Research.

When Green Hurts Value Unless You Run Lean: How Operational Efficiency and Board Size Shape ESG's Impact on Firm Value

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Abstract. *This study investigated the ESG-firm value relationship in asset-heavy industries listed on the Indonesia Stock Exchange, where sustainability efforts often involve high capital intensity and long-term payoffs. Previous research offered mixed results, with limited attention to internal firm-level moderators in emerging markets. Addressing this gap, this study examined whether asset utilization enhanced the valuation impact of ESG performance. Using unbalanced panel data from 165 firm-year observations (2018–2023), ESG performance negatively affected firm value, reflecting market skepticism in capital-intensive sectors. However, asset utilization positively moderated this effect, suggesting that operational efficiency could mitigate ESG-related value erosion. Board size also showed a negative effect, indicating governance inefficiencies. These findings emphasized the importance of embedding ESG in operations to strengthen investor confidence.*

Keywords: ESG performance, firm value, asset utilization, capital-intensive sectors.

INTRODUCTION

Background

Environmental, social, and governance (ESG) considerations have transitioned from regulatory compliance to strategic imperatives amid intensifying global environmental and social challenges, particularly within asset-heavy industries such as energy, basic materials, and infrastructure (Chen et al., 2023; Ho et al., 2024). These sectors are central to global economic development and are among the largest contributors to environmental degradation. The energy sector alone accounts for 73.2% of global GHG emissions, with coal, oil, and gas contributing 37%, 26%, and 18%, respectively (International Energy Agency, 2020; Ritchie, 2020). ESG frameworks have emerged to support companies in balancing operational efficiency with stakeholder expectations, enhancing transparency, accountability, and long-term value creation (Fatemi et al., 2018).

Despite the broad momentum of ESG, institutional and geopolitical disruptions persist. The second withdrawal from the Paris Agreement by the U.S. government in early 2025 through Executive Order 14162 has raised uncertainty over the stability of global climate commitments (Haskett, 2025). Although no further exits occurred as of April 2025, the UNFCCC reported stagnating aggregate emissions targets. This geopolitical reversal poses systemic risks to emerging markets, especially asset-heavy industries that rely on long-horizon capital projects and stable regulatory frameworks. Nevertheless, ESG resilience endures. More than 23,000 firms have subscribed to the United Nations Global Compact (United Nations Global Compact, 2023), and global sustainability reporting has risen by 62% in the last five years (Alhawaj et al., 2023).

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In Indonesia, ESG adoption is accelerating through regulatory and institutional frameworks. The Financial Services Authority (OJK) reported a 92.7% surge in capital market investors in 2021 and mandated sustainability reporting through its Sustainable Finance Roadmap Phase II (2021-2025), which aims to embed ESG risk into governance structures and align green finance across sectors (Otoritas Jasa Keuangan, 2021). In July 2025, the national accounting body, IAI, formally adopted PSPK 1 and PSPK 2, aligned with IFRS S1 and S2, to standardize climate and sustainability disclosures (Ikatan Akuntan Indonesia, 2025). These initiatives aim to elevate the transparency, comparability, and investor relevance of ESG disclosures in capital markets.

Asset-heavy industries are especially salient to ESG analysis because of their inherent operational exposure and measurable environmental and social externalities. Unlike asset-light sectors, their operations generate visible environmental, social, and governance (ESG) impacts from emissions and resource extraction to infrastructure disruption, resulting in greater regulatory and reputational risks (Khan et al., 2016). Moreover, capital intensity and long asset lifecycles necessitate ESG integration at the strategic level (Fatemi et al., 2018). However, sectoral heterogeneity persists: while environmental risks dominate the energy sector, the infrastructure and basic material industries face distinct stakeholder and land-use concerns. This study employs sectoral dummy variables to account for such intra-sectoral variation, following Khan et al. (2016).

The relationship between ESG and firm value remains empirically contested. Studies highlight positive links through operational efficiency, reputational capital, and stakeholder alignment (Bissoondoyal-Bheenick et al., 2023; Ding et al., 2024; Wong et al., 2021). ESG-driven firms benefit from a reduced cost of capital and enhanced firm valuation. On the other hand, emerging research identifies neutrality or even negative effects, often driven by ESG rating disagreements (Liu et al., 2025), weak governance environments (Duque-Grisales & Aguilera-Caracuel, 2021), or overinvestment in sustainability initiatives (Demers et al., 2021). These discrepancies reflect the broader challenges of data reliability, institutional readiness, and valuation mechanisms, particularly in emerging markets.

To advance the debate, this study examines asset utilization as a moderating variable in the ESG-firm value nexus, which is a firm's ability to convert assets into revenue. High asset turnover (TATO) not only enhances profitability but also signals operational discipline in asset-heavy firms, potentially increasing the credibility of ESG efforts (Garcia et al., 2024). Within RBT, asset utilization represents a VRIN (valuable, rare, inimitable, non-substitutable) capability that contributes to sustained competitive advantage (Barney et al., 2021). Stakeholder Theory suggests that transparent and efficient asset use enhances stakeholder trust and legitimacy.

This study explores whether firms with superior asset utilization are better positioned to translate ESG performance into financial value by synthesizing these frameworks. The findings offer actionable insights for corporate managers, investors, and policymakers, particularly in capital-intensive sectors navigating ESG disclosure mandates, investment constraints, and sustainability transitions.

Research Question

1. Does ESG performance positively or negatively impact the firm value of companies engaged in asset-heavy industries listed on the IDX?

2. Does asset utilization positively moderate the relationship between ESG performance and firm value?

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LITERATURE REVIEW

ESG Performance and Firm Value

ESG performance reflects a firm's strategic alignment with long-term sustainability goals and stakeholder expectations. ESG initiatives signal responsible corporate behavior, reduce reputational risk, and strengthen trust with key constituencies, including investors, regulators, and communities (Cadez et al., 2019; Ho et al., 2024). This is particularly critical in asset-heavy industries, where capital-intensive and resource-dependent operations increase environmental degradation, social displacement, and regulatory scrutiny (Broadstock et al., 2021; Fatemi et al., 2018).

In the Indonesian context, regulatory mandates such as POJK No. 51/POJK.03/2017 (Peraturan Otoritas Jasa Keuangan Nomor 51/POJK.03/2017 Tentang Penerapan Keuangan Berkelanjutan Bagi Lembaga Jasa Keuangan, Emiten, Dan Perusahaan Publik, 2017)and recent sustainability disclosure standards (PSPK 1 and 2) aligned with IFRS S1 and S2 (Ikatan Akuntan Indonesia, 2025) reinforce ESG adoption. These developments emphasize ESG not merely as compliance but as a strategic enabler of firm value, especially in industries targeted by the OJK Sustainable Finance Roadmap (Otoritas Jasa Keuangan, 2021).

Empirical studies provide mixed evidence on the relationship between ESG and firm value. Positive effects are reported in settings with mature ESG institutions and credible disclosures (Z. Chen & Xie, 2022; Fatemi et al., 2018), where ESG performance enhances market valuation and crisis resilience (Ding et al., 2024; Wong et al., 2021). However, recent findings also show valuation inconsistencies, particularly in emerging markets. Liu et al. (2025) identified that ESG rating disagreement dilutes investor confidence, whereas A. S. Garcia and Orsato (2020) and Nollet et al. (2016) documented negative effects in environments with governance weaknesses or misaligned ESG investments. ESG overinvestment without operational integration can lead to reduced profitability and inefficient capital allocation in some cases (Aydoğmuş et al., 2022; Demers et al., 2021).

Given these divergent outcomes, this study examines ESG performance using Refinitiv ESG scores, a globally recognized benchmark comprising over 630 metrics across ESG dimensions. This approach allows for standardization and comparability across Indonesian asset-heavy firms listed on the Indonesia Stock Exchange (IDX). Based on the above discussion, the following hypothesis is proposed:

H_1: ESG performance has a significant positive or negative effect on the value of asset-heavy companies listed on the IDX.

Moderating Role of Asset Utilization

While ESG initiatives may offer reputational and strategic advantages, their financial realization often depends on a firm's internal capabilities. Under RBT, firms must possess the necessary operational competencies to absorb and execute ESG strategies efficiently (Barney et al., 2021). Asset utilization, commonly proxied by TATO, reflects a firm's ability to convert large-scale capital investments into revenue in asset-heavy sectors. High asset utilization signals operational efficiency and strategic alignment, which are necessary to unlock ESG-driven financial benefits (Garcia et al., 2024).

Asset utilization meets the VRIN criteria as a strategic resource. It is (1) valuable because it improves cost-efficiency; (2) rare because few firms consistently achieve high TATO; (3) inimitable because of embedded routines and capabilities; and (4) non-substitutable, especially in infrastructure-heavy operations where tangible assets are central to business performance (Barney et al., 2021). From the Stakeholder Theory perspective, high TATO reinforces the credibility of ESG efforts by demonstrating discipline in resource management that is critical in securing stakeholder trust.

Empirical studies support this logic. Garcia et al. (2024) showed that firms with high TATO are more resilient to short-termism and market pressure, reinforcing strategic signaling. Although not specific to ESG, their findings suggest that operational efficiency strengthens

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stakeholder perception and firm value realization. High asset utilization may serve as a signal of authenticity in ESG contexts, aligning ESG disclosures with observable business outcomes. Conversely, low TATO may undermine ESG credibility, suggesting misalignment or inefficiency.

Despite this theoretical relevance, few studies empirically examine asset utilization as a moderator in the ESG-firm value relationship, particularly in Indonesia's asset-heavy sectors where ESG integration is both challenging and material. This study fills that gap. Based on the above discussion, the following hypothesis is proposed:

H_2: Asset utilization positively moderates the relationship between ESG performance and firm value in IDX-listed asset-heavy companies.

RESEARCH METHODS

Research Design and Philosophical Foundation

This study adopts a positivist, quantitative explanatory approach to examine the relationship between ESG performance and firm value, with asset utilization as a moderating variable. Grounded in Stakeholder Theory and RBT, it tests whether ESG commitments enhance firm value and whether firms with high operational efficiency strengthen this relationship. Stakeholder Theory posits that transparency and accountability mitigate reputational risk and support long-term valuation (Z. Chen & Xie, 2022), while RBT highlights the strategic role of tangible resources, such as asset efficiency, in reinforcing competitive advantage and implementing environmental, social, and governance (ESG) (Barney et al., 2021).

The research object comprises firms from asset-heavy sectors listed on the IDX, including basic materials, energy, and infrastructure that are industries characterized by capital intensity and ESG exposure. These sectors present an ideal context for evaluating how ESG efforts, moderated by asset utilization, impact firm value.

Variable Operationalization

Table 1

Measurement of Each Variable

Variable (Var)	Measurement	Source
Dependent Variable		
PBV	Natural logarithm of the price-to-Book Value ratio.	(Aydoğmuş et al., 2022)
Independent Variable		
ESG	The ESG percentile scores (0-100) aggregated from Refinitiv Eikon.	(Liu et al., 2025)
Moderating Variable		
TATO	Revenue generated per asset unit.	(Garcia et al., 2024)
Control Variables		
Beta	Beta coefficient.	(Keskin et al., 2020)
Firm Size (Firm)	Natural logarithm of the total assets.	(Keskin et al., 2020)
COVID-19 Dummy (Covid)	- 1: The pandemic (2020-2022). - 0: Non-pandemic (pre-2020 and post-2022).	-
Institutional Shareholding (IS)	% of institutional investors' shares	(He et al., 2024)
Board Size (Board)	Natural logarithm of the total number of board members.	(Bai et al., 2024)

Source: Author's work, 2025.

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This study measures each variable to determine the correlations between the independent, control, and dependent variables. Table 1 above provides the measurements for every variable.

Sample and Data

A purposive sampling approach was employed, selecting 36 publicly listed firms in asset-heavy sectors with at least one annual ESG score between 2018 and 2023. This yielded an un-balanced panel of 165 firm-year observations. Secondary data were sourced from Refinitiv Eikon and S&P Capital IQ, enabling robust cross-validation and the inclusion of ESG, financial, and operational metrics. Winsorization (1st and 99th percentiles) was applied to mitigate outliers. The un-balanced panel structure addresses the voluntary nature of ESG disclosure in EMs (Cantero-Saiz et al., 2024).

Descriptive and Diagnostic Analysis

Descriptive statistics summarize the central tendencies and distributions of key variables. Sectoral dummy variables and one-way analysis of variance were employed to control for intra-industry differences in firm value, recognizing that ESG materiality varies across sectors. The VIF tests were used to detect multicollinearity, with a threshold of 10 indicating potential concern.

Panel Model Testing and Regression Strategy

To identify the appropriate panel model, the study sequentially applies the Chow test (CEM vs. FEM), Hausman test (FEM vs. REM), and LM test (CEM vs. REM). Regression analysis uses a stepwise approach across three models, as described in Table 2 below:

Table 2

Regression Model

Model	Specification
Model 1 (Baseline)	$PBV = \alpha + \beta1(ESG) + \epsilon$
Model 2 (Controlled)	$PBV = \alpha + \beta1(ESG) + \beta2(Size) + \beta3(Beta) + \beta4(Institutional\ Shareholding) + \beta5(Board\ Size) + \beta6(Covid\ Dummy) + \epsilon$
Model 3 (Moderation)	$PBV = \alpha + \beta1(ESG) + \beta2(Asset\ Utilization) + \beta3(ESG \times Asset\ Utilization) + \beta4(Size) + \beta5(Beta) + \beta6(Institutional\ Shareholding) + \beta7(Board\ Size) + \beta8(Covid\ Dummy) + \epsilon$

Source: Author's work, 2025.

Moderated regression analysis assesses the effect of ESG and asset utilization on firm value. All models are executed using StataMP18 with robust standard errors.

Classical Assumption Testing

Classical assumptions were tested using established econometric techniques to ensure the validity of the regression models, as described in Table 3 below (Shakil, 2021).

Tests Conducted:

Table 3
Classical Assumption Testing

Assumption	Test Applied	Criteria
Normality	Skewness-Kurtosis Test, Shapiro-Wilk Test	$p > 0.05$: Residuals are normally distributed.
Multicollinearity	Variance Inflation Factor (VIF)	VIF ≤ 10 indicates no multicollinearity.
Autocorrelation	Not directly tested (panel data context)	Addressed through panel data structure and robust standard errors.
Heteroskedasticity	Breusch-Pagan/Cook-Weisberg s Test	$p > 0.05$: Homoskedasticity (constant residual variance) was assumed.

Source: Author's work, 2025.

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RESULTS AND DISCUSSION

Descriptive Statistical Analysis

Descriptive statistics provide a preliminary overview of the central tendency and dispersion of key variables used in this study, offering foundational insights into ESG performance, firm value, asset utilization, and control variables across asset-heavy industries listed on the IDX. Table 4 presents summary statistics using StataMP18 for all variables after preprocessing using an unbalanced panel dataset. Winsorization at the 1st and 99th percentiles was applied to asset utilization (TATO) and institutional shareholding that both exhibited skewness beyond the -2 to +2 range and kurtosis exceeding 6-7 to reduce the influence of extreme outliers and enhance the analysis's robustness.

Table 4

Descriptive Statistics of the Study Variables

Var	N	Mean	Std. Dev.	Min	Max
PBV	193	0.2765	0.3729	-0.7286	1.3754
ESG	165	53.7593	17.8911	9.8455	89.1851
TATO	209	0.5252	0.3254	0.1239	1.4747
Beta	201	1.4634	0.8036	-0.4130	3.4580
Firm	215	21.7380	0.9948	18.7254	23.6912
Covid	216	0.5000	0.5012	0	1
IS (%)	195	8.8007	6.4517	0.0130	31.3700
Board	166	1.7860	0.3790	0.6931	3.0445

Source: Stata output which processed by author, 2025.

The dependent variable, firm value proxied by the natural logarithm of PBV (lnPBV), shows a mean of 0.2765 (approximately 0.5 PBV) with a standard deviation of 0.3729 (approximately 2.3 PBV). The minimum and maximum values are -0.7286 (approximately 0.1 PBV) and 1.3754 (approximately 23.74 PBV), respectively. This substantial upper bound is primarily driven by PT Bayan Resources Tbk (BYAN) during 2021-2023, when aggressive share repurchases by its owner (Mr. Low Tuck Kwong) led to a sharp increase in stock prices amid the coal boom. Although extreme, this outlier reflects real market dynamics during the post-COVID-19 commodity cycle and highlights the influence of ownership behavior on asset-heavy sectors' market valuation.

The independent variable, ESG Score, has a mean of 53.76 (on a 0-100 scale) and a standard deviation of 17.89. The lowest observed ESG score was 9.85, while the highest was 89.19. This wide range reflects differing degrees of ESG integration and disclosure quality among IDX-listed companies, consistent with emerging markets' sustainability practices' evolving maturity.

The moderating variable, TATO, has a mean of 0.5252 and a standard deviation of 0.3254. After winsorization, its values range from 0.1239 to 1.4747. This distribution reflects moderate efficiency in using assets to generate revenue, which is especially important for asset-heavy sectors. Compared to the mean TATO figures of 0.6000 reported in the Chinese market by Shan et al. (2024), the values in this study are slightly lower but remain within a reasonable range, suggesting that despite regional and industry differences, operational efficiency across firms is relatively comparable.

The mean market risk (beta) among the control variables is 1.46, with values ranging from -0.41 to 3.46. Negative beta values though rare, appear in MDKA and POWR cases. For POWR (a standalone electricity provider), the negative beta could reflect unique non-market dynamics, while MDKA's negative beta may be an anomaly. On the upper end, construction firms such as WSKT and ACSET, which tend to exhibit high volatility due to cyclical exposure and leverage, have betas exceeding 3. Compared with the benchmark mean beta of 1.00 reported by Ding et al. (2024), the higher mean and greater dispersion observed in this study are consistent with the asset-heavy sectors in Indonesia's inherently riskier nature.

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Firm size, calculated as the natural log of total assets, has a mean of 21.74 with a relatively low dispersion (SD = 0.99), consistent with stable asset bases across asset-heavy IDX firms. Given the sectoral composition, especially mining, infrastructure, and telecommunications, the slightly larger mean is justified.

The COVID-19 dummy variable confirms a balanced panel across the pre- and post-COVID-19 periods with a mean of 0.5, enabling a robust analysis of the structural effects of the pandemic.

The mean institutional shareholding after winsorization is 8.8%, with values ranging from 0.013% to 31.37%. Although institutional ownership levels in this study are lower than those in more mature markets, such as the 39.76% mean reported by He et al. (2024) for China's A-share market, this range reflects the structure of Indonesia's capital market, where ownership is often concentrated among majority or founder shareholders. The narrower distribution and lower mean further align with localized institutional investor behavior, as noted by He et al. (2024).

Finally, the mean board size is 1.786 in log scale (approximately 6 directors), ranging from 0.693 (2 directors, e.g., Avian) to 3.0445 (21 directors, e.g., ISAT). The wider range is reasonable that is smaller family-controlled firms tend to operate lean governance structures, whereas large multinationals, such as Indosat, with foreign ownership from Qatar and Hong Kong, enforce more complex oversight systems. Compared with Ben Fatma and Chouaibi (2023), who reported a mean board size of 2.50 (approximately 12 directors) and a standard deviation of 1.55 in a broader international context, the distribution observed in this study appears notably narrower (SD = 0.38). This suggests that Indonesian asset-heavy firms may adopt more compact board compositions, which may reflect localized governance norms, concentrated ownership, and regulatory environments common in emerging markets.

These descriptive statistics provide a comprehensive view of the research dataset and indicate that all variables are appropriately scaled and exhibit suitable variability for regression analysis. The combination of ESG scores, operational efficiency, and financial risk indicators lays the foundation for evaluating the relationship between ESG and firm value under the influence of internal capabilities and market dynamics.

Table 5

Descriptive Summary of Firm Value by Sector

Sector	Mean	Std. Dev.	N
Basic Materials	0.2974	0.4008	66
Energy	0.2198	0.3630	46
Infrastructure	0.2918	0.3558	81
Total	0.2765	0.3729	193

Source: Stata output which processed by author, 2025.

A one-way analysis of variance (ANOVA) was conducted to examine whether firm value differs significantly across asset-heavy sectors using the log-transformed Price-to-Book Value (lnPBV) as the dependent variable and industry classification as the grouping factor. The sectors analyzed include basic materials, energy, and infrastructure, which represent the core asset-heavy industries listed on the IDX.

Although basic materials firms show the highest average firm value (lnPBV = 0.2974), followed by infrastructure (0.2918) and energy (0.2198), the differences in means are relatively small, as shown in Table 5. The standard deviations within each sector also indicate a moderate firm valuation variation across firms.

To determine whether these differences are statistically significant, a one-way analysis of variance test was conducted, and the results are shown in Table 6.

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Table 6
One-Way Analysis of Variance Results: Firm Value by Sector

Source	SS	of	MS	F	*Prob* > F
Between Groups	0.1972	2	0.0986	0.71	0.4944
Within Groups	26.4986	190	0.1395		
Total	26.6958	192	0.1390		

Source: Stata output which processed by author, 2025.

Based on Table 6, the F-statistic of 0.71 with a p-value of 0.4944 indicates no statistically significant difference in firm value across the three sectors at the 5% significance level. Although sectoral characteristics may influence other financial or ESG variables, the average market valuation (as proxied by lnPBV) of firms within asset-heavy industries in Indonesia does not differ significantly by sector.

The abovementioned descriptive statistics support this result, showing only minor variations in average firm value between basic materials (0.2974), Infrastructure (0.2918), and Energy (0.2198). However, the overall standard deviation for lnPBV is relatively wide at 0.3729, with a maximum of 1.3754 (approx. 23.74 PBV) and a minimum of -0.7286 (approx. 0.1 PBV). This broad distribution, particularly the upper bound, is driven largely by exceptional cases, such as the 2021–2023 Bayan Resources (BYAN) during 2021-2023. During that period, aggressive share repurchases by the controlling shareholder, coinciding with the post-COVID-19 coal boom, significantly inflated stock prices. Although rare, these outliers reflect genuine market dynamics shaped by ownership behavior and commodity cycles in capital-intensive industries.

Nevertheless, to account for any potential residual heterogeneity across sectors, particularly regarding ESG materiality and value transmission mechanisms, the regression specification initially included sectoral dummy variables (ind_basic, ind_infra, and ind_energy). However, because sectoral classification is a time-invariant firm characteristic, due to perfect multicollinearity, these dummy variables were automatically omitted in the fixed-effects (within) regression. The fixed-effects model absorbs all time-invariant firm-level attributes, including sector affiliation. The exclusion of these dummies does not compromise the model's integrity. Instead, it reinforces the methodological decision to rely on within-firm variation over time, which aligns with the study's core objective of identifying dynamic relationships between ESG performance, asset utilization, and firm value. A detailed explanation of the panel model testing is provided in the subsequent section.

Panel Model Testing

This study employs an un-balanced panel data regression technique that combines cross-sectional and time-series data to better capture variations across firms and time. The use of un-balanced panel data is particularly appropriate for analyzing the ESG-firm value relationship in asset-heavy industries, as it allows for controlling unobservable heterogeneity and improving the efficiency of estimators.

The following model specification tests were conducted sequentially to identify the most appropriate estimation model, i.e., common effect model (CEM), fixed effect model (FEM), or random effect model (REM): Chow test, Lagrange Multiplier (LM) Test, and Hausman Test.

Table 7
Chow Test

Test	Statistic	Prob.	Decision	Model Preferred
Chow Test *(F)*	21.29	0.0000	Reject H_0	Fixed-effect model

Source: Stata output which processed by author, 2025.

The Chow test evaluates whether a pooled regression (CEM) is appropriate or whether firm-specific effects must be accounted for through a fixed-effects specification.

Interpretation of Table 7: A p-value of 0.0000 < 0.05 indicates significant heterogeneity across firms. Therefore, the fixed-effects model is statistically more appropriate than the pooled OLS (CEM), justifying the use of firm-specific intercepts.

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Table 8
Lagrange Multiplier (LM) Test

Test	Statistic	Prob.	Decision	Model Preferred
LM Test (Chi-bar²)	109.96	0.0000	Reject H_0	Random-effect model (REM)

Source: Stata output which processed by author, 2025.

The LM test was employed to evaluate the necessity of random effects over pooled OLS.

Interpretation of Table 8: The result confirms the presence of significant individual effects, thus rejecting the pooled OLS's appropriateness. At this point, both FEM and REM remain viable, necessitating the Hausman test for the final decision.

Table 9

The Hausman Test

Test	Chi²(7)	Prob.	Decision	Model Preferred
Hausman Test	30.76	0.0001	Reject H_0	Fixed-effect model

Source: Stata output which processed by author, 2025.

The Hausman test determines whether regressors are correlated with individual effects. If yes, FEM is preferred; otherwise, REM offers efficiency gains.

Interpretation of Table 9: With a p-value of 0.0001 < 0.05, the null hypothesis is rejected, indicating that the regressors are not orthogonal to the unobserved effects. Hence, fixed-effect model (FEM) is the appropriate estimation technique.

Classical Assumption Testing

After conducting the panel model tests, performing classical assumption tests on the research data is necessary. This step ensures compliance with the best linear unbiased estimator (BLUE) criteria. Based on the results of the unbalanced panel model, the fixed effect approach was selected. Therefore, only three classical assumption tests are required: the normality, multicollinearity, and heteroskedasticity tests.

Table 10
Normality Test of Regression Residual Analysis

Test	Statistic	Value	p-value	Inter-pretation
Skewness	Pr(skewness)	-	0.0241	Significant → residuals show slight skewness
Kurtosis	Pr(kurtosis)	-	0.6902	Not significant
Joint Chi-Square	Adj $chi^2(2)$	5.21	0.0739	Not significant at 5% → acceptable overall
Shapiro-Wilk (W)	W	0.9809	0.0343	Significant → mild deviation from normal

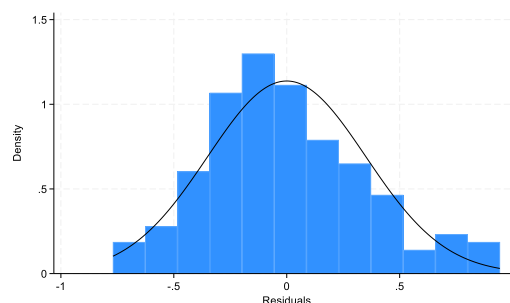Source: Stata output which processed by author, 2025.

Figure 1. Histogram with Normal Curve Overlay

Source: Stata output which processed by author, 2025.

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Although the formal tests described in Table 10 detect mild deviations from normality, especially due to skewness, the visual inspection shown in Figure 1 supports the assumption of approximate normality. Given that the study uses un-balanced panel data with more than 150 observations and relies on Fixed Effects (FEM) which is consistent and efficient even under mild non-normality, the residual distribution is deemed acceptable for linear regression analysis. Furthermore, robust standard errors are applied in subsequent regressions to safeguard the validity of the inference.

Table 11
VIF Results

Variable	VIF	1/VIF
ESG	1.40	0.7140
TATO	1.58	0.6317
Beta	1.08	0.9224
Firm	1.52	0.6589
Covid	1.02	0.9820
IS	1.20	0.8344
Board	1.35	0.7433
Mean VIF	1.31	

Source: Stata output which processed by author, 2025.

As shown in Table 11, all VIF values are well below the commonly accepted threshold of 10, indicating the absence of serious multicollinearity problems. The highest VIF observed is 1.58 for the TATO variable, whereas the average VIF is 1.31. These results confirm that the regression model does not suffer from multicollinearity and is therefore suitable for further hypothesis testing.

Table 12
Heteroskedasticity Test Results

Test Type	Chi²(1)	Prob > Chi²
Breusch-Pagan / Cook-Weisberg	0.40	0.5277

Source: Stata output which processed by author, 2025.

As described in Table 12 the null hypothesis cannot be rejected because the p-value exceeds the 5% significance threshold. This indicates that the residuals exhibit constant variance, and the model lacks evidence of heteroskedasticity. Thus, the classical assumption of homoskedasticity is satisfied, ensuring reliable standard error estimates and robust statistical inference.

Analysis and Discussion of Regression Results

This study employed a fixed-effects (within) un-balanced panel regression model with robust standard errors to examine the effect of ESG performance on firm value and to test the moderating role of asset utilization. The regression outcomes are presented in Table 13 and are structured across three model specifications: the baseline model (Model 1), the control-adjusted model (Model 2), and the moderation model (Model 3). Table 14 summarizes further significance test results for Model 3 (Moderation).

Table 13

Regression Test Results

Var	Model 1	Model 2	Model 3
ESG	-0.006** (0.002)	-0.004* (0.002)	-0.005* (0.002)
Beta	-	0.132 (0.069)	0.130 (0.069)
Firm	-	-0.051 (0.058)	-0.061 (0.057)

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Var	Model 1	Model 2	Model 3
COVID	-	0.032 (0.029)	0.023 (0.029)
IS	-	0.008 (0.005)	0.008 (0.006)
Board	-	-0.230* (0.109)	-0.229* (0.111)
ESG × TATO	-	-	0.002 (0.001)
Constant	0.585*** (0.099)	1.746 (1.189)	1.945 (1.174)
N (Observations)	156	152	151
R-squared	0.077	0.182	0.196
Adj. R-squared	0.071	0.148	0.157

Standard errors are in parenthesis.

Note: *p<0.05, ** p<0.01, *** p<0.001

Source: Stata output which processed by author, 2025.

Model 1 (Baseline: ESG → Firm Value) examines the direct effect of ESG performance on firm value without incorporating any control variables. The regression output indicates a statistically significant negative relationship with an ESG coefficient of -0.006 (p = 0.003), suggesting that higher ESG performance is associated with lower firm valuation, as proxied by the natural logarithm of PBV (lnPBV). The model explains approximately 7.7% of the within-firm variance in firm value (R^2 = 0.077). This result supports Hypothesis 1, which posits that ESG performance has either a significant positive or negative effect on the value of asset-heavy companies listed on the IDX.

Furthermore, this finding partially diverges from prior empirical studies, such as Aydoğmuş et al. (2022); Fatemi et al. (2018), which report that ESG performance has positive valuation effects depending on context. Fatemi et al. (2018) highlighted that ESG enhances firm value when disclosures are credible and investor trust is high. Similarly, Aydoğmuş et al. (2022) found that ESG improves the valuation of manufacturing firms with proactive sustainability reporting. In contrast, Liu et al. (2025) report a negative relationship between ESG ratings and firm performance, suggesting that high ESG scores may signal inefficient resource allocation. Interestingly, they find that ESG rating disagreement weakens this negative effect, acting as a moderating factor. When rating agencies disagree, the market may discount the ESG signal altogether, reducing its perceived relevance, especially in firms with strong disclosure but poor governance.

Several contextual factors may also explain this outcome. First, ESG initiatives in asset-heavy industries, such as infrastructure, mining, or utilities, often require substantial up-front investments in equipment upgrades, emission controls, or workforce restructuring. These costs may dilute short-term profitability, causing investors to react negatively, particularly in emerging markets such as Indonesia, where valuation emphasis often favors near-term growth potential over long-term sustainability orientation. For instance, during Indonesia's recent coal boom, which falls within the timeframe of this study, firms in the mining sector saw their PBVs rise sharply due to commodity-driven earnings, with little correlation to ESG scores, which are typically more conservative and slower to reflect short-term performance trends.

Second, ESG implementation in Indonesia is still in its early stages. Although the Financial Services Authority (OJK) introduced ESG disclosure regulations in 2017, with mandatory reporting beginning in 2018, integration remains largely compliance-driven. Most companies focus on meeting disclosure requirements (e.g., GRI or SASB) rather than embedding ESG within strategic operations and asset management. This transitional phase, marked by fragmented governance, limited investor buy-in, and weak strategic alignment, contributes to market skepticism regarding ESG as a value-adding factor.

Therefore, the significant negative coefficient observed in Model 1 highlights the market's current perception of ESG as a cost center rather than a value enhancer in asset-heavy industries. This perception may shift in the future as regulatory maturity improves and ESG becomes more deeply integrated into firms' core value drivers. However, for now, the evidence reflects a short-term penalty in market valuation for ESG-leading firms in this context.

Model 2 (ESG with Control Variables) incorporates firm-specific control variables, such as firm size, Beta, institutional shareholding, board size, and a COVID-19 dummy. After accounting for these controls, the ESG coefficient remains significantly negative at -0.004 (p = 0.044), supporting Hypothesis 1, which posits that ESG performance has either a significant positive or negative effect on the firm value of asset-heavy companies listed on the IDX. This result reinforces the robustness of the baseline model (Model 1), indicating that the inverse ESG-firm value relationship persists even after controlling for firm-specific factors. Among the control variables, board size shows a statistically significant negative effect (-0.230, p = 0.043), suggesting that larger boards have more governance inefficiency.

However, this finding contrasts with Bai et al. (2024), who reported a positive and significant relationship between board size and ESG performance in Chinese firms (coefficient = 0.160, p < 0.01), suggesting that larger boards can enhance ESG outcomes through resource diversity and broader stakeholder representation. However, in the context of this study, the negative coefficient on board size (-0.230, p = 0.043) reflects a potential governance inefficiency, where expanded board composition may lead to diluted accountability, slower decision-making, and coordination challenges, particularly in Indonesian asset-heavy firms where ESG integration remains immature. This divergence may be attributable to contextual differences. While the sample of Bai et al. (2024) benefits from stronger institutional frameworks and ESG incentives, Indonesian firms may still view board expansion as formal compliance rather than strategic ESG oversight, resulting in diminished firm value rather than enhancement.

Although Beta approaches marginal significance (p = 0.066), this finding is consistent with that of Keskin et al. (2020), who report that Beta is statistically insignificant in emerging market contexts when examining the relationship between sustainability efforts and financial indicators. Their study suggests that investors tend to disregard market risk factors such as Beta when evaluating ESG initiatives in emerging markets like Indonesia, unlike in developed markets where Beta might influence ESG valuation through risk-return tradeoffs. This reflects a short-term, growth-oriented investor mindset, where sustainability investments are not yet fully integrated into valuation models, thereby explaining the insignificant role of Beta in both their study and this thesis.

Firm size, another important control in ESG studies, shows no significant effect in this model. This contrasts with the findings of Keskin et al. (2020), who found a significant positive relationship between firm size and ESG-financial performance linkage, suggesting that larger firms may benefit from scale, investor visibility, or disclosure capacity. The lack of significance in the Indonesian context may reflect the sample's sectoral homogeneity, where most firms already operate at large asset scales, reducing the variation in size effects.

Institutional shareholding also fails to show a statistically significant impact on firm value. This contrasts with He et al. (2024), who found that institutional investors can amplify ESG performance, especially when combined with media visibility in China. The difference may reflect contextual gaps, as Indonesian institutional investors may be less proactive in ESG enforcement and more compliance-focused, thereby limiting their influence on ESG valuation.

The inclusion of all controls improves the model's explanatory power to R^2 = 0.182, indicating a better fit compared to the baseline model. Overall, the model demonstrates that certain governance and risk-related controls, particularly board size and beta, exert meaningful influence in the asset-heavy sector landscape while ESG maintains a negative direct effect.

Model 3 (Moderation by Asset Utilization (ESG × TATO)) incorporates an interaction term between ESG performance and asset utilization, as proxied by TATO. The main effect of ESG remains significantly negative (-0.005, p = 0.017), consistent with Models 1 and 2 that support Hypothesis 1. Crucially, the interaction term ESG × TATO is positive and marginally significant (0.002, p = 0.089),

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suggesting that firms with higher asset utilization experience a weakening of the negative relationship between ESG performance and firm value. This moderating effect supports Hypothesis 2, indicating that efficient asset utilization can enhance a firm's ability to convert ESG investments into value-relevant outcomes in IDX-listed asset-heavy sectors.

Theoretically, this finding aligns with Barney et al. (2021) 's resource-based theory, which asserts that firms with superior internal capabilities, such as effective resource utilization, can better exploit strategic initiatives, such as ESG, to achieve sustained competitive advantage. High asset turnover reflects operational agility and signals a firm's proficiency in transforming resources into revenue streams, which is especially valuable when ESG initiatives require long-term commitment and integration across business functions.

This finding is consistent with Garcia et al. (2024), who found that high asset turnover moderates the effect of firm behavior on market performance by enhancing transparency and reducing investor uncertainty. Their study demonstrates that ATR acts as a persistent and credible signal of a firm's revenue-generating efficiency, enabling investors to better evaluate the quality of reported earnings and strategic consistency. High TATO mitigates investor skepticism in contexts where ESG spending might otherwise be misperceived as a cost center, thereby reinforcing the financial salience of ESG commitments.

Model 3 retains similar patterns as Model 2 in terms of control variables. Board size remains significantly negative (p = 0.047), while Beta remains marginally significant (p = 0.068). Other variables, such as firm size, institutional shareholding, and the COVID-19 dummy, remain statistically insignificant. Model 3 also demonstrates the highest explanatory power among the three, with R² = 0.196 and Adjusted R² = 0.157, underscoring the added value of incorporating the ESG-TATO interaction in explaining firm value variations.

Table 14
Significance Test Results for Model 3 (Moderation)

Var	t-Statistic	p-Value
ESG	-2.51	0.017
ESG × TATO	1.75	0.089
Beta	1.88	0.068
Firm	-1.07	0.294
COVID	0.80	0.431
IS	1.46	0.154
Board	-2.06	0.047
F-Stat (Prob > F)	-	0.0065
Adjusted R²	-	0.157

Source: Stata output which processed by author, 2025.

The significance test results for Model 3 (Moderation) presented in Table 14 validate the main conclusions of Model 3:

1.   The ESG score significantly reduces firm value (p = 0.017), supporting H1.
2.   ESG × TATO is marginally significant (p = 0.089), supporting H2 and confirming the asset utilization's moderating role.
3.   Board size remains a significant negative factor (p = 0.047), reinforcing governance concerns in larger boards.
4.   Overall, the model is statistically significant (F-test p = 0.0065) and explains 15.7% of the variation in firm value (Adjusted R² = 0.157).

Summary of the key findings:

1.   ESG-Firm Value Relationship: ESG performance consistently demonstrates a significant negative relationship with firm value across all three models in asset-heavy industries. This may reflect delayed payoffs or skepticism of the market toward ESG-related expenditures in capital-intensive sectors.

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2. Moderating Role of Asset Utilization: The interaction term ESG × TATO is positively signed and weakly significant, suggesting that firms with higher asset turnover can better absorb or offset the short-term costs of ESG implementation. This finding supports H2 and aligns with the RBT.

3. Control Variables: Board size is a consistent negative determinant of firm value, reflecting potential governance inefficiencies in larger boards. Other controls, such as firm size, institutional ownership, COVID-19 exposure, and beta, show limited or marginal influence.

The combined regression results emphasize the ESG value creation's context-dependent nature. While ESG alone may be perceived negatively in asset-heavy firms due to cost burdens or long gestation periods, asset utilization can act as a strategic enabler, mitigating this downside. These insights underscore the importance of integrating ESG within broader performance strategies and contribute to the growing empirical debate on ESG valuation impacts in emerging markets.

CONCLUSIONS AND SUGGESTIONS

Conclusion

This study examines the relationship between ESG performance and firm value among asset-heavy firms listed on the IDX, focusing on TATO's moderating role. Grounded in Stakeholder Theory and RBT, the findings suggest three key conclusions. First, ESG performance exhibits a consistently negative and significant effect on firm value across all models, supporting Hypothesis 1. This implies that ESG initiatives may still be perceived as cost centers within Indonesia's capital-intensive sectors, possibly due to weak strategic integration, long-term payoff horizons, or early-stage regulatory enforcement (Aydoğmuş et al., 2022; Liu et al., 2025). Second, asset utilization positively moderates this relationship, as shown by a marginally significant interaction term (p = 0.089), supporting Hypothesis 2. Firms with high operational efficiency are more likely to translate ESG into credible, value-enhancing outcomes, reinforcing investor confidence (Garcia et al., 2024). Third, board size consistently shows a negative impact on firm value, indicating possible governance inefficiencies or symbolic compliance. Collectively, these findings highlight the financial materiality of ESG in asset-heavy industries and underscore the importance of internal capabilities in contextualizing ESG valuation.

Theoretical Contributions

This study contributes to the literature by integrating Stakeholder Theory and RBT in the context of EMs. Stakeholder Theory explains ESG as a legitimacy mechanism, while RBT frames asset utilization as a VRIN capability that enables ESG to be strategically executed (Barney et al., 2021). This study refines ESG valuation frameworks for capital-intensive sectors by positioning asset utilization as a dynamic moderator, where long investment cycles and scrutiny demand strong operational leverage. The empirical evidence adds to the limited body of research on ESG-firm value relationships with firm-level moderators in Indonesia.

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Practical Implications

ESG should be embedded within core operations rather than treated as a compliance layer for practitioners. Investments in asset efficiency, lean systems, and performance-driven ESG budgeting can enhance disclosure credibility and value relevance. Governance structures, especially board size and ESG oversight, require recalibration to prevent value dilution. For investors, ESG analysis should be complemented by operational indicators, such as asset turnover, to distinguish between symbolic and substantive sustainability practices. Long-term valuation perspectives are crucial, particularly in asset-heavy sectors where efficiency may delay but amplify ESG benefits. Regulators, such as OJK and IAI, are advised to strengthen ESG disclosure standards, including utilization-based metrics, and ensure the effective adoption of PSPK 1 and PSPK 2 aligned with IFRS S1/S2 by 2027. ESG taxonomies or incentive structures may be introduced to reward firms that demonstrate both sustainability and operational productivity.

Limitations and Future Research

This study acknowledges several limitations. The marginal significance of some variables (10%) invites cautious interpretation and calls for future studies with larger samples or alternative proxies such as Tobin's Q or ROA. The unbalanced panel, due to voluntary ESG reporting in earlier years (2018-2020), may limit consistency. Additionally, the focus on three IDX sectors constrains generalizability. Future research should explore cross-industry variations in ESG materiality or conduct sensitivity analyses across regulated and unregulated sectors.

Recommendations

Based on these findings, to enhance disclosure integrity, management should align ESG strategy with operational metrics such as asset productivity. To improve investment quality, investors are encouraged to integrate efficiency ratios (e.g., TATO, energy use per output) into ESG screening models. Academics may expand this study to the ASEAN or Asia-Pacific contexts, incorporate forward-looking ESG data, and test moderating factors such as innovation capacity or carbon intensity.

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