquidity matter? *Research in International Business and Finance*, 52, 101123. <https://doi.org/10.1016/j.ribaf.2019.101123>
30. Ruiz, M. M., Estrada, A. L., Yoong, C., & Ormeño-Candelario, V. (2024). Bank size and type impact on efficiency: Evidence from Ecuador. *22nd LACCEI International Multi-Conference for Engineering, Education, and Technology*. <https://doi.org/10.18687/LACCEI2024.1.1.337>
31. Stewart, R., & Chowdhury, M. (2021). Banking sector distress and economic growth resilience: Asymmetric effects. *Journal of Economic Asymmetries*, 24(November 2020), e00218. <https://doi.org/10.1016/j.jeca.2021.e00218>
32. Suryandari, N. N. A., Yadnyana, I. K., Ariyanto, D., & Erawati, N. M. (2023). Determinant of fraudulent behavior in the Indonesian rural bank sector using the fraud hexagon perspective. *Banks and Bank Systems*, 18(4), 181-194. [https://doi.org/10.21511/bbs.18\(4\).2023.16](https://doi.org/10.21511/bbs.18(4).2023.16)
33. Tran, V. T., & Nguyen, H. (2024). Competition, liquidity creation and bank stability. *Accounting and Finance*, 64(2), 2111-2146. <https://doi.org/10.1111/acfi.13212>
34. Uddin, M. H., Akter, S., Mollah, S., & Al Mahi, M. (2022). Differences in bank and microfinance business models: An analysis of the loan monitoring systems and funding sources. *Journal of International Financial Markets, Institutions and Money*, 80(April), 101644. <https://doi.org/10.1016/j.intfin.2022.101644>
35. Vuong, G. T. H., Nguyen, Y. D. H., Nguyen, M. H., & Wong, W. K. (2024). Assessing the impact of macroeconomic uncertainties on bank stability: Insights from ASEAN-8 countries. *Heliyon*, 10(11), e31711. <https://doi.org/10.1016/j.heliyon.2024.e31711>
36. Wang, H., Sua, L. S., & Dolar, B. (2024). CAMELS-DEA in assessing the role of major factors in achieving higher efficiency levels: evidence from Turkish banks. *Applied Economics*, 57(27), 3844-3861. <https://doi.org/10.1080/00036846.2024.2339186>
37. Wu, Q., & Cole, R. A. (2024). Macroeconomic conditions and bank failure. *Journal of Forecasting*, 43(5), 1212-1234. <https://doi.org/10.1002/for.3066>
38. Zамore, S., Beisland, L. A., & Mersland, R. (2023). Excessive focus on risk? Non-performing loans and efficiency of microfinance institutions. *International Journal of Finance and Economics*, 28(2), 1290-1307. <https://doi.org/10.1002/ijfe.2477>