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The Effect Of Gender Diversity Of Directors And Commissioners And Esg Disclosure On Financial Performance: A Study Of Energy Companies Listed On The Idx In 2023–2025

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Abstract

This study examines the effects of board of directors gender diversity, board of commissioners gender diversity, and environmental, social, and governance (ESG) disclosure on financial performance measured by return on assets (ROA). Secondary data were drawn from 29 energy companies listed on the Main Board of the Indonesia Stock Exchange during 2023–2025, selected through purposive sampling, yielding 87 firm-year observations. Gender diversity is measured with the Blau index, ESG disclosure with a 25-theme binary index, and the analysis uses panel data regression with a random effects model and firm-clustered standard errors. The results show that gender diversity in both boards has no significant effect on ROA, while ESG disclosure is significantly and negatively related to ROA (β = −0.1892; p = 0.0317). This negative relationship does not hold once year dummies are added (β = +0.0319; p = 0.7981), indicating sensitivity to model specification. None of the three positive hypotheses is supported. The findings are associative and limited to Main Board energy firms that did not report a loss.

Keywords: Gender Diversity; ESG Disclosure; Financial Performance; Return On Assets; Energy Sector

INTRODUCTION

Financial performance reflects a company's ability to conduct business activities and generate profits. This study focuses on the ability of assets to generate net income, as measured by ROA, an accounting-based measure that differs from market-based measures such as Tobin's Q (Brahma et al., 2021; Kampoowale et al.,

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2025). The energy sector faces changes in commodity prices, investment needs, operational risks, and demands for environmental and social accountability. The benchmark coal price (HBA) for 6,322 calories was recorded at USD 330.97 per ton in October 2022 and USD 122.51 per ton in December 2024 (APBI-ICMA, 2025), while the average Newcastle thermal coal price fell from USD 136 per ton in 2024 to USD 108 per ton in 2025 (Hema, 2026). These two figures come from different benchmarks and are therefore not combined; they only provide context for the selection period 2023–2025.

In such circumstances, corporate governance becomes relevant. In the Indonesian corporate structure, management is carried out by the board of directors, while oversight and advisory functions are carried out by the board of commissioners (Republic of Indonesia, 2007, Article 1, paragraphs 5 and 6). Gender diversity in both bodies should therefore not be treated as a single, equal measure. The argument concerns the diversity of perspectives in board composition and processes, not the assumption that a particular gender automatically produces better decisions (Brahma et al., 2021; Ermawati & Soewarno, 2024). Female representation in the leadership of large Indonesian companies remains limited: the IDX200 company census recorded approximately 15% women in executive leadership teams in 2025 (Metapos, 2026).

Research findings on board gender and performance are mixed. Brahma et al. (2021) found a positive relationship in UK companies, with stronger results when there were three or more women. Basdekis et al. (2023) reported a positive panel relationship with profitability, while Chaabouni et al. (2025) found no significant relationship with ROA, ROE, or ROIC in Saudi Arabian companies. For Indonesian boards of commissioners, Ermawati and Soewarno (2024) found a positive relationship with Tobin's Q but an insignificant relationship with market-to-book value.

ESG disclosure is also receiving increasing attention. Issuers' sustainability reporting frameworks are regulated, among other things, through OJK Regulation No. 51/POJK.03/2017 (OJK, 2017), and the Indonesian Institute of Accountants (IAI) ratified PSPK 1 and PSPK 2 in July 2025, with an effective date of January 1, 2027 (IAI, 2025). The relationship with performance varies: positive for ROA and ROE of Saudi Arabian companies (Almulhim & Metwally, 2025), insignificant for ROA of Indonesian energy companies (Nindya, 2025; Oktasya & Wijaya, 2025) and European energy companies (Widoretno et al., 2025), and negative for EBIT-based ROA on the IDX (Wardani et al., 2025).

The novelty of this study does not lie in the claim that the Indonesian energy sector is understudied. Previous studies on the sector ended in 2023 (Nindya, 2025; Oktasya & Wijaya, 2025). This study extends the observation to 2025, separating gender diversity of directors from boards of commissioners, and using a binary

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disclosure index coded directly from company reports. The objective is to empirically test the effect of gender diversity of directors, gender diversity of boards of commissioners, and ESG disclosure on the ROA of energy companies listed on the IDX Main Board for the period 2023–2025.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Theoretical basis

Agency theory views the board of directors and commissioners as mechanisms to reduce agency costs due to the separation of ownership and management. A more diverse board is believed to strengthen oversight by bringing a broader perspective (Adams & Ferreira, 2009). However, Adams and Ferreira (2009) also show that stronger oversight is not always followed by a positive performance relationship after controlling for endogeneity, so the theoretical relationship still needs to be tested.

Stakeholder theory states that companies are accountable to all parties who influence or are influenced by the achievement of their objectives (Freeman, 1984, in Zhou et al., 2022). ESG disclosure is one way to demonstrate this responsibility, particularly in the energy sector, where activities interact with the environment, occupational safety, and society. Signaling theory views disclosure as communication that helps external parties distinguish a company's sustainability practices (Almulhim & Metwally, 2025). The credibility of the signal depends on the content and verifiability of the information, and the costs and benefits of disclosure can emerge at different times (Oktasya & Wijaya, 2025).

Critical mass theory (Kanter, 1977) explains that the number of minority group members influences decision dynamics. Brahma et al. (2021) found stronger results on boards with three or more women, but this number is not a universal threshold. This theory is used as a supporting explanation, not directly tested.

Hypothesis Development

A more gender-diverse board of directors can bring broader risk considerations and perspectives to operational and investment decisions, resulting in more efficient asset utilization. This positive trend aligns with Brahma et al. (2021), Basdekis et al. (2023), and Kampoowale et al. (2025), although Chaabouni et al. (2025) did not find a significant relationship. The first hypothesis is formulated as follows.

H1: Gender diversity of directors has a positive impact on financial performance.

A more diverse board of commissioners can strengthen oversight of board policies and reduce agency costs (Adams & Ferreira, 2009). Ermawati and Soewarno (2024) support a positive trend for market-based performance measures on

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Indonesian boards of commissioners, while Nindya (2025) reports a positive baseline coefficient of the Blau index on ROA of energy companies in an interaction model. The second hypothesis is formulated as follows.

H2: Gender diversity of the board of commissioners has a positive effect on financial performance.

Companies that disclose ESG more broadly convey signals and commitments to stakeholders, which can improve trust, access to funding, and legitimacy. This positive trend aligns with Almulhim and Metwally (2025) and Minh et al. (2026) for the social and governance pillars, although Oktasya and Wijaya (2025), Nindya (2025), and Wardani et al. (2025) did not find this trend. The hypothesis is positively oriented according to theory, while null or negative results are still treated as valid findings.

H3: ESG disclosure has a positive impact on financial performance.

The three hypotheses were tested in an additive model without mediators, moderators, interactions, or control variables.

RESEARCH METHODS

Design, Population, and Sample

This research is quantitative-causal with ex post facto secondary data analyzed through panel data regression using EViews 14. The population is 90 energy sector issuers according to the IDX Industrial Classification on the list of December 31, 2025, including coal mining, oil and gas, and supporting services. The sample was selected purposively with the following criteria: (1) listed on the IDX no later than December 31, 2022 and remain listed during 2023–2025; (2) on the Main Board on December 31, 2025; (3) has an annual report, consolidated financial statements, and sustainability report 2023–2025; and (4) does not experience a consolidated current year loss during that period. Companies without female board members are retained because a Blau index of zero is a valid value. The selection procedure is presented in Table 1.

Table 1. Sample Selection Procedure

Criteria	Number of Companies
Energy sector issuers as of December 31, 2025	90
Does not meet listing criteria	(16)
Not on the Main Board	(44)
Incomplete report	(0)
Consolidated current year loss in 2023, 2024, or 2025	(1)
Number of samples	**29**
Number of observations (29 × 3 years)	**87**

Source: processed data (2026).

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The panel is balanced. Because the Main Board criteria exclude approximately 49% of the population, and the no-loss criteria exclude one company, the results apply to relatively established energy issuers, not to all issuers in the sector.

Operationalization of Variables

The operationalization of the variables is presented in Table 2. The composition of the board of directors and commissioners is taken as of December 31 of each year, and gender is determined from explicit information in official documents. The ESG disclosure index is adapted from Refinitiv themes (in Hjelmberg & Holmgren, 2022) and cross-checked with the LSEG (2024) methodology. This index consists of 10 environmental themes, 9 social themes, and 6 governance themes, each with equal weighting. A score of one is assigned if the theme is specifically disclosed and traceable in the annual report or sustainability report, and a score of zero otherwise. The denominator remains 25, allowing the score to change in increments of 0.04. This index is not an official Refinitiv/LSEG score and only measures the breadth of disclosure, not the quality of ESG implementation.

Table 2. Operationalization of Variables

Variables	Measurement	Scale
Financial performance (ROA)	Consolidated profit for the year / consolidated total assets at the end of the year	Ratio
Gender diversity of directors (GD)	$1 - [pD^2 + (1 - pD)^2]$, pD = proportion of female directors	Ratio
Gender diversity of the board of commissioners (GK)	$1 - [pK^2 + (1 - pK)^2]$, pK = proportion of female commissioners	Ratio
ESG Disclosure (PESG)	Number of ESG themes revealed / 25	Ratio

Sources: Chaabouni et al. (2025); Kampoowale et al. (2025); Ermawati and Soewarno (2024); Hjelmberg and Holmgren (2022); LSEG (2024).

The Blau Index for the two gender categories ranges from 0 to 0.5. A score of zero is achieved by both all-male and all-female boards, so this index measures compositional diversity and is not identical to the percentage of women.

Analysis Techniques

The model tested is $ROAit = \beta_0+\beta_1 GDit + \beta_2 GKit + \beta_3 PESGit + \varepsilon it$, where i represents the firm and t represents the year. The common effects (CEM), fixed effects (FEM), and random effects (REM) models are first estimated using conventional

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standard errors, then selected using the Chow test, the Hausman test, and the Breusch–Pagan Lagrange Multiplier test at the 5% level (Baltagi, 2021). The classical Hausman test is not designed to be robust to serial correlation within firms (Papke & Wooldridge, 2023), so the results should be interpreted in conjunction with other considerations.

The coefficients of the selected model were tested using White period standard errors, which group errors by company, because three observations from one company can be related; the number of groups is 29 (MacKinnon et al., 2023). The White cross-section option was not used because it produces a singular covariance matrix with only three periods. Residual normality was tested using Jarque–Bera, multicollinearity with correlation, and variance inflation factor (VIF < 10) (Gujarati & Porter, 2009). Hypotheses were tested using t-tests and Wald tests at the 5% level; hypotheses were supported if the coefficients were positive and significant. As a sensitivity analysis, REM was re-estimated with markers for 2024 and 2025 (base year 2023) because average ROA decreased while average ESG disclosure increased during the observation period.

RESEARCH RESULTS

Descriptive Statistics

Descriptive statistics of 87 observations are presented in Table 3.

Table 3. Descriptive Statistics (n = 87)

Variables	Average	Median	Minimum	Maximum	Standard Deviation
ROA	0.1136	0.0820	0.0016	0.4026	0.0981
GD	0.2003	0.2188	0.0000	0.5000	0.1946
GK	0.1427	0.0000	0.0000	0.4444	0.1812
PESG	0.8041	0.8000	0.4800	0.9600	0.1023

Source: processed data (2026).

ROA is right-skewed (skewness 1.3503) with a standard deviation of 0.0981; the non-negative minimum value is a consequence of the sampling criterion that excludes loss-making companies. The median GD corresponds to one female director out of eight, and 39 of 87 observations have zero GD. Fifty-two of 87 observations (approximately 60%) have zero GK, with a standard deviation of 0.1812. The average PESG of 0.8041 corresponds to approximately 20 of the 25 themes, no observation covers all themes, and the skewness is negative (−0.6870). The average ROA decreases from 0.1446 in 2023 to 0.1160 in 2024 and 0.0802 in 2025, while the average PESG increases from 0.7407 to 0.8290 and 0.8428. The gender composition of directors remained unchanged over three years in 14 of the 29 companies and the composition of commissioners

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remained unchanged in 18 companies, so within-company variation for GD and GK was very limited.

Model Selection

Table 4. Model Selection Test Results

Test	Statistics	Probability	Decision
Chow (F cross section; db 28, 55)	5.7732	0.0000	FEM over CEM
Hausman (χ^2; df 3)	4.9016	0.1791	REM over FEM
LM Breusch–Pagan (cross-section)	27.3827	0.0000	REM over CEM

Source: EViews 14 output, processed (2026).

The Chow test rejects CEM, the Hausman test does not reject REM, and the LM test rejects CEM, so REM is selected as the primary model. Selection is based on the test procedure, not on the model that produces the most significant coefficients.

Assumption Testing and Diagnosis

The Jarque–Bera test on the REM residuals yielded a statistic of 25.4645 (p = 0.000003), indicating that the residuals were not normally distributed, consistent with a right-skewed distribution of ROA. No observations were removed or transformed, and the t-test should be read with caution. The highest correlation between the independent variables was only 0.229 (GK and PESG), and the centered VIFs for GD, GK, and PESG were 1.0094, 1.0562, and 1.0655, respectively, indicating no indication of multicollinearity. The Glejser and Breusch–Godfrey tests can only be run on pooled regressions without a panel structure and therefore do not represent REM errors; coefficient testing therefore uses grouped standard errors as a safeguard.

Hypothesis Test Results

The results of REM estimation with White period standard error are presented in Table 5.

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Table 5. REM Estimation Results with White Period Standard Error

Variables	Coefficient	Standard error	t	Probability	Results
GD	−0.0480	0.0694	−0.6919	0.4947	H1 is not supported
GK	−0.0302	0.0679	−0.4452	0.6596	H2 is not supported
PESG	−0.1892	0.0837	−2.2616	0.0317	H3 is not supported (significantly negative)

Description: constant 0.2797 (p = 0.0014); weighted R^2 0.0634, adjusted weighted R^2 0.0295, unweighted R^2 0.0020. Wald test of $\beta_1 = \beta_2 = \beta_3 = 0$: F = 2.1599 (df 3, 83; p = 0.0989) and χ^2 = 6.4798 (df 3; p = 0.0905). Source: EViews 14 output, processed (2026).

The coefficients for GD and GK are negative and insignificant, thus H1 and H2 are not supported. The coefficient for PESG is negative and significant at the 5% level, in the opposite direction to H3, thus H3 is not supported. An increase in one theme (0.04) is associated with a lower ROA of approximately 0.0076 or 0.76 percentage points when other variables are held constant; this interpretation is statistical and not causal. The Wald test indicates that all three variables are not significant together, and the low R^2 indicates that most of the variation in ROA comes from factors outside the model.

Sensitivity Analysis with Year Effects

Table 6.Comparison of Main Model and Model with Year Dummies

Variables	Main model: coefficient (p)	With year marker: coefficient (p)
GD	−0.0480 (0.4947)	−0.0388 (0.5850)
GK	−0.0302 (0.6596)	−0.0369 (0.5078)
PESG	−0.1892 (0.0317)	+0.0319 (0.7981)
2024	—	−0.0318 (0.1036)
2025	—	−0.0667 (0.0369)
Wald test with GD, GK, PESG (p, F statistic)	0.0989	0.8390

Source: EViews 14 output, White period standard error, processed (2026).

After the year markers were entered, the coefficients of GD and GK remained negative and insignificant, while the PESG coefficient turned positive (+0.0319) and insignificant (p = 0.7981). The 2025 marker was negative and significant, meaning that

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the 2025 ROA was approximately 0.067 lower on average than in 2023. The Wald test for all three study variables remained insignificant (F = 0.2809; p = 0.8390). The conclusion that H1, H2, and H3 were not supported therefore remained unchanged, but the negative relationship of PESG in the main model did not withstand time control.

DISCUSSION

Gender diversity of directors and financial performance (H1). The GD coefficient is negative and insignificant, differing from agency theory predictions and those of Brahma et al. (2021), Basdekis et al. (2023), and Kampoowale et al. (2025), but consistent with Chaabouni et al. (2025), who found no significant relationship between gender and ROA. Several explanations can be put forward without definitive distinction. First, the variation in GD is limited: 39 of 87 observations are zero, and composition remains unchanged in 14 of 29 firms. The linear Blau index also does not test the three-female threshold as in Brahma et al. (2021). Second, the model does not include control variables and the time period is only three years, so commodity price pressures are not separated from the influence of board composition. Third, the sign of the relationship between gender and performance can change depending on the estimation method (Adams & Ferreira, 2009); a similar pattern is observed here, with a GD coefficient of −0.1022 in the CEM and nearly zero (−0.0037) in the FEM. The negative sign therefore cannot be interpreted as evidence that female directors are detrimental to performance.

Gender diversity of the board of commissioners and financial performance (H2). The GK coefficient is negative and insignificant. Ermawati and Soewarno (2024) found a positive correlation between the commissioners' Blau index and Tobin's Q, but an insignificant correlation with market-to-book value; both are market measures, not ROA. This finding aligns with the insignificant result for the latter measure and with Chaabouni et al. (2025). The positive baseline Blau index coefficient in Nindya (2025) was obtained in a model with a board independence interaction and is therefore not fully comparable. The most likely cause lies in the data distribution: 52 of 87 observations have zero GK, and board composition remains unchanged in 18 of 29 companies, so the model only compares a small group of companies with diverse boards of commissioners with a larger group that do not. The supervisory function of commissioners may also be more reflected in market size than in current year profit. These results do not justify reducing board diversity.

ESG disclosure and financial performance (H3). The PESG coefficient in the main model is negative and significant, contrary to stakeholder theory and signaling theory. This result differs from Almulhim and Metwally (2025) and Zhou et al. (2022), which reported a positive relationship, although Zhou et al. (2022) used ESG performance and market value. The direction is consistent with Wardani et al. (2025)'s

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analysis of EBIT-based ROA on the IDX, but after-tax profit and EBIT are not identical. This study differs from Oktasya and Wijaya (2025), who found no significant effect on Indonesian energy, but similarly found no support for a positive relationship.

The negative relationship does not persist after the inclusion of year markers: the PESG coefficient changes from −0.1892 to +0.0319 and is no longer significant, while the 2025 marker is negative and significant. While average ROA does decline and average PESG increases over the observation period, the data are insufficient to suggest that changes in coal prices or increases in ESG costs are the cause. Other explanations remain possible. First, substantial ESG costs can depress short-term earnings before their benefits are realized (Oktasya & Wijaya, 2025), but these costs were not measured here. Second, an equally weighted aggregate index may mask differences in the relationship between pillars (Minh et al., 2026). Third, a year's report is published after part of that year's financial results have been released, so a bidirectional relationship cannot be ruled out. Negative results in the main model should therefore not be interpreted as evidence of stability, let alone causality, and should not imply that companies should reduce ESG disclosure.

CONCLUSION, LIMITATIONS AND SUGGESTIONS

Conclusion

This study examines the effect of board of directors gender diversity, board of commissioners gender diversity, and ESG disclosure on ROA in 29 energy sector companies on the IDX Main Board during 2023–2025 (87 observations). The selected model is a random effects model with White period standard error. Board of directors gender diversity (β = −0.0480; p = 0.4947) and board of commissioners gender diversity (β = −0.0302; p = 0.6596) do not significantly affect ROA, thus H1 and H2 are not supported. ESG disclosure is significantly negatively related in the main model (β = −0.1892; p = 0.0317), thus H3 is not supported, but the relationship changes to positive and insignificant after the year marker is included (β = +0.0319; p = 0.7981). The three variables are not significant together (Wald test p = 0.0989 in the main model and p = 0.8390 in the model with year markers), and the weighted R^2 is only 0.0634. The conclusion is associative and limited to Main Board energy issuers that did not incur losses during 2023–2025.

Limitations

First, the period is only three years and within-firm variation is very limited, particularly in GD and GK. Second, the main model does not include control variables, so firm size, leverage, and commodity prices are not directly tested. Third, sample selection based on the Main Board and the absence of losses potentially introduces

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selection bias, and the number of inference groups is only 29 (MacKinnon et al., 2023). Fourth, residuals are not normally distributed, and the choice of standard errors is determined after the initial output is examined, although partial decisions do not change between the conventional standard errors and the White period. Fifth, the PESG index is independently constructed with equal weights, coded by a single coder, and measures only the breadth, not the quality, of disclosure. Sixth, the ex post facto design does not address endogeneity (Adams & Ferreira, 2009).

Suggestion

For companies, ESG disclosure should be viewed as part of sustainability accountability and communication, not as an instrument that automatically increases or decreases short-term profitability, while the selection of directors and commissioners should still consider competence, governance functions, and diversity. For investors and report users, information on board gender and the number of ESG themes should be used as complementary information, along with indicators such as commodity prices and cost structures. For further research, it is recommended to: (1) extend the period and control for changes in conditions between years; (2) add control variables and test sensitivity to sample selection, including loss-making companies; (3) separate environmental, social, and governance pillars (Minh et al., 2026); (4) use the number or category of women to test the critical mass theory (Brahma et al., 2021); (5) consider endogeneity and inference for small groups; (6) use other performance measures such as ROE and Tobin's Q and test the mediating or moderating role of ESG (Kampoowale et al., 2025; Muazaroh et al., 2025). and (7) conducting ESG coding by two coders with checks for agreement between coders.

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