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# Green Accounting, Green Finance, and Firm Value: The Moderating Role of ESG Disclosure in Energy Firms

**Khairil Pajeri[1*], Afrijal[1], Hendry Kurniawan[1]**
[1]Universitas Pasir Pengaraian, Indonesia
* Correspondence e-mail; khairilpajeri@upp.ac.id

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**Abstract**

Indonesia has progressively strengthened sustainability reporting requirements for listed companies; however, the market value of energy firms during 2021–2025 appears to have been influenced more by commodity prices than by sustainability disclosure. This study examines the effects of green accounting and green finance on firm value and the moderating role of ESG disclosure. The sample comprises 49 energy-sector companies listed on the Indonesia Stock Exchange, yielding 210 firm-year observations in an unbalanced panel. Firm value is measured using Tobin's Q. Green accounting is assessed through 31 GRI 300 indicators, green finance through ten indicators based on POJK 51/2017, the Indonesian Sustainable Finance Taxonomy, and the Green Bond Principles, and ESG disclosure through 38 indicators from SEOJK 16/SEOJK.04/2021. Hypotheses are tested using moderated regression analysis with a random-effects model, firm-clustered standard errors, and wild cluster bootstrap. The results reveal no significant direct effects of the three disclosure variables on firm value. ESG disclosure weakens the green accounting–firm value relationship, particularly among coal producers, although the evidence is statistically weak and fails several robustness tests. ESG disclosure does not moderate the green finance–firm value relationship. Overall, disclosure breadth alone does not appear to enhance market valuation in Indonesia's energy sector.

**Keywords** Energy Sector; ESG Disclosure; Firm Value; Green Accounting; Green Finance; Indonesia Stock Exchange

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## INTRODUCTION

Firm value remains a primary objective of corporate financial management because it reflects shareholder wealth and investors' expectations of future cash flows and associated risks (Brigham & Houston, 2019). Tobin (1969) defines firm value through the ratio of market value to the replacement cost of assets, commonly approximated using the method developed by Chung and Pruitt (1994). Consequently, companies with similar financial performance may receive different market valuations depending on how investors perceive their business risks. Environmental, social, and governance (ESG) considerations have increasingly influenced these perceptions. Friede et al. (2015), based on more than 2,000 empirical

studies, demonstrate that ESG factors generally have positive or non-negative relationships with financial performance.

These considerations are particularly relevant to energy companies because their operations involve natural resource extraction, greenhouse gas emissions, and substantial exposure to energy transition risks. Indonesia has strengthened its sustainable finance agenda through the Just Energy Transition Partnership (JETP), launched in November 2022 with approximately USD 20 billion in funding commitments and a target of limiting power-sector emissions to 290 million tonnes by 2030 (The Jakarta Post, 2022). Regulatory developments have reinforced this direction. POJK 51/POJK.03/2017 requires financial institutions, issuers, and public companies to implement sustainable finance and publish sustainability reports, while SEOJK 16/SEOJK.04/2021 establishes reporting requirements. Law No. 4 of 2023 further expands the sustainable finance framework, followed by the Indonesian Sustainable Finance Taxonomy (TKBI) in 2024 and its second version in 2025 (OJK, 2017, 2021, 2024, 2025).

Despite these developments, market movements during 2021–2025 indicate that energy-sector valuations remain strongly influenced by commodity price fluctuations. The IDX Energy index increased by 48.19% in 2021 and 76.6% by early November 2022, largely driven by commodity prices (Bisnis.com, 2021; Kontan, 2022). Following a decline in early 2025, the index subsequently recovered to a year-to-date increase of 63.66% by December 2025 (Bisnis.com, 2025a; IDX Channel, 2025). Similarly, the median Tobin's Q of the companies examined declined below one in 2023–2024 before recovering in 2025. These developments raise questions about whether sustainability disclosure contributes meaningfully to market valuation. Kamila and Putri (2026), for example, found that green accounting negatively affected firm value among Indonesian energy companies, suggesting that investors may perceive environmental expenditure as an additional operating cost.

Green accounting involves identifying, measuring, and disclosing the environmental impacts and costs of corporate activities (Schaltegger & Burritt, 2000; Lako, 2018). Previous Indonesian studies have produced inconsistent findings. Al Gamar and Widoretno (2024) and Sari and Hidayat (2026) report positive effects on firm value, whereas Mawarni and Kurniawati (2024) find no significant relationship. Kamila and Putri (2026) identify a negative effect, while Wiguna et al. (2026) demonstrate that external assurance can change the relationship from negative to positive. These differences suggest that environmental disclosure may not

automatically generate higher valuations, particularly when its credibility and economic implications remain uncertain.

Green finance represents funding and investment directed toward environmentally beneficial activities, including green bonds and sustainability-linked loans (Lindenberg, 2014; OJK, 2017). Although such financing can attract long-term investors and support sustainable operations, its implementation may involve substantial costs and delayed financial returns. Ban et al. (2025) identify a positive relationship between green bond issuance and firm value, while Jiang et al. (2022) and Yao et al. (2021) highlight circumstances in which green investment and credit policies may negatively affect corporate performance. However, empirical evidence concerning green finance among Indonesian non-financial energy companies remains limited.

ESG disclosure provides broader information about corporate environmental, social, and governance performance (Tamimi & Sebastianelli, 2017). Its relationship with firm value also remains inconclusive. Rohendi et al. (2024) report a positive effect, Angir and Weli (2024) identify a negative relationship, and Prasetiyo and Annisa (2025) find no significant effect. Furthermore, Prayogo et al. (2026) report an insignificant pooled relationship across 52 Indonesian studies, indicating substantial research heterogeneity. This inconsistency suggests that ESG disclosure may function not only as an independent determinant but also as a moderating factor influencing how investors interpret environmental information and green financing activities. Fatemi et al. (2018) provide supporting evidence for the moderating role of ESG disclosure in corporate valuation relationships.

Based on these findings, three research gaps emerge. First, previous studies provide inconsistent evidence regarding green accounting and firm value, while the combined effects of green accounting and green finance among Indonesian energy issuers remain underexplored. Second, ESG disclosure has predominantly been examined as an independent variable rather than as a moderator. Third, an appropriate disclosure-based green finance measurement for non-financial companies remains underdeveloped. Therefore, this study examines the effects of green accounting and green finance on firm value and investigates whether ESG disclosure moderates these relationships. Using 210 firm-year observations from 49 energy companies listed on the Indonesia Stock Exchange during 2021–2025, this study develops a ten-item green finance disclosure index based on relevant regulations and market principles and measures ESG disclosure using 38 indicators from SEOJK 16/SEOJK.04/2021. The findings are expected to contribute empirical

evidence to sustainability reporting and corporate valuation research, particularly in Indonesia's energy sector.

## METHODS

This study employs a quantitative explanatory design using panel data from energy-sector companies listed on the Indonesia Stock Exchange (IDX) during 2021–2025. The firm-year serves as the unit of analysis, with secondary data collected from IDX and company websites. The population comprises 90 companies classified under IDX-IC Energy as of December 31, 2025. Purposive sampling was applied based on five criteria: continuous listing since 2021, availability of annual reports and audited financial statements, accessible sustainability reports, complete year-end stock price and outstanding share data, and consistent or convertible financial reporting currencies. Firms with incomplete reporting or unavailable market data were excluded. Table 1 presents the sample selection process.

**Table 1.** Sample Selection

| No. | Criterion | Number |
|---|---|---|
| 1 | Energy-sector companies listed on the IDX as of 31 December 2025 (population) | 90 |
| 2 | Listed after 1 January 2021 | (25) |
| 3 | Incomplete annual reports or audited financial statements for 2021–2025 | (9) |
| 4 | Sustainability reports for 2021–2025 unavailable or inadequate for coding | (7) |
| 5 | Incomplete share price or shares outstanding data | (0) |
| 6 | Sample firms | 49 |
| 7 | Firm-year observations (49 × 5) | 245 |
| 8 | Observations whose report files were unavailable or unreadable | (35) |
| 9 | Observations analysed (unbalanced panel) | 210 |

Source: IDX listed company profiles and company reports, processed (2026)

Nine firms were excluded due to incomplete audited financial statements, while seven lacked accessible sustainability reports. Of 245 potential firm-year observations, 35 were unavailable because reports were missing, empty, or unreadable. These observations were excluded rather than assigned zero disclosure scores. The final unbalanced panel comprised 210 observations from 49 firms during 2021–2025. Although missing observations were concentrated in 2021–2022, comparisons showed no significant differences in Tobin's Q, firm size, leverage, or ROA, except sales growth. Firm value was measured using Tobin's Q (Chung & Pruitt, 1994), with PBV employed for robustness testing. Financial data came from audited IDX filings and year-end stock prices.

**Table 2.** Variable Operationalisation

| Variable | Definition | Measurement | Source of indicators |
|---|---|---|---|
| Firm value (Y) | Market valuation of the firm relative to its assets | Tobin's Q = (MVE + TL) / TA; MVE = shares outstanding × year-end closing price | Tobin (1969); Chung and Pruitt (1994) |
| Green accounting (X1) | Extent of environmental disclosure | GRI 300 items disclosed / relevant items (31 items: GRI 301 = 3, 302 = 5, 303 = 5, 304 = 4, 305 = 7, 306 = 5, 308 = 2) | GRI (2016a, 2016b, 2016c, 2016d, 2016e, 2018, 2020); Sari and Hidayat (2026); Wiguna et al. (2026) |
| Green finance (X2) | Extent of green funding and investment disclosure | GFDI: items disclosed / relevant items (10 items; Table 3) | OJK (2017, 2021, 2024); ICMA (2021); Lindenberg (2014) |
| ESG disclosure (Z) | Extent of environmental, social, and governance disclosure | Items disclosed / relevant items (38 items: E = 14, S = 13, G = 11) | Appendix II SEOJK 16/SEOJK.04/2021 (OJK, 2021); Tamimi and Sebastianelli (2017) |
| Firm size (SIZE) | Scale of firm resources | Natural log of total assets (rupiah) | Brigham and Houston (2019); Kamila and Putri (2026) |
| Leverage (LEV) | Share of assets financed by debt | Total liabilities / total assets | Brigham and Houston (2019) |
| Profitability (ROA) | Ability of assets to generate profit | Net income / total assets | Brigham and Houston (2019) |
| Sales growth (GROWTH) | Change in revenue from the previous year | $(Sales_t - Sales_{t-1}) / Sales_{t-1}$ | Brigham and Houston (2019) |

Source: Compiled by the authors (2026)

All three disclosure indices employ dichotomous scoring (1 = disclosed; 0 = not disclosed), calculated as the total disclosed items divided by applicable items. Non-relevant items are excluded from the denominator. Green accounting uses 31 GRI 300 indicators, while ESG disclosure adopts 38 relevant indicators from Appendix II of SEOJK 16/SEOJK.04/2021, covering environmental, social, and governance dimensions (OJK, 2021). Since no standardized green finance indicator exists for non-financial issuers, this study develops a Green Finance Disclosure Index (GFDI) based on POJK 51/2017, SEOJK 16/2021, the Green Bond Principles (ICMA, 2021), TKBI, and relevant literature. For 2021–2023, green finance activities were assessed by their characteristics rather than formal TKBI compliance.

**Table 3.** Items of the Green Finance Disclosure Index (GFDI) and Their Sources

| Code | Item disclosed | Source |
|---|---|---|

| Code | Item disclosed | Source |
|---|---|---|
| GF1 | Sustainable funding policy or strategy | OJK (2017); Appendix II SEOJK 16/2021 (OJK, 2021) |
| GF2 | Issuance of green or sustainability-linked bonds or sukuk | ICMA (2021); Flammer (2021) |
| GF3 | Green or sustainability-linked loans obtained | Lindenberg (2014); Hafizha and Arifin (2026) |
| GF4 | Use of proceeds for green projects | ICMA (2021), component 1 |
| GF5 | Project evaluation and selection process | ICMA (2021), component 2 |
| GF6 | Value of investment or capital expenditure for environmentally friendly activities | Item F.3, Appendix II SEOJK 16/2021 (OJK, 2021); Jiang et al. (2022); Widarwati et al. (2024) |
| GF7 | Renewable energy, energy efficiency, or emission reduction projects financed | TKBI version 1, energy sector (OJK, 2024) |
| GF8 | Funding or investment targets for the energy transition | Item F.3, Appendix II SEOJK 16/2021 (OJK, 2021); Law No. 4 of 2023 (Republik Indonesia, 2023) |
| GF9 | Impact reporting on the use of green funds | ICMA (2021), component 4 |
| GF10 | External review or second-party opinion on green instruments | ICMA (2021); Flammer (2021) |

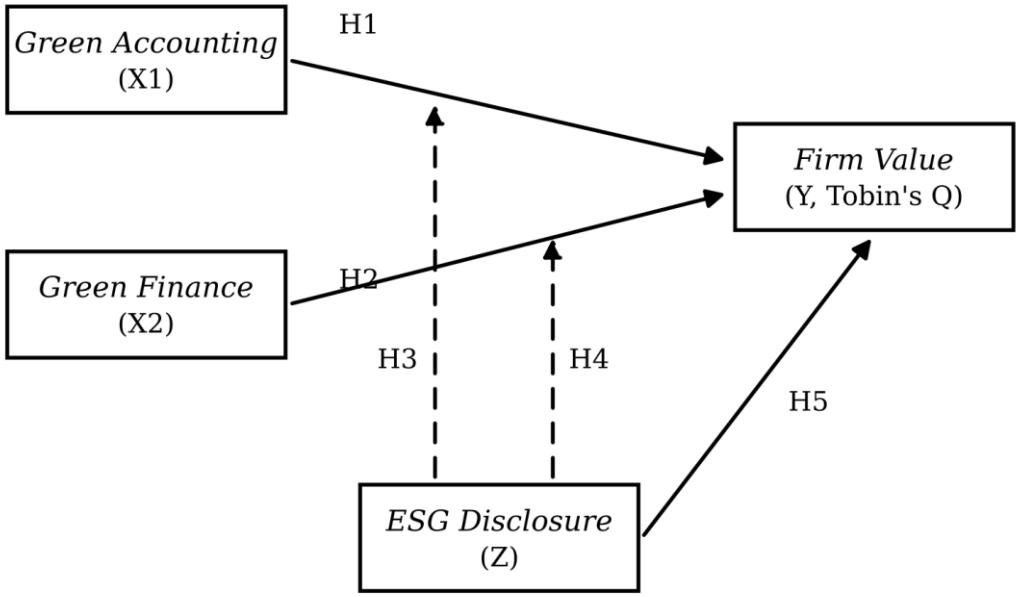
Source: Compiled by the authors (2026)

Data were collected through documentation using a coding sheet containing scores, page references, and supporting quotations to ensure traceability. Sustainability report index tables were used to identify disclosed GRI and SEOJK items. Items with corresponding page references received a score of 1, while undisclosed items received 0. Reports without index tables and all green finance indicators were assessed through manual examination of relevant pages. Quantitative environmental indicators required numerical evidence, whereas green finance disclosure required evidence of actual policies, instruments, projects, or funding.

Initial coding was supported by JavaScript-based PDF text extraction, the Claude language model (Anthropic, Opus series), and Python 3.13. The language model proposed scores, but all proposals were reviewed against source quotations and page references, with final decisions made by the researcher. Of 446 reviewed scores, 416 (93.3%) were retained. Cohen's kappa indicated substantial to almost perfect agreement, with values of 0.728 for green accounting, 0.879 for ESG disclosure, and 0.831 overall. However, verification involved the same researcher and was not an independent inter-coder assessment. All corrections were completed before regression analysis. Figure 1 illustrates the research framework, positioning

green accounting and green finance as explanatory variables and ESG disclosure as both an independent variable (H5) and a moderator (H3 and H4).

**Figure 1.** Research Framework




Note: solid lines = direct effects (H1, H2, H5); dashed lines = moderating effects (H3, H4)

Two regression models were estimated to examine direct effects and moderation effects using moderated regression analysis. Model 1 tested the effects of green accounting, green finance, and ESG disclosure on Tobin's Q, while Model 2 incorporated interaction terms between ESG disclosure and the two explanatory variables. All disclosure indices were mean-centred before interaction construction. The analysis included firm controls and year effects. Model selection used Chow, Lagrange Multiplier, and Hausman tests. Diagnostic tests assessed multicollinearity, normality, heteroscedasticity, and autocorrelation. Inference employed firm-clustered standard errors and wild cluster bootstrap with 1,999 replications. Robustness checks included alternative valuation measures, variable specifications, fixed-effects estimation, and coal versus non-coal subsample analysis.

## FINDINGS AND DISCUSSION

### Sample Profile and Descriptive Statistics

Of the 49 sample firms, 34 report in US dollars and 15 in rupiah, which reflects the export-oriented and dollar-denominated revenues of coal, oil, and gas businesses. Firm size varies widely, from total assets of Rp3.87 billion (AIMS, 2024) to Rp169.62 trillion (ADRO, 2022), with a median of Rp5.07 trillion. For descriptive purposes, the

firms were grouped by their main business into coal (19 firms, 80 observations), oil and gas (8 firms, 34 observations), and energy support services (22 firms, 96 observations). These groups were constructed by the authors from business descriptions in annual reports and do not match IDX-IC sub-industries exactly. Table 4 reports descriptive statistics for the 210 observations.

**Table 4.** Descriptive Statistics

| Variable | N | Min | Max | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Tobin's Q | 210 | 0.264 | 49.208 | 2.297 | 1.069 | 4.464 |
| PBV | 200 | 0.182 | 1,126.270 | 11.277 | 1.098 | 81.731 |
| Green accounting (GA) | 210 | 0.000 | 1.000 | 0.370 | 0.306 | 0.324 |
| Green finance (GF) | 210 | 0.000 | 0.400 | 0.041 | 0.000 | 0.077 |
| ESG disclosure (ESGD) | 210 | 0.000 | 1.000 | 0.722 | 0.974 | 0.359 |
| SIZE (ln total assets) | 210 | 22.077 | 32.765 | 29.293 | 29.188 | 1.910 |
| LEV | 210 | 0.031 | 2.418 | 0.522 | 0.492 | 0.369 |
| ROA | 210 | −3.540 | 0.616 | 0.050 | 0.048 | 0.285 |
| GROWTH | 210 | −0.973 | 13.891 | 0.286 | 0.049 | 1.268 |

Source: Secondary data processed (2026); PBV excludes 10 observations with negative parent equity

Descriptive statistics reveal substantial variation in firm value and sustainability disclosure among Indonesian energy companies during 2021–2025. Mean Tobin's Q was 2.297, exceeding the median of 1.069 because of several extreme observations. The median declined from 1.190 in 2021 to 0.972 in 2024 before recovering to 1.226 in 2025. Green accounting disclosure averaged 0.370, with 28 observations reporting no GRI 300 items. Waste management and energy consumption were the most frequently disclosed indicators, whereas Scope 3 emissions received limited attention. Green finance disclosure was considerably lower, averaging 0.041, with 71.9% of observations recording zero scores. Renewable energy and emission reduction projects were the most frequently reported activities, while green bonds and sukuk were absent. ESG disclosure averaged 0.722, with substantial improvements following the implementation of the SEOJK 16/2021 reporting format. Kruskal-Wallis tests indicate significant differences among coal, oil and gas, and support-service companies in Tobin's Q, green accounting, green finance, and ESG disclosure. Coal companies generally demonstrated higher environmental and green finance disclosure. Overall, sustainability reporting has expanded, but substantial differences remain in disclosure depth and green financing practices across Indonesian energy companies.

## Model Selection and Diagnostic Tests

Model selection tests rejected pooled OLS, with significant Chow (21.844; $p < 0.001$) and Lagrange Multiplier (186.589; $p < 0.001$) results. The robust Mundlak test ($\chi^2 = 11.419$; $p = 0.121$) supported the random-effects specification, which was subsequently used for hypothesis testing. Variance inflation factors (1.027–2.555) indicated no multicollinearity concerns. However, diagnostic tests identified non-normal residuals, heteroscedasticity, and serial correlation. These issues were addressed using firm-clustered standard errors and a wild cluster bootstrap. Importantly, the estimated effects of green accounting, green finance, and ESG disclosure remained insignificant across pooled, fixed-effects, and random-effects models.

## Regression Results and Hypothesis Tests

Table 5 presents the estimates of both models. Model 1 is jointly significant ($F = 25.865$; $p < 0.001$) and explains about 59% of the variation in Tobin's Q, most of it attributable to ROA.

**Table 5.** Estimation Results of Model 1 and Model 2 (Random Effects)

| Variable | Model 1 Coef. | SE | p | Model 2 Coef. | SE | p |
|---|---|---|---|---|---|---|
| Constant | 10.790 | 13.249 | 0.416 | 10.152 | 13.249 | 0.444 |
| GA | −1.421 | 1.083 | 0.191 | −0.855 | 0.959 | 0.374 |
| GF | 1.590 | 3.225 | 0.623 | 1.052 | 2.850 | 0.712 |
| ESGD | 0.631 | 0.874 | 0.471 | −0.530 | 0.910 | 0.561 |
| GA × ESGD | | | | −6.899 | 2.766 | 0.013 |
| GF × ESGD | | | | 5.025 | 5.932 | 0.398 |
| SIZE | −0.270 | 0.440 | 0.540 | −0.232 | 0.440 | 0.599 |
| LEV | −0.562 | 0.658 | 0.394 | −0.733 | 0.691 | 0.290 |
| ROA | −7.537 | 1.058 | < 0.001 | −7.612 | 0.931 | < 0.001 |
| GROWTH | −0.025 | 0.110 | 0.818 | −0.059 | 0.111 | 0.598 |
| Year effects | Yes | | | Yes | | |
| $R^2$ | 0.591 | | | 0.622 | | |
| $\Delta R^2$ | | | | 0.031 | | |
| F (p) | 25.865 (< 0.001) | | | 24.690 (< 0.001) | | |
| N | 210 | | | 210 | | |

Source: Secondary data processed (2026); firm-clustered standard errors; GA, GF, and ESGD are mean-centred in Model 2

The regression results indicate that green accounting (−1.421; $p = 0.191$), green finance (1.590; $p = 0.623$), and ESG disclosure (0.631; $p = 0.471$) have no significant

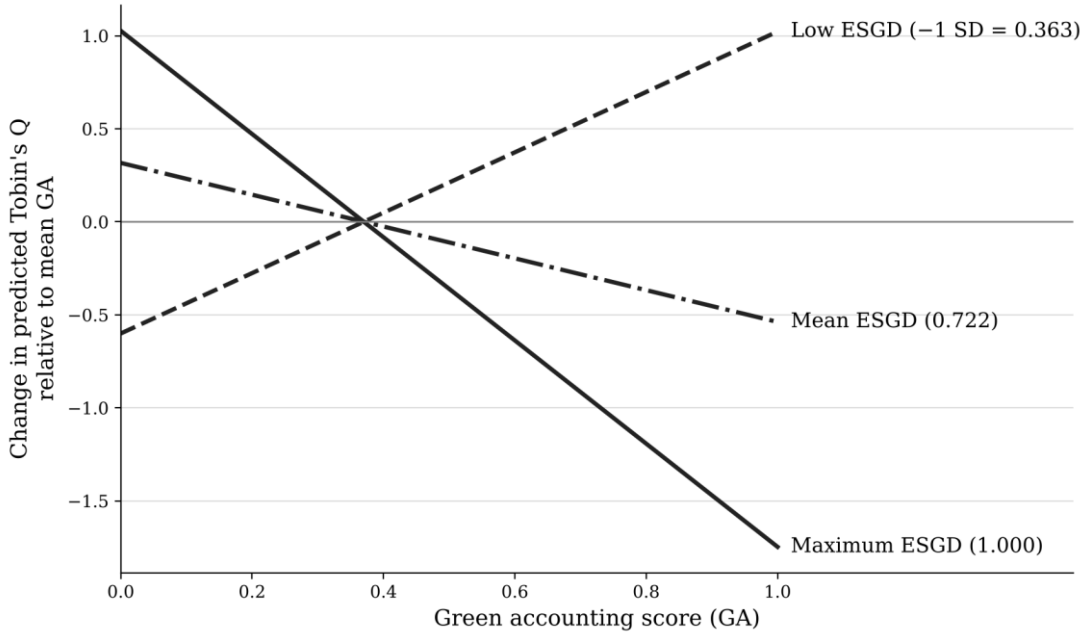
direct effects on firm value. Therefore, H1, H2, and H5 are rejected. However, the interaction between green accounting and ESG disclosure is negative and significant (−6.899; p = 0.013), supporting H3 and indicating that ESG disclosure weakens the relationship between green accounting and firm value. ESG disclosure functions as a pure moderator in this relationship. Conversely, the green finance–ESG interaction is insignificant (5.025; p = 0.398), leading to the rejection of H4. The interaction terms increase $R^2$ by 3.1%.

**Table 6.** Simple Slope Analysis

| ESGD level | ESGD value | Slope of GA (p) | Slope of GF (p) |
|---|---|---|---|
| Observed minimum | 0.000 | 4.126 (0.083) | −2.576 (0.594) |
| Mean − 1 SD | 0.363 | 1.623 (0.281) | −0.753 (0.821) |
| Mean | 0.722 | −0.855 (0.374) | 1.052 (0.712) |
| Observed median | 0.974 | −2.592 (0.017) | 2.317 (0.495) |
| Observed maximum | 1.000 | −2.774 (0.014) | 2.450 (0.482) |

Source: Secondary data processed (2026); slopes computed from Model 2 with firm-clustered standard errors

**Figure 2.** Effect of Green Accounting on Tobin's Q at Three Levels of ESG Disclosure




At low ESGD the slope of GA is positive but not significant at 5%, so the data cannot show that green accounting raises value among firms with narrow ESG disclosure. At the mean the slope is negative and also insignificant. At the median and maximum, it is negative and significant (−2.774; p = 0.014 at ESGD = 1.000): among firms with a full ESGD score, a 10 percentage point rise in GA is associated with a Tobin's Q about 0.28 lower. The Johnson-Neyman region confirms this

pattern, with the GA slope significantly negative at 5% when ESGD is 0.877 or higher, a range that covers 127 of 210 observations. For GF, the slope moves from negative at low ESGD to positive at high ESGD, in line with the positive interaction term, but none of the slopes is significant.

**Robustness Checks**

Table 7 reports the main coefficients across eleven specifications, including those that do not support the hypotheses, and Table 8 compares clustered and bootstrap p-values.

**Table 7.** Robustness Checks

| Specification | N | GA | GF | ESGD | GA × ESGD | GF × ESGD |
|---|---|---|---|---|---|---|
| Main model (RE, Tobin's Q) | 210 | −1.421 | 1.590 | 0.631 | −6.899** | 5.025 |
| Y = PBV (no negative equity) | 200 | 12.204 | 15.808 | −21.646 | 12.683 | 141.015 |
| Z = ESGD-SG | 210 | −1.394 | 1.631 | 0.646 | −7.002** | 5.444 |
| Without controls | 210 | −1.388 | 3.694 | 0.846 | −4.862 | 2.879 |
| Winsorised 1%–99% | 210 | −0.512 | 4.522 | 0.487 | −4.391 | 1.513 |
| GA, GF, ESGD at t−1 | 161 | −0.573 | −0.494 | −0.229 | −0.175 | 3.986 |
| Without negative equity | 200 | −1.393 | 1.598 | 0.645 | −6.935** | 4.854 |
| Fixed effects | 210 | −1.410 | 1.574 | 0.359 | −6.442** | 7.182 |
| Without AIMS and TCPI | 202 | 0.280 | 3.354 | −0.081 | −3.724 | 1.935 |
| Coal subsample | 80 | −1.439 | 0.129 | 0.779 | −9.301** | 5.542 |
| Non-coal subsample | 130 | −0.650 | 4.120 | 0.263 | 1.269 | 3.308 |

Source: Secondary data processed (2026); ** $p < 0.05$; direct effects from Model 1, interactions from Model 2

**Table 8.** Hypothesis Testing Summary

| Hypothesis | Coefficient | p (cluster) | p (bootstrap) | Decision |
|---|---|---|---|---|
| H1: GA → firm value | −1.421 | 0.191 | 0.251 | Rejected |
| H2: GF → firm value | 1.590 | 0.623 | 0.693 | Rejected |
| H3: ESGD moderates GA → firm value | −6.899 | 0.013 | 0.095 | Accepted under clustered test (weakening; pure moderation); limited evidence |
| H4: ESGD moderates GF → firm value | 5.025 | 0.398 | 0.425 | Rejected (potential moderation) |
| H5: ESGD → firm value | 0.631 | 0.471 | 0.499 | Rejected |

Source: Secondary data processed (2026); wild cluster bootstrap with Rademacher weights and 1,999 replications

The direct effects of green accounting (GA), green finance (GF), and ESG disclosure (ESGD) remain insignificant across all specifications, consistently rejecting H1, H2, and H5. However, the GA × ESGD interaction is significant in only four of ten alternative specifications. It remains negative when using ESGD-SG, excluding negative-equity firms, and applying fixed effects, but becomes insignificant under other robustness tests. Its significance also weakens under wild cluster bootstrap. Subsample analysis shows a significant negative interaction among coal firms (−9.301; p = 0.032), but not non-coal firms. Thus, H3 provides preliminary, context-specific evidence rather than a robust finding.

**Discussion**

The absence of a direct effect of green accounting does not prove that environmental disclosure is irrelevant, since the wide confidence interval leaves room for small effects of either sign. A plausible explanation, consistent with the data though not tested directly, comes from the conditions for an effective signal (Spence, 1973; Connelly et al., 2011). The items disclosed most often concern waste, energy consumption, and energy reduction, information already gathered for PROPER and therefore cheap to report. Signals that are cheap and easy to imitate tell investors little. The items most relevant to climate risk, such as Scope 3 emissions and supplier environmental assessment, are rarely reported, so a high GA score does not necessarily mean greater openness about the risks that matter most. The insignificant result matches Mawarni and Kurniawati (2024) and differs from the positive effects reported by Al Gamar and Widoretno (2024) and Sari and Hidayat (2026). The negative sign is closer to Kamila and Putri (2026) and Wiguna et al. (2026); differences in significance may reflect sample period and size and the control for firm and year effects used here. Individual cases show the same picture. PGAS consistently scored between 0.710 and 1.000 on GA while its Tobin's Q stayed between 0.733 and 0.899, and ITMG reached a full GA score in 2023 and 2024 while its Tobin's Q fell from 1.323 in 2022 to 0.972 in 2024 as coal prices and earnings declined. The strength of ROA in the model likewise suggests that investors pay more attention to financial performance than to the breadth of environmental disclosure.

For green finance, the most direct explanation lies in the data rather than in theory. With zero scores in 71.9% of observations, the model has little variation with which to detect an effect. Flammer (2021) and Ban et al. (2025) observed clear instruments such as green bond issuance, whereas no sample firm issued a green bond or sukuk over 2021–2025. The items met were mainly renewable energy

investments and policy statements, small relative to core operations. ITMG, for example, reported additional renewable energy capital expenditure of USD 3.3 million in 2024 and USD 5.7 million in 2025, modest sums against the scale of its coal business. The result is closer to Hafizha and Arifin (2026), who found no direct effect, and to the Chinese evidence that value gains from green bonds fade as green investment erodes profit (Jiang et al., 2022) and that green credit policy can weaken heavily polluting firms (Yao et al., 2021). TOBA illustrates the point. Its GF score rose from 0.100 in 2021 to 0.400 in 2025, the highest in the sample, alongside planned decarbonisation investment of about USD 500–600 million and floating solar financing, yet its Tobin's Q fell from 1.310 in 2021 to 0.722 in 2023 before returning to 1.188 in 2025. One possibility, not tested here, is that the market is waiting for evidence that the transition will generate cash flows. The rise in GF scores after TKBI suggests that any effect may only become visible over a longer period.

The moderation result runs against the reasoning used to develop H3, which expected broad ESG disclosure to help investors read environmental costs as investments. One possible explanation is that complete disclosure makes environmental risk easier to see. This was not tested directly, because investors' risk perceptions were not measured, but it fits several patterns in the data. For energy issuers, and coal producers in particular, broad ESG disclosure includes emission, waste, and transition data that expose the firm's vulnerability to climate risk. When this information appears in a complete report, investors can more readily estimate compliance and transition costs, and additional environmental disclosure may then be read as a cost signal. This interpretation is consistent with the negative effect of green accounting reported by Kamila and Putri (2026). Fatemi et al. (2018) offer more direct support: among US firms, they found that disclosure reduces the valuation benefit of ESG strengths while also softening the penalty for weaknesses. A weakening moderating role of disclosure has thus been observed before, albeit in a different setting and with different measures. The subsample results point the same way. The effect appears only among coal firms, the group that discloses most (mean GA 0.514) and faces the greatest threat from the energy transition. For these firms, more detailed reporting on emissions and energy makes their dependence on a commodity with declining expected demand all the more apparent, a message that the same disclosure does not carry for service or oil and gas firms.

The contrast with Wiguna et al. (2026), who found that external assurance reverses the negative effect of green accounting, suggests that the credibility of information may matter more than its breadth. Independent verification (G.1) was

the least disclosed ESGD item, so high ESGD scores mostly reflect complete formatting rather than information checked by an outside party. This reading also helps explain why ESGD has no direct effect, a result in line with Prasetiyo and Annisa (2025) and the meta-analysis by Prayogo et al. (2026), and neither supporting the broadly non-negative synthesis of Friede et al. (2015) nor the negative effect reported by Angir and Weli (2024). Once the median ESGD reached 1.000 in 2023, more than half of the observations disclosed every relevant item, and a score shared by most firms loses its power to discriminate. In signaling terms, ESG disclosure under the SEOJK format is a signal that every firm can send at the same cost.

For green finance, the positive interaction and the shift of the GF slope from negative to positive as ESGD rises agree with the agency argument that broader disclosure, including governance information, eases concern about misuse of the green label (Jensen & Meckling, 1976). Yet no slope is significant and the interaction fails in every specification. Agency theory implies that governance disclosure is most useful when there are green funds to account for, and in this sample such funds were almost absent. The result differs from Pratama et al. (2025), who found that green financing strengthens the effect of environmental performance on mining firm value, and from Hafizha and Arifin (2026), who found that green finance moderates the ESG and value link among banks. Both studies treat green funding as the moderator, whereas this study treats it as the moderated variable. In an energy sector that is only beginning to use green funding instruments, such funding is not yet large enough to be priced, whatever the breadth of ESG disclosure.

## CONCLUSION

This study concludes that green accounting, green finance, and ESG disclosure do not have a significant direct effect on the firm value of Indonesian energy companies, as measured by Tobin's Q. ESG disclosure demonstrates a weak moderating effect on the relationship between green accounting and firm value, indicating that greater environmental disclosure may be associated with lower market valuation among firms with higher ESG scores, particularly in the coal sector. However, this finding is only significant at the 10% level under the wild cluster bootstrap and does not remain consistent across robustness tests. Meanwhile, ESG disclosure does not moderate the relationship between green finance and firm value. These findings suggest that the extent of sustainability disclosure alone is insufficient to increase investor confidence or market valuation. Companies need to demonstrate credible environmental commitments through measurable emission reduction targets, transparent environmental risk management, Scope 3 reporting, and concrete

green financing strategies. Investors should also evaluate the substance and credibility of sustainability information rather than merely its completeness. This study is limited by its reliance on disclosure-based measurements, missing observations, limited variation in green finance disclosure, and the relatively short observation period. Future research should incorporate actual environmental performance indicators, independently verified disclosure assessments, external assurance, and longer observation periods to provide more comprehensive evidence of the relationship between corporate sustainability practices and firm value.

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