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ESG Score and Carbon Intensity in ASEAN High-Emission Sectors: Implications for Tax Aggressiveness

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Abstract: Sustainability pressures have raised questions about whether sustainability performance is associated with tax behavior in high-emission sectors. This study examines the effects of ESG score and carbon intensity on tax aggressiveness among firms in the energy, utilities, and industrials sectors across six ASEAN countries during 2020–2024. Using purposive sampling, the study analyzes 275 firm-year observations from 55 firms using data obtained from the Refinitiv database. Tax aggressiveness is measured using the Effective Tax Rate, while firm size and leverage are control variables. Data are analyzed using Partial Least Squares Structural Equation Modeling with 5,000 bootstrap subsamples. The results show that neither ESG score nor carbon intensity significantly affects tax aggressiveness. Firm size has a significant effect on the Effective Tax Rate, indicating lower tax aggressiveness among larger firms, whereas leverage has no significant effect. The findings suggest that sustainability characteristics do not appear to be primarily determinants of tax behavior among high-emission ASEAN firms.

Keywords: ASEAN, Carbon Intensity, ESG Score, Tax Aggressiveness, Tax Avoidance.

INTRODUCTION

Tax aggressiveness refers to efforts undertaken by taxpayers to achieve tax payment efficiency as long as such efforts do not violate tax regulations. It involves efforts to minimize taxable income through tax planning, either legally through tax avoidance or illegally through tax evasion. This issue has become an important concern in corporate governance because it may create reputational risks, political pressure, and consumer boycotts (Elgharbawy & Aladwey, 2025). Corporate income tax is an important source of tax revenue in ASEAN, contributing 66.8% of total tax revenue in Malaysia, 51.0% in Singapore, 42.2% in Indonesia, 37.2% in Thailand, 33.3% in the Philippines, and 27.7% in Vietnam (OECD, 2024). These figures demonstrate the importance of corporate tax compliance in maintaining the fiscal capacity of the region. Although tax avoidance may be conducted within the legal framework, it may be viewed as inconsistent with the broader objective of taxation as a source of public financing, thereby creating an ethical dilemma in corporate governance (Heimberger, 2021).

At the same time, climate change and increasing energy demand have intensified sustainability pressure across ASEAN economies (International Energy Agency, 2024). Carbon dioxide emissions in the region increased during 2015–2024, with Indonesia recording the highest emissions, followed by Vietnam, Malaysia, Thailand, the Philippines, and Singapore (Global Carbon Budget, 2025). This study focuses on the energy, utilities, and industrials sectors because they are relatively energy- and capital-intensive, with substantial fixed assets and debt financing. These characteristics may provide opportunities for tax planning through depreciation, interest tax shields, and temporary differences between accounting and taxable income.

Tax aggressiveness is proxied by Effective Tax Rate (ETR), calculated as tax expense divided by pre-tax income. A lower ETR indicates a higher level of tax aggressiveness (Dyreng et al., 2008; Salihu et al., 2014). Sustainability pressures in high-emission sectors are also reflected in the development of sustainability reporting regulations across ASEAN countries. Although these regulations share the objective of improving ESG transparency, their implementation, scope, and reporting mechanisms vary across countries, making cross-country research relevant. Corporate responses to sustainability pressures can be reflected in Environmental, Social, and Governance (ESG) performance. Based on stakeholder theory (Freeman, 1984), firms are expected to consider the interests of broader stakeholders and demonstrate responsible and transparent business practices, including tax-related decisions. However, previous studies have reported inconsistent findings regarding the relationship between ESG score and tax aggressiveness. Some studies find a negative relationship due to reputational concerns (Yoon et al., 2021; Dalimunthe et al., 2024), whereas others suggest that firms may use ESG reputation as a legitimacy mechanism to compensate for sustainability-related costs through tax avoidance strategies (Davis et al., 2016; Mitroulia et al., 2025).

Carbon intensity, measured as carbon emissions relative to corporate revenue, represents another dimension of sustainability pressure in high-emission sectors. Previous research has also produced mixed findings regarding its relationship with tax aggressiveness. Some studies find that higher environmental costs encourage tax avoidance as firms seek to compensate for sustainability-related burdens (Compagnie et al., 2023; Souguir et al., 2024), while others indicate that market-based environmental regulations may influence tax avoidance through their effects on corporate cash flows (Feng et al., 2022). Previous studies have predominantly focused on developed countries or individual-country settings, limiting the generalizability of their findings. Moreover, ESG score and carbon intensity have generally been examined separately in relation to tax aggressiveness. In particular, limited evidence is available on whether both ESG score and carbon intensity are associated with tax aggressiveness when examined simultaneously among high-emission firms across ASEAN countries. Therefore, this study examines the effects of ESG score and carbon intensity on tax aggressiveness among firms in the energy, utilities, and industrials sectors across six ASEAN countries during 2020–2024, with firm size and leverage included as control variables. This study contributes to the literature by providing cross-country evidence on the relationship between sustainability performance and tax behavior in high-emission sectors within the ASEAN region.

METHODS

This study employs a quantitative approach to examine sustainability performance and tax behavior among firms in the energy, utilities, and industrials sectors across six ASEAN countries: Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam during 2020–2024. The population consists of high-emission sector firms available in the Refinitiv Database with complete ESG score, carbon intensity, and financial data. The sample was selected using purposive sampling based on the following criteria: (1) firms in the energy, utilities, and industrials sectors available in Refinitiv during 2020–2024; (2) complete ESG

score and carbon intensity data; (3) complete financial data required to calculate ETR, firm size, and leverage; and (4) firms that did not report a loss, defined as negative pre-tax income, throughout the observation period because ETR cannot be meaningfully interpreted under such conditions. Based on these criteria, the final sample consists of 55 firms and 275 firm-year observations.

The study uses quantitative secondary data obtained from Refinitiv database, including sustainability and annual reports. Data were collected through documentation and secondary-data searches, followed by verification of data completeness according to the sampling criteria. Tax aggressiveness is the dependent variable, proxied by Effective Tax Rate (ETR), while ESG score and carbon intensity are the independent variables. Firm size and leverage are included as control variables. Variable operationalization is presented in Table 1. All variables were modeled as single-indicator constructs based on their respective operational measures.

Table 1. Variable Measurement

Variable	Measurement
ESG Score (ESG)	Refinitiv ESG Score (Overall ESG Score; range 0-100)
Carbon Intensity (CI)	Total Carbon Emissions ÷ Revenue
Tax Aggressiveness (ETR)	Effective Tax Rate (ETR) = Total Tax Expense ÷ Pre-tax Income
Firm Size (SIZE)	Ln (Total Assets)
Leverage (LEV)	Total Debt / Total Assets

Source: Research Data, compiled by the authors (2026)

Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4, following Hair et al. (2019). PLS-SEM was selected as a variance-based approach that employs nonparametric bootstrapping for parameter significance testing and does not require multivariate normality. The analysis includes descriptive statistics, measurement model evaluation (outer model), and structural model evaluation (inner model), including R-squares, path coefficients, effect size (f-square), and collinearity assessment using the Variance Inflation Factor (VIF).

Model estimation employed the Path Weighting Scheme, with significance assessed using 5,000 bootstrap subsamples in a two-tailed test at a 5% significance level. A hypothesis is supported when the p-value is below 0.05. Additional analyses included a sensitivity test for potential outliers identified using Z-scores ($|Z| > 3$) and a robustness test using an alternative carbon intensity measure based on total assets rather than revenue to assess the consistency of the estimated relationships.

RESULTS AND DISCUSSION

Descriptive Statistics

Descriptive statistics for 275 firm-year observations from 55 firms in high-emission sectors across ASEAN are presented in table 2. ESG score has a mean of 55.932 and a standard deviation of 17.794, indicating substantial variation in sustainability performance across firms. Carbon intensity has a mean of 0.822 and a median of 0.205, indicating a right-skewed distribution caused by a small number of firms with substantially higher emission intensity. Firm size and leverage show relatively close mean and median values, while ETR has a mean of 0.225 with considerable variation across firms. The Cramér-von Mises normality test yields p-values below 0.05 for all variables, indicating that the data are nor normally distributed.

Table 2. Descriptive Statistics

Variabel	Min	Max	Mean	Std. Deviation	Median	Cramér-von Mises (*p-value)*
ESG Score (X1)	7,349	91,729	55,932	17,794	59,121	0,000
Carbon Intensity (X2)	0,000	11,750	0,822	1,898	0,205	0,000
Firm Size (C1)	17,310	25,366	21,565	1,546	21,601	0,000
Leverage (C2)	0,002	0,700	0,285	0,179	0,282	0,000
ETR (Y)	0,001	0,806	0,225	0,146	0,221	0,000

Source: Research Data, compiled by the authors (2026)

Structural Model and Hypothesis Testing

All constructs (ESG score, carbon intensity, firm size, leverage, and tax aggressiveness) are represented by single indicators with outer loadings/weights of 1.000. Therefore, convergent and discriminant validity tests are not applicable. The structural model produces an R-square of 0.030 and an adjusted R-square of 0.016, indicating that the four predictor variables jointly explain 3.0% of the variation in tax aggressiveness. The remaining 97.0% of the variance is associated with factors not included in the model. VIF values range from 1.038 to 1.299, indicating no collinearity concerns.

Hypothesis testing based on 5,000 bootstrap subsamples is presented in Table 3. ESG score has a positive but insignificant path coefficient ($\beta = 0.028$; $p = 0.675$; f-square = 0.001), indicating that ESG score does not significantly affect tax aggressiveness and H1 is not supported. Carbon intensity also has a negative and insignificant effect ($\beta = -0.052$; $p = 0.589$; f-square = 0.003), resulting in H2 not being supported. Among the control variables, firm size has a positive and significant effect on ETR ($\beta = 0.157$; $p = 0.014$; f-square = 0.020), indicating lower tax aggressiveness among larger firms. Leverage has no significant effect ($\beta = -0.016$; $p = 0.803$; f-square ≈ 0).

Table 3. Hypothesis Testing

Path	β (O)	t-statistics	p-value	*f-square*
H1: ESG Score → Tax Aggressiveness*	0,028	0,420	0,675	0,001
H2: Carbon Intensity → Tax Aggressiveness*	-0,052	0,541	0,589	0,003
SIZE → Tax Aggressiveness* (control)	0,157	2,455	0,014	0,020
LEV → Tax Aggressiveness* (control)	-0,016	0,250	0,803	0,000

Source: Research Data, compiled by the authors (2026)

*Tax aggressiveness is proxied by Effective Tax Rate

Sensitivity and Robustness Tests

The sensitivity test removed 13 observations identified as outliers using $|Z| > 3$, leaving 262 observations. The conclusions for H1 and H2 remained unchanged. However, the p-value for carbon intensity decreased from 0.589 to 0.082, while the p-value for firm size increased from 0.014 to 0.059. The R-square also increased from 0.030 to 0.081. The robustness test using asset-based rather than revenue-based carbon intensity produced a negative coefficient ($\beta = -0.004$; $p = 0.982$). The result is consistent with the negative direction of the main model, although the relationship remains statistically insignificant.

Discussion

The insignificant relationship between ESG score and tax aggressiveness differs from studies reporting a significant negative relationship (Yoon et al., 2021; Hidayat & Zuhroh, 2023; Syahputri, 2025), but is consistent with Mitroulia et al. (2025), which reports generally insignificant or relatively small associations between ESG and tax avoidance. One possible explanation is that Refinitiv ESG scores are largely based on corporate disclosures, may not fully represent substantive sustainability practices or their integration into tax decisions. This

may reflect a decoupling between sustainability disclosure and actual corporate practices (Souguir et al., 2024). Differences in regulatory maturity and enforcement across ASEAN countries may also create heterogeneous sustainability pressures. In addition, the use of an aggregate ESG score may obscure the effects of individual environmental, social, and governance dimensions (Li et al., 2023). The relatively large and disclosure-oriented firms in the sample may further limit variation in ESG scores.

The insignificant effect of carbon intensity also differs from studies reporting a positive relationship with tax avoidance (Feng et al., 2022; Souguir et al., 2024), but is consistent with evidence that environmental uncertainty does not significantly affect tax avoidance in Southeast Asia (Septriani et al., 2025). A possible explanation is that high carbon intensity is an inherent characteristic of the energy, utilities, and industrials sectors rather than a discretionary decision directly associated with tax strategy. In addition, carbon pricing and carbon tax mechanisms in several ASEAN countries were still developing during 2020–2024, potentially limiting the economic pressure for firms to adjust their tax strategies. Heterogeneity across subsectors may also weaken the ability to identify a systematic relationship between carbon intensity and tax aggressiveness (Busch & Lewandowski, 2018).

For the control variables, firm size has a significant effect on ETR, suggesting that larger firms exhibit lower tax aggressiveness. This finding is consistent with Nurlis et al. (2021) and Oktrivina (2022) and may reflect greater scrutiny from diverse stakeholders, encouraging larger firms to adopt more cautious tax strategies. In contrast, leverage does not significantly affect tax aggressiveness, consistent with Mohanadas et al. (2020). This result may indicate that, in capital-intensive sectors such as energy, utilities, and industrials, debt financing is primarily associated with long-term investment needs rather than being used principally as a tax-saving strategy through tax shields.

CONCLUSION

This study examines the effects of ESG score and carbon intensity on tax aggressiveness, with firm size and leverage as control variables, among 55 firms in the energy, utilities, and industrials sectors across six ASEAN countries during 2020–2024, comprising 275 firm-year observations. The PLS-SEM results show that neither ESG score nor carbon intensity has a significant effect on tax aggressiveness, as proxied by the Effective Tax Rate, and therefore H1 and H2 are not supported. These findings remain consistent after the outlier sensitivity test and the robustness test using an alternative measure of carbon intensity. Among the control variables, firm size has a positive and significant effect on ETR, indicating lower tax aggressiveness among larger firms, while leverage has no significant effect.

The findings suggest that sustainability characteristics, as reflected by ESG score and carbon intensity, have not yet become primary determinants of corporate tax behavior in high-emission sectors across ASEAN. This may indicate that sustainability and tax-related decisions remain relatively separate within the regional corporate context. Practically, the findings encourage firms to strengthen substantive sustainability practices beyond disclosure, while governments and regulators may consider strengthening the integration between sustainability oversight and tax governance.

This study is subject to several limitations. The sample is restricted to high-emission sectors and is unevenly distributed across countries, with the Philippines and Malaysia contributing relatively more observations and Vietnam represented by only one firm. The observation period is also limited to 2020–2024, while carbon intensity is represented by a single proxy. Furthermore, the model has a relatively low R-square of 0.030, indicating that other factors outside the model may explain a substantial portion of variation in tax aggressiveness. Future research could expand and balance the ASEAN sample, extend the observation period and sector coverage, and examine the environmental, social, and

governance dimensions separately to provide a more detailed understanding of the relationship between corporate sustainability and tax behavior.

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