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The Effects of Green Finance, NPF, CAR, and Firm Size on the Financial Sustainability of Islamic Commercial Banks in ssIndonesia, 2021–2025

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Abstract

This study aims to analyze the effects of green finance, non-performing financing (NPF), capital adequacy ratio (CAR), and firm size on the financial sustainability of Islamic commercial banks in Indonesia over the 2021–2025 period. It uses a quantitative approach with secondary data taken from financial statements and sustainability reports published on the website of the Financial Services Authority (OJK) and the official websites of the respective banks. Of the 14 Islamic commercial banks in the population, 9 banks met the purposive sampling criteria, yielding 45 observations. The data were analyzed using multiple linear regression in SPSS version 22. The results show that green finance, NPF, CAR, and firm size each have a significant effect on financial sustainability. Simultaneously, these four variables also have a significant effect on the financial sustainability of Islamic commercial banks in Indonesia during 2021–2025.

Keywords: *Financial sustainability; green finance; non-performing financing; capital adequacy ratio; firm siz*

I. INTRODUCTION

The growth and development of a country's economy are closely tied to the development of its banking sector, because banks serve as the main source of funding for business actors (Pungus et al., 2024). In Indonesia, where the majority of the population is Muslim, conventional banks are often regarded as unsuitable. As a result, Islamic banking has grown rapidly as an alternative whose activities are entirely based on Islamic Sharia principles (Margarita & Kholis, 2021).

Financial ratios are used to assess the growth of a bank and play an important role in its development. *Financial sustainability* is a ratio that determines the other ratios. It is the ability of a bank to start, grow, and sustain its business with short-term and long-term financial stability (Cohen & Malkogianni, 2021). Essentially, financial sustainability consists of two main components, expenses and income, which are used to calculate the ratio (Alim & Sina, 2020). A financial sustainability value is considered good if it exceeds 100%, meaning that the higher a bank's financial sustainability, the greater its ability to continue its operations (Rianasari & Pangestuti, 2016).

Data on the financial sustainability of Islamic commercial banks in Indonesia during 2021–2025 show fluctuations. The average financial sustainability in 2021 reached only 94.06%, an unfavorable situation because it was below 100%, indicating that the banks were unstable. This condition was still within the post-pandemic recovery phase, caused by high operating expenses that banks could not yet offset with income growth. In 2022, the average rose to 107.45%, an improvement of 13.39%, showing that the gap in the previous year had begun to be overcome. It then fell in 2023 to 104.78%, a decline of 2.67%, indicating that performance growth had begun to slow. In 2024 it reached 121.51% and increased again to 123.72% in 2025, the highest figure compared with previous years. This indicates that banks are increasingly able to maintain their financial sustainability over the long term, because the higher a bank's financial sustainability, the stronger its ability to continue operating.

Given the fluctuation and inconsistency in the financial sustainability of Islamic banking in Indonesia, banks are required to survive and grow while keeping their financial sustainability above 100%. Several factors may influence financial sustainability, such as green finance, non-performing financing (NPF), capital adequacy ratio (CAR), and firm size. Green finance is a financial concept that encourages investment in environmentally friendly sustainable development (Desiana et al., 2026). Non-performing financing refers to problematic financing, namely credit whose repayment is late and does not meet the minimum obligation (Hadiyati & Baskara, 2013). The capital adequacy ratio is used to assess whether a bank's capital is sufficient to support risk-bearing assets (Fanesha et al., 2021). Firm size, meanwhile, is a scale indicating how large or small a company is, which can be seen from its total assets (Prasetyorini, 2013).

Previous studies on financial sustainability have produced inconsistent findings. Putri et al. (2024) showed that non-performing financing affects financial sustainability, whereas Fortuna et al. (2024) found that it does not. Rustam and Adil (2022) found that the capital adequacy ratio affects financial sustainability, but Widodo et al. (2025) reported that it does not. Ridwansyah et al. (2025) found that firm size affects financial sustainability, while Sihite and Marsono (2024) showed that it does not.

This study is grounded in three theories. *Sustainability theory* was first introduced by Meadows, Meadows, Randers, and Behrens in 1972 through the report *The Limits to Growth*, which became an important foundation for understanding sustainability from a global systems perspective. The report explains that the earth's capacity to provide natural resources and to absorb waste has certain limits. In terms of financial sustainability, banking institutions are required to create innovative services and products while considering the three main aspects of sustainability: economic, social, and environmental (Najam et al., 2022).

Agency theory was first proposed by Jensen and Meckling in 1976. It explains the contractual relationship among members of a company or organization; the most commonly used model focuses on two parties, the principal and the agent, viewed from behavioral and structural perspectives. In this relationship, the principal delegates authority to the agent to carry out tasks and make decisions on the principal's behalf (Ghozali, 2020, p. 86). *Signaling theory* was proposed by Spence in 1973. It explains how a signaler conveys certain information in order to influence the decisions or behavior of the signal receiver. In general, a signal is a cue given by a company (its managers) to outside parties (investors), and the information conveyed may be directly observable or may require further examination (Ghozali, 2020, p. 166).

Based on the phenomena and previous research described above, this study aims to analyze the effects of green finance, NPF, CAR, and firm size on the financial sustainability of Islamic commercial banks in Indonesia during 2021–2025, both partially and simultaneously, so as to provide a theoretical contribution to the development of financial management science and a practical contribution to bank management, investors, and future researchers.

II. METHOD

A. Research Design and Data

This study uses a quantitative approach with secondary data. The data were obtained from the financial statements and sustainability reports of Islamic commercial banks for 2021–2025, published on the official website of the Financial Services Authority (OJK) and the official websites of the respective banks. The population comprises 14 Islamic commercial banks registered with OJK during 2021–2025. Using purposive sampling with specific criteria, 9 Islamic commercial banks with a 5-year observation period were selected, giving a total of 45 observations.

The data were analyzed using multiple linear regression in SPSS version 22, comprising descriptive statistics, classical assumption tests (the Shapiro–Wilk normality test, the multicollinearity test, the heteroscedasticity test, and the Durbin–Watson autocorrelation test), hypothesis tests (the t-test and the F-test), and the coefficient of determination (R^2). Hypotheses H1–H4 concern the partial effects of green finance, NPF, CAR, and firm size on financial sustainability, respectively, and H5 concerns their simultaneous effect.

B. Variable Measurement

Financial sustainability (the dependent variable) indicates a bank's growth from one period to the next and shows whether its operations are running well and can support sustainable performance (Abbas et al., 2020). It is considered good when its percentage exceeds 100%, which means that the bank's income exceeds its expenses (Alim & Sina, 2020). It is measured by the financial sustainability ratio (FSR):

$$\text{FSR} = (\text{Total financial revenue} / \text{Total financial expenses}) \times 100$$

Green finance is a financial-sector innovation that encourages the channeling of funds to more environmentally friendly economic activities (Mahayani et al., 2026). It is measured using 16 indicators: each disclosed indicator is scored 1, and each undisclosed indicator is scored 0.

$$\text{GF} = (\text{Number of indicators implemented} / \text{Total indicators [16]}) \times 100$$

Non-performing financing is the failure of debtors to meet their obligation to pay the principal installments of credit together with the interest agreed by both parties in the credit agreement (Putri et al., 2024).

$$\text{NPF} = (\text{Total problematic financing} / \text{Total financing}) \times 100$$

The *capital adequacy ratio* is an important component in assessing the soundness of a bank. Capital adequacy requirements must set bank capital at a level large enough to support the expansion of operations and the survival of the bank (Whalen & Thomson, 1988).

$$\text{CAR} = (\text{Total bank capital} / \text{Total risk-weighted assets}) \times 100$$

Firm size reflects how large or small a company is, measured by the natural logarithm of its total assets; the larger the assets, the greater the bank's capacity to generate income (Afifah & Hasymi, 2020).

$$\text{Firm Size} = \text{Ln} (\text{Total Assets})$$

III. RESULTS AND DISCUSSION

A. Descriptive Statistics

Descriptive statistics give an overview of the independent and dependent variable data, showing the minimum, maximum, mean, and standard deviation of each variable. The results are presented in Table I.

TABLE I. DESCRIPTIVE STATISTICS RESULTS

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Green finance (GF)	45	0.625	1.000	0.81111	0.092788
NPF	45	0.007	0.088	0.02573	0.018339
CAR	45	0.187	0.581	0.28171	0.104223
Firm size (SIZE)	45	15.643	19.938	17.05142	1.099393
Financial sustainability (FS)	45	0.287	1.808	1.30147	0.339016
Valid N (listwise)	45				

Source: SPSS version 22 output

B. Classical Assumption Tests

Classical assumption tests were conducted to determine whether the data satisfy the classical assumptions, using SPSS version 22. *Normality*: the Shapiro–Wilk test produced a significance value of 0.947, which is greater than 0.05, so the residuals are normally distributed.

Multicollinearity: all independent variables have tolerance values above 0.10 and VIF values below 10.0 (green finance: tolerance 0.291, VIF 3.432; NPF: tolerance 0.804, VIF 1.244; CAR: tolerance 0.626, VIF 1.597; firm size: tolerance 0.305, VIF 3.277). Thus, there is no multicollinearity in the regression model.

Heteroscedasticity: the scatterplot of the regression studentized residuals against the regression standardized predicted values shows points scattered randomly without a particular pattern, so the regression model meets the classical assumption. *Autocorrelation*: the Durbin–Watson statistic is 1.896, which lies between dU (1.720) and 4 – dU (2.280), that is, $1.720 < 1.896 < 2.280$. The regression model therefore satisfies the assumption of no autocorrelation.

C. Multiple Linear Regression

The regression equation obtained is as follows, where X1 is green finance, X2 is NPF, X3 is CAR, and X4 is firm size:

$$\text{FS} = 0.847 - 7.287X_1 - 18.603X_2 + 6.097X_3 + 0.339X_4$$

The equation shows a constant (α) of 0.847 and regression coefficients of -7.287 for green finance, -18.603 for NPF, 6.097 for CAR, and 0.339 for firm size. This means that an increase in green finance or NPF tends to lower financial sustainability, whereas an increase in CAR or firm size tends to raise it.

D. Hypothesis Testing

Partial test (t-test). The t-test is used to examine the extent to which each independent variable affects the dependent variable. The results are presented in Table II.

TABLE II. RESULTS OF THE PARTIAL TEST (T-TEST)

Variable	B	Std. Error	Beta	t	Sig.
(Constant)	0.847	0.452	–	1.873	0.068
GF	–7.287	1.798	–0.764	–4.052	0.000
NPF	–18.603	9.006	–0.234	–2.066	0.045
CAR	6.097	1.781	0.440	3.422	0.001
SIZE	0.339	0.078	0.798	4.333	0.000

Dependent variable: FS. Source: SPSS version 22 output

All independent variables have an absolute t-value greater than the t-table value of 1.683 (obtained from $df = n - k = 45 - 5 = 40$), with significance values below 0.05. Green finance has $t = -4.052$ ($|t| > 1.683$) with a significance of $0.000 < 0.05$; NPF has $t = -2.066$ ($|t| > 1.683$) with a significance of $0.045 < 0.05$; CAR has $t = 3.422 > 1.683$ with a significance of $0.001 < 0.05$; and firm size has $t = 4.333 > 1.683$ with a significance of $0.000 < 0.05$. Hence, H1, H2, H3, and H4 are accepted: green finance, NPF, CAR, and firm size each have a significant effect on the financial sustainability of Islamic commercial banks in Indonesia during 2021–2025.

Simultaneous test (F-test). The F-test is used to determine whether all independent variables, namely green finance, NPF, CAR, and firm size, jointly affect the dependent variable, financial sustainability. The results are presented in Table III.

TABLE III. RESULTS OF THE SIMULTANEOUS TEST (F-TEST)

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	32.165	4	8.041	14.141	0.000
Residual	22.746	40	0.569		
Total	54.910	44			

Dependent variable: FS. Predictors: (Constant), SIZE, NPF, CAR, GF. Source: SPSS version 22 output

The calculated F-value is 14.141, while the F-table value is 2.61 (obtained from $df1 = k = 4$ and $df2 = n - k - 1 = 45 - 4 - 1 = 40$). Because the calculated F exceeds the F-table value ($14.141 > 2.61$) and the significance value is $0.000 < 0.05$, H5 is accepted. Green finance, NPF, CAR, and firm size therefore simultaneously affect the financial sustainability of Islamic commercial banks in Indonesia during 2021–2025.

E. Coefficient of Determination

The coefficient of determination measures how far the independent variables can explain the variation in the dependent variable; the closer it is to one, the more of the required information the independent variables provide. The results are presented in Table IV.

TABLE IV. RESULTS OF THE COEFFICIENT OF DETERMINATION TEST

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.765	0.586	0.544	0.75408301

Predictors: (Constant), SIZE, NPF, CAR, GF. Dependent variable: FS. Source: SPSS version 22 output

The R Square value of 0.586 shows that the four independent variables explain 58.6% of the variation in financial sustainability, while the remaining 41.4% is explained by other factors outside the model. The Adjusted R Square value of 0.544 indicates that, after adjusting for the number of independent variables and

the sample size, the regression model explains 54.4% of the variation in financial sustainability, while the remaining 45.6% is influenced by other factors outside the research model.

F. Discussion

The effect of green finance on financial sustainability. The statistical tests show that green finance has a significant effect on the financial sustainability of Islamic commercial banks in Indonesia during 2021–2025, with an absolute t-value greater than the t-table value ($|-4.052| > 1.683$) and a significance value below 0.05 ($0.000 < 0.05$). Thus, the first hypothesis (H1) is accepted. This finding supports sustainability theory through the triple bottom line concept, which emphasizes that corporate sustainability is determined not only by the ability to earn profit but also by the ability to integrate and balance the profit (economic), people (social), and planet (environmental) aspects, that is, economic interests, social responsibility, and environmental preservation (Arowoshegbe et al., 2016). The result is also consistent with Diani (2025), who found that green finance affects financial sustainability.

The effect of non-performing financing on financial sustainability. The statistical tests show that NPF has a significant effect on financial sustainability, with $|-2.066| > 1.683$ and a significance value of $0.045 < 0.05$. Thus, the second hypothesis (H2) is accepted. This finding supports signaling theory: information published by a company becomes a signal for investors, creditors, and other stakeholders in assessing the company's condition. A high NPF ratio is regarded as a negative signal (*bad news*) because it indicates poorer financing quality and a growing risk of default (Fortuna et al., 2024). The result is also consistent with Astutik et al. (2025) and Widodo et al. (2025).

The effect of the capital adequacy ratio on financial sustainability. The statistical tests show that CAR has a significant effect on financial sustainability, with $3.422 > 1.683$ and a significance value of $0.001 < 0.05$. Thus, the third hypothesis (H3) is accepted. This finding supports agency theory, in which management, as the agent, is responsible for managing the company's resources effectively to maximize the welfare of shareholders, who act as the principal. One form of this responsibility is maintaining an adequate level of capital so that the company can withstand the various risks that may arise. The result is also consistent with Rustam and Adil (2022) and Putri et al. (2024).

The effect of firm size on financial sustainability. The statistical tests show that firm size has a significant effect on financial sustainability, with $4.333 > 1.683$ and a significance value of $0.000 < 0.05$. Thus, the fourth hypothesis (H4) is accepted. This finding supports signaling theory: firm size can serve as information that signals to external parties the company's condition and its ability to sustain its business. The result is also consistent with Anggara et al. (2025) and Pangestu et al. (2026).

IV. CONCLUSIONS

Based on the results of the analysis, it can be concluded that: (1) green finance has a significant effect on financial sustainability; (2) non-performing financing (NPF) has a significant effect on financial sustainability; (3) the capital adequacy ratio (CAR) has a significant effect on financial sustainability; and (4) firm size has a significant effect on financial sustainability. Simultaneously, the four independent variables have a significant effect on the financial sustainability of Islamic commercial banks in Indonesia during 2021–2025.

Islamic commercial banks are advised to improve the effectiveness of green finance implementation in a more selective and productive manner, to maintain financing quality so that the NPF ratio stays low through sound risk management, to maintain capital adequacy in accordance with regulatory requirements, and to match asset growth with operational efficiency. Investors are advised to consider financial sustainability, green finance, NPF, CAR, and firm size comprehensively in investment decisions. Future research is expected to extend the observation period, enlarge the sample to include Islamic Business Units (UUS) and Islamic Rural Financing Banks (BPRS), and add other variables that may influence financial sustainability, such as return on assets, the financing to deposit ratio, and good corporate governance.

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