Symbolic or Substantive? Greenwashing and Environmental Disclosure Misalignment in Indonesian Banking

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Abstract

Main Purpose *- This study investigates whether Environmental Disclosure Scores (EDS) accurately reflect actual environmental performance, as proxied by GHG emissions, in the Indonesian banking sector.*

Method *- The research employs panel data analysis using 16 publicly listed Indonesian banks from 2009 to 2023. A random-effects regression is applied, followed by the construction of a binary Greenwashing Index (GWI) to identify misalignments between EDS and actual greenhouse gas (GHG) emissions.*

Main Findings *- The findings indicate that EDS are not significantly associated with lower GHG emissions, suggesting a symbolic rather than substantive role. Although larger banks tend to emit more GHG, they are less likely to engage in greenwashing, likely due to greater regulatory scrutiny. In contrast, higher profitability increases greenwashing risk, while stronger capital adequacy reduces it.*

Theory and Practical Implications *- The findings suggest that ESG reporting should be based on performance metrics rather than narrative disclosures to ensure accountability. Policymakers are encouraged to enforce independent environmental audits and adopt outcome-based ESG frameworks.*

Novelty *- This study contributes a novel dual-approach Greenwashing Index to identify disclosure–performance misalignment, offering empirical insights for ESG research in emerging markets.*

Keywords *: Environmental Disclosure, ESG Reporting, Greenhouse Gas Emissions, Greenwashing, Sustainable Banking*

Abstrak

Tujuan Utama - Penelitian ini mengkaji apakah Skor Pengungkapan Lingkungan (EDS) secara akurat mencerminkan kinerja lingkungan yang sebenarnya, yang diproksikan melalui emisi gas rumah kaca (GRK), dalam sektor perbankan Indonesia.

Metode - Penelitian ini menggunakan data panel dari 16 bank yang terdaftar di Bursa Efek Indonesia selama periode 2009–2023. Analisis dilakukan dengan regresi efek acak, serta pembangunan Indeks Greenwashing (Greenwashing Index/GWI) berbasis selisih antara EDS dan emisi gas rumah kaca (GRK) aktual.

Temuan Utama - Temuan ini menunjukkan bahwa EDS tidak berasosiasi secara signifikan dengan penurunan emisi gas rumah kaca (GRK), yang mengindikasikan peran yang lebih bersifat simbolik daripada substantif. Meskipun bank-bank besar cenderung menghasilkan emisi GRK lebih tinggi, mereka lebih kecil kemungkinannya melakukan greenwashing, kemungkinan karena pengawasan regulasi yang lebih ketat. Sebaliknya, profitabilitas yang tinggi meningkatkan risiko greenwashing, sementara kecukupan modal yang kuat berperan sebagai faktor pelindung.

Implikasi Teori dan Kebijakan - Hasil penelitian ini menunjukkan perlunya pengungkapan ESG berbasis kinerja nyata, bukan hanya narasi atau kepatuhan administratif. Regulator seperti OJK perlu mendorong audit lingkungan independen dan menerapkan kerangka evaluasi ESG berbasis hasil.

Kebaruan Penelitian - Penelitian ini memberikan kontribusi melalui pengembangan Indeks Greenwashing dengan pendekatan ganda untuk mengidentifikasi ketidaksesuaian antara pengungkapan dan kinerja, serta menawarkan wawasan empiris bagi penelitian ESG di pasar negara berkembang.

Kata Kunci**:** Pengungkapan lingkungan, Greenwashing, Pelaporan ESG, Emisi gas rumah kaca, Perbankan berkelanjutan

INTRODUCTION

In recent years, Environmental, Social, and Governance (ESG) practices have evolved into a key institutional mechanism through which companies communicate their strategic commitment to sustainability. According to Liu et al. (2022), ESG disclosure strategies are generally shaped by institutional pressures and resource dependencies, which encourage firms to integrate sustainability principles into their core operations. In the banking sector, ESG disclosure serves not only as a tool for transparency but also as a proxy for institutional credibility—closely linked to public trust and the sector's role in advancing sustainable development goals (Oncioiu et al., 2020; Teja, 2023). While ESG encompasses environmental, social, and governance dimensions, this study focuses exclusively on the environmental component, particularly the misalignment between disclosure and actual greenhouse gas (GHG) emissions. However, the effectiveness of ESG disclosures in reflecting real environmental performance has been widely debated (Cho et al., 2015; Testa et al., 2018), especially when such disclosures are used symbolically without corresponding changes in operational behavior.

Greenwashing has emerged as a critical issue within this context (Hao et al., 2025). It refers to strategies employed by companies—including financial institutions—that create a perception of sustainability through high ESG scores without providing concrete evidence of reduced environmental impact, such as lower greenhouse gas (GHG) emissions (Kathan et al., 2025). The misalignment between disclosure narratives and actual performance raises concerns about the integrity of ESG, especially in supporting the Sustainable Development Goals (SDGs), notably SDG 12 (responsible consumption and production) and SDG 13 (climate action) (Biju et al., 2023).

As financial intermediaries, banks hold a strategic position in facilitating the transition toward a low-carbon economy (World Bank Group, 2022). This role extends beyond green financing to include environmentally responsible operations and sustainable governance practices (Gunawan et al., 2022). Nonetheless, in Indonesia, ESG practices in the banking sector often reveal a disconnect between disclosure claims and actual environmental performance. Such discrepancies open space for potential greenwashing—either as intentional misrepresentation or due to insufficient verification and accountability mechanisms (Sneideriene & Legenzova, 2025).

A concrete example of this inconsistency was identified in the present study. Several banks with high Environmental Disclosure Scores (EDS) recorded substantial annual GHG emissions. On average, sampled banks emitted 123,975 tons of CO_2 per year, with a maximum of 678,846 tons—even among banks with above-median EDS. Spearman correlation analysis further revealed a significant positive relationship between EDS and GHG emissions ($\rho = 0.325$; $p < 0.05$), suggesting that higher ESG scores do not necessarily align with improved environmental outcomes. Moreover, the Greenwashing Index (GWI) developed in this study indicates that over 53% of observations reflect a misalignment between ESG disclosures and actual emissions data. These findings reinforce concerns that some banks in Indonesia may be using ESG reporting symbolically to craft a sustainability image without implementing meaningful operational changes.

Although ESG literature is rapidly expanding, a review of existing studies reveals a notable gap in empirical research that explicitly compares environmental disclosure scores (EDS) with actual emissions data in the banking sector—particularly in emerging markets (Kılıç & Kuzey, 2019; Mou & Ma, 2023; Pinheiro et al., 2024). This gap underscores the need for data-driven assessments of ESG integrity that go beyond narrative disclosures to evaluate the alignment between reported information and actual environmental performance.

In response to these issues and research gaps, this study seeks to answer three key questions:

1. Does ESG disclosure, as measured by EDS, reflect the actual environmental performance of banks, particularly in terms of GHG emissions?
2. Do banks with higher EDS demonstrate better emissions efficiency than those with lower scores?
3. Are there specific characteristics—such as bank size, profitability, and capital adequacy—that systematically correlate with the likelihood of greenwashing practices in the Indonesian banking sector?

This study aims to make a significant contribution to the ESG and sustainability accountability literature, particularly in the context of the banking sector in emerging economies. Its empirical findings not only enrich academic understanding of greenwashing potential in ESG reporting but also offer strategic insights for regulators—particularly the Financial Services Authority of Indonesia (OJK)—in designing performance-based ESG assessment frameworks that go beyond declarative narratives.

As a scientific contribution, this study introduces a novel approach to evaluating ESG integrity by developing a Greenwashing Index (GWI)—an indicator that combines disclosure scores (EDS) with actual GHG emissions data. This index enables a more objective assessment of greenwashing potential in the banking sector. Additionally, the study promotes a performance-based ESG disclosure perspective as a more credible and accountable foundation for sustainability analysis and policy.

Theoretical Framework and Hypothesis Development

Theoretical Foundations: Legitimacy and Signaling in ESG Disclosure

Environmental, Social, and Governance (ESG) disclosure has become a pivotal mechanism through which companies—particularly those in the financial sector—communicate their sustainability commitments. Legitimacy theory posits that an organization's survival depends on how well it aligns with prevailing social norms and values (Suchman, 1995). From this perspective, ESG reporting enables banks to construct a socially and environmentally responsible image, thereby gaining public approval (Cho & Patten, 2007). However, when ESG disclosure is motivated primarily by a desire to meet external expectations without corresponding operational changes, such disclosures risk becoming merely symbolic (Campbell, 2007). This symbolic function is particularly prevalent in contexts characterized by weak accountability systems and the absence of objective ESG measurement standards (Delmas & Burbano, 2011; Marquis et al., 2016).

Complementing this view, signaling theory explains that firms use ESG disclosure as a strategic signal to convey long-term orientation, environmental responsibility, and governance quality to external stakeholders (Dhaliwal et al., 2011; Eccles et al., 2014; Spence, 1973). However, the strength and credibility of such signals depend on the consistency between reported narratives and actual performance outcomes. When inconsistencies arise—particularly between ESG disclosure scores and actual greenhouse gas (GHG) emissions—signals become "noisy," and stakeholder trust may be eroded (Kotsantonis et al., 2016; Lyon & Montgomery, 2015). In such situations, information asymmetry enables symbolic disclosures to flourish, as firms possess full knowledge of their environmental impact, while the public relies solely on voluntary reporting (Angir & Weli, 2024).

ESG, Emissions, and Greenwashing

Discrepancies between ESG disclosure and actual environmental performance have led to the phenomenon of greenwashing, defined as the strategic exaggeration or manipulation of a company's environmental responsibility image (Delmas & Burbano, 2011). Greenwashing manifests in two forms: symbolic greenwashing, where firms alter only their external communications without internal change, and structural greenwashing, driven by institutional pressures, fragmented reporting regimes, or organizational weaknesses (Bowen & Aragon-Correa, 2014). In the banking sector, greenwashing occurs when institutions report high ESG scores or launch sustainability initiatives while continuing to finance carbon-intensive industries or failing to reduce their operational emissions. Although the conceptual discourse on greenwashing is growing, empirical studies directly comparing Environmental Disclosure Scores (EDS) and actual GHG emissions remain scarce, especially in emerging markets (Kılıç & Kuzey, 2019; Mou & Ma, 2023; Pinheiro et al., 2024). This research gap highlights the need for discrepancy-based analysis to objectively assess alignment between disclosure and performance.

The Financial Sector's Role in the SDG Agenda

The banking industry plays a central role in achieving the 2030 Sustainable Development Goals (SDGs), particularly SDG 12 (responsible consumption and production) and SDG 13 (climate action) (Griggs

et al., 2013). Banks not only provide capital for sustainable projects but are also expected to internalize ESG principles into their governance systems and risk management frameworks (Park & Kim, 2020; Sutrisno et al., 2024). However, this potential can be undermined if ESG reporting becomes a tool for symbolic reputation-building rather than authentic transformation (Gunawan et al., 2022; Kolk et al., 2008). In such cases, ESG disclosures may mislead stakeholders and weaken the financial system's effectiveness in driving a credible sustainability transition.

ESG Disclosure as an Instrument for Green Economic Transition

Normatively, ESG disclosure is positioned as a strategic driver of the green economy transition—defined as low-carbon, resource-efficient, and socially inclusive development (OECD, 2021). Sustainability reporting is intended to signal corporate commitments to emissions reduction, energy efficiency, and environmentally responsible practices. However, when such disclosures are driven more by reputational goals than by operational improvement, ESG narratives risk becoming superficial (Zhang et al., 2024). This challenge is especially relevant in the Indonesian banking sector, which lacks mandatory environmental audits and external assurance systems—factors that heighten the risk of symbolic behavior (Gunawan et al., 2022).

Hypothesis Development

Grounded in legitimacy theory (Suchman, 1995) and signaling theory (Spence, 1973), this study aims to evaluate the alignment between Environmental Disclosure Scores (EDS) and actual environmental performance, proxied by greenhouse gas (GHG) emissions, in the Indonesian banking sector. These theoretical lenses provide a nuanced understanding of how firms utilize ESG disclosures either to secure social legitimacy or to convey strategic signals to external stakeholders.

To objectively assess the integrity of ESG disclosures, this study introduces a novel Greenwashing Index (GWI)—a binary indicator identifying the misalignment between ESG disclosure levels and actual GHG emissions. Given the limited empirical evidence in emerging markets, as well as the increasing use of ESG as a symbolic tool in capital markets, the following hypotheses are proposed:

A high Environmental Disclosure Score (EDS) is generally interpreted as an indicator of a firm's commitment to sustainability, including efforts to manage environmental risks such as carbon emissions. From the legitimacy perspective, organizations are incentivized to enhance ESG disclosures to gain societal approval. However, if such disclosures are not accompanied by tangible improvements in environmental performance, they may serve only symbolic legitimacy functions, potentially reflecting greenwashing practices. Accordingly:

H1: Environmental Disclosure Score (EDS) is negatively associated with greenhouse gas (GHG) emissions.

When a bank simultaneously exhibits both high EDS and high GHG emissions, this inconsistency between disclosure and actual impact suggests the presence of greenwashing. To operationalize this misalignment, a Greenwashing Index (GWI) is constructed. Thus, the second hypothesis is proposed as:

H2: Banks classified as having both high EDS and high GHG emissions are more likely to exhibit greenwashing behavior.

From a signaling theory standpoint, firm characteristics can shape how credible and strategic a disclosure is perceived. One such factor is bank size. Larger banks are typically subject to greater media attention, regulatory scrutiny, and market expectations. As a result, they have stronger incentives to maintain consistency between ESG narratives and operational reality to preserve institutional trust and minimize reputational risk. Hence:

H3a: Bank size is negatively associated with the likelihood of greenwashing.

Profitability, on the other hand, may amplify the symbolic use of ESG disclosures. While financially strong banks may have more capacity to invest in sustainability, they may also be more motivated to use ESG strategically as a reputation management tool, particularly when ESG disclosures are not linked to

actual environmental improvements. Accordingly:
H3b: Profitability (ROA) is positively associated with the likelihood of greenwashing.

A bank's capital strength, proxied by the Risk-Based Capital Ratio (RBCR), reflects its financial resilience and ability to integrate authentic sustainability practices. Banks with stronger capital buffers are better positioned to implement environmentally responsible strategies, thus reducing the likelihood of relying on symbolic disclosures. Therefore:
H3c: Risk-Based Capital Ratio (RBCR) is negatively associated with the likelihood of greenwashing.

These hypotheses are empirically tested using panel data regression and logistic estimation models to examine the determinants of misalignment between ESG disclosure and environmental performance, and to identify the prevalence of symbolic ESG behavior within Indonesia's banking sector.

RESEARCH METHOD

Research Design and Analytical Strategy

This study employs a quantitative panel data design to evaluate the misalignment between Environmental Disclosure Scores (EDS) and actual greenhouse gas (GHG) emissions as an indicator of potential greenwashing practices within the Indonesian banking sector. The analytical strategy consists of the following steps:

- Random-effects panel regression to examine the effect of ESG disclosure on GHG emissions *(Model 1: RE Panel – GHG)*;
- Construction of the Greenwashing Index (GWI) based on the divergence between disclosure and actual performance *(Model 2: GWI Construction)*;
- Random-effects logistic regression to identify bank-level factors influencing the likelihood of greenwashing *(Model 3: RE Logit – GWI)*.

Data and Sample

The study population includes all conventional commercial banks listed on the Indonesia Stock Exchange (IDX) and recorded in the Bloomberg ESG database as of 2024. Based on the latest Bloomberg data, 48 actively listed banks had issuer codes on the Indonesian capital market at the time of data collection.

However, not all banks met the required data completeness criteria for ESG and environmental performance analysis. Therefore, the following inclusion criteria were applied: (1) conventional commercial banks; (2) consistent publication of annual and sustainability reports during 2009–2023; (3) complete ESG data in Bloomberg, particularly Environmental Disclosure Score (EDS) and actual GHG emissions; and (4) full financial data availability, including ROA, RBCR, and total assets.

Using purposive sampling, 16 of the 48 banks (approximately 33.3%) met all criteria and were selected as the final sample. These banks represent the segment with the highest transparency in ESG disclosure.

Table 1. List of Sample Banks

No.	Bank Code	Bank Name
1	BBHI	Allo Bank Indonesia Tbk
2	BTPS	Bank BTPN Syariah Tbk
3	BTPN	PT Bank BTPN Tbk
4	BBCA	PT Bank Central Asia Tbk
5	BNGA	PT Bank CIMB Niaga Tbk
6	BDMN	PT Bank Danamon Indonesia Tbk
7	ARTO	PT Bank Jago Tbk
8	BMRI	PT Bank Mandiri (Persero) Tbk
9	BNII	PT Bank Maybank Indonesia Tbk

10	MEGA	PT Bank Mega Tbk
11	BBNI	PT Bank Negara Indonesia Tbk
12	BNLI	PT Bank Permata Tbk
13	BBRI	PT Bank Rakyat Indonesia Tbk
14	BRIS	PT Bank Syariah Indonesia Tbk
15	BBTN	PT Bank Tabungan Negara Tbk
16	PNBN	PT Bank Pan Indonesia Tbk

Source: Author's compilation based on Bloomberg and bank annual reports.

To operationalize the study, six key variables are defined: Environmental Disclosure Score (EDS), greenhouse gas (GHG) emissions, the Greenwashing Index (GWI), bank size, return on assets (ROA), and the Risk-Based Capital Ratio (RBCR). To reduce the influence of extreme values and enhance estimation stability, winsorization was applied at the 5th and 95th percentiles for EDS, GHG emissions, ROA, log of total assets, and RBCR. The definitions and data sources for each variable are summarized in Table 2.

Table 2. Operational Definitions of Variables and Data Sources

Variable	Operational Definition	Reference Sources	Data Sources
Environmental Disclosure Score (EDS)	Environmental disclosure score (0–100), indicating the intensity of environmental reporting within ESG frameworks.	Alazzani et al., (2021); Manita et al., (2018)	Bloomberg ESG Database
Greenhouse Gas Emissions (GHG)	Total annual GHG emissions (in tons of CO_2) reported by the bank.	Jung et al., (2018)	Bloomberg; Sustainability Reports
Greenwashing Index (GWI)	Dummy = 1 if EDS ≥ median and GHG emissions ≥ median in the same year; 0 otherwise.	Lyon & Montgomery, (2015); Delmas & Burbano, (2011); developed by the author	Calculated from Bloomberg and Sustainability Reports
Bank Size (Log Assets)	Natural logarithm of total assets (in million IDR).	Berger & Bouwman, (2009); Cornett et al., (2016)	Bloomberg; Annual Reports
Return on Assets (ROA)	Net income divided by total assets.	Dietrich & Wanzenried, (2011); Athanasoglou et al., (2008)	Bloomberg
Risk-Based Capital Ratio (RBCR)	Capital adequacy ratio based on risk-weighted assets.	(Basel Committee on Banking Supervision, 2011)	Bloomberg; Annual Reports

Source : Author's compilation based on relevant literature and Bloomberg data.

Model Estimation

This study employs three main models to analyze the relationship between ESG disclosure and environmental performance and to identify the determinants of greenwashing behavior in the Indonesian banking sector.

Model 1: Random-Effects Panel Regression – GHG Emissions

The first model investigates whether a bank's Environmental Disclosure Score (EDS) is associated with its reported greenhouse gas (GHG) emissions, while controlling for firm-level characteristics.
Model Equation:

$$GHG_{it} = \alpha + \beta 1\ EDS_{it} + \beta 2\ logAset_{it} + \beta 3\ ROA_{it} + \beta 4\ RBCR_{it} + \sum_t \delta_t\ Year_t + \varepsilon_{it}$$

Where:

- GHG_{it} = Total annual GHG emissions (in tons CO_2) of bank *i* in year *t*, winsorized at the 5th and 95th

percentiles.

- EDS_{it} = Environmental Disclosure Score, winsorized at the 5th and 95th percentiles.
- $logAset_{it}$ = Natural log of total assets.
- ROA_{it} = Return on Assets, as a profitability indicator.
- $RBCR_{it}$ = Risk-Based Capital Ratio.
- $\sum_t \delta_t Year_t$ = Year fixed effects, a set of dummy variables capturing unobserved time-specific effects such as macroeconomic shifts or regulatory changes.
- ε_{it} = Error term.

Justification for Random Effects (RE) Model:

The model is estimated using a random-effects specification for two reasons. First, the Hausman test indicates that the RE estimator is consistent and more efficient than fixed effects (Hausman, 1978). Second, random effects are conceptually appropriate since key bank characteristics (e.g., size, ESG strategy, ownership structure) exhibit limited variation over time. Therefore, RE better captures inter-bank differences without losing cross-sectional information.

Model 2: Construction of the Greenwashing Index (GWI)

To evaluate potential misalignment between ESG disclosure and actual environmental performance, a binary Greenwashing Index (GWI) is constructed using two complementary approaches:

1. Residual-Based GWI:

Residuals from Model 1 serve as indicators of disclosure–performance mismatch. Observations with residuals above the median of the positive distribution are classified as greenwashing cases, as their actual emissions exceed the expected level based on disclosure and firm characteristics.

2. Median-Based GWI:

A dummy variable GWI = 1 if both EDS and GHG emissions are above the median in the same year; otherwise, GWI = 0. This method flags banks that report high ESG scores but simultaneously emit large amounts of GHG.

This dual approach enables triangulated identification of potential greenwashing, balancing statistical objectivity and conceptual clarity.

Model 3: Random-Effects Logistic Regression – Likelihood of Greenwashing

The third model examines the bank-level factors influencing the probability of engaging in greenwashing, using GWI as the binary dependent variable.

Model Equation:

$$Pr(GWI_{it} = 1) = logit^{-1}(\alpha + \beta 1\ EDS_{it} + \beta 2\ logAset_{it} + \beta 3\ ROA_{it} + \beta 4\ RBCR_{it} + \sum_t \delta_t\ Year_t + \varepsilon_{it})$$

Where:

- $Pr(GWI_{it} = 1)$ = Probability that bank *i* in year *t* is classified as engaging in greenwashing.
- EDS_{it} = Environmental Disclosure Score, winsorized at the 5th and 95th percentiles.
- $logAset_{it}$ = Natural log of total assets.
- ROA_{it} = Return on Assets, as a profitability indicator.
- $RBCR_{it}$ = Risk-Based Capital Ratio.
- $\sum_t \delta_t Year_t$ = Year fixed effects, a set of dummy variables capturing unobserved time-specific effects such as macroeconomic shifts or regulatory changes.
- ε_{it} = Error term.

Since the dependent variable is binary, this model is estimated using random-effects logistic regression, with standard errors clustered at the bank level.

Justification for Using Random-Effects Logistic Regression:

Fixed-effects logistic models (xtlogit, fe) exclude all observations with no within-group variation, potentially discarding valuable data. In contrast, random-effects logistic regression (xtlogit, re) retains more observations and is more appropriate when firm-level characteristics are relatively stable over time. This approach aligns with best practices in prior ESG studies employing binary outcomes (e.g., Albuquerque et al., 2020; Jiraporn et al., 2014).

Validity and Robustness Tests

To ensure the validity and reliability of the regression results, several diagnostic and robustness checks were conducted as follows:

- Normality Test: The Shapiro–Wilk test was employed to assess whether the primary variables followed a normal distribution. The results showed that all variables had p-values below 0.05, indicating a violation of the normality assumption. Consequently, robust procedures such as winsorization and the use of clustered standard errors were applied to enhance the validity of the estimates. The Shapiro–Wilk test is particularly recommended for small to medium sample sizes and is considered more sensitive than other normality tests (Mohd Razali & Bee Wah, 2011).
- Multicollinearity Test: Variance Inflation Factor (VIF) was used to detect multicollinearity among the independent variables. All VIF values were below the conservative threshold of 5, indicating no serious multicollinearity concerns in the model (Kutner et al., 2004).
- Spearman Correlation Test: Given the non-normal distribution of several key variables, Spearman's rank-order correlation was employed to measure bivariate associations. This non-parametric method is effective in capturing monotonic relationships, even when the data contain outliers or are non-normally distributed (Hauke & Kossowski, 2011). The results revealed significant correlations between EDS and GHG emissions, as well as between bank size and GHG emissions, suggesting potential spurious relationships that required further control in multivariate regressions.
- Hausman Test for Model 1: The Hausman test was applied to determine the most appropriate panel regression model. The result indicated that the random-effects model was preferable to fixed effects ($p > 0.05$), thus the random-effects estimator was used for Model 1 (Hausman, 1978).
- Winsorization: To mitigate the influence of extreme values (outliers), key variables—EDS, GHG emissions, ROA, asset size, and RBCR—were winsorized at the 5th and 95th percentiles. This approach helps stabilize data distributions without deleting observations, as recommended by Wilcox & Keselman, (2003) for heavy-tailed financial datasets.
- Year Fixed Effects: Year dummy variables were included in all models to control for macroeconomic variation, changes in regulatory policy, and time-specific trends that may affect ESG performance and GHG emissions. This approach is widely adopted in longitudinal ESG studies (Ben-David et al., 2018; Flammer, 2021).
- Cluster-Robust Standard Errors: To address potential heteroskedasticity and serial correlation within banks over time, the study employs cluster-robust standard errors at the bank level. This method corrects for within-cluster dependence and yields more reliable standard error estimates in panel data settings, especially when the number of clusters is moderate to large (Colin Cameron & Miller, 2015; Petersen, 2009).

Taken together, these procedures enhance the internal and external validity of the estimation models, ensuring that the empirical findings on ESG disclosure integrity and greenwashing risks are robust and reliable for both policy implications and theoretical advancement.

RESULTS

Descriptive Statistics

Table 3 presents the descriptive statistics for all key variables used in this study, both before and after the winsorization process. Winsorization was applied to mitigate the influence of extreme outliers without removing observations, thereby enhancing the robustness of the analysis (Wilcox & Keselman, 2003).

The average Environmental Disclosure Score (EDS) is 8.12 on a 0–100 scale, indicating a generally low level of environmental reporting among sampled banks. The relatively high standard deviation (10.08) suggests substantial disparity in disclosure practices across institutions.

The mean level of reported greenhouse gas (GHG) emissions is 123,975 tons of CO_2 per year, reflecting a significant environmental footprint—particularly from larger banks—relative to Indonesia's national emissions reduction commitments. The large dispersion, as shown by the standard deviation of 171,676 tons, highlights pronounced variability in banks' environmental performance.

The Greenwashing Index (GWI) has a mean value of 0.53, implying that over half (53%) of the observations show a potential misalignment between EDS and actual GHG emissions. This provides an initial indication that greenwashing may be systematically present in the Indonesian banking sector.

Regarding control variables, the average Return on Assets (ROA) is 1.62%, suggesting moderate profitability in the context of the banking industry. Meanwhile, the average Risk-Based Capital Ratio (RBCR) is 23.85%—substantially above the Basel III minimum requirement of 8%—indicating that the sampled banks maintain strong capital buffers.

Bank size, measured as the natural logarithm of total assets, has a mean of 32.38. This reflects the dominance of large banks in the sample, such as Bank Mandiri, BRI, BCA, and BNI, which are characterized by extensive operational scale and greater public visibility and scrutiny.

Table 3. Descriptive Statistics of Research Variables (Before and After Winsorization)

Variable	Obs	Min	Max	Median	Mean	Std. Dev.
EDS	168	0.000	34.0985	3.6847	8.1234	10.0794
EDS (winsorized)	168	0.000	29.9003	3.6847	8.0410	9.8859
GHG Emissions (tons)	49	103.216	678,846	29,949.1	123,975	171,676.4
GHG Emissions (winsorized)	49	234.800	492,370	29,949.1	118,826.4	157,336.2
Greenwashing Index (GWI)	230	0.000	1.000	1.000	0.5348	0.4999
ROA (%)	227	–12.2842	10.2080	1.4743	1.6174	2.1372
ROA (winsorized)	227	–1.5257	3.7431	1.4743	1.6071	1.1693
RBCR (%)	221	11.35	169.92	20.29	23.8530	17.2890
RBCR (winsorized)	221	13.24	79.53	20.29	23.0851	12.1649
Log(Assets)	230	26.8484	35.3154	32.8004	32.3789	1.8831
Log(Assets, winsorized)	230	28.1795	34.8124	32.8004	32.4021	1.7775

Source: Author's calculation using Stata, based on Bloomberg data and annual reports.

Normality Assessment of Key Variables

Table 4. Shapiro–Wilk Normality Test Results

No	Variable	N	W	Z	Prob > z	Distribution
1	EDS	168	0.8431	6.846	0.0000	Non-Normal
2	GHG Emissions (tons)	49	0.7152	5.493	0.0000	Non-Normal
3	ROA	227	0.7418	8.710	0.0000	Non-Normal
4	RBCR	221	0.4720	10.299	0.0000	Non-Normal
5	Log(Assets)	230	0.9005	6.534	0.0000	Non-Normal

Notes: *N* = Number of observations; *W* = Shapiro–Wilk statistic (closer to 1 indicates greater normality); *Z* = Standardized value used to derive the p-value (Prob > z). Source: Author's calculation using Stata, based on Bloomberg data and annual reports.

The Shapiro–Wilk test was conducted for all key variables to assess normality. As shown in Table 4, all variables yielded Prob > z values below 0.05, indicating that their distributions deviate significantly from normality at the 5% significance level. To mitigate potential estimation bias due to non-normality, outliers were winsorized, and regression models were estimated using robust standard errors—an approach well-suited for non-normally distributed data.

Spearman Correlation Analysis

Table 5. Spearman Correlation Matrix of Key Variables

Variable	EDS	GHG	ROA	RBCR	Log Assets
EDS	1	0.325*	0.102	0.086	0.214*
GHG		1	0.425*	0.025	0.826*
ROA			1	0.487*	0.487*
RBCR				1	–0.184
Log Assets					1

Note: * indicates correlation is significant at the 0.05 level.
Source: Author's calculation using Stata.

Given the non-normal distribution of key variables (see Normality Table 4), Spearman's rank-order correlation was employed to assess bivariate associations. This non-parametric method is effective for identifying monotonic relationships, especially when the data deviate from normality.

The results in Table 5 reveal several important insights:

- A significant positive correlation is found between the Environmental Disclosure Score (EDS) and GHG emissions ($\rho = 0.325$; $p < 0.05$). This contradicts the normative expectation that ESG disclosure reflects a firm's commitment to emissions reduction. Instead, it suggests that banks with higher EDS tend to report higher GHG emissions, potentially indicating greenwashing behavior.
- Bank size (log of assets) shows a very strong positive correlation with GHG emissions ($\rho = 0.826$; $p < 0.05$), implying that larger banks tend to generate more emissions, likely due to greater operational scale and involvement in more capital-intensive financing activities.
- Profitability (ROA) is also positively correlated with GHG emissions ($\rho = 0.425$; $p < 0.05$), indicating that more profitable banks do not necessarily demonstrate better environmental performance. This supports the hypothesis of a potential trade-off between financial and environmental performance.
- Positive and significant correlations are also observed between ROA and RBCR ($\rho = 0.487$), and between ROA and log of assets ($\rho = 0.487$), suggesting that stronger profitability is generally associated with higher capital adequacy and larger institutional size.
- In contrast, RBCR shows a weak and statistically insignificant negative correlation with bank size ($\rho = –0.184$) and no significant relationship with GHG emissions.

These findings highlight the potential presence of spurious relationships, particularly between ESG disclosure and environmental performance. Such associations warrant further investigation through multivariate regression analysis, with adequate controls for financial indicators and institutional size to ensure robust interpretation.

Multicollinearity Test

Table 6. VIF Test Results for Regression Models

Variable	VIF (GHG Model)	1/VIF	VIF (GWI Model)	1/VIF
Log Assets	3.36	0.298	2.37	0.421
RBCR	2.87	0.349	1.67	0.599

Variable	VIF (GHG Model)	1/VIF	VIF (GWI Model)	1/VIF
ROA	1.64	0.610	1.39	0.718
EDS	1.11	0.897	1.44	0.692
Mean VIF	**2.25**	—	**1.72**	—

Source: Author's calculation using Stata.

Table 6 reports the Variance Inflation Factor (VIF) test results used to assess potential multicollinearity among independent variables in two regression models: the GHG emissions model and the Greenwashing Index (GWI) model. All VIF values fall well below the conservative threshold of 5, with average VIF scores of 2.25 for the GHG model and 1.72 for the GWI model. The variable *log of assets* shows the highest VIF in both models (3.36 and 2.37, respectively), but still within acceptable bounds. Moreover, the 1/VIF values—which approach 1 for most predictors—confirm the low level of linear intercorrelation among the independent variables.

These findings indicate no serious multicollinearity concerns, suggesting that the regression estimates are statistically valid and not distorted by redundant predictors.

Panel Model Selection: Hausman Test

Table 7 reports the Hausman test results comparing the fixed-effects and random-effects specifications for Model 1. The test yields a $Chi^2(12)$ value of 19.64 with a p-value of 0.0741. Since the p-value exceeds the 5% significance threshold, the null hypothesis of no systematic difference between the coefficients cannot be rejected. This supports the use of the random-effects estimator for the main regression analysis of GHG emissions (Hausman, 1978).

Table 7. Hausman Test Results for Model 1 (RE vs FE)

Variable	Fixed Effects (b)	Random Effects (B)	Difference (b–B)	Std. Error
EDS	5,427.76	–1,266.02	6,693.79	6,668.01
Log Assets	351,424.60	141,539.80	209,884.80	335,227.50
ROA	110,513.60	–4,700.43	115,214.03	75,236.89
RBCR	–35,738.81	7,005.44	–42,744.25	26,084.21
Year_2015	–242,229.00	110,348.20	–352,577.30	135,050.50
Year _2017	–310,929.40	28,062.54	–338,991.94	358,801.30
Year _2018	–279,399.80	68,633.36	–348,033.16	337,500.80
Year _2019	–309,823.10	59,185.32	–369,008.42	302,305.50
Year _2020	–305,096.20	42,482.11	–347,578.31	312,995.20
Year _2021	–341,996.80	–3,239.51	–338,757.29	277,323.20
Year _2022	–336,265.40	65,671.01	–401,936.41	286,148.40
Year_2023	–241,121.70	258,599.70	–499,721.40	252,084.30

Test summary:

- $Chi^2(12) = 19.64$
- $Prob > Chi^2 = 0.0741$
- Note: V_b–V_B is not positive definite

Source: Author's estimation using Stata, based on Bloomberg data.

Panel Regression Results (Model 1)

The random-effects panel regression reveals that ESG disclosure, as measured by EDS, has no statistically significant effect on GHG emissions. This non-significance supports the hypothesis that ESG disclosure may serve symbolic purposes without reducing actual environmental impact. Bank size (log

assets) and capital adequacy (RBCR) are both positively and significantly associated with GHG emissions, while ROA shows no significant effect.

Table 8. Random-Effects Estimation: EDS and GHG Emissions

Variable	Coefficient	Std. Error	p-value	Interpretation
EDS	–1,266.02	2,925.40	0.559	Not significant
Log Assets	141,539.80	46,091.00	0.002**	Positive, significant
ROA	–4,700.43	38,170.50	0.919	Not significant
RBCR	7,005.44	2,702.25	0.009**	Positive, significant
Constant	–4,830,137	1,470,067	0.002**	—

Note: ** indicates significance at the 0.01 level.
Source: Author's calculation using Stata.

Logistic Panel Regression on Greenwashing (Model 3)

The random-effects logistic regression reveals that ESG disclosure (EDS) is not a statistically significant predictor of greenwashing likelihood (GWI = 1). Bank size is negatively and significantly associated with greenwashing, suggesting that larger banks may face greater external scrutiny. ROA is positively associated with greenwashing risk, implying that more profitable banks may use ESG disclosure symbolically. RBCR is negatively associated with greenwashing likelihood, highlighting its potential role as a protective factor.

Table 9. Random-Effects Logistic Regression: Determinants of Greenwashing (GWI = 1)

Variable	Coefficient	Std. Error	p-value	Interpretation
EDS	–0.113	0.071	0.110	Not significant
Log Assets	–2.224	1.056	0.035*	Negative, significant
ROA	+1.740	0.835	0.037*	Positive, significant
RBCR	–0.126	0.061	0.039*	Negative, significant
Constant	+77.237	36.156	0.033	Significant

Note: * indicates significance at the 0.05 level.
Source: Author's calculation using Stata.

DISCUSSION

Misalignment Between ESG Disclosure and Actual Emissions: Evidence of Greenwashing

The findings of this study reveal that the Environmental Disclosure Score (EDS) has no significant effect on greenhouse gas (GHG) emissions. Moreover, a positive correlation is observed between EDS and GHG emissions. In other words, a higher disclosure score does not necessarily correspond to lower emissions generated by banks. This suggests the presence of greenwashing practices, where ESG disclosures are used as symbolic instruments rather than being accompanied by substantive environmental actions.

These results support the arguments of legitimacy theory and signaling manipulation, which suggest that firms often use ESG reporting to manage external perceptions rather than to communicate actual sustainability performance (Cho et al., 2015; Lyon & Montgomery, 2015; Walker & Wan, 2012).

The findings are consistent with studies by Jang et al., (2022) and Treepongkaruna et al., (2024), who noted that ESG disclosures are frequently employed to divert attention from poor environmental performance and often fail to align with actual emissions data—especially in Southeast Asian banking institutions. However, the results contrast with prior research by Drempetic et al., (2020), Khan et al., (2016), and Michelon et al., (2015), which found that higher or materially relevant ESG disclosures are

typically associated with reduced emissions and tangible improvements in environmental performance, particularly in sectors with direct environmental impacts.

This discrepancy highlights the critical role of institutional and regulatory environments. In emerging economies like Indonesia—where ESG frameworks remain underdeveloped—symbolic ESG disclosure is more likely to proliferate, allowing firms to project an image of environmental responsibility without committing to real change.

Bank Size and Greenwashing: The Role of External Scrutiny?

This study finds that bank size, proxied by the natural logarithm of total assets, is negatively and significantly associated with the likelihood of greenwashing, suggesting that larger banks tend to demonstrate greater alignment between ESG disclosures and actual environmental performance. This result supports stakeholder theory, which posits that larger firms face greater external pressure and public scrutiny (Clarkson et al., 2008). It aligns with findings by Huang & Kung, (2010), who argue that large firms are more accountable due to their heightened visibility, and by Husted & Sousa-Filho, (2017), who demonstrate that firms in emerging markets with greater exposure to global capital and stakeholder networks tend to exhibit stronger sustainability performance in response to reputational concerns. However, this result contrasts with Velte, (2017), who finds that large firms do not necessarily behave more responsibly, often relying on symbolic legitimacy strategies, and with Marquis & Qian, (2014), who argue that companies in less stringent institutional environments may adopt ESG disclosures to maintain legitimacy rather than to signal genuine environmental improvements. Interestingly, while bank size reduces the likelihood of greenwashing, it is positively associated with GHG emissions in the main regression, reflecting that larger banks, by virtue of their operational scale, contribute more to emissions despite being more consistent in reporting—highlighting that large bank size does not necessarily reduce carbon intensity but rather enhances alignment between reported disclosures and actual performance due to increased scrutiny.

Profitability and Strategic Signaling of Sustainability

The findings reveal that Return on Assets (ROA) is positively and significantly associated with the likelihood of greenwashing, suggesting that more profitable banks are more inclined to use ESG disclosures as symbolic tools rather than reflections of genuine environmental efforts. This supports the argument that ESG can function as a form of reputational window-dressing (Jang et al., 2022; Wanyan & Zhao, 2024), where firms leverage their financial strength to craft a sustainable image without substantial behavioral change. This result is consistent with studies such as Yoon et al., (2018), who find that highly profitable firms often use CSR/ESG reporting to bolster image rather than alter operations, and Delmas & Burbano, (2011), who note that firms with greater financial capacity face stronger incentives to greenwash. However, contrasting evidence suggests that profitability can also enhance a firm's ability to implement substantive sustainability strategies. For instance, Eccles et al., (2014) show that financially successful firms actively embed ESG into strategic management, while Fatemi et al., (2015) find a positive relationship between profitability and environmental performance. These mixed findings imply that profitability does not inherently drive authentic sustainability; instead, its effect depends on managerial intent and the intensity of stakeholder pressure.

Capital Strength as a Protective Factor Against Greenwashing

This study finds that the Risk-Based Capital Ratio (RBCR) is negatively and significantly associated with the likelihood of greenwashing, suggesting that banks with stronger capital buffers are less likely to engage in symbolic ESG disclosures and more capable of implementing authentic sustainability practices. This supports the prudential ESG perspective, which argues that financial strength enhances a bank's capacity to embed sustainability meaningfully (Weber, 2014; Wu et al., 2024). The result aligns with findings by Chih et al., (2010), who report that financially sound banks are more inclined to adopt CSR as part of their corporate policy, and Goss & Roberts, (2011), who demonstrate that well-capitalized banks enjoy lower funding costs due to reduced perceived ESG risk. However, this contrasts with studies such

as Lins et al., (2017), who find that capital structure does not consistently predict ESG integrity, particularly in settings with weak regulatory oversight, and Ioannou & Serafeim, (2015), who argue that banks with stronger capital positions may face less pressure to act responsibly, leveraging their market power against both regulators and the public. These diverging results suggest that capital strength alone is not a definitive safeguard against greenwashing; rather, its effectiveness depends on the level of external pressure and the bank's internal cultural commitment to sustainability.

Theoretical Contributions and Policy Implications

This study makes significant theoretical contributions to the growing literature on sustainability management, social and environmental accounting, and green finance by exploring the misalignment between ESG disclosures and actual environmental performance in the banking sector of a developing country context. It advances and refines both legitimacy theory (Deegan, 2002; Suchman, 1995) and signaling theory (Spence, 1973), demonstrating that ESG disclosures may serve as instruments of symbolic legitimacy rather than reflecting genuine sustainability commitments.

From the perspective of legitimacy theory, the findings support the notion that firms can manipulate public perceptions through formal disclosures without substantive improvements in performance—commonly referred to as greenwashing. Simultaneously, the study challenges the boundaries of signaling theory by showing that sustainability signals, as conveyed through ESG scores, may lack credibility if not substantiated by concrete emission outcomes. Consequently, this research proposes a disclosure–performance gap framework as a more context-sensitive theoretical approach, particularly relevant to institutional environments in developing economies where signal distortion is more prevalent in ESG practices.

In addition, the study contributes to the literature on risk governance and prudential sustainability in banking by showing that the Risk-Based Capital Ratio (RBCR) plays a mitigating role against greenwashing. This supports a paradigm shift from intention-based corporate social responsibility (voluntary CSR) toward compliance-oriented and risk-based sustainability management in financial institutions.

On the policy front, the findings underscore the need to move beyond declarative, narrative-driven approaches and adopt outcome-based ESG regulation—especially within the financial sector. Regulatory bodies such as Indonesia's Financial Services Authority (OJK) and Bank Indonesia (BI) are advised to:

- Integrate actual environmental performance metrics (e.g., GHG emissions data) into ESG assessment systems for banks;
- Mandate independent environmental audits as a required component of sustainability reporting;
- Develop greenwashing assessment tools, such as the Greenwashing Index (GWI) introduced in this study, for both internal monitoring and external verification;
- Design incentive and penalty schemes based on verified environmental outcomes to enhance accountability.

More broadly, this study supports the Sustainable Development Goals (SDGs), particularly Goal 12 (responsible consumption and production) and Goal 13 (climate action), by providing empirical evidence for the urgent reform of sustainability reporting standards. Such reforms are essential to ensuring that the financial sector fulfills its strategic role in enabling a low-carbon economic transition.

CONCLUSION

This study evaluates the integrity of ESG disclosure in the Indonesian banking sector by examining the alignment between Environmental Disclosure Scores (EDS) and actual greenhouse gas (GHG) emissions. The findings indicate that EDS is not significantly associated with lower GHG emissions, suggesting that ESG disclosure may function more as a symbolic signal than a reflection of true sustainability performance. The results also reveal that banks with high EDS can still report high emissions, highlighting the presence of potential greenwashing practices. While bank size is positively related to

emissions, it is negatively associated with greenwashing likelihood, possibly due to greater external scrutiny. In contrast, profitability (ROA) increases the likelihood of greenwashing, while higher capital adequacy (RBCR) appears to reduce it, implying that stronger financial foundations may enhance ESG reporting credibility. Overall, ESG disclosure in its current form cannot be assumed to represent authentic environmental commitment, underscoring the risks of symbolic legitimacy in sustainability communication within the Indonesian banking sector.

SUGGESTION

Practical advice: Regulators such as the Financial Services Authority (OJK) are advised to strengthen ESG disclosure standards by mandating performance-based environmental reporting and ensuring independent verification of GHG emission data. Such measures will enhance the credibility of sustainability reports and mitigate the risk of greenwashing, particularly in the financial sector. Banks should be required to integrate verifiable environmental performance indicators into their internal audit and compliance frameworks. Moving beyond symbolic compliance, financial institutions must adopt outcome-based ESG strategies that align with national green transition priorities and support the achievement of SDG 13. Investors are also encouraged to exercise greater scrutiny toward ESG disclosures by prioritizing audited, performance-based indicators over voluntary or unaudited ESG scores when making investment decisions.

Theoretical Suggestions: This study contributes to ESG disclosure scholarship by introducing a dual-approach Greenwashing Index, combining residual-based and median-based classifications, as a novel empirical tool to detect the misalignment between disclosure and actual environmental performance. However, this study is constrained by limited availability and coverage of standardized GHG emissions data in the Indonesian banking sector. The analysis also focuses exclusively on the environmental pillar of ESG, omitting the social and governance dimensions that are equally important in assessing the integrity of sustainability claims. Future research is recommended to broaden the dataset by incorporating emissions data from alternative sources such as the Carbon Disclosure Project (CDP) or using modeled estimates based on bank characteristics. Additionally, scholars should develop an integrated greenwashing risk index that includes S and G elements, and conduct comparative analyses across countries or ESG data providers to explore institutional, regulatory, or cultural factors that shape disclosure–performance alignment.

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