

The Effect of Financing Risk (NPF) and Operating Expenses (BOPO) on Return on Assets (ROA) in Islamic Commercial Banks

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Abstract

This study examines the relationship between financing risk, operational efficiency, and profitability in Indonesian Islamic Commercial Banks. Monthly aggregate data published by the Financial Services Authority (OJK) from January 2019 to December 2023 were used, resulting in 60 observations. Return on Assets (ROA) was employed as the profitability measure, while Non-Performing Financing (NPF) and Operating Expenses to Operating Income (BOPO) served as explanatory variables. The analysis included descriptive statistics, Ordinary Least Squares regression, diagnostic tests, stationarity testing, cointegration analysis, and a first-difference regression with calendar-month fixed effects and Newey–West HAC standard errors. The benchmark regression in levels showed negative and statistically significant relationships between both NPF and BOPO and ROA. However, diagnostic tests indicated non-stationarity, heteroskedasticity, and serial correlation, while no significant cointegration relationship was identified. After correcting these statistical properties, the robust first-difference model showed that both NPF and BOPO retained negative coefficients but were not statistically significant at the 5% level. These findings indicate that financing risk and operational inefficiency are directionally associated with lower profitability, but short-run monthly changes in the two ratios do not independently explain changes in ROA. The study highlights the importance of considering time-series properties before drawing conclusions from banking financial-ratio regressions.

Keywords: BOPO, Islamic Commercial Banks, NPF, Profitability, ROA, Time-Series Analysis.

INTRODUCTION

The profitability of Islamic Commercial Banks is an important indicator of financial performance and institutional sustainability. Return on Assets (ROA) reflects the ability of banks to generate earnings from the assets under their management and is therefore frequently used to evaluate banking profitability. In Islamic banking, profitability is influenced by various internal financial conditions, particularly financing quality and operational efficiency. Two indicators commonly associated with these conditions are Non-Performing Financing (NPF), which reflects financing risk, and Operating Expenses to Operating Income (BOPO), which represents operational efficiency (Otoritas Jasa Keuangan, 2024).

NPF represents the proportion of problematic financing within the financing portfolio. An increase in NPF may reduce expected financing income and place pressure on bank profitability. Meanwhile, BOPO indicates the proportion of operating income absorbed by operating expenses. A higher BOPO ratio reflects lower operational efficiency because a larger proportion of operating income is required to cover operational costs. Therefore, financing quality and operational efficiency are theoretically and empirically relevant to the profitability of Islamic Commercial Banks (Ramdhani & Maksum, 2024; Nasution et al., 2024).

Previous studies, however, have produced inconsistent empirical findings regarding the relationships between NPF, BOPO, and ROA. Nasution et al. (2024) found that NPF did not have a statistically significant effect on ROA, whereas BOPO showed a significant relationship with profitability. Similarly, Ramdhani and Maksum (2024) reported that NPF had an insignificant negative relationship with ROA, while BOPO had a significant negative effect. More recent evidence also indicates that the relationship between financing risk and profitability is not always statistically significant. Farodisa et al. (2026) reported that NPF was not statistically significant in explaining ROA, whereas BOPO had a significant effect. Likewise, Kasmawati et al. (2026) found a negative but statistically insignificant coefficient for NPF while BOPO exhibited a negative and significant relationship with ROA.

These differences indicate that the relationship between financing risk, operational efficiency, and profitability may depend not only on the observation period, sample characteristics, and data aggregation, but also on the statistical treatment of financial-ratio observations over time. A methodological issue therefore arises when monthly aggregate banking ratios are analyzed using conventional regression without explicitly considering their time-series properties, because persistent trends, serial dependence, heteroskedasticity, and non-stationarity may influence coefficient estimates and statistical inference. In such circumstances, statistically significant relationships observed in the levels of financial ratios may partly reflect common temporal movements rather than stable relationships between the underlying variables. Failure to account for these properties may influence statistical inference and the interpretation of regression coefficients (Dickey & Fuller, 1979; Newey & West, 1987).

This study addresses this methodological issue by examining monthly aggregate data for Indonesian Islamic Commercial Banks published by the Financial Services Authority (OJK) from January 2019 to December 2023 and explicitly treating the observations as time-series data. The use of monthly regulatory statistics provides 60 observations and allows changes in financing risk, operational efficiency, and profitability to be examined in greater detail than a limited annual dataset (Otoritas Jasa Keuangan, 2020; Otoritas Jasa Keuangan, 2024). This study addresses this methodological issue by examining monthly aggregate data for Indonesian Islamic Commercial Banks published by the Financial Services Authority (OJK) from January 2019 to December 2023 and explicitly treating the observations as time-series data. In addition, the analysis evaluates stationarity and regression diagnostics before conducting final statistical inference, thereby reducing the possibility of interpreting relationships that may arise primarily from common temporal trends or residual dependence (Dickey & Fuller, 1979; Engle & Granger, 1987).

Accordingly, this study aims to examine the relationship between NPF and BOPO and the profitability of Indonesian Islamic Commercial Banks as measured by ROA. The study contributes to the Islamic banking literature by using monthly regulatory data within a time-series framework that distinguishes relationships observed in the levels of financial ratios from short-run relationships obtained after their temporal properties are appropriately addressed. From a practical perspective, the findings are expected to provide additional insight for bank management and regulators regarding the roles of financing quality and operational efficiency in profitability management.

METHOD

This study employs a quantitative explanatory approach using secondary monthly data from Indonesian Islamic Commercial Banks (Bank Umum Syariah or BUS) published in the *Sharia Banking Statistics* of the Financial Services Authority (OJK). The observation period covers January 2019 to December 2023, resulting in 60 monthly observations. The 60 observations were compiled directly from the monthly BUS financial-ratio series reported in the official OJK Sharia Banking Statistics (Statistik Perbankan Syariah), using the December 2019, December 2020, December 2021, December 2022, and December 2023 editions to obtain the complete January–December series for each corresponding year. The variables examined are Return on Assets (ROA) as the dependent variable, while Non-Performing Financing (NPF) and Operating Expenses to Operating Income (BOPO) are used as independent variables. The definitions and measurements of these financial ratios follow the indicators reported in the official OJK Sharia Banking Statistics (Otoritas Jasa Keuangan, 2020; Otoritas Jasa Keuangan, 2024). The monthly observations were organized chronologically from January 2019 through December 2023, and the complete dataset used in the empirical analysis is presented in Appendix A to facilitate independent verification and reproducibility of the statistical results.

The analysis began with descriptive statistics followed by Ordinary Least Squares (OLS) regression as the benchmark model. Several diagnostic procedures were then conducted to evaluate the statistical properties of the regression. Multicollinearity was examined using the Variance Inflation Factor (VIF), residual normality was evaluated using the Jarque–Bera test, and

heteroskedasticity was assessed using the Breusch–Pagan test (Jarque & Bera, 1980; Breusch & Pagan, 1979). Residual autocorrelation was examined using the Durbin–Watson statistic and the Breusch–Godfrey Lagrange Multiplier test (Durbin & Watson, 1950; Godfrey, 1978).

Because the observations constitute monthly time-series data, the Augmented Dickey–Fuller (ADF) test was applied to determine whether ROA, NPF, and BOPO were stationary (Dickey & Fuller, 1979). A cointegration test was subsequently conducted to determine whether the non-stationary variables shared a stable long-run equilibrium relationship (Engle & Granger, 1987). Since ROA, NPF, and BOPO were found to be non-stationary in levels and no significant cointegration relationship was identified, the final regression was estimated using first-differenced variables. Calendar-month fixed effects were included to control for possible recurring monthly patterns. In addition, Newey–West heteroskedasticity and autocorrelation consistent (HAC) standard errors were applied to provide more robust statistical inference in the presence of heteroskedasticity and temporal dependence (Newey & West, 1987). All hypotheses were evaluated at a 5% significance level.

Table 1 presents the complete monthly dataset of ROA, NPF, and BOPO used in the empirical analysis, comprising 60 observations from January 2019 to December 2023.

Table 1. Complete Monthly Dataset Used in the Analysis

Month	ROA (%)	NPF (%)	BOPO (%)
January 2019	1.51	3.39	87.69
February 2019	1.32	3.44	89.09
March 2019	1.46	3.44	87.82
April 2019	1.52	3.58	86.95
May 2019	1.56	3.49	86.29
June 2019	1.61	3.36	85.72
July 2019	1.62	3.36	85.58
August 2019	1.64	3.44	85.59
September 2019	1.66	3.32	85.14
October 2019	1.65	3.49	85.55
November 2019	1.67	3.47	85.32
December 2019	1.73	3.23	84.45
January 2020	1.88	3.46	83.62
February 2020	1.85	3.38	82.78
March 2020	1.86	3.43	83.04
April 2020	1.55	3.41	84.60
May 2020	1.44	3.35	85.72
June 2020	1.40	3.34	86.11
July 2020	1.38	3.31	86.25
August 2020	1.36	3.30	86.22
September 2020	1.36	3.28	86.12
October 2020	1.35	3.18	86.08
November 2020	1.35	3.22	86.10
December 2020	1.40	3.13	85.55
January 2021	1.79	3.20	85.44
February 2021	2.15	3.18	82.98
March 2021	2.06	3.23	82.10
April 2021	1.97	3.29	81.86
May 2021	1.92	3.30	82.33
June 2021	1.94	3.25	83.15
July 2021	1.91	3.23	83.48
August 2021	1.88	3.25	83.86
September 2021	1.87	3.19	81.69

October 2021	1.59	3.04	83.79
November 2021	1.66	2.64	82.81
December 2021	1.55	2.59	84.33
January 2022	2.03	2.65	93.10
February 2022	1.91	2.65	89.51
March 2022	1.99	2.59	86.76
April 2022	1.98	2.58	80.58
May 2022	2.01	2.67	79.44
June 2022	2.04	2.63	78.53
July 2022	2.04	2.63	77.91
August 2022	2.04	2.64	77.34
September 2022	2.07	2.57	76.67
October 2022	2.05	2.54	76.86
November 2022	2.04	2.50	76.71
December 2022	2.00	2.35	77.28
January 2023	2.04	2.41	77.51
February 2023	2.08	2.37	76.05
March 2023	2.18	2.38	75.78
April 2023	2.14	2.38	75.88
May 2023	2.10	2.36	75.98
June 2023	2.08	2.36	76.02
July 2023	2.04	2.36	76.47
August 2023	2.03	2.36	76.60
September 2023	2.04	2.28	76.53
October 2023	2.03	2.24	76.61
November 2023	1.99	2.20	77.09
December 2023	1.88	2.10	78.31

Source: Financial Services Authority of Indonesia (Otoritas Jasa Keuangan/OJK), Sharia Banking Statistics (Statistik Perbankan Syariah), December 2019–December 2023 editions, Bank Umum Syariah (BUS) financial-performance ratios.

RESULTS AND DISCUSSION

Data Verification and Analytical Specification

Prior to hypothesis testing, the dataset was reconstructed using publicly verifiable data from the *Sharia Banking Statistics (Statistik Perbankan Syariah, SPS)* published by the Financial Services Authority of Indonesia (Otoritas Jasa Keuangan/OJK). The original manuscript reported 25 observations derived from five Islamic Commercial Banks over the 2019–2023 period. However, the identities of the five banks and the underlying bank-year observations were not reported, making the originally stated dataset and regression estimates impossible to independently reproduce.

To ensure transparency and replicability, the present analysis therefore uses monthly aggregate financial ratios for Indonesian Islamic Commercial Banks (*Bank Umum Syariah* or BUS) from January 2019 through December 2023. This produces 60 monthly observations for each variable. OJK defines Non-Performing Financing (NPF) as the ratio of problematic financing to total financing, Return on Assets (ROA) as annualized earnings before tax relative to average total assets, and BOPO as the ratio of operating expenses to operating revenue. The use of a single regulatory data source ensures consistency in the definition and measurement of all variables across the observation period.

The official OJK statistics also confirm the historical development of the ratios used in this study. For example, at the end of 2023, BUS recorded ROA of 1.88%, NPF of 2.10%, and BOPO of 78.31%.

Descriptive Statistics Analysis

Descriptive statistical analysis was first performed to describe the central tendency and dispersion of ROA, NPF, and BOPO during the January 2019–December 2023 observation period. All descriptive statistics were calculated directly from the 60 monthly observations used in the empirical analysis and reported in Table 1. The results are presented in Table 2.

Table 2. Descriptive Statistics of Research Variables, January 2019–December 2023

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Return on Assets (ROA)	60	1.32	2.18	1.804	0.261
Non-Performing Financing (NPF)	60	2.10	3.58	2.950	0.451
Operating Expenses to Operating Income (BOPO)	60	75.78	93.10	82.412	4.366

Source: Authors' calculations based on OJK Sharia Banking Statistics, 2019–2023.

ROA has a mean of 1.804%, with a minimum of 1.32% and a maximum of 2.18%. The standard deviation of 0.261 percentage points indicates that aggregate Islamic banking profitability fluctuated during the five-year observation period, although the dispersion was substantially lower than that reported in the previous 25-observation table. The minimum ROA occurred during the weaker profitability phase surrounding the early pandemic period, whereas the upper values were recorded as profitability subsequently recovered.

NPF has an average value of 2.950%, with values ranging from 2.10% to 3.58%. The relatively moderate standard deviation of 0.451 percentage points indicates that financing risk changed gradually rather than displaying extreme monthly volatility. More importantly, the data reveal a broad downward movement in NPF over the sample period. The year-end NPF ratio decreased from 3.23% in December 2019 to 3.13% in December 2020, 2.59% in December 2021, 2.35% in December 2022, and 2.10% in December 2023. The latter figure is directly reported in OJK's December 2023 statistics.

BOPO recorded the widest absolute dispersion among the three variables. Its mean value was 82.412%, with a minimum of 75.78%, a maximum of 93.10%, and a standard deviation of 4.366 percentage points. Since BOPO measures operating expenses relative to operating revenue, a lower ratio generally represents greater operating efficiency. The downward movement observed over much of the study period therefore suggests an improvement in industry-level operating efficiency, although the pattern was not uniform in every month.

To provide a clearer representation of the evolution of the three ratios, Table 3 reports both the average monthly ratio for each calendar year and the year-end observation.

Table 3. Annual Development of ROA, NPF, and BOPO

Year	Mean ROA	Mean NPF	Mean BOPO	Year-End ROA	Year-End NPF	Year-End BOPO
2019	1.579	3.418	86.266	1.73	3.23	84.45
2020	1.515	3.316	85.183	1.40	3.13	85.55
2021	1.858	3.116	83.152	1.55	2.59	84.33
2022	2.017	2.583	80.891	2.00	2.35	77.28
2023	2.053	2.317	76.569	1.88	2.10	78.31

Source: Authors' calculations based on monthly OJK Sharia Banking Statistics.

The annual pattern provides several noteworthy observations. First, average ROA declined slightly from 1.579% in 2019 to 1.515% in 2020, before increasing to 1.858% in 2021, 2.017% in 2022, and 2.053% in 2023. The reduction in 2020 is consistent with a period in which the banking sector operated under substantial economic uncertainty, while the subsequent

increase indicates an improvement in aggregate asset profitability during the recovery period. This pattern should be interpreted descriptively rather than causally because macroeconomic variables are not explicitly incorporated in the present model.

Second, average NPF declined almost continuously, from 3.418% in 2019 to 2.317% in 2023. The downward development indicates an improvement in the aggregate financing-quality ratio over the observation period. However, profitability did not move one-for-one with NPF. For example, the average NPF ratio declined between 2019 and 2020 while average ROA also declined. This observation already suggests that movements in financing risk alone are insufficient to explain short-term movements in profitability.

Third, BOPO decreased considerably over the period, from an average of 86.266% in 2019 to 76.569% in 2023, while average ROA generally increased after 2020. At the descriptive level, therefore, operational efficiency and profitability demonstrate a pronounced inverse co-movement: lower BOPO tends to coincide with higher ROA. Nevertheless, descriptive co-movement does not establish a statistically valid causal relationship, particularly when variables exhibit common trends over time.

Preliminary Multiple Linear Regression Analysis

As an initial benchmark, ROA was regressed on NPF and BOPO in their observed levels using ordinary least squares (OLS). This specification is comparable with the multiple-regression approach commonly applied in previous research and provides an initial indication of the unconditional relationships among the variables.

Table 4. Benchmark OLS Regression in Levels

Variable	Coefficient (B)	Std. Error	t-statistic	p-value
Constant	4.7708	0.5056	9.436	<0.001
NPF	-0.1746	0.0762	-2.291	0.026
BOPO	-0.0298	0.0079	-3.769	<0.001

Notes: Model statistics: N = 60; $R^2 = 0.563$; Adjusted $R^2 = 0.548$; F = 36.711; $p < 0.001$.

The benchmark equation is: $ROA = 4.7708 - 0.1746(NPF) - 0.0298(BOPO) + \epsilon$

At first sight, the level regression indicates statistically significant negative coefficients for both NPF and BOPO. Holding BOPO constant, a one-percentage-point higher NPF ratio is associated with approximately 0.175 percentage points lower ROA. Similarly, holding NPF constant, a one-percentage-point higher BOPO ratio is associated with approximately 0.030 percentage points lower ROA.

The F-statistic of 36.711 is statistically significant, while R^2 of 0.563 suggests that approximately 56.3% of the variation in the level of ROA is statistically associated with NPF and BOPO in this specification.

However, these estimates cannot immediately be treated as valid hypothesis-test results. Because the observations constitute a monthly time series, classical OLS inference requires examination of stationarity, serial dependence, heteroskedasticity, and other diagnostic conditions. A statistically significant coefficient in a trending time series can reflect common temporal movement rather than a stable economic relationship.

Diagnostic Tests of the Benchmark Model

A series of diagnostic procedures was therefore applied to the benchmark model. The results are summarized in Table 5.

Table 5. Diagnostic Tests for the Benchmark Level Regression

Diagnostic Test	Statistic	p-value / Criterion	Interpretation
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Jarque–Bera normality test	1.136	0.567	Residual normality not rejected
VIF – NPF	2.268	< 5	No serious multicollinearity
VIF – BOPO	2.268	< 5	No serious multicollinearity
Breusch–Pagan heteroskedasticity test	LM = 24.687	<0.001	Heteroskedasticity detected
Durbin–Watson	0.664	substantially below 2	Strong positive serial correlation indicated
Breusch–Godfrey LM, lag 1	28.124	<0.001	Serial correlation detected
Breusch–Godfrey LM, lag 4	30.173	<0.001	Serial correlation detected

Source: Authors' statistical calculations.

The Jarque–Bera test does not reject residual normality in the benchmark model ($p = 0.567$). Multicollinearity is also not a critical problem: the VIF of both NPF and BOPO is 2.268, substantially below commonly used warning thresholds.

The more serious problems arise from heteroskedasticity and serial correlation. The Breusch–Pagan statistic is significant at $p < 0.001$, indicating that the residual variance is not constant. More critically, the Durbin–Watson statistic is only 0.664, which strongly indicates positive residual autocorrelation. The Breusch–Godfrey tests confirm this finding at both one and four lags.

Consequently, conventional OLS standard errors and associated t-tests from the level model cannot be relied upon for final hypothesis inference. The statistically significant coefficients displayed in Table 4 therefore constitute descriptive benchmark relationships rather than final evidence of a statistically robust effect.

Stationarity Analysis

Because ROA, NPF, and BOPO exhibit visible movements over time, the Augmented Dickey–Fuller (ADF) unit-root test was employed to examine whether the variables are stationary. Stationarity is particularly important because regression among non-stationary variables may produce apparently high statistical significance even when the relationship is driven largely by common trends.

Table 6. Augmented Dickey–Fuller Unit-Root Tests

Variable	ADF Statistic, Level	p-value	ADF Statistic, First Difference	p-value	Integration
ROA	-0.991	0.757	-4.475	<0.001	I(1)
NPF	0.080	0.965	-8.425	<0.001	I(1)
BOPO	-1.631	0.467	-6.857	<0.001	I(1)

Source: Authors' statistical calculations.

The ADF tests fail to reject the presence of a unit root for ROA, NPF, and BOPO in levels. Their p-values of 0.757, 0.965, and 0.467, respectively, are substantially above 0.05. Hence, all three variables are non-stationary in levels.

After first differencing, however, each variable becomes stationary. The ADF statistics are -4.475 for ΔROA , -8.425 for ΔNPF , and -6.857 for $\Delta BOPO$, with p-values below 0.001. Therefore, the series may be classified as integrated of order one, I(1).

A cointegration test was subsequently conducted to determine whether the non-stationary level variables nevertheless share a stable long-run equilibrium relationship. The Engle–Granger cointegration statistic was -3.323 with a p-value of 0.132. Because the null hypothesis of no cointegration cannot be rejected at the 5% level, the evidence is insufficient to

support a stable cointegrating relationship among ROA, NPF, and BOPO over the observation period.

This result has a major methodological implication. The statistically significant level regression in Table 4 should not be used as the final hypothesis test because the series are non-stationary and no statistically significant cointegration relationship is identified. Estimation in first differences is therefore more defensible for assessing whether short-run changes in NPF and BOPO are associated with short-run changes in ROA.

Robust Short-Run Regression Analysis

The final regression was estimated using the first differences of the three ratios. Because monthly OJK profitability and efficiency ratios may display systematic calendar effects, calendar-month fixed effects were included. In addition, Newey–West heteroskedasticity and autocorrelation consistent (HAC) standard errors with four lags were applied to produce inference that is more robust to heteroskedasticity and temporal dependence. The estimated model can be represented as:

$$\Delta ROA_t = \alpha + \beta_1 \Delta NPF_t + \beta_2 \Delta BOPO_t + \text{Month Fixed Effects} + \varepsilon_t$$

The results are reported in Table 7.

Table 7. First-Difference Regression with Calendar-Month Fixed Effects and Newey–West HAC Standard Errors

Variable	Coefficient	HAC Std. Error	Test Statistic	p-value	Hypothesis Decision
ΔNPF	-0.0860	0.1164	-0.739	0.460	H1 not supported
$\Delta BOPO$	-0.0065	0.0156	-0.419	0.676	H2 not supported

Notes: Model information: N = 59; Calendar-month fixed effects = included; $R^2 = 0.407$; Adjusted $R^2 = 0.235$; HAC overall F = 5.022, $p < 0.001$.

Source: Authors' statistical calculations.

The estimated coefficient of ΔNPF is -0.0860 . The negative sign is consistent with the theoretical expectation that an increase in financing risk may be associated with lower profitability. Economically, a one-percentage-point monthly increase in NPF is associated with an estimated 0.086-percentage-point reduction in the monthly change in ROA, holding changes in BOPO and calendar-month effects constant. However, its p-value of 0.460 is substantially above 0.05. Therefore, the data do not provide sufficient statistical evidence that short-run changes in NPF independently explain changes in ROA.

The coefficient of $\Delta BOPO$ is also negative at -0.0065 . Thus, an increase in operating expenses relative to operating income is directionally associated with a reduction in profitability. Nevertheless, the coefficient is not statistically significant ($p = 0.676$). The second hypothesis is consequently also not supported in the robust short-run specification.

A joint Wald test was conducted specifically on the coefficients of ΔNPF and $\Delta BOPO$. The resulting F-statistic is 0.580 with a p-value of 0.564. Thus, the null hypothesis that both substantive coefficients are jointly equal to zero cannot be rejected. This distinction is important because the overall HAC F-test of the complete model is statistically significant ($F = 5.022$, $p < 0.001$), but that test also includes the calendar-month fixed effects. The significant overall model should therefore not be interpreted as evidence that NPF and BOPO themselves are jointly significant.

Post-Estimation Diagnostics of the Robust Model

Additional diagnostic tests were applied to the first-difference specification.

Table 8. Diagnostics of the Final Short-Run Model

Diagnostic	Statistic	p-value	Interpretation
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Durbin–Watson	1.984	–	No material first-order autocorrelation indicated
Breusch–Godfrey LM, lag 4	2.247	0.690	Residual serial correlation not detected
Breusch–Pagan	25.110	0.022	Residual heteroskedasticity remains
Jarque–Bera	23.377	<0.001	Residual normality rejected

Source: Authors' statistical calculations.

The Durbin–Watson value improves substantially from 0.664 in the level regression to 1.984 in the final specification. The Breusch–Godfrey LM test at four lags is also insignificant ($p = 0.690$), indicating that residual serial correlation is no longer a material problem after differencing and controlling for calendar effects.

The Breusch–Pagan test remains statistically significant ($p = 0.022$), indicating residual heteroskedasticity. This provides additional justification for the use of Newey–West HAC standard errors rather than conventional OLS standard errors.

The Jarque–Bera test rejects strict residual normality. Therefore, the results should be interpreted cautiously, particularly given the relatively limited five-year time span. Nevertheless, the use of heteroskedasticity- and autocorrelation-robust standard errors makes inference less dependent on conventional homoskedastic OLS assumptions. The remaining non-normality should be acknowledged as a limitation rather than concealed.

Discussion

The Relationship between Financing Risk (NPF) and Profitability (ROA)

The final empirical results indicate that changes in NPF have a negative but statistically insignificant relationship with changes in ROA. The negative coefficient is consistent with the expected direction of the relationship between financing risk and profitability, but its statistical insignificance indicates that month-to-month changes in NPF did not independently explain short-run changes in ROA during the 2019–2023 period.

Conceptually, a negative relationship remains economically plausible. An increase in problematic financing can weaken the income-generating capacity of a financing portfolio and may increase the need for impairment allowances or expected-credit-loss provisions. These mechanisms can reduce earnings and, consequently, ROA. From a financial intermediation perspective, the quality of financing is therefore relevant to the ability of Islamic banks to convert their asset base into sustainable earnings.

The descriptive pattern also indicates that the relationship was not uniform over time: average NPF declined from approximately 3.418% in 2019 to 3.316% in 2020, while average ROA simultaneously declined from approximately 1.579% to 1.515%, before profitability improved alongside further reductions in NPF during 2021–2023. This pattern suggests that financing risk remains economically relevant, although short-run profitability movements are likely to reflect additional factors beyond contemporaneous changes in NPF.

This finding is consistent with several empirical studies. Nasution et al. (2024), using 45 monthly observations from OJK for January 2020–September 2023, found that NPF did not have a statistically significant effect on ROA, whereas BOPO was significant. Ramdhani and Maksum (2024) similarly reported an insignificant negative relationship between NPF and ROA for Indonesian Islamic Commercial Banks during 2017–2021. More recently, Farodisa et al. (2026) reported that NPF was not statistically significant in explaining ROA during 2020–2024, with a reported significance value of 0.202.

Recent panel evidence also produces a comparable result. Kasmawati et al. (2026), using seven Islamic Commercial Banks and 35 observations for 2020–2024, found a negative NPF coefficient but a p -value of 0.0701, which was not significant at the conventional 5% level. Nevertheless, the wider literature is mixed rather than unanimous. Other studies using different bank-level samples, observation periods, and model specifications have reported statistically significant negative NPF coefficients. These differences suggest that the empirical relationship

between NPF and ROA is sensitive to data aggregation, observation period, sample structure, and econometric specification.

The contrast between the benchmark and final models further illustrates this sensitivity: although NPF was statistically significant in the level regression, the relationship became insignificant after the non-stationary series were transformed and robust inference was applied. Accordingly, the findings support a cautious interpretation in which financing quality remains an important component of profitability management, but changes in aggregate NPF are not necessarily followed by proportional changes in aggregate ROA within the same month.

From a managerial perspective, this result does not imply that NPF management is unimportant. Financing risk remains central to the soundness and sustainability of Islamic banking. Prudent financing assessment, monitoring, restructuring, and impairment management therefore remain important even when the immediate statistical association between monthly NPF movements and ROA is weak.

The Relationship between Operational Efficiency (BOPO) and Profitability (ROA)

BOPO also exhibits a negative coefficient in the final regression, indicating that increases in operating expenses relative to operating income are directionally associated with reductions in profitability. However, after correcting for non-stationarity, calendar effects, heteroskedasticity, and temporal dependence, the coefficient is not statistically significant at the 5% level.

The descriptive evidence nevertheless indicates a clear longer-horizon inverse pattern: average BOPO declined from approximately 86.266% in 2019 to 76.569% in 2023, while average ROA increased from 1.579% to 2.053% over the same broad period. This pattern is economically consistent with the expectation that greater operating efficiency is associated with stronger profitability, although the first-difference results show that the relationship is not sufficiently stable at the monthly level to establish a significant contemporaneous effect.

The negative direction of the coefficient is nevertheless economically intuitive. BOPO measures how much operating expense is required relative to operating revenue. When operating expenses absorb a greater proportion of operating income, the residual margin available to generate profit is reduced. Conversely, greater operational efficiency can create more room for earnings, provided other determinants of revenue and asset utilization remain favorable.

A number of prior studies report a statistically significant negative BOPO–ROA relationship. Nasution et al. (2024), using monthly SPS-OJK data, found BOPO to have a significant effect on ROA. Ramdhani and Maksum (2024) also found BOPO to have a significant negative influence on ROA. Farodisa et al. (2026) reported a significant BOPO effect with $p = 0.001$ for the 2020–2024 period. Kasmawati et al. (2026), using a bank-level Common Effect Model, likewise found a negative and significant BOPO coefficient of approximately -0.064 .

The difference between these studies and the present findings is important because previous evidence was derived from different samples, data structures, and model specifications, including level regressions and bank-level panel variation. In contrast, the final model in this study examines whether short-run changes in industry-level BOPO are associated with short-run changes in ROA after the temporal properties of the series are taken into account. Thus, the contrasting significance levels do not necessarily indicate inconsistent economic mechanisms, but rather reflect differences in the empirical relationship being estimated.

The results therefore indicate that operational efficiency remains relevant to profitability, particularly over broader periods, while month-to-month changes in BOPO should not be interpreted as producing an immediate proportional change in ROA. From a managerial perspective, operational efficiency remains economically relevant despite the lack of a statistically significant short-run coefficient. Management should continue monitoring the relationship between operating expenses and operating revenue, but efficiency strategies should be assessed over an appropriate horizon rather than assuming that monthly cost changes will immediately translate into proportional ROA changes.

Simultaneous Interpretation of NPF and BOPO

The joint Wald test of Δ NPF and Δ BOPO produces an F-statistic of 0.580 with a p-value of 0.564. Therefore, after controlling for calendar-month effects and using robust inference, the null hypothesis that the two substantive short-run coefficients are jointly equal to zero cannot be rejected.

This result indicates that contemporaneous monthly changes in NPF and BOPO, when considered jointly, do not provide sufficient explanatory power for short-run changes in ROA. Although the benchmark level regression showed a statistically significant overall relationship, the final specification provides a more appropriate basis for short-run inference because it accounts for the temporal properties identified in the data.

The final results instead suggest that the profitability of Indonesian Islamic Commercial Banks cannot be adequately explained by contemporaneous monthly movements in NPF and BOPO alone. Profitability is likely to reflect a broader set of bank-level and macroeconomic determinants, including capital adequacy, financing growth and composition, liquidity, funding structure, asset size, margin or profit-sharing income, inflation, economic growth, monetary conditions, and institutional characteristics.

Overall Interpretation of the Findings

Overall, the findings reveal an important distinction between longer-horizon co-movement and short-run statistical relationships. Descriptively, declining NPF and BOPO generally coincided with stronger profitability over much of the observation period, while the benchmark level regression also indicated negative associations between both ratios and ROA. However, after accounting for the time-series properties of the data, the short-run coefficients of both NPF and BOPO remained negative but were not statistically significant.

The results therefore suggest that financing quality and operational efficiency remain economically relevant to Islamic bank profitability, but their effects are unlikely to operate as simple and immediate month-to-month relationships. This interpretation is broadly consistent with previous evidence showing an insignificant NPF–ROA relationship, while the weaker short-run BOPO result differs from several earlier studies that reported significant effects using alternative samples and model specifications (Nasution et al., 2024; Ramdhani & Maksum, 2024; Farodisa et al., 2026; Kasmawati et al., 2026). Taken together, these findings emphasize the importance of considering the temporal structure and empirical specification of banking financial-ratio data when interpreting profitability relationships.

Theoretical and Managerial Implications

The findings provide a more nuanced interpretation of the relationship between financing quality, operational efficiency, and profitability. Financing quality and operational efficiency remain conceptually connected to profitability because both affect the ability of an intermediary institution to transform funds and assets into earnings. However, the absence of significant short-run coefficients indicates that these relationships may not operate instantaneously.

The effect of deteriorating financing quality may emerge with a lag through restructuring, provisioning, impairment recognition, and eventual changes in financing income. Similarly, improvements in operating efficiency may require time before they are reflected in profitability, particularly when efficiency initiatives involve initial investment costs or when operating revenue changes simultaneously. These lagged mechanisms cannot be fully captured by a simple contemporaneous regression.

For bank management, the evidence therefore supports an integrated rather than single-ratio approach to profitability management. NPF should continue to be controlled through prudent financing selection, monitoring, risk assessment, and timely restructuring. BOPO should continue to be monitored through cost discipline and improvement in the productivity of operating expenditure. Nevertheless, neither ratio should be treated as an isolated or instantaneous determinant of profitability.

For regulators and researchers, the findings highlight the importance of considering the temporal properties of published banking ratios. Monthly regulatory data provide considerably more observations than a short annual sample, but they also require appropriate time-series treatment. Statistical significance should therefore be evaluated after testing stationarity and residual dependence rather than relying solely on conventional multiple linear regression.

Research Limitations and Further Research

The analysis remains subject to several limitations. First, the reconstructed dataset represents aggregate BUS industry performance rather than individual-bank observations. Aggregate data provide a consistent and auditable industry-level series but may conceal substantial heterogeneity among Islamic Commercial Banks. A bank with very low profitability and high BOPO may behave differently from a more efficient and profitable bank even though both contribute to the aggregate ratio.

Second, the observation period covers only January 2019–December 2023. Although 60 monthly observations provide substantially greater statistical information than five annual observations, the period includes unusual economic conditions and therefore may not fully represent longer-run banking dynamics.

Third, only NPF and BOPO are included as substantive explanatory variables. The model does not control directly for CAR, FDR, bank size, financing growth, financing composition, funding costs, inflation, policy rates, GDP growth, or other macro-financial determinants. Omitted factors may influence both profitability and the explanatory ratios.

Fourth, the final model is designed primarily to estimate contemporaneous short-run relationships. It does not establish structural causality and does not examine whether NPF or BOPO exert lagged effects on ROA. Future research may employ distributed-lag models, autoregressive distributed lag approaches where their assumptions are satisfied, or bank-level panel models incorporating fixed or random effects.

Finally, future bank-level research should explicitly disclose the banks included in the sample and report the complete bank-year dataset. If annual observations from individual banks are used, panel-data techniques should be preferred to pooled multiple linear regression, with formal model-selection procedures and appropriate tests for cross-sectional and temporal dependence. Such transparency would substantially improve the reproducibility and external validity of research on Islamic banking profitability.

CONCLUSION

This study examined the relationship between Non-Performing Financing (NPF), Operating Expenses to Operating Income (BOPO), and Return on Assets (ROA) in Indonesian Islamic Commercial Banks using 60 monthly observations from January 2019 to December 2023. Descriptive analysis showed that financing quality and operational efficiency generally improved during the observation period, as reflected in the declining trends of NPF and BOPO, while profitability showed a general recovery after 2020.

The initial regression in levels indicated that NPF and BOPO had negative and statistically significant relationships with ROA. However, further diagnostic analysis revealed that the variables were non-stationary and that the benchmark model was affected by heteroskedasticity and serial correlation. In addition, no significant cointegration relationship was identified. Therefore, the level regression was not considered sufficient for final hypothesis inference.

After the variables were transformed into first differences and the model was estimated using calendar-month fixed effects and Newey–West HAC standard errors, both NPF and BOPO retained negative coefficients but were not statistically significant at the 5% level. Accordingly, the study does not find sufficient evidence that short-run monthly changes in NPF and BOPO independently determine short-run changes in ROA during the 2019–2023 period. Thus, the first and second hypotheses are not supported in the final robust model.

These findings suggest that profitability in Islamic Commercial Banks is influenced by broader financial and economic conditions rather than by contemporaneous movements in NPF and BOPO alone. Nevertheless, financing quality and operational efficiency remain economically relevant indicators that should continue to be monitored by bank management. Future studies are encouraged to use bank-level panel data, longer observation periods, and additional variables such as capital adequacy, liquidity, bank size, financing composition, inflation, and economic growth to provide a more comprehensive explanation of Islamic banking profitability.

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