

Beyond Green Lending: Sustainable Loans, Social Environmental Costs, and Bank Performance in Indonesia

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Abstract—While prior research on sustainable banking in Indonesia has focused predominantly on green lending, the broader regulatory mandate also requires banks to disclose social and environmental costs (SEC), that is largely overlooked. This study moves beyond green lending by jointly examining how both sustainable loans (SL) and SEC influence the financial performance of Indonesian commercial banks during the early implementation of the Sustainable Finance Implementation Policy (2019–2024). Using panel data from 44 commercial banks with core capital above IDR 6 trillion, profitability is measured by Net Interest Margin (NIM) and operating efficiency by Operating Cost to Operating Income (OCOI). Specification tests select Fixed Effects for NIM and Random Effects for OCOI, with robust estimation applied. The results show that neither SL nor SEC has a statistically significant effect on bank profitability or operating efficiency, with directionally consistent findings under one- and two-year lagged specifications. These findings provide policymakers and practitioners in emerging markets with evidence that banks can expand sustainable finance activities without compromising short-term financial performance, and highlight the need for differentiated policy mechanisms that account for banks' capital strength.

Keywords—Sustainable finance, sustainable loan, social environmental cost, emerging markets, bank performance

I. INTRODUCTION

Climate change impacts are now imminent. The World Meteorological Organization [1] reports that the global near-surface temperature is 1.55°C above the pre-industrial level. Indonesia experienced this firsthand when Greater Jakarta and Bekasi flooded in March 2025, with an estimated economic loss of 1.7 trillion Rupiah [2]. To achieve Indonesia's Net Zero Emissions target by 2060, all stakeholders, including commercial banks, must participate. In 2019, Indonesia's Financial Service Authority (OJK) introduced the Sustainable Finance Implementation Policy to regulate and promote sustainable practices in financial institutions.

The policy mandates public companies to disclose sustainable finance action plans, creating an operational burden for banks to classify borrowers, meet disclosure requirements, and integrate environmental

considerations into business activities [3]. To accelerate carbon reduction efforts and achieve sustainable goals, Indonesia needs an estimated Rp67,803 trillion until 2030 [4]. However, recent evidence suggests many banks treat sustainable finance primarily as a regulatory obligation rather than a strategic opportunity. As of December 2025, the growth of sustainable loan portfolios has been declining, with a concentration in larger banks, and primarily funding MSMEs.

Examining SL and SEC jointly is essential because the Sustainable Finance Implementation Policy imposes both mandates simultaneously but through two distinct financial dimensions. SL captures the asset-side dimension, how banks allocate credit toward sustainable activities, reflecting a strategic, revenue-generating dimension of sustainable finance. SEC captures the expenditure-side dimension, how banks internalize social and environmental obligations through direct operating spending, reflecting a compliance-oriented activities. Studying either in isolation risks conflicting strategic sustainable lending with reactive compliance spending, producing misleading inference on the policy's true financial impact. A joint specification is therefore necessary to identify whether the two mandates generate trade-offs, synergies, or a neutral effect on bank performance.

Banks seem reluctant to significantly expand sustainable loan portfolios because the financial performance impact in Indonesia remains uncertain. Notably, prior Indonesian research has been confined to the green-lending dimension, leaving the social environmental cost (SEC) mandate, another core requirement of the same policy, largely unexplored [5], [6]. Meanwhile, global research indicates that sustainable finance has tangible spillover effects on the real economy [7].

Accordingly, this study addresses two research questions. These questions are operationalized through the four hypotheses developed in Section II (H1–H4).

RQ1: Do sustainable loans (SL) affect the profitability and operating efficiency of Indonesian commercial banks during the 2019–2024 policy implementation window?

RQ2: Do social environmental costs (SEC) affect the profitability and operating efficiency of the same banks over the same period?

This study contributes to the literature on sustainable banking in emerging markets in three ways. First, it moves beyond the prevailing sustainable-lending lens by

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jointly examining sustainable loans and social environmental costs, two regulatory mandates that have been studied largely in isolation in the Indonesian context. Second, it provides a policy-evaluation perspective on the first six years of the Sustainable Finance Implementation Policy, offering timely empirical evidence at a critical inflection point in implementation. Third, by employing panel data analysis across 44 commercial banks (2019–2024) with multiple specification tests and lagged robustness checks, this study delivers actionable insights for regulators and bank managers in emerging markets navigating similar transitions. The remainder of the paper is organized as follows: Section II reviews the literature and develops the hypotheses; Section III describes the data and methodology; Sections IV and V present the main and robustness results; Section VI discusses the findings; and Section VII concludes.

II. HYPOTHESES DEVELOPMENT

Shareholder theory holds that the sole social responsibility of business is to make money [8]. Freeman's stakeholder theory challenged this, arguing that organizations should generate value for all stakeholders [9]. Through CSR, firms add value beyond shareholders, with sustainable activities evolving from voluntary to imperative for legitimation and survival [10]. Sustainable loans, financing projects with substantial environmental contribution [11], have become an important CSR instrument.

A. Stakeholder Theory and Sustainable Loans

Stakeholder theory and environmental credit risk theory together support a relationship between green loans and bank financial performance. Signaling theory describes how firms send signals of their quality through sustainability-linked instruments, enhancing reputation and attracting environmentally conscious customers [12], [13]. Conversely, perceived CSR failures send negative signals that deteriorate long-term performance [14]. Environmental credit risk theory argues green loans carry inherent risks; failure to mitigate can increase NPL and credit costs [15], [16]. However, green loans may also reduce bank risk depending on ownership structure and size [16], [17].

Empirical evidence on green loans and profitability remains inconclusive. A meta-analysis by Muchiri et al. [18] confirmed a positive but weak relationship; Sutrisno et al. [5] found positive ROA effects in Indonesia; conversely, Riyanti et al. [6] found a negative impact on ROA, ROE, and NIM. Operating efficiency effects are mixed, with some studies finding positive effects [19] while others find no improvement [20].

H1. Sustainable loan is positively related to profitability.

H2. Sustainable loan is positively related to operating efficiency.

B. CSR and Social Environmental Costs

Resource-based view theory posits that internal firm resources meeting VRIO attributes create sustained competitive advantage and positive financial performance [22]. CSR can become a multi-purpose resource positively impacting long-term profitability [21]. Hamad and Cek [23] demonstrated CSR's moderating role in governance, enhancing ROA. Hojer and Maigne [24] found ESG score positively impacts profitability, especially when CSR performance is exceptional. CSR also influences reputation through positive signaling, gaining stakeholder trust, and improving bank efficiency [25], [26].

H3. Social environmental costs are positively related to profitability.

H4. Social environmental costs are positively related to operating efficiency.

III. DATA AND METHODOLOGY

This research examines the relationship between sustainable finance activities and banks' financial performance amid slow policy adoption [27].

A. Sample Selection

The Indonesian banking system comprises the central bank, supervisory authority (OJK), and commercial banks. As of June 2025, the highest tier (KBMI 4, core capital above IDR 70 trillion) holds approximately 51.3% of total assets [28]. In 2017, OJK enacted the Sustainable Finance Implementation Policy, requiring commercial banks to disclose their sustainable loan portfolio and social environmental costs based on the green taxonomy. Implementation is phased, beginning with large-capital banks. Since 2021, sustainable loan portfolio growth has been declining, with more than half directed to MSMEs.

The final sample comprises 44 Indonesian commercial banks observed annually over six years (2019–2024), yielding a balanced panel of 264 bank-year observations. Data frequency is annual, consistent with the reporting cadence mandated by OJK. All variables were manually hand-collected from banks' consolidated annual reports, sustainability reports, and OJK's Sustainable Finance Statistics. To ensure comparability across banks with heterogeneous disclosure quality, two-tailed 95th-percentile winsorization and predictive mean matching (PMM) imputation were applied to address outliers and missing values, respectively.

Table I.
Sample Banks Summary

Bank type	Core Capital (in trillion Rupiah)			
Bank type	6-14	17-70	>70	No. Banks
State-Owned Bank	-	1	3	4
Regional Development Bank	5	-	-	5
National Private Bank	16	13	1	30

Bank type	Core Capital (in trillion Rupiah)			
Branch Office of Foreign-Based Bank	5	-	-	5
Total	26	14	4	44

B. Variable Measurements

1) Variable of interest

Sustainable Loan (SL) is defined as the ratio of the outstanding sustainable-finance portfolio, classified under OJK Green Taxonomy, covering the 12 mandated categories (e.g., renewable energy, energy efficiency, sustainable agriculture, MSME financing) to total gross loans in year t (Eq. 1).

Social Environmental Cost (SEC) is defined as the natural logarithm of total annual expenditure disclosed under the "Social and Environmental Responsibility" section of the sustainability report, aggregating spending on community development, environmental protection, employee welfare programs, and philanthropic initiatives (Eq. 2). The log transformation addresses the large-scale disparity across KBMI tiers.

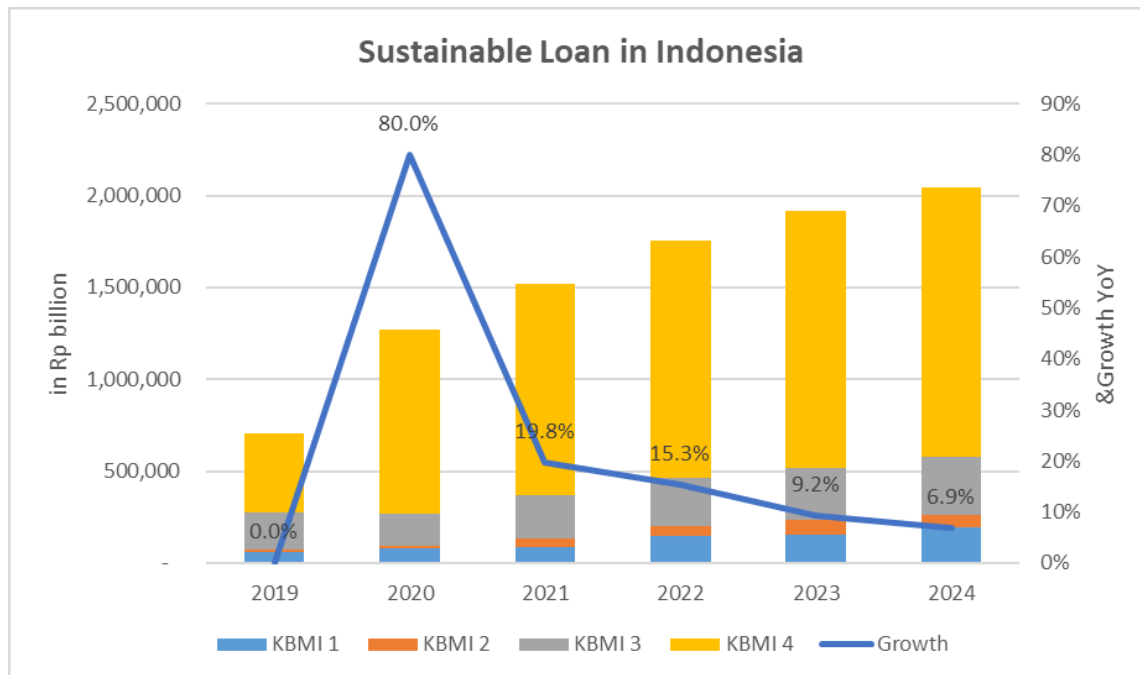


Figure. 1.
Sustainable loan portfolio and growth in Indonesia

2) Dependent variables

Net Interest Margin (NIM) measures profitability and is widely used in bank loan profitability research [29]. Cost-to-Income Ratio, also known as Operating Cost to Operating Income (OCOI) in Indonesia, measures operating efficiency [30]. NIM is calculated as net interest income divided by interest-earning assets; OCOI is operating cost divided by operating income.

3) Control variables

Control variables include NPL, LDR, CAR, and the log of total assets, drawing from bank-specific determinants literature [22], [31]. NPL captures asset quality and is negatively associated with profitability and efficiency [32]; LDR proxies liquidity and is positively associated with profitability [33]; CAR captures loss absorption ability; the log of assets proxies size, which can affect profitability depending on region [34]. Control variables are drawn from the bank-specific determinants literature and enter each model contemporaneously: NPL (asset quality), LDR (liquidity), CAR (capitalization), and $\ln(\text{Asset})$ (bank size). Table II summarizes variable definitions.

Table II.
Variable Definitions

Variable	Definitions
Net Interest Margin (%)	Net interest income / interest-earning assets
Operating Cost to Operating Income (%)	Total operating expense / total operating income
Sustainable Loan (%)	Sustainable finance portfolio / total gross loan
Social Environmental Cost	Log (Social environmental cost)
Non-Performing Loan (%)	Total non-performing loan / total gross loan
Loan Deposit Ratio (%)	Total liquid assets / total liabilities
Capital Adequacy Ratio (%)	(Tier 1 Capital + Tier 2 Capital) / risk-weighted assets
Log (Asset)	Log of total assets

C. Research Design

The econometric models are specified as follows:
where X represents the control variables.

Model selection follows the standard three-step panel procedure [35]. First, the Chow F-test compares POLS against Fixed Effects (FE); rejection indicates unobserved bank-specific heterogeneity. Second, the Breusch–Pagan LM test compares POLS against Random Effects (RE); rejection supports panel structure over pooling. Third, the Hausman test distinguishes FE from RE by examining whether the individual effects are correlated with regressors: rejection favors FE (consistent estimator), whereas non-rejection favors RE (efficient estimator).

Model specification tests (Table III) show for the NIM model, the Hausman test rejects the null at 5%, indicating correlation between the individual effects and regressors, FE is therefore preferred despite the LM test also supporting RE. For the OCOI model, the Hausman test fails to reject the null, so RE is retained as the more efficient estimator. Finally, the modified Wald test (for FE) and Breusch–Pagan test (for RE) rejects homoskedasticity in both models; consequently, cluster-robust standard errors clustered at the bank level are applied to correct inference.

Table III.
Model Specification Tests Results

Test	NIM model	OCOI model
Chow F (POLS vs FE)	$p < 0.001 \rightarrow$ reject H_0	$p < 0.001 \rightarrow$ reject H_0
Breusch–Pagan LM (POLS vs RE)	$\chi^2 = 342.75$, $p < 0.001$	$\chi^2 = 299.89$, $p < 0.001$
Hausman (FE vs RE)	$\chi^2 = 16.75$, $p = 0.010 \rightarrow$ FE	$\chi^2 = 3.20$, $p = 0.0783 \rightarrow$ RE
Modified Wald (heteroskedasticity)	$\chi^2 = 3074.05$, $p < 0.001 \rightarrow$ robust SE	$\chi^2 = 885.32$, $p < 0.001 \rightarrow$ robust SE

IV. RESULTS

Descriptive statistics (Table IV) show NIM and OCOI averages of 4% and 82%, respectively; SL average is 15%, SEC is 22.23 (≈Rp4.5 trillion). CAR is well above OJK's 8% requirement at 31%; NPL is maintained low at 3%; LDR averages 87%.

Table IV.
Descriptive Statistics

Variable	Obs	Mean	Std. dev	CV	Min	Max
NIM	264	0,04	0,00	0,02	0,01	0,08
OCOI	264	0,82	0,01	0,01	0,56	1,17
SL	264	0,15	0,01	0,06	0,00	0,48
SEC	264	22,23	0,15	0,01	17,98	26,15
NPL	264	0,03	0,00	0,04	0,00	0,06
LDR	264	0,87	0,02	0,02	0,45	1,46
CAR	264	0,31	0,01	0,03	0,16	0,80
Log (Asset)	264	32,15	0,08	0,00	30,03	34,88

Pearson's correlation analysis (Table V) confirms no multicollinearity issues between explanatory variables.

Table V.
Correlation Matrix

	CAR	NPL	LDR	Log (Asset)	SL	SEC
CAR	1,00					
NPL	-0,39*	1,00				
LDR	0,20*	-0,22*	1,00			
Log (Asset)	-0,42*	0,08	-0,01	1,00		
SL	0,00	0,03	-0,10	0,24*	1,00	
SEC	-0,44*	0,10	-0,03	0,78*	0,22*	1,00

Note: * indicates a significance level at 5% or better
Table VI presents POLS, FE, and RE regression results. Specification tests select FE for NIM and RE for OCOI; both exhibit heteroskedasticity, requiring robust

estimation. We note an inconsistency between the LM and Hausman tests for NIM models; the Hausman test indicates correlation between unrelated effects and regressors, so FE is preferred.

Table VI.
Regression Results Using Pols, Fe, And Re Estimates

Variable	NIM	OCOI				
Variable	POLS	FE	RE	POLS	FE	RE
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-0,0458	-0,3806***	-0,1610***	1,6087***	2,6337***	1,8834***
Constant	(0,0341)	(0,0965)	(0,0539)	(0,2723)	(0,9298)	(0,4389)
SL	0,3988***	0,0067	0,0100	-0,0219	0,1205*	0,0971
SL	(0,0077)	(0,0072)	(0,0070)	(0,0619)	(0,0698)	(0,0632)
SEC	0,0003	-0,0008	-0,0008	-0,0072	-0,0073	-0,0070
SEC	(0,0007)	(0,0006)	(0,0006)	(0,0057)	(0,0055)	(0,0052)
CAR	0,0231***	0,0083	0,0125*	0,0534	0,0552	0,0448
CAR	(0,0082)	(0,0072)	(0,0068)	(0,0660)	(0,0696)	(0,0624)
NPL	-0,0919	-0,1160**	-0,1285**	4,3852***	3,4189***	3,5824***
NPL	(0,0775)	(0,0535)	(0,0528)	(0,6191)	(0,5155)	(0,4885)
LDR	0,0057	0,0215***	0,0178***	0,2886	0,0091	0,0150
LDR	(0,0040)	(0,0041)	(0,0034)	(0,0323)	(0,0396)	(0,0351)
Ln Asset	0,0021	0,0132***	0,0064***	-0,0241**	-0,0553*	-0,0323**
Ln Asset	(0,0013)	(0,0030)	(0,0018)	(0,0106)	(0,0055)	(0,0147)
Number of obs	264	264	264	264	264	264
Prob > F	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000

Notes: *, **, *** indicate the statistical significance at 10%, 5%, and 1%, respectively.

Table VII reports the final robust estimates. For the NIM model (FE, cluster-robust), the SL coefficient is +0.007 (SE=0.007, $p \approx 0.35$, 95% CI: [-0.007, 0.021]), implying that a one-standard-deviation increase in the sustainable-loan share (≈ 16 percentage points) is associated with only a ≈ 0.11 percentage-point rise in NIM, which economically negligible and statistically insignificant. The SEC coefficient is -0.0008 (SE=0.0006, $p \approx 0.18$); a one-log-unit increase in SEC ($\approx 2.7 \times$ spending) corresponds to a ≈ 0.08 percentage-point decline in NIM, not distinguishable from zero. Among controls, LDR ($\beta = +0.021$, $p < 0.05$) and Ln(Asset) ($\beta = +0.013$, $p < 0.05$) are positive and significant, whereas NPL is negative but only marginal.

For the OCOI model (RE, cluster-robust), the SL coefficient is +0.097 (SE=0.063, $p \approx 0.12$, 95% CI: [-0.027, 0.221]); a one-standard-deviation rise in SL corresponds to a ≈ 1.6 -percentage-point increase in the cost-to-income ratio — directionally consistent with short-term compliance costs but statistically insignificant. The SEC coefficient is -0.007 (SE=0.005, $p \approx 0.18$), economically small. NPL is the only strongly significant driver ($\beta = +3.58$, $p < 0.01$), while Ln(Asset) is negative and significant ($\beta = -0.032$, $p < 0.05$), supporting scale efficiencies. All four hypotheses are rejected.

Table VII.
Regression Results Using Final and Robust Estimation

Variables	NIM	OCOI
Variables	(1)	(2)
SL	0.007 (0.01)	0.097 (0.11)
SEC	-0.001 (0)	-0.007 (0.01)
CAR	0.008 (0.02)	0.045 (0.14)
NPL	-0.116 (0.08)	3.582*** (1.01)
LDR	0.021** (0.01)	0.015 (0.05)
Ln Asset	0.013** (0.01)	-0.032** (0.02)
Constant	-0.381* (0.21)	1.884*** (0.51)
Number of obs.	264	264
Prob > F	0.0253	0.0000

Notes: *, **, *** indicate the statistical significance at 10%, 5%, and 1%, respectively.

V. ROBUSTNESS TESTS

Robustness tests use raw data and explore one- and two-year lagging effects of profitability and operating efficiency (Table VIII). For NIM models, SL exhibits a positive relationship with economically meaningful estimates but p-values above 0.05; the SEC relationship remains inconclusive. LDR and Total Assets remain the most significant NIM determinants.

Table VIII.
Robustness Tests Results

Variable	NIM	OCOI				
Variable	Raw Data	Lag 1Y	Lag 2Y	Raw Data	Lag 1Y	Lag 2Y
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-0,8620**	-0,3763**	-0,2721*	4.1250**	1.9653***	1.6653***
Constant	(0,3797)	(0,1746)	(0,1497)	(1.7430)	(0.5237)	(0.6070)
SL	0.0045	0.0121	0.0002	0.0293	0.0913	-0.0313
SL	(0,0123)	(0,0102)	(0,0067)	(0.2227)	(0.1438)	(0.0968)
SEC	0.0004	-0.0001	0.0001	0.0030	-0.0026	0.0005
SEC	(0,0004)	(0,0008)	(0,0009)	(0.0042)	(0.0049)	(0.0064)
CAR	-0.1275	0.0262	0,0399***	0.1628**	0.0556	0.0823
CAR	(0,0113)	(0,0204)	(0,0143)	(0.0694)	(0.1046)	(0.1039)
NPL	-0.1140	-0.1073	-0,1363**	4.7284***	2.7655***	2.5205***
NPL	(0,0846)	(0,0639)	(0,0521)	(1.6800)	(0.9827)	(0.8744)
LDR	0,0171**	0.0071	-0.0002	0.0905	0.0705	0.1350*
LDR	(0,0076)	(0,00717)	(0,0063)	(0.0674)	(0.0634)	(0.0748)
Ln Asset	0,0278**	0,0127**	0,0095**	-0.1121**	-0.0388***	-0.0329
Ln Asset	(0,0120)	(0,0054)	(0,0046)	(0.0542)	(0.0175)	(0.0210)
Number of obs	254	220	176	254	220	176
Prob > F	0.0015	0.1528	0.0200	0.0027	0.0082	0.0207

Notes: *, **, *** indicate the statistical significance at 10%, 5%, and 1%, respectively.

For OCOI models, SL shows a positive relationship in the raw data and one-year lag specifications. Under the two-year lag, the relationship turns negative, implying improved operational efficiency over the longer term, though statistically insignificant.

VI. DISCUSSION

The results suggest that sustainable finance policy in Indonesia has a neutral effect on bank profitability and operating efficiency. Banks can expand sustainable finance activities without jeopardizing short-term financial performance. The positive but insignificant SL–NIM relationship contrasts with Riyanti et al. [6] but supports the broader meta-analysis by Muchiri et al. [18]. For operating efficiency, the positive SL–OCOI relationship (lower efficiency) aligns with Nabil [20].

Three chasms may hinder sustainable loans' financial benefit. First, sustainable loans are perceived as riskier than conventional loans, increasing costs and reducing profitability, making banks risk averse. This explains why Indonesian commercial banks' portfolios mostly fund the fossil-fuel industry, which has shown positive ROA impact [36]. To address perceived risk, syndicated sustainable loans for large-scale projects are recommended for their risk-sharing characteristics.

Second, sustainable loans are often perceived as unattractive because they offer indifference compared to conventional loans. Banks should (i) engage in public-private syndicated loans for government-related borrowers, offering lower spreads and fewer collateral

requirements; and (ii) develop sustainability-linked loans (SLLs) that link loan spreads to borrowers' Sustainability Performance Targets (SPTs), offering 9.5 bps lower spreads on average [37]. Indonesian banks can also benefit from Bank Indonesia's tiered reserve requirement incentives, which effectively stimulate sustainable lending without increasing short-term NPL [38].

Third, managing sustainable loans incurs high operational compliance costs (approximately \$530,000 per annum [3]). The OCOI two-year lag effect turning negative suggests potential long-term efficiency gains. Regulators should simplify administrative and disclosure requirements, especially for lower-capital banks, while maintaining report usability. Commercial banks should streamline sustainability practices through industry-specific standardized ESG assessment frameworks integrated into existing credit systems.

For the SEC, the empirical results show a negative (n.s.) relationship with profitability and a positive (n.s.) relationship with operating efficiency. Using resource-based view theory, the small positive association between CSR expenditures and operating efficiency may indicate that Indonesian commercial banks do not yet treat CSR as a strategic resource. Banks should strategically allocate CSR budgets aligned with core operations and competencies; only when CSR is exceptionally executed will it yield positive financial returns [24].

VII. CONCLUSION

This study examines the effect of Indonesia's sustainable finance policy on commercial banks' financial performance, moving beyond the conventional green-

lending lens to jointly assess sustainable loans and social environmental costs. The findings show that increases in sustainable loan portfolios are associated with a small rise in NIM and a slight decline in OCOI; higher social environmental expenditures show a minor negative effect on profitability and a slight positive effect on efficiency. Both effects are statistically insignificant, suggesting that expanding sustainable finance does not meaningfully compromise financial performance.

Policy recommendations: regulators should introduce financial incentives or punitive measures that are financially meaningful, simplify administrative requirements for lower-capital banks, and maintain report usability. For commercial banks, syndicated sustainable loans can mitigate perceived risk for large projects; CSR budgets should be allocated strategically as resources for sustainable competitive advantage. For emerging-market regulators, the findings underline the importance of differentiated policy mechanisms calibrated to banks' capital strength and operational capabilities.

Limitations: the sample is restricted to Indonesian commercial banks. Future research could extend the time horizon and country scope and examine whether sustainable banking practices reduce carbon emissions.

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