

## Capital Adequacy, Profitability, Credit Risk, and Operational Efficiency in Indonesian Banks' Price to Book Value

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### Abstract

*This study examines the associations between capital adequacy, profitability, credit risk, and operational efficiency and Price to Book Value (PBV) among 15 listed Indonesian conventional banks classified as Kelompok Bank Berdasarkan Modal Inti (KBMI) 3 and KBMI 4 during 2021–2024. PBV is the substantive valuation measure, whereas its natural logarithm,  $\ln(\text{PBV})$ , is the dependent variable in the regression analysis. The balanced panel comprises 60 bank-year observations reconstructed from the source thesis. The original pooled regression is retained as a benchmark and compared with bank fixed-effects and random-effects specifications. Model diagnostics support controlling for bank heterogeneity and common year effects. In the preferred bank and year fixed-effects model with bank-clustered standard errors, Capital Adequacy Ratio (CAR) is positively associated with  $\ln(\text{PBV})$  ( $B = 0.0596$ ,  $p = 0.0007$ ), while Return on Assets (ROA) ( $B = 0.2454$ ,  $p = 0.0600$ ), Non-Performing Loan (NPL) ( $B = -0.0689$ ,  $p = 0.4613$ ), and Operating Expenses to Operating Income Ratio (BOPO) ( $B = 0.0098$ ,  $p = 0.3846$ ) are not statistically significant at 5%. Wild cluster bootstrap inference corroborates support only for CAR ( $p = 0.0020$ ). The benchmark positive NPL coefficient ( $B = 0.122$ , conventional  $p = 0.040$ ) is therefore specification-sensitive and does not establish that credit deterioration improves valuation. The theoretical contribution is to distinguish financial signals and separate pooled between-bank patterns from conditional within-bank associations. These observational findings qualify uniform signaling predictions without identifying investor beliefs or causal effects.*

**Keywords:** BOPO, Capital Adequacy Ratio, Non-Performing Loan, Price to Book Value, Return on Assets

### 1. INTRODUCTION

The banking sector is one of the pillars of the financial system because it acts as a financial intermediary that connects parties with surplus funds and parties in need of funds. Banks mobilize public funds through savings accounts, current accounts, and time deposits and then channel them back as loans to individuals and businesses, thereby supporting business development, investment, and national economic growth. Accordingly, banking performance and stability are major concerns for policymakers, financial authorities, and capital market participants in assessing the condition and prospects of the banking industry ([Anwar et al., 2023](#)).

The 2021–2024 period represents a transition from pandemic disruption toward recovery for Indonesian banks, rather than a uniform improvement across all institutions and years. Earlier evidence documents changes in profitability and credit risk around the pandemic and differences between banking business models ([Chand et al., 2023](#); [Rohman et al., 2022](#); [Rosyadi et al., 2025](#); [Wahyuni et al., 2021](#)). Four indicators are relevant to this transition, such as the Capital Adequacy Ratio (CAR), Return on Assets (ROA), Non-Performing Loan (NPL), and Operating Expenses to Operating Income (BOPO). They describe capital strength, earnings generation, loan quality, and cost efficiency, respectively, and feature in research on bank soundness and financial performance ([Nurwulandari et al., 2022](#)). The Otoritas Jasa Keuangan/OJK bank-soundness framework and minimum-capital provisions provide the institutional context ([Otoritas Jasa Keuangan, 2017, 2022](#)). However, regulatory compliance and the explanatory power of accounting ratios for market valuation are different questions. A bank can satisfy prudential requirements without attracting a higher valuation multiple, while a change in its financial ratios can coincide with market-wide repricing. Accordingly, the regulatory references are used to contextualize the indicators rather than to establish a mechanical valuation rule. Figure 1 presents the industry-level development of these ratios over the observation period.

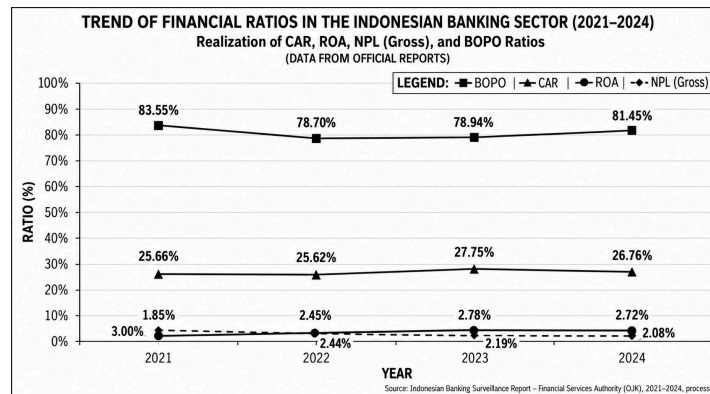


Figure 1. Trends in banking financial ratios, 2021–2024

Figure 1 reports an increase in industry CAR from 25.66% in 2021 to 26.76% in 2024 and an increase in ROA from 1.85% to 2.78% in 2023, followed by a slight decrease to 2.72% in 2024. The NPL ratio declined from 3.00% to 2.08%, whereas BOPO moved from 83.55% to 78.70%, 78.94%, and 81.45% across the four years. These series describe stronger aggregate capitalization and lower recorded problem-loan ratios, alongside an uneven recovery in profitability and operating efficiency. In particular, BOPO increased between 2022 and 2024, even though its final value remained below the 2021 level. The industry series are descriptive context, they are neither the averages of the 15 sampled banks nor direct evidence of how an individual bank's valuation responds to a financial ratio. This distinction matters because aggregate improvements can coexist with heterogeneous financial positions and share-price movements among listed banks.

Against this industry background, market valuation did not follow a common upward path. PBV compares the market price per share with book value per share and therefore connects market pricing with the accounting value attributable to shareholders (Fredy & Toni, 2020). A ratio above one indicates a market price above book value, while a ratio below one indicates a market price below book value but does not by itself demonstrate investment mispricing. Figure 2 illustrates substantial differences among the four large banks. Bank BRI's PBV increased from 2.17 in 2021 to 2.90 in 2023 before declining to 2.07 in 2024. Bank Mandiri's PBV increased from 1.73 to 2.07 between the first and last observation years. Bank BCA's PBV was 4.62 in 2021, reached 4.97 in both 2022 and 2023, and declined to 4.71 in 2024. Bank BNI's PBV increased from 1.05 to 1.37 in 2023 before decreasing to 1.03 in 2024. These examples motivate an analysis of bank-year variation rather than an inference from industry averages alone.

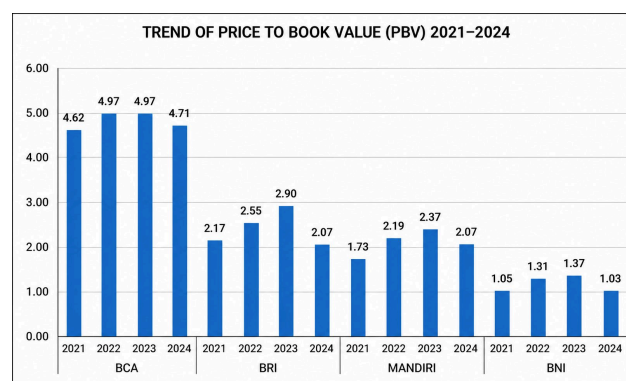


Figure 2. Development of bank PBV, 2021–2024

The central research problem is therefore the coexistence of improving aggregate banking indicators with uneven bank-level valuation multiples. This is a motivation for investigation, not proof that financial fundamentals and market prices are disconnected. Financial ratios summarize different dimensions of bank condition, while PBV incorporates expectations about future returns, risks, and the accounting equity base. Research on credit risk and market valuation suggests that adverse

loan-quality information can matter, but the relevant transmission need not be identical across banking systems ([Arhinful et al., 2025](#)). Research on company value also highlights the relevance of assets, growth opportunities, and leverage, including in nonbank samples ([Gunariato et al., 2023](#); [Whetyningtyas et al., 2025](#)). Accordingly, PBV is useful here as a market-to-accounting valuation measure, rather than as an automatically stable or complete representation of bank quality. A high multiple may reflect expected profitability or growth, whereas a low multiple can reflect risk, weak expected returns, or differences in the equity denominator. This study investigates whether the four financial indicators remain associated with valuation when repeated observations and persistent differences between banks are recognized.

CAR describes capital relative to risk-weighted assets, ROA summarizes earnings generated from assets, NPL measures recorded problem loans relative to lending, and BOPO captures operating expenses relative to operating income. Their economic roles are also distinct. Capital buffers can support resilience but may also accompany restrained lending or different risk choices ([Hendrawan et al., 2023](#)). Profitability and credit quality interact with bank characteristics and the economic environment ([Nurwulandari et al., 2022](#); [Rohman et al., 2022](#)), whereas problem loans are related to broader financial development and institutional conditions ([Ozili, 2019](#)). External conditions, including interest rates, inflation, and market sentiment, can also affect valuations. The source thesis focuses on the four internal ratios because the required information is consistently available in bank reports. This scope is retained, but it does not eliminate the omitted-variable risk. Bank fixed effects address time-invariant differences, and year effects absorb common annual conditions, neither control substitutes for bank-specific, time-varying explanatory variables. Findings from models of bank financial performance also caution against treating internal ratios as independent of their operating context ([Gusti et al., 2025](#)).

Previous empirical findings do not provide an unambiguous prediction for this setting. [Fredly and Toni \(2020\)](#) reported positive relationships between CAR and ROE and Indonesian bank PBV, but no statistically significant NPL relationship. [Siagian \(2023\)](#) examined market price and reported a role for capital adequacy, while operational efficiency and NPL were not significant. [Hidayat and Khoirunnisa \(2026\)](#) found that the CAR relationship with the price earnings ratio differed between state-owned and private banks. [Rosario and Mavuri \(2026\)](#) examined Indian banks using asset-quality and market-valuation measures. These studies differ in outcomes, ownership groups, national settings, and specifications; evidence for a share price, price earnings ratio, or profitability measure cannot be treated as an identical test of PBV. Related contributions by [Khoirunnisa et al. \(2025\)](#), [Ludwiga et al. \(2025\)](#), and [Widyantari et al. \(2026\)](#) concern company valuation in energy, transportation, logistics, and food and beverage settings, respectively. They inform the relevance of financial signals but do not establish their transferability to large conventional banks. A more specific unresolved issue is whether pooled associations among financial ratios and PBV persist after accounting for bank heterogeneity and common annual conditions in the recent Indonesian recovery period.

This study addresses this issue using a balanced panel of 15 listed conventional banks in the KBMI 3 and KBMI 4 categories during 2021–2024. Its objective is to estimate the conditional association of each ratio with PBV, operationalized as  $\ln(\text{PBV})$  in the regressions, and to examine how the conclusions depend on recognizing the panel structure. The setting is informative because banks with substantial core capital share a prudential framework but retain different franchises, ownership structures, loan portfolios, and market valuation levels. The four-year recovery period also contains common annual changes that may otherwise be attributed to bank ratios. Therefore, the contribution is contextual and analytical: the study differentiates capital, profitability, loan quality, and operating efficiency as signals and evaluates pooled versus within-bank evidence. It does not claim that the ratios, theoretical perspectives, or Indonesian setting are new. For management and investors, the analysis clarifies which associations are supported under the stated specification and which require caution. For theory, it examines the boundary between plausible signaling or agency explanations and the narrower evidence available from annual observational data.

## 2. LITERATURE REVIEW

### 2.1 Agency Theory, Signaling Theory, and Price to Book Value

Agency theory describes the delegation of decision-making authority from shareholders to managers and the resulting possibility of conflicting objectives and unequal access to information ([Panda & Leepsa, 2017](#)). In banking, this perspective directs attention to how managers allocate capital, select and monitor borrowers, generate earnings, and control operating expenses. The four ratios provide observable, incomplete indicators of these decisions rather than direct measures of agency costs. CAR concerns the balance between loss absorption and productive capital deployment, ROA concerns returns generated from the asset base, NPL concerns realized loan-quality problems, and BOPO concerns costs relative to operating income. A favorable value for one ratio does not establish effective stewardship across all four dimensions. For example, a bank can maintain a large capital buffer while earning low returns, or report strong earnings while accumulating credit exposures whose losses emerge later. The framework therefore motivates examining the ratios jointly, while recognizing that annual financial data do not directly reveal managers' incentives, monitoring effort, or private information. The regression tests associations consistent with these mechanisms, not the mechanisms themselves.

Signaling theory complements this agency perspective by explaining how observable information may reduce uncertainty when managers and external investors possess different information. Recent synthesis emphasizes the roles of signal characteristics and the context in which receivers interpret them ([Connelly et al., 2025](#)). In this study, capital strength, realized profitability, credit quality, and operating efficiency are considered separate dimensions of publicly available information. A higher ROA may indicate greater earnings generation, whereas a higher CAR may indicate resilience or a different allocation of Risk-Weighted Assets (RWA). Higher NPL generally signals weaker recorded loan quality, and higher BOPO signals a larger operating-cost burden. The interpretation can vary with disclosure credibility, business models, the economic cycle, and expectations already reflected in the prices. Evidence from other Indonesian sectors supports the examination of financial signals in their sectoral context ([Khoirunnisa et al., 2025](#); [Widyantari et al., 2026](#)). Agency theory explains why managerial choices require evaluation, and signaling theory explains why reported outcomes may convey information. Neither theory warrants the assumption that every ratio receives the same valuation weight or that an estimated coefficient reveals investors' reasoning.

PBV was calculated as the market price per share divided by the book value per share, with the book value per share obtained from total equity divided by shares outstanding. It measures market valuation relative to accounting equity rather than financial performance alone ([Fredy & Toni, 2020](#)). Differences in expected profitability, growth, risk, and accounting equity can all contribute to different multiples. Therefore, a high PBV is not conclusive evidence of efficient management, just as a low PBV is not conclusive evidence that shares are undervalued. Studies on bank asset quality and corporate financial disclosures illustrate why interpretation depends on the information set and the industry examined ([Arhinful et al., 2025](#); [Rosario & Mavuri, 2026](#); [Widyantari et al., 2026](#)). The PBV remains the substantive dependent variable of interest. The natural logarithm was used as the modeled outcome to accommodate its positive and asymmetric distribution. Consequently, the coefficient estimates concern differences in  $\ln(\text{PBV})$ , and their economic interpretation must be expressed as proportional valuation differences rather than additions to raw PBV.

### 2.2 The Effect of Capital Adequacy Ratio on Price to Book Value

CAR measures the ratio of regulatory capital to risk-weighted assets and indicates the resources available to absorb losses relative to risk exposure. Research on Indonesian banks shows that capital buffers are connected with profitability and risk-taking decisions, making their interpretation broader than a single measure of safety ([Hendrawan, Defung, & Wardhani, 2023](#)). The capital buffer setting is also relevant to differences between larger and smaller Indonesian banks ([Khoiriah, Rokhim, & Wibowo, 2026a](#); [Khoiriah, Rokhim, & Wibowo, 2026b](#)). Under signaling theory, stronger capitalization may communicate resilience and reduce uncertainty about a bank's ability to withstand losses. Under agency theory, however, managers must also deploy capital productively rather than

accumulate resources without adequate returns. These mechanisms can coexist: a larger buffer may support lending capacity, but it may also arise from a lower level or different composition of risk-weighted assets. CAR is therefore not interchangeable with ROA or operating efficiency. A positive valuation association is plausible when the market values the additional capacity to absorb risk, while a weak association is plausible where capitalization is already adequate or changes are not accompanied by profitable investment opportunities.

Empirical evidence reflects these competing mechanisms. [Freddy and Toni \(2020\)](#) reported a positive CAR relationship with PBV, whereas [Hidayat and Khoirunnisa \(2026\)](#) found differences across ownership groups using the price earnings ratio. [Rosario and Mavuri \(2026\)](#) considered financial ratios and market valuation in another national banking context. Capital structure and operating efficiency can also influence profitability through different channels; therefore, profitability findings should not be equated with direct evidence on PBV ([Mehzabin, Shahriar, Hoque, Wanke, & Azad, 2023](#)). Within the present sample, a high average capital position may reduce the contrast between clearly undercapitalized and adequately capitalized banks, even while changes in buffers retain economic relevance. The hypothesis below retains the positive directional prediction developed in the source thesis. It is evaluated as a conditional statistical association, and a nonsignificant estimate would indicate insufficient evidence under the model rather than demonstrate that capital adequacy is irrelevant to investors.

*H<sub>1</sub>: Capital Adequacy Ratio has a positive effect on Price to Book Value*

### **2.3 The Effect of Return on Assets on Price to Book Value**

ROA measures earnings relative to the asset base and summarizes a bank's ability to generate profits from the resources it controls. This dimension differs from capital adequacy, as a well-capitalized bank need not earn a high return on assets, and a profitable bank can face different future credit risks. Evidence on bank profitability emphasizes both efficiency and the wider financial environment ([Dsouza et al., 2022](#); [Gusti et al., 2025](#); [Rohman et al., 2022](#)). Since deposits and other funding finance a substantial share of bank assets, earnings generation reflects the combined outcome of asset allocation, funding costs, credit losses, and operating decisions. ROA is also used in research on bank soundness and performance ([Nurwulandari et al., 2022](#)). Within agency theory, profitability provides an observable outcome against which managerial stewardship can be assessed. Within signaling theory, it may convey information about earnings capacity. Neither interpretation implies that current profitability fully captures future returns or that its contemporaneous association with valuation is necessarily causal.

Studies in other Indonesian sectors report differing profitability–valuation relationships. [Khoirunnisa et al. \(2025\)](#) consider financial and macroeconomic indicators in energy companies, [Ludwiga et al. \(2025\)](#) report a positive profitability relationship in transportation and logistics, and [Widyantari et al. \(2026\)](#) report a positive ROA relationship in food and beverage companies. [Whetyningtyas et al. \(2025\)](#) report a nonsignificant profitability relationship in their company-value setting. These results motivate, but do not resolve, the banking hypothesis because sector, period, valuation measure, and model design differ. The expected sign is positive: higher earnings generated from assets can be consistent with stronger expected returns relative to accounting equity. At the same time, persistent differences between highly profitable and less profitable banks can produce a pooled association even when year-to-year changes within a bank provide weaker evidence. The panel analysis therefore distinguishes the directional expectation from the precision and stability of its empirical estimate.

*H<sub>2</sub>: Return on Assets has a positive effect on Price to Book Value*

### **2.4 The Effect of Non-Performing Loan on Price to Book Value**

NPL measures recorded problem loans relative to total loans and capture one aspect of credit risk. Problem loans arise when borrowers do not meet contractual repayment obligations, although

classification and measurement depend on the applicable reporting framework. The source thesis uses the reported ratio rather than individual loan histories. Research links NPL to borrower conditions, bank characteristics, and the broader economy ([Peday et al., 2026](#); [Radivojević & Jovović, 2017](#)). A deterioration in loan quality can require greater provisioning, reduce earnings, and weaken a bank's capacity to extend credit ([Arhinful et al., 2025](#); [Rohman et al., 2022](#)). Studies of smaller US banks and a small-island banking system also show why context matters for the relationship between problem loans and bank outcomes ([Skorburg & Shenai, 2021](#); [Chand et al., 2023](#)). Under agency theory, loan quality is relevant to screening and monitoring; under signaling theory, recorded NPL provides information about asset quality. The ratio does not directly measure all latent credit losses, provision coverage, or investors' expectations.

The expected negative association between NPLs and valuation is because weaker asset quality reduces expected shareholder returns or increases uncertainty. [Arhinful et al. \(2025\)](#) analyze credit risk and investor confidence, whereas [Rosario and Mavuri \(2026\)](#) examine asset quality and market valuation using Indian banking data. [Freddy and Toni \(2020\)](#) and [Siagian \(2023\)](#) reported non-significant NPL relationships in Indonesian valuation settings. These differences do not justify treating an unexpected positive estimate as evidence that the market rewards poor loans. Such a coefficient may reflect correlated bank characteristics, the timing of loss recognition, omitted lending or provisioning variables, or the relative contribution of between-bank and within-bank variations. The hypothesis retains the negative direction specified in the original thesis. It is tested with the other three ratios held constant and bank and year effects included in the preferred specification. Neither an NPL level below a prudential reference point nor a nonsignificant coefficient demonstrates that credit risk has ceased to be important.

*H<sub>3</sub>: Non-Performing Loan has a negative effect on Price to Book Value*

## 2.5 The Effect of Operating Expenses to Operating Income on Price to Book Value

BOPO measures operating expenses relative to operating income and is interpreted as a cost efficiency indicator, with a higher ratio indicating a larger cost burden per unit of operating income ([Nurwulandari et al., 2022](#)). Operating costs and income reflect a bank's business mix, funding structure, service provision, and current operating conditions. Evidence on Indian banks links efficiency with profitability, but this outcome differs from market valuation ([Dsouza et al., 2022](#)). Related Asian evidence examines operating efficiency together with capital structure and non-interest income ([Mehzabin et al., 2023](#)). Indonesian research by [Malik et al. \(2024\)](#) relates BOPO and digital banking to financial performance; [Sari et al. \(2022\)](#) examine bank efficiency and competition. These contributions support the relevance of operating costs without establishing an identical coefficient for PBV. Agency theory links cost control to the stewardship of shareholders' resources, while signaling theory suggests that a sustained cost burden may convey information about future earnings capacity.

The expected BOPO association is negative because, all else being equal, a greater operating-cost burden can reduce the earnings available to shareholders. However, a high ratio can also accompany spending, whose benefits emerge later, and accounting overlap between ROA and BOPO may affect their conditional estimates. [Malik et al. \(2024\)](#) and [Nurwulandari et al. \(2022\)](#) provide evidence concerning financial performance, while [Siagian \(2023\)](#) reports no significant relationship between operational efficiency and market price. Their different outcomes and specifications should be made explicit rather than being pooled into a claim of universal valuation effects. [Fajar and Umanto \(2017\)](#) further show the importance of bank-specific and macroeconomic conditions for Indonesian credit risk, providing context for the broader operating environment rather than a direct test of BOPO and PBV. The following hypothesis retains the negative directional prediction of the source thesis. Its evaluation considers whether the association remains distinguishable from zero after controlling for the other ratios and panel structure. Figure 3 presents the four hypothesized relationships in this study.

*H<sub>4</sub>: Operating Expenses to Operating Income has a negative effect on Price to Book Value*

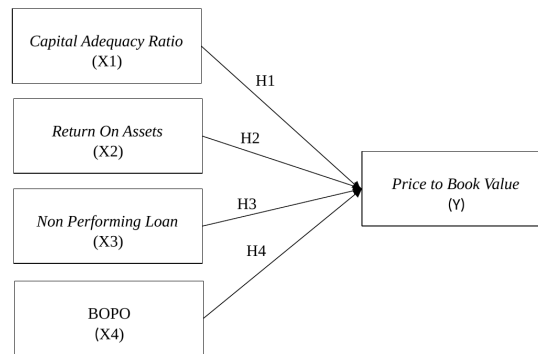


Figure 3. Research model

Figure 3 illustrates the conceptual framework examining the effects of Capital Adequacy Ratio (CAR), Return on Assets (ROA), Non-Performing Loan (NPL), and Operating Expenses to Operating Income Ratio (BOPO) on Price to Book Value (PBV). The four independent variables are hypothesized to influence PBV, which serves as the dependent variable.  $H_1$ ,  $H_2$ ,  $H_3$ , and  $H_4$  represent the respective relationships between each independent variable and PBV.

### 3. RESEARCH METHODOLOGY

This study uses a quantitative observational design and secondary annual financial-statement and share-market data for 2021–2024. The source thesis obtained the information from the Indonesia Stock Exchange and the official websites of the sampled banks through documentation and a review of relevant academic and institutional publications. The bank-year dataset is reconstructed from Appendix 8 of that thesis, preserving its reported values and bank-year identities. The reconstruction yields 15 banks observed in each of the four years, with no duplicate bank-year records or missing values for the five study variables. Purposive selection retains listed conventional banks in either KBMI 3 or KBMI 4, these categories are alternatives rather than simultaneous requirements. The original screening excludes KBMI 1 and KBMI 2 banks and one non-conventional bank, as summarized in Table 1. The thesis also specifies rupiah-denominated statements. This criterion concerns the source data used for the sample and is not treated as a separate exclusion count, where Table 1 does not report one. Selection is not random; therefore, statistical conclusions are conditional on the sampled institutions and cannot be assumed to represent all Indonesian banks.

The KBMI classifies banks by core capital. Under OJK Regulation No. 12/POJK.03/2021, KBMI 3 covers core capital above IDR 14 trillion up to IDR 70 trillion, while KBMI 4 covers core capital above IDR 70 trillion ([Otoritas Jasa Keuangan, 2021](#)). The thesis focuses on these groups to examine relatively large conventional institutions under a common banking framework. This restriction improves contextual comparability but does not make the banks homogeneous in franchise value, ownership, business mix, lending exposure, or valuation. It also does not automatically remove size-related bias. The panel specification therefore includes bank effects to address persistent unobserved differences. Islamic banks are excluded because their business arrangements and financing-quality measures differ, including the use of non-performing financing rather than the conventional NPL indicator. The study retains the group assignments and screening reported in the thesis, it does not assert that every bank's KBMI classification was unchanged in every year. Table 1 presents the original sample-selection counts.

Table 1. Sample selection criteria

| No                    | Description                                                         | Total |
|-----------------------|---------------------------------------------------------------------|-------|
| 1                     | Banking sector companies listed on the IDX during 2021–2024         | 47    |
| 2                     | Banking sector companies in the KBMI 2 category                     | (8)   |
| 3                     | Banking sector companies in the KBMI 1 category                     | (23)  |
| 4                     | Banking sector companies that are not conventional commercial banks | (1)   |
| Total research sample |                                                                     | 15    |

| No                                                          | Description | Total |
|-------------------------------------------------------------|-------------|-------|
| Observation years                                           |             | 4     |
| Total observations processed (n sample × observation years) |             | 60    |

Table 1 shows that the research sample consists of 15 conventional commercial banks over 4 observation years, yielding 60 observations, namely Bank Central Asia Tbk., Bank Rakyat Indonesia Tbk., Bank Mandiri Tbk., Bank Negara Indonesia Tbk., Bank CIMB Niaga Tbk., Bank Pan Indonesia Tbk., Bank Danamon Indonesia Tbk., Bank Permata Tbk., Bank Tabungan Negara Tbk., Bank OCBC NISP Tbk., Bank Mega Tbk., Bank Pembangunan Daerah Jawa Barat, Bank Pembangunan Daerah Jawa Timur, Bank BTPN Tbk., and PT Bank Woori Saudara Indonesia 1906 Tbk. The operationalization of the research variables is presented in Table 2.

Table 2. Variable operationalization

| Variables                                        | Variable Definition                                                                                                                                        | Formula                                                                     | Formula Source         |
|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|------------------------|
| Price to Book Value ( $Y$ )                      | A market ratio that measures a firm's share price relative to its book value, thereby reflecting the market's assessment of the firm (Freddy & Toni, 2020) | $PBV = \text{Share Price per Share} / \text{Book Value per Share}$          | Freddy and Toni (2020) |
| Capital Adequacy Ratio ( $X_1$ )                 | A financial ratio used to assess the adequacy of bank capital in facing risks arising from operational activities (Hendrawan et al., 2023)                 | $CAR = \text{Capital} / \text{Risk-Weighted Assets (ATMR)} \times 100\%$    | OJK (2022)             |
| Return on Assets ( $X_2$ )                       | A profitability ratio measuring earnings generated relative to the bank's asset base (Dsouza et al., 2022)                                                 | $ROA = \text{Profit Before Tax} / \text{Average Total Assets} \times 100\%$ | OJK (2017)             |
| Non-Performing Loan ( $X_3$ )                    | The level of problem loans, namely loans that no longer generate interest or principal payments in accordance with the agreed terms (Peday et al., 2026)   | $NPL = \text{Total Non-Performing Loans} / \text{Total Loans} \times 100\%$ | OJK (2017)             |
| Operating Expenses to Operating Income ( $X_4$ ) | The ratio of the operating expenses incurred by a bank to the operating income it earns (Nurwulandari et al., 2022)                                        | $BOPO = \text{Operating Expenses} / \text{Operating Income} \times 100\%$   | OJK (2017)             |

The original thesis estimated a pooled multiple linear regression using IBM SPSS Statistics 22. This analysis is retained as a reproducible benchmark rather than treated as sufficient for repeated bank observations. The appendix data reproduce the reported descriptive statistics and, to rounding, the benchmark coefficients, F statistic, and adjusted  $R^2$ . Descriptive summaries follow the distinction between data description and distributional testing (Mishra et al., 2019). The benchmark Kolmogorov–Smirnov, variance inflation factor, Glejser, scatterplot, and Durbin–Watson results are retained for transparency. However, failure to reject a diagnostic null does not prove an assumption, Variance Inflation Factor (VIF) values do not establish the absence of correlated regressors, and normal residuals do not establish independent bank-year observations (Ernst & Albers, 2017; Kim, 2019). The Durbin–Watson ranges from zero to four; therefore, the original rule based on  $-2$  and  $+2$  is invalid. The panel reanalysis is calculated in Python using the thesis observations. Pooled OLS, bank fixed effects, and feasible random effects are compared; the random-effects estimator uses a balanced-panel variance-component transformation. A pooled-versus-bank-effects F test and a Breusch–Pagan random-intercept LM test examine the relevance of bank heterogeneity. A correlated-random-effects specification adds bank means of the four ratios and tests them jointly with bank-clustered inference,

rather than relying on an invalid Hausman covariance difference (Wooldridge, 2019). Common year indicators are also examined. The preferred specification includes bank and year fixed effects. Standard errors are clustered by bank, allowing heteroscedasticity and unrestricted within-bank residual dependence, with the finite-sample multiplier  $[15/14] \times [59/(60-K)]$  and a *t* distribution with 14 degrees of freedom for individual coefficients, *K* counts all estimated parameters (Abadie et al., 2023; MacKinnon et al., 2023). Because 15 clusters remain a small number, individual hypotheses are additionally assessed using a null-imposed, two-sided wild cluster bootstrap with 9,999 replications, Webb six-point weights, and seed 7342026 (Pustejovsky & Tipton, 2018; Roodman et al., 2019). The panel model is expressed in Formula (1).

$$\ln(PBV_{it}) = \alpha_i + \lambda_t + \beta_1 CAR_{it} + \beta_2 ROA_{it} + \beta_3 NPL_{it} + \beta_4 BOPO_{it} + \varepsilon_{it} \quad (1)$$

In Formula 1, *i* denotes the bank and *t* denotes the year. PBV is the valuation ratio,  $\ln(PBV)$  is its natural logarithm and the modeled dependent variable. The bank intercept  $\alpha_i$  captures time-invariant bank characteristics, while  $\lambda_t$  captures common year effects, with one year omitted as the reference category. CAR, ROA, NPL, and BOPO enter in percentage-point units, as recorded in the thesis. Thus, a one-percentage-point increase in a ratio corresponds to  $\beta$  additional log points of PBV, holding the other regressors and fixed effects constant; the associated proportional difference is  $100[\exp(\beta)-1]\%$ . The model does not include the logarithms of the four explanatory ratios. Directional hypotheses are assessed using two-sided 5% tests and the predicted sign: a statistically nonsignificant estimate leaves a hypothesis unsupported rather than proving a zero relationship. Cluster-robust and bootstrap results take priority over conventional pooled *p* values. Within *R*<sup>2</sup> describes fit for the panel specification, whereas the original adjusted *R*<sup>2</sup> describes only the benchmark's  $\ln(PBV)$  outcome. None of these fit measures identifies causality or a specific investor-perception mechanism (Ernst & Albers, 2017).

#### 4. RESULTS AND DISCUSSION

Table 3 presents the original descriptive statistics for the 60 bank-year observations, which are reproduced from the data reconstructed from the thesis. PBV is reported in its original ratio scale here, the regression outcome is  $\ln(PBV)$ . Tables 4–8 retain the thesis's pooled-regression diagnostics and output as a benchmark. The panel estimates reported after Table 8 govern the revised hypothesis assessment.

Table 3. Descriptive statistics

| Variables | N  | Minimum | Maximum | Mean      | Std. Deviation |
|-----------|----|---------|---------|-----------|----------------|
| PBV       | 60 | 0.43    | 4.97    | 1.3297    | 1.15101        |
| CAR       | 60 | 17.9105 | 35.2907 | 25.007828 | 4.5546639      |
| ROA       | 60 | 0.7246  | 4.8551  | 2.161937  | 0.9988109      |
| NPL       | 60 | 0.9294  | 4.4800  | 2.281110  | 0.8435105      |
| BOPO      | 60 | 40.1770 | 90.2000 | 70.414455 | 12.8602946     |

Table 3 reports the PBV between 0.43, observed for Bank OCBC NISP in 2022, and 4.97, observed for Bank Central Asia in 2022 and 2023, with a mean of 1.3297 and a standard deviation of 1.15101. CAR ranges from 17.9105 for Bank Pembangunan Daerah Jawa Barat in 2021 to 35.2907 for Bank Permata in 2023, with a mean of 25.007828 and a standard deviation of 4.5546639. ROA ranges from 0.7246 for Bank Permata in 2021 to 4.8551 for Bank Central Asia in 2024, with a mean of 2.161937 and a standard deviation of 0.9988109. The NPL ranges from 0.9294 for Bank Woori Saudara Indonesia in 2021 to 4.4800 for Bank Pembangunan Daerah Jawa Timur in 2021, with a mean of 2.281110 and a standard deviation of 0.8435105. BOPO ranges from 40.1770 for Bank Central Asia in 2024 to 90.2000 for Bank Pembangunan Daerah Jawa Barat in 2024, with a mean of 70.414455 and a standard deviation of 12.8602946. These statistics describe dispersion without establishing that the mean is representative, because it exceeds its standard deviation. Across all 60 observations,  $\ln(PBV)$  has a mean of 0.02731, and a standard deviation of 0.66994. The overall CAR

dispersion is 4.5547 percentage points, but its bank-demeaned standard deviation is only 1.3408. This distinction is important because pooled and fixed-effects estimates draw on different sources.

The original pooled model produced a Kolmogorov–Smirnov significance value of 0.008 before the outcome transformation and 0.200 after the PBV was transformed into  $\ln(\text{PBV})$  (Table 4). The transformation is feasible because all observed PBV values are positive. These diagnostics explain the choice of outcome scale in this study but do not establish the independence or correct specification of regression errors. In particular, a reported normality-test value above 0.05 indicates that the test does not reject its null at that threshold, it does not prove exact normality or remove the need to account for repeated observations. Therefore, the revised analysis consistently retains the logged outcome and addresses the panel structure separately.

Table 4. Results of the One-Sample Kolmogorov-Smirnov Test

| Description                        | Before Transformation | After LN Transformation |
|------------------------------------|-----------------------|-------------------------|
| N                                  | 60                    | 60                      |
| Normal Parameters: Mean            | 0.0000000             | 0.0000000               |
| Normal Parameters: Std. Deviation  | 0.58757093            | 0.33455163              |
| Most Extreme Differences: Absolute | 0.135                 | 0.055                   |
| Most Extreme Differences: Positive | 0.135                 | 0.055                   |
| Most Extreme Differences: Negative | -0.079                | -0.047                  |
| Test Statistic                     | 0.135                 | 0.055                   |
| Asymp. Sig. (2-tailed)             | 0.008                 | 0.200                   |
| Conclusion                         | Not normal            | Normal                  |

Table 5 retains the benchmark's multicollinearity and Glejser diagnostics. The tolerance values exceed 0.10 and the VIF values are below 10, suggesting no extreme collinearity under those conventional reference points. This is not evidence that the ratios are statistically unrelated or that their partial coefficients will be stable across specifications. The Glejser p values are 0.494 for CAR, 0.692 for ROA, 0.945 for NPL, and 0.083 for BOPO; hence, the test does not reject its specified null at 5%. Limited power and the repeated-observation design nevertheless prevent interpreting these values as proof of homoscedastic and independent errors. Bank-clustered standard errors are therefore used in the panel analysis regardless of these benchmark diagnostics.

Table 5. Results of the multicollinearity test and heteroscedasticity test (Glejser)

| Variables | Tolerance | VIF   | <i>t</i> (Glejser) | Sig. (Glejser) | Remarks                                            |
|-----------|-----------|-------|--------------------|----------------|----------------------------------------------------|
| CAR       | 0.560     | 1.786 | -0.689             | 0.494          | Free from multicollinearity and heteroscedasticity |
| ROA       | 0.354     | 2.828 | -0.398             | 0.692          | Free from multicollinearity and heteroscedasticity |
| NPL       | 0.850     | 1.176 | 0.069              | 0.945          | Free from multicollinearity and heteroscedasticity |
| BOPO      | 0.304     | 3.289 | -1.768             | 0.083          | Free from multicollinearity and heteroscedasticity |

Figure 4 reproduces the original pooled-model residual scatterplot. Its visual pattern does not show an obvious systematic widening or narrowing, but visual inspection cannot establish that the errors have constant variance or are independent within banks. The figure is retained as a descriptive diagnostic of the benchmark. The panel inference instead permits heteroscedasticity and within-bank residual correlation through bank clustering, with the limitations associated with only 15 clusters stated explicitly.

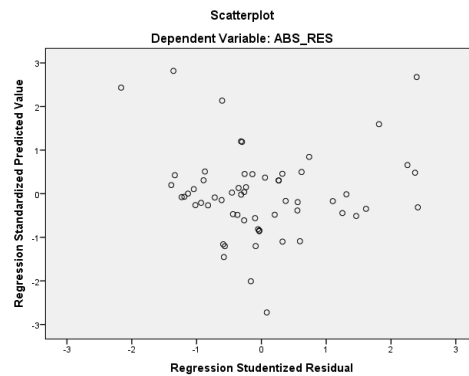


Figure 4. Scatterplot of the heteroscedasticity test

Table 6. Model summary (coefficient of determination and Durbin-Watson)

| Model | R     | R-Square | Adjusted R-Square | Std. Error of the Estimate | Durbin-Watson |
|-------|-------|----------|-------------------|----------------------------|---------------|
| 1     | 0.866 | 0.751    | 0.732             | 0.34650                    | 1.076         |

Table 6 reports the benchmark Durbin–Watson statistic of 1.076. A value between  $-2$  and  $+2$  is not a valid criterion for excluding autocorrelation because the range is zero–four. In addition, a statistic computed over stacked bank-year records depends on record ordering and does not provide sufficient panel serial correlation assessment. Therefore, the original claim that all regression assumptions were satisfied was withdrawn. Table 7 retains the conventional pooled coefficients and standard errors solely to document the thesis benchmark; the subsequent panel analysis and robust inference determine the revised conclusions.

Table 7. Results of multiple linear regression and *t*-test

| Variables  | B      | Std. Error | Beta   | <i>t</i> | Sig.  | Decision       |
|------------|--------|------------|--------|----------|-------|----------------|
| (Constant) | -0.134 | 0.868      |        | -0.154   | 0.878 |                |
| CAR        | -0.008 | 0.013      | -0.051 | -0.570   | 0.571 | $H_1$ rejected |
| ROA        | 0.478  | 0.076      | 0.712  | 6.291    | 0.000 | $H_2$ accepted |
| NPL        | 0.122  | 0.058      | 0.154  | 2.104    | 0.040 | $H_3$ rejected |
| BOPO       | -0.014 | 0.006      | -0.262 | -2.147   | 0.036 | $H_4$ accepted |

Table 7 yields the original pooled benchmark in Formula (2). Its dependent variable is explicitly  $\ln(\text{PBV})$ , not raw PBV. The coefficients are rounded as in the source output.

$$\ln(\text{PBV}) = -0.134 - 0.008\text{CAR} + 0.478\text{ROA} + 0.122\text{NPL} - 0.014\text{BOPO} \quad (2)$$

In Formula 2, the intercept of  $-0.134$  is a predicted log valuation at zero values of all four ratios, an extrapolation outside the observed banking data rather than a negative predicted PBV. The coefficient represents a conditional log-point difference for a one-percentage-point difference in the corresponding ratio. Using the rounded coefficients, the proportional differences are approximately  $-0.8\%$  for CAR,  $+61.3\%$  for ROA,  $+13.0\%$  for NPL, and  $-1.4\%$  for BOPO, calculated as  $100[\exp(B) - 1]$ . These are model associations, not changes that are guaranteed to occur following managerial intervention. The large benchmark ROA association also warrants attention to between-bank differences, as banks with persistently high profitability may have persistently high franchise valuations. Exponentiating a fitted log outcome provides a conditional median interpretation under appropriate error assumptions, an arithmetic-mean prediction of raw PBV would additionally require a retransformation adjustment. This study does not present such mean predictions.

Under the conventional pooled inference in Table 7, CAR is not significant ( $B = -0.008$ ,  $p = 0.571$ ), ROA is positive and significant ( $B = 0.478$ ,  $p = 0.000$ ), NPL is positive and significant ( $B = 0.122$ ,  $p = 0.040$ ), and BOPO is negative and significant ( $B = -0.014$ ,  $p = 0.036$ ). Values displayed by

SPSS as 0.000 were interpreted as  $p < 0.001$ , not as probabilities equal to zero. These benchmark results support the predicted signs for  $H_2$  and  $H_4$  under the original model, leave  $H_1$  unsupported, and contradict the negative direction of  $H_3$ . They do not establish that a higher NPL improves investors' confidence. Merely clustering the pooled model by bank changes the NPL  $p$ -value to 0.171 and the BOPO  $p$ -value to 0.139, while the CAR  $p$ -value is 0.632 and the ROA  $p$ -value is below 0.001. This comparison shows why conventional pooled significance is insufficient for the panel design. Table 8 presents the benchmark joint tests.

Table 8. F-test results (ANOVA)

| Model      | Sum of Squares | df | Mean Square | F      | Sig.  |
|------------|----------------|----|-------------|--------|-------|
| Regression | 19.877         | 4  | 4.969       | 41.388 | 0.000 |
| Residual   | 6.604          | 55 | 0.120       |        |       |
| Total      | 26.481         | 59 |             |        |       |

Table 8 reports the original pooled F statistic of 41.388 with  $p < 0.001$ . The benchmark adjusted  $R^2$  of 0.732 refers to the variation in  $\ln(\text{PBV})$ , not directly to the variation in raw PBV. Neither statistic validates the independence assumption or implies that the remaining variation is fully explained by omitted variables. The reconstructed data reproduce  $R^2 = 0.750627$ , adjusted  $R^2 = 0.732491$ , and  $F = 41.388350$ . In the panel comparison, the bank-effects F test rejects pooling,  $F(14, 41) = 12.657$ ,  $p < 0.001$ . The random-intercept LM statistic is 60.768, also  $p < 0.001$ . Feasible random effects produce coefficients of 0.0201 for CAR, 0.3539 for ROA, 0.1184 for NPL, and  $-0.0026$  for BOPO. However, an ordinary Hausman comparison yields a covariance-difference matrix with negative eigenvalues and is not used as a valid chi-square selection test. The bank-mean terms in the correlated-random-effects specification are jointly significant using bank-clustered inference,  $F(4, 14) = 7.579$ ,  $p = 0.0018$ , including year indicators gives  $F(4, 14) = 7.623$ ,  $p = 0.0018$ . This evidence favors allowing bank heterogeneity to be correlated with the observed ratios. Bank-only fixed effects produce CAR = 0.0368 (clustered  $p = 0.0566$ ), ROA = 0.1273 ( $p = 0.3509$ ), NPL = 0.0560 ( $p = 0.5230$ ), and BOPO =  $-0.0055$  ( $p = 0.5785$ ), with within  $R^2 = 0.2028$ . Adding common year indicators improves fit, with the conventional nested  $F(3, 38) = 4.516$ ,  $p = 0.0084$ , and a bank-clustered year-term test of  $F(3, 14) = 3.634$ ,  $p = 0.0397$ . The preferred bank and year fixed-effects estimates are CAR = 0.05962 (clustered SE = 0.01379,  $p = 0.0007$ ; 95% CI [0.03004, 0.08920]), ROA = 0.24536 (SE = 0.11993,  $p = 0.0600$ , CI  $[-0.01186, 0.50258]$ ), NPL =  $-0.06893$  (SE = 0.09100,  $p = 0.4613$ , CI  $[-0.26411, 0.12624]$ ), and BOPO = 0.00985 (SE = 0.01097,  $p = 0.3846$ , CI  $[-0.01369, 0.03338]$ ). Its within  $R^2$ , measured relative to bank-demeaned  $\ln(\text{PBV})$ , is 0.4123, the four slopes are jointly significant in the clustered Wald test,  $F(4, 14) = 10.378$ ,  $p = 0.0004$ . Null-imposed wild cluster bootstrap  $p$  values are 0.0020, 0.1152, 0.4185, and 0.3344 for CAR, ROA, NPL, and BOPO, respectively. Thus, only  $H_1$  receives support at 5% in the preferred specification,  $H_2$ – $H_4$  remain unsupported. The contrast with the pooled benchmark is part of the substantive result, not a reason to select the model that reproduces the original significance pattern.

#### 4.1 The Effect of Capital Adequacy Ratio on Price to Book Value

The original pooled CAR estimate is negative and not significant ( $B = -0.008$ ,  $p = 0.571$ ), but this is insufficient to conclude that capital adequacy is irrelevant to valuation. The sample consists of relatively large banks with CAR values between 17.9105% and 35.2907%, so it contains no direct comparison with severely undercapitalized banks. Moreover, the overall standard deviation of 4.5547 percentage points is substantially larger than the bank-demeaned standard deviation of 1.3408 points. Restricted within-bank variation can reduce precision, while persistent differences between banks can affect the pooled estimate. The bank-only fixed-effects coefficient is positive but not significant at 5% ( $B = 0.0368$ , clustered  $p = 0.0566$ ). With bank and year effects included, CAR is positively associated with  $\ln(\text{PBV})$  ( $B = 0.05962$ , clustered  $p = 0.0007$ , wild bootstrap  $p = 0.0020$ ). A one-percentage-point higher CAR corresponds to approximately 6.14% higher PBV under this conditional log specification.  $H_1$  is supported in the preferred model, although the difference across specifications requires caution about the role of common annual conditions. The findings demonstrate why nonsignificance in one regression should not be interpreted as proof of an economically absent relationship.

Theoretically, stronger capitalization can be consistent with a resilience signal, while agency theory emphasizes the productive allocation of resources entrusted to management. These interpretations should be evaluated collectively in future studies to confirm their validity. A higher CAR may reflect additional capital, lending contracts, changes in risk weights, or a different asset mix. The regression does not separate these channels and, therefore, cannot show that investors specifically reward larger loss-absorption buffers during crises. The minimum capital framework provides an institutional context, but compliance does not mechanically explain the coefficients (OJK, 2022). Research on capital buffers and risk-taking identifies the possibility of different profitability and lending implications (Hendrawan, Defung, & Wardhani, 2023; Khoiriah, Rokhim, & Wibowo, 2026a; Khoiriah, Rokhim, & Wibowo, 2026b). The preferred positive association is directionally compatible with Freddy and Toni (2020) and Siagian (2023), capital-related market-price evidence, but their outcomes and specifications are not identical. Hidayat and Khoirunnisa (2026) report ownership-dependent results for the price earnings ratio, while Rosario and Mavuri (2026) examine another banking system in a different country. Differences among these studies remain possible consequences of outcome measurement, sample composition, and modeling choices rather than evidence that any one explanation has been established. This study aims to qualify the original null interpretation through explicit panel comparisons.

#### 4.2 The Effect of Return on Assets on Price to Book Value

The pooled benchmark reports a positive ROA association ( $B = 0.478$ , conventional  $p < 0.001$ ), which remains significant when only the pooled standard errors are clustered by bank. However, the bank-only fixed-effects estimate is smaller and less precise ( $B = 0.1273$ , clustered  $p = 0.3509$ ). In the preferred bank and year fixed-effects model, ROA remains positive ( $B = 0.24536$ ) but is not significant at 5% using clustered inference ( $p = 0.0600$ ) or the wild cluster bootstrap ( $p = 0.1152$ ). Its clustered 95% confidence interval includes zero. Therefore,  $H_2$  is unsupported under the preferred specification, although a positive relationship remains compatible with the point estimate. This distinction is important: the analysis does not establish that profitability has no economic relevance, but it also does not justify describing its within-bank association as robustly significant. The contrast suggests that the strong pooled pattern partly reflects persistent differences among banks and the annual conditions included in the panel model.

Agency theory makes earnings generation relevant to the assessment of managerial stewardship, whereas signaling theory makes reported profitability a plausible source of information about future returns. These theoretical expectations remain reasonable even when a particular estimate lacks sufficient precision. Evidence by Ludwiga et al. (2025) and Widyantari et al. (2026) reports positive profitability–valuation relationships in the transportation and logistics and food and beverage companies, respectively. Khoirunnisa et al. (2025) further places company valuation within a combination of financial and macroeconomic indicators. These studies support contextual comparisons, not the claim that the same effect is established in large banks. Whetyningtyas et al. (2025) report a nonsignificant profitability relationship, illustrating variation in empirical evidence. With only four years of observations per bank, the present study cannot distinguish persistent earning capacity from temporary accounting performance in detail. Accordingly, profitability should be discussed as a theoretically relevant signal whose estimated association depends on the level of comparison and the controls included, rather than as the uniquely dominant determinant of bank valuation.

#### 4.3 The Effect of Non-Performing Loan on Price to Book Value

The positive NPL coefficient in the benchmark ( $B = 0.122$ , conventional  $p = 0.040$ ) is opposite to  $H_3$  and must not be interpreted as evidence that worsening loan quality increases firm value. When the same pooled model uses bank-clustered standard errors, its  $p$  value increases to 0.171. Bank-only fixed effects yield a positive but nonsignificant estimate ( $B = 0.0560$ , clustered  $p = 0.5230$ ), while the preferred bank and year fixed-effects model yields a negative, nonsignificant coefficient ( $B = -0.06893$ , clustered  $p = 0.4613$ , wild bootstrap  $p = 0.4185$ ). Its 95% confidence interval includes both negative and positive values. Therefore,  $H_3$  is unsupported at 5% in the preferred specification, even though the point estimate has the predicted negative sign. The sequence of results indicates sensitivity

to bank heterogeneity, annual conditions, and the covariance estimator. It does not identify an investor response that favors problem loans or establish that the sample's credit risk was harmless.

Credit expansion, provisioning practices, differences in borrower composition, and the timing of loan recognition are possible explanations for heterogeneous NPL–valuation relationships. These remain untested mechanisms because the model does not include lending growth, provision coverage, or loan-level exposures. Research on monetary policy and bank credit behavior, NPL determinants, and credit-risk management provides context for these possibilities ([Anwar et al., 2023](#); [Chand et al., 2023](#); [Aluonzi et al., 2024](#)). [Peday et al. \(2026\)](#) examined restructuring in a specific bank-branch setting, however, its evidence cannot establish the mechanism operating among these 15 listed banks. Although observed NPL ranges from 0.9294% to 4.4800%, being below a commonly cited prudential reference does not demonstrate that investors ignored credit risk ([Otoritas Jasa Keuangan, 2017](#)). The nonsignificant results are closer in inferential terms to [Freddy and Toni \(2020\)](#) and [Siagian \(2023\)](#) than the original positive-significance claim, but they should not be described as evidence of an identical underlying relationship. [Arhinful et al. \(2025\)](#) and [Rosario and Mavuri \(2026\)](#) motivated attention to adverse credit-quality information in other banking settings. The theoretical implication is a limit on the inference that can be drawn from the unexpected pooled coefficient, rather than a reversal of the economic meaning of NPL.

#### 4.4 The Effect of Operating Expenses to Operating Income on Price to Book Value

The original pooled BOPO coefficient is negative and conventionally significant ( $B = -0.014$ ,  $p = 0.036$ ), but the significance does not persist with bank-clustered pooled inference ( $p = 0.139$ ). Bank-only fixed effects yield  $B = -0.0055$  (clustered  $p = 0.5785$ ). In the preferred bank and year fixed-effects model, BOPO has a small positive point estimate ( $B = 0.00985$ ) with substantial uncertainty (clustered  $p = 0.3846$ , wild bootstrap  $p = 0.3344$ ). Therefore,  $H_4$  is unsupported. The change in sign and precision means that the benchmark cannot establish a robust negative within-bank relationship between operating cost intensity and valuation. It also does not establish that higher operating costs will improve valuation. BOPO and ROA summarize related accounting outcomes, and their partial coefficients depend on the controls and sources of variation available. The present data do not disentangle recurring inefficiencies from expenditures undertaken to develop future capabilities.

Cost control remains relevant to agency theory because managers are accountable for the resources they consume, and it remains a plausible signal of earnings capacity under signaling theory. However, a conceptual rationale should not substitute for empirical support. [Malik, Rusmianto, and Ridwansyah \(2024\)](#) link BOPO to the financial performance of conventional banks. [Nurwulandari, Hasanudin, Subiyanto, and Pratiwi \(2022\)](#) also studied bank performance within a soundness framework. These studies concerned financial performance, whereas the present outcome is a market-to-book valuation multiple. [Sari, Ajija, Wasiaturrehman, and Ahmad \(2022\)](#) additionally placed bank efficiency within competitive conditions, which the present specification does not measure directly. The preferred nonsignificant BOPO result is compatible with [Siagian \(2023\)](#) absence of a significant operational-efficiency relationship with market price, subject to differences in design. Overall, the four ratios should be interpreted as distinct but related dimensions of bank information. Their pooled associations cannot be translated automatically into within-bank valuation responses, and none of the regressions directly measures the way investors received or interpreted a signal.

## 5. CONCLUSIONS

### 5.1 Conclusion

This study evaluates four financial indicators in relation to PBV for 15 listed Indonesian conventional banks during 2021–2024, modeling  $\ln(\text{PBV})$  as the dependent variable. First, CAR is positively associated with valuation in the preferred bank and year fixed-effects specifications ( $B = 0.05962$ , clustered  $p = 0.0007$ , wild bootstrap  $p = 0.0020$ ), supporting  $H_1$ . The nonsignificant pooled estimate does not establish that capital adequacy is irrelevant. Second, ROA has a positive but statistically nonsignificant preferred estimate at 5% ( $B = 0.24536$ ; clustered  $p = 0.0600$ ; bootstrap  $p = 0.1152$ ), which does not support  $H_2$ , and Third, NPL has a negative and nonsignificant preferred estimate ( $B = -0.06893$ , clustered  $p = 0.4613$ , bootstrap  $p = 0.4185$ ), which does not support  $H_3$ . The

positive benchmark coefficient is specification-sensitive and provides no basis for claiming that credit deterioration enhances value or investor confidence. Fourth, BOPO has a nonsignificant preferred estimate ( $B = 0.00985$ , clustered  $p = 0.3846$ , bootstrap  $p = 0.3344$ ), which does not support  $H_4$ . These are conditional observational associations, not causal effects of changes in banking policies. The contribution to signaling and agency theories is the distinction of the informational roles of capital, profitability, loan quality, and cost efficiency, while showing why pooled valuation differences cannot be equated with within-bank relationships. Management should assess capital deployment, earnings quality, credit exposure, and operating costs. Investors should avoid relying on a single ratio or significant results from one specification.

## **5.2 Research Limitations**

The analysis is limited to four internal financial ratios and a purposively selected panel of 15 conventional banks over four years. It does not directly include interest rates, inflation, market sentiment, lending growth, provisioning coverage, governance arrangements or business model changes. Bank fixed effects absorb time-invariant differences, and year effects absorb common annual conditions, however, neither addresses all time-varying bank-specific confounding, reverse causality, or measurement error. Only 15 bank clusters are available, therefore, finite-sample uncertainty remains despite bank clustering and the wild bootstrap. Common year indicators cannot account for every source of cross-bank residual dependence, and four years provide little scope for the reliable estimation of more complex dynamics. The analysis reproduces the values in the thesis appendix, including rounding, rather than independently re-auditing each published annual statement. Its sample selection and KBMI assignments were retained from the source research. Therefore, the conclusions do not generalize automatically to Islamic banks, KBMI 1 and KBMI 2 banks, unlisted institutions, or other periods. Finally, neither investor beliefs nor managerial agency costs are directly observed; therefore, theoretical mechanisms remain interpretations to be tested in further research.

## **5.3 Suggestions and Directions for Future Research**

Future studies should extend the observation period and bank coverage while recording the timing of KBMI reclassifications, reporting changes, and relevant market events. Longer panels would allow researchers to examine lagged financial information, distinguish temporary from persistent profitability, and investigate the timing between annual disclosures and market valuation. Additional covariates may include the loan-to-deposit ratio, return on equity, governance characteristics, lending growth, provision coverage, bank size, and macroeconomic conditions. Care is needed to avoid adding a minimum-capital measure that merely duplicates CAR under a different label. Comparison across conventional, Islamic, and digital banks should use measures appropriate to each business model. Robustness analysis should continue to distinguish pooled, within-bank, and common-year associations and report uncertainty under inference suitable for the number of banks. Designs using well-defined disclosure events, plausibly external policy variation, or direct measures of investor responses would be required to evaluate causal and signaling mechanisms more convincingly. Such extensions should test the possible explanations for NPL and BOPO sensitivity rather than assume that the present coefficients reveal those mechanisms.

## **ACKNOWLEDGEMENT**

The authors would like to express their gratitude to Politeknik Negeri Lampung for its academic support and research facilities and to the Indonesia Stock Exchange for providing publicly accessible financial statement and stock market data.

## **AUTHOR CONTRIBUTIONS**

EM conducted the source thesis research and the empirical analysis. UK served as the corresponding author, supervised the research, and drafted and critically reviewed the manuscript. R co-supervised the study and contributed to the manuscript review and finalization. N contributed to data validation, manuscript improvement and final editing. All authors have reviewed and approved the final version of the manuscript.

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