

Capital Structure Decisions and ESG Disclosure: Evidence from Energy Sector Companies in Indonesia

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ABSTRACT

This study examines the relationship between firm capital structure and environmental, social, and governance (ESG) disclosure in Indonesian energy-sector companies amid the capital-intensive energy transition. Using a quantitative panel-data design with 128 firm-year observations from 32 energy companies listed on the Indonesian Stock Exchange (IDX) during 2020–2023, ESG disclosure measures were manually constructed based on Global Reporting Initiative (GRI) indicators. Panel regression results reveal that the shareholders' equity ratio (SER) is positively associated with aggregate ESG (coef = 1.434, $p < 0.01$) and environmental disclosure (coef = 3.221, $p < 0.01$), but negatively with social (coef = -0.820, $p < 0.05$) and governance disclosure (coef = -0.820, $p < 0.05$). Total debt (TDA) is positively associated with governance disclosure (coef = 1.629, $p < 0.10$), while debt-based measures show no significant links to environmental or social dimensions. These findings demonstrate that the relationship between capital structure and ESG disclosure is dimension-specific. These findings suggest that greater equity-based financial flexibility may be associated with more extensive environmental reporting. Thus, managers should maintain balanced financing, and regulators should expand transition-finance access to align capital structures with sustainability goals.

Keywords: Capital Structure; Corporate Governance; Energy Sector; Environmental Disclosure; ESG Disclosure

JEL Classification: G32; M14; Q56

INTRODUCTION

In the past decade, global economic uncertainties (Demirgüç-Kunt et al., 2020) and accelerating energy transitions (Pangestuti et al., 2026; Yucel & Yucel, 2024) have transformed sustainability from a predominantly ethical concern into an increasingly important component of corporate strategy and accountability. Sustainability-oriented investors and other stakeholders demand greater corporate transparency (Al Amosh & Mansor, 2021; Fitriasisari, 2023). Firms face increasing pressure to disclose information concerning their environmental, social, and governance (ESG) activities, risks, and commitments. In Indonesia, the Financial Services Authority (OJK), together with developments in the domestic capital market such as the introduction of the ESG Leaders Index, has strengthened expectations for standardized sustainability reporting and broader ESG disclosure (Nareswari et al., 2023). Against this background, an important question remains regarding whether and how firms' financing structures are associated with the extent and composition of ESG disclosure.

This relationship is theoretically ambiguous. From an agency-theory perspective, debt financing may strengthen external monitoring because creditors require greater transparency, accountability, and information disclosure to evaluate risks (Al Amosh et al., 2022). Under this mechanism, greater creditor scrutiny may encourage firms to provide more comprehensive ESG information to reduce information asymmetry. On the contrary, the trade-off and debt-overhang theories imply that high levels of indebtedness can limit companies' capacity to obtain financing and lead to resource allocation towards debt repayments rather than sustainability projects (Bae et al., 2019). These financial limitations may also have an impact on the quality of ESG disclosures because environmental and social reporting requires not just ESG practices to be undertaken but also sufficient resources necessary for gathering, measuring, verifying, and transmitting non-financial information. As a result, capital structure may determine the types of ESG disclosures, as companies must have the capacity to perform sustainability activities and have the ability and incentive to disclose such activities transparently.

The Indonesian institutional environment constitutes an especially important context for the analysis of this relationship. One important regulatory development in this area is OJK Regulation No. 51/POJK.03/2017, designed to govern sustainable finance and impose sustainability obligations on financial institutions and companies listed on stock exchanges. These regulations, along with initiatives aimed at sustainable development in the capital market, have made the fact that ESG reporting has become of crucial importance in Indonesia (Nareswari et al., 2023). However, the quantity and quality of corporate ESG reports can significantly differ among companies, as this process depends not only on regulations but on companies' own resources, financing, governance systems, and pressure from stakeholders.

The mentioned matters are of particular importance in the Indonesian energy market. Historically, Indonesia's energy system and national earnings have been linked to fossil-fuel-based activities. Accordingly, Indonesia has committed to achieving net-zero emissions by 2060, resulting in increasing transition pressure on carbon-intensive companies (Ulfa & Rahman, 2024). Energy companies are thus subject to significant pressures regarding the implementation of investments in clean technologies, transition projects, and risk management in the context of environmental issues. Meanwhile, the implementation of ESG in Indonesia suffers from the problems of standards compliance and availability of data (Chong & Loh, 2023). Such circumstances strengthen the demand for reliable ESG information from stakeholders and make it relevant to study the sector.

The issue is complicated by the financing situation. Indonesian energy companies operate in an emerging market where financing is relatively costly, green financing is quite scarce, and, in some cases, companies are highly dependent on external financing (Aldiyansa & Kristanti, 2021). There are many aspects of the financing situation that may influence ESG disclosure. Companies with better financing may have more chances to introduce sustainable practices and develop an appropriate reporting system to report on their activities. As opposed to that, higher exposure to debt may prevent firms from utilizing available funds and require creditors to attempt to closely supervise and ask for transparency in their governance. Therefore, different parts of the financial structure may have different roles in determining ESG disclosure, instead of having an equal impact on the disclosure across all ESG components.

In spite of the presence of these alternative theories, research into the link between capital structure and ESG disclosure is still extremely scarce. Capital structure has been researched extensively in regard to corporate flexibility, liquidity, firm value, and classical financial performance (Bajaj et al., 2020; Stamou et al., 2020; Yildirim et al., 2018). On the other hand, previous ESG research has usually focused on the factors of firm governance (Al Amosh et al., 2022; Chen et al., 2021; Shamil et al., 2014). With regard to the capital structure-ESG connection, it should be emphasized that the few empirical studies that were able to establish a link between the two phenomena were exclusively conducted in developed countries or some developing markets like Jordan (Al Amosh & Khatib, 2022). Therefore, there is not enough empirical evidence on the relationship of various components of finance with overall ESG disclosure and its components in capital-intensive industries of emerging markets.

In order to fill in this gap, this research looks at the connection between capital structure and ESG disclosure in Indonesian energy firms listed on the stock exchange over the period of 2020-2023. To evaluate capital structure, this research utilizes short-term debt to total assets (STDA), long-term debt to total assets (LTDA), total debt to total assets (TDA), and the shareholders' equity ratio (SER). Meanwhile, ESG disclosure is assessed both as a composite score and through its individual environmental (ENV), social (SOC), and governance (GOV) pillars.

This particular study makes several significant contributions to finance and corporate reporting literature. First, it adopts agency, trade-off, and pecking order theories in order to analyze the role of financing structure in achieving ESG reporting goals based on financial flexibility, external scrutiny, and capability to report. Second, the research presents evidence from Indonesia, which is a key emerging market characterized by numerous challenges in terms of raising necessary funds to comply with newfound sustainability disclosure requirements. Finally, the research engages in differentiation between aggregated and separate components of ESG disclosure, which makes the relationship between capital structure and sustainability reporting different and non-homogeneous.

LITERATURE REVIEW

Theoretical Review: Agency, Trade-off, and Pecking Order Perspectives

By considering the interaction between capital structure and sustainability disclosure from the standpoint of three theoretical perspectives in corporate finance – (1) agency theory; (2) trade-off theory; and (3) pecking order theory – one may gain an understanding of the relationship. Capital structure specifies the structure of short-term debt, long-term debt, total leverage, and owners' equity that has an impact on the firm's financial flexibility, monitoring level, and information environment (Bajaj et al., 2020; Stamou et al., 2020; Yildirim et al., 2018). The mainstream research on capital structure

investigates the influence of various financing choices on profitability, liquidity, risk, and value of the firm (Bajaj et al., 2020; Bolarinwa & Adegboye, 2021; Rahayu et al., 2020), but the same financing choices can relate to ESG disclosure through their influence on external monitoring, available resources, and reporting capability.

In terms of agency theory, debt financing could enhance the capacity of creditors to monitor and limit the ability of managers to manage free cash flow (Al Amosh & Khatib, 2022). Given that creditors and bondholders need information about the financial and non-financial risks, the increased use of debt would motivate the managers to provide more information regarding governance and sustainability in an attempt to resolve the asymmetric information problem. This approach is particularly relevant to governance disclosure because higher debt facilitates better monitoring by creditors, which makes sure that relevant information is disclosed in regard to the board of directors, control processes, risk management, and accountability systems. Nevertheless, the impact of debt on monitoring may depend on the kind of debt that is used. While short-term debt entails effective refinancing and liquidity pressure, long-term debt results in prolonged contractual agreements with covenants. Total debt serves as an indicator of the extent of leverage of the firm and indicates the intensity of creditor claims for the usage of resources.

The trade-off theory gives an alternative perspective by highlighting the discovery of the optimal levels of debt financing by weighing the pros and cons of debt financing (Chen et al., 2021). While debt can provide the advantages of tax benefits and monitoring, a high level of debt increases the risk of going bankrupt and the pressure to pay debts, as well as debt overhang. The burden of debt has a negative impact on the financial flexibility of companies concerning the implementation of long-term environmental and social projects and their ability to collect and verify ESG data. Organizations with high debt will be challenged in their ability to implement their sustainability-related activities and maintain ESG reporting systems. On the other hand, firms with a strong equity base will enjoy more financial flexibility and will be able to support their sustainability initiatives and implement the required information infrastructure for reporting on such initiatives. Thus, according to the trade-off theory, the relationship between capital structure and ESG disclosure may lead to balancing the benefits of debt financing and the problems of getting enough resources.

Pecking order theory adds an information-asymmetry perspective to the analysis. The theory proposes that firms generally prefer internally generated funds, followed by debt financing, and use external equity as a less preferred source of finance because of asymmetric information and issuance costs (Villarón-Peramato et al., 2018). In the context of ESG disclosure, firms with stronger internal financing capacity may face fewer external financing constraints and may therefore have greater flexibility to support long-term sustainability and reporting activities. Conversely, firms that rely heavily on external financing may face stronger demands from capital providers for transparent non-financial information. Therefore, pecking order theory does not necessarily predict a uniformly positive or negative relationship between equity and ESG disclosure; rather, it helps explain how financing hierarchy and information asymmetry shape both firms' financing choices and their incentives to disclose sustainability information.

Taken together, these three theoretical perspectives suggest that capital structure may be associated with ESG disclosure through multiple, potentially competing mechanisms. Agency theory emphasizes external monitoring and accountability, trade-off theory highlights financial flexibility and distress-related constraints, while pecking order theory explains the role of financing hierarchy and information asymmetry. From this, STDA and LTDA, TDA, and the SER can be correlated with both aggregate ESG transparency and

its distinct pillars. Such theory heterogeneity serves as a prerequisite for seeing ESG disclosure in a multidimensional manner rather than concluding that all components of a capital structure have similar links to different dimensions of ESG.

The Interplay of Financial Theories of ESG Disclosure

The application of agency theory, trade-off theory, and pecking order theory each gives a unique explanation for corporate finance decisions. However, the best approach is combining them to achieve a better understanding of the capital structure and ESG (Al Amosh & Khatib, 2022). This means that the perspectives are not independent of each other because financing decisions change the financial flexibility of the firms, the level of external monitoring, and the system of information exchanged. Trade-off theory is more concerned with the costs and gains of using debt, including its tax advantages as well as potential costs related to financial distress and bankruptcy (Chen et al., 2021). In capital-heavy industries like energy, these costs can play a huge role as high leverage and debt can limit the amount of available finance. The resulting debt-overhang pressure may constrain firms' capacity to undertake long-term sustainability initiatives and to maintain the organizational resources required for collecting, verifying, and reporting ESG information (Bae et al., 2019; Flammer, 2021). Thus, the implications of leverage for ESG disclosure may extend beyond its effects on substantive sustainability investment to firms' broader capacity to communicate sustainability-related activities to stakeholders.

Agency theory provides a complementary mechanism by emphasizing the monitoring role of external capital providers. As debt financing increases, firms' contractual obligations to creditors, lenders, and bondholders may demand greater transparency to evaluate risks (Al Amosh et al., 2022). The monitoring process can encourage management to better disclose information pertaining to governance frameworks, risk management, internal controls, and matters related to sustainability as a means of reducing the level of information asymmetry. Nevertheless, the information monitoring benefit can appear in conjunction with the constraints stemming from the trade-off theory. Thus, the debt financing model might demonstrate different correlations with ESG disclosure; that is, intensifying creditor oversight might lead to governance disclosures being more intensive, whereas financial constraints and limited amount of resources may hinder environmental and social reporting. Moreover, the significance of these mechanisms may vary depending on the type of debt the borrowing company uses: various debt types involve different levels of maturity pressure and oversight systems.

The pecking order theory develops this explanation further by emphasizing the importance of the idea of financing hierarchy and considerations related to information asymmetry. According to this theory, firms are assumed to always prefer using internal financing sources first, debt financing second, and external equity financing third (Villarón-Peramato et al., 2018). In the area of ESG disclosure, firms that have a higher ability for internal financing can undertake long-term sustainability initiatives and ensure the required infrastructure for reporting on such initiatives. Alternatively, firms that are primarily financed by external sources would like to receive clear and transparent ESG information from their creditors and investors. Hence, the pecking order theory does not mean that there is only a positive association between SER and ESG information. Rather, it states that the hierarchy of financing sources and issues of information asymmetry would impact financing decisions as well as how much non-financial information firms are willing to disclose to external financing parties.

These theoretical perspectives suggest that the relationship between capital structure and ESG disclosure is unlikely to be the same across its components and dimensions. Agency theory emphasizes external monitoring and accountability, trade-off theory

posits the contradictory impact of the benefits of debt and the constraints of financial distress, and pecking order theory states that the financing hierarchy and the influence of information asymmetry on resource availability and disclosure. Therefore, for the purposes of this study, STDA, LTDA, TDA, and SER may vary in terms of their influence on total ESG disclosure and Environmental (ENV), Social (SOC), and Governance (GOV) Disclosure. Hence, this theoretical integration provides grounds for studying capital structure in terms of its multidimensionality and ESG disclosure in terms of its multidimensionality in the energy sector of Indonesia.

Hypotheses Development

Capital Structure and Environmental Disclosure

Environmental projects tend to be capital demanding, have long payback times, and entail major technological hazards (Dang et al., 2022). The application of trade-off and overhang theory indicates that energy companies with heavy debt loads and pressure to meet their payments are disinclined to fund long-term environmentally friendly projects (Flammer, 2021). The presence of high short-term and long-term indebtedness limits the available financial resources and renders decision-makers in a situation where they are forced to prioritize the investment of money into their current operations and repayments rather than engaging in eco-friendly initiatives.

On the contrary, organizations that are more dependent on equity financing might display a higher level of financial slack as well as operational flexibility, which allows them to undertake long-term environmental projects that require significant initial investment (Flammer, 2021). Such projects lead to the creation of environmental activities, data, and results, which can then be used in corporate environmental reporting. The extent of environmental disclosure also, however, depends on the ability of a company to gather, confirm, and disseminate information through proper sustainability reports. In sectors with high levels of emissions, comprehensive environmental disclosure becomes crucial for the assurance of stakeholders' trust and communication of work on environmental risk management (Al Amosh & Mansor, 2021; Avinda et al., 2025; Farman et al., 2026). Consequently, the capital structure can make its impact on environmental disclosure via two connected channels: shaping the financial means that are available for effective environmental projects and influencing the organizational capacity needed for the documentation and reporting of those projects.

H1a: Capital structure significantly influences environmental disclosure.

Capital Structure and Social Disclosure

Social disclosure includes information about the well-being of employees, diversity in the workplace, labor protection, and community engagement initiatives (Kartika et al., 2023). From the perspectives of agency theory and trade-off theory, highly leveraged firms often face liquidity constraints, more rigorous covenants, and increased scrutiny from creditors, thus limiting resources available to fund discretionary social initiatives. The same holds true for social disclosure due to the fact that the application of social programs leads to the acquisition of the information that is later conveyed to stakeholders by companies and the fact that the process of disclosure itself requires resources of the company in order to collect the information, confirm it, and report it. That is, capital structure affects social disclosure not only as far as the organizational abilities regarding completing social initiatives are concerned but also in terms of obtaining the necessary data.

Whereas equity financing-based flexibility would increase resources for social projects and improve the internal information reporting system that reports social information. Social projects might strengthen stakeholder support in terms of financial advantage in

the medium-to-long term (Bhuiyan & Nguyen, 2020), and the influence of social disclosure depends on the level of social project activities and how much the firm is equipped to deliver on that information. Hence two transmission paths of the financing composition's impact on social disclosure: it affects how much a firm can spend on social projects, and it increases the internal structure that is suitable for managing, reporting, and verifying social activities. Using the proposed logic, debt constraints might contribute to restricted social disclosure, while high equity-based financial flexibility would lead to a higher level of social disclosure.

H1b: Capital structure significantly influences social disclosure.

Capital Structure and Governance Disclosure

Governance disclosure refers to the reporting of information related to board oversight, transparency, shareholder rights, and internal control mechanisms (Kartika et al., 2023; Nugraha, 2023). From an agency-theory perspective, capital structure may be associated with governance disclosure through the monitoring and transparency demands imposed by external capital providers. Debt financing introduces external oversight from banks and bondholders, which may increase management's incentives to provide more detailed information on governance structures, internal controls, accountability mechanisms, and risk management practices in order to satisfy creditor requirements and reduce information asymmetry (Atan et al., 2018; Al Amosh & Khatib, 2022). Thus, the relationship between debt financing and governance disclosure may operate not only through changes in actual governance practices, but also through stronger external demands for the documentation and communication of those practices.

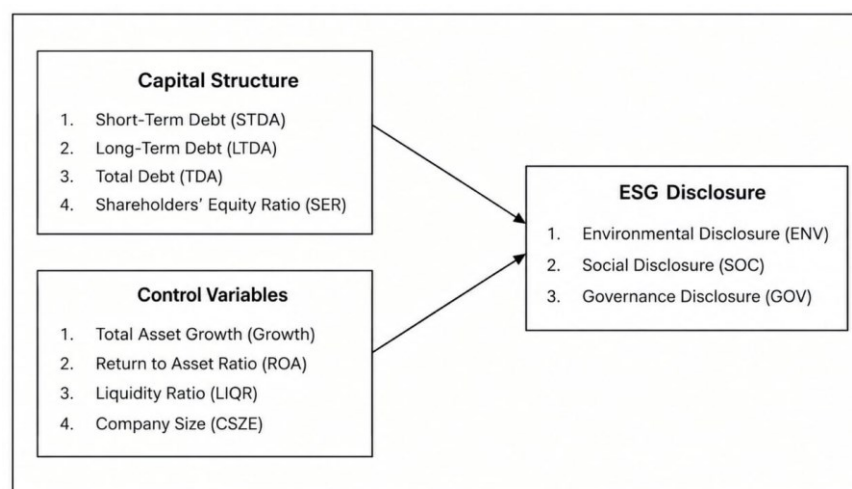
At the same time, excessive debt may increase financial distress and managerial short-termism, potentially limiting the organizational resources and managerial attention available for comprehensive governance reporting. In contrast, sufficient equity holdings could also result in higher financial latitude, which in turn could enable the continued financing of existing governance mechanisms and reporting systems; on the other hand, greater financial independence from the lenders might imply diminished pressure to adhere to monitoring standards by those external bodies. Hence, capital structure might be related to governance disclosure through two mutually interconnected means: by influencing the level of external monitoring and pressure to provide accountability, and by financing the collection, validation, and dissemination of information on governance. Appropriate capital structures can therefore enable efficient governance disclosure by offering both adequate flexibility in finances and mechanisms to ensure monitoring and accountability by external entities (Atan et al., 2018; Nugraha, 2023).

H1c: Capital structure significantly influences governance disclosure.

Conceptual Framework

The theorized model demonstrating the relationship between firm financing and ESG Disclosure is described in Figure 1. Under the Capital Structure construct, the independent financing factors examined were STDA, LTDA, TDA, and SER, while the dependent factor was ESG Disclosure and then into its sub-dimensions, namely: Environmental Disclosure (ENV), Social Disclosure (SOC), and Governance Disclosure (GOV). These interactions take place according to agency theory, trade-off theory, and pecking order theory, explaining how the debt-equity structure of a firm permits and prevents it from implementing or reporting on long-term programs.

Figure 1. Conceptual Framework



RESEARCH METHOD

Research Design

This empirical research focuses on energy companies that are listed and actively traded in the Indonesian Stock Exchange (IDX). Energy companies on the IDX are 86 companies initially. A purposive sampling procedure was adopted to gain valid and reliable data for the following reasons: (1) the company has no stock delisting record in the IDX in the study period (2020-2023), (2) the financial data and Global Reporting Initiative (GRI) data have to be available in each annual and sustainability report (see Table 1).

Table 1. Samples' Result

No.	Sample Criteria	Number
1	Total energy sector companies listed on the IDX	86
2.	Companies excluded due to incomplete data and/or delisting during the study period	(54)
3	Number of companies included in the study	32
4	Total firm-year observations during 2020–2023	128

The interval of the sample in our empirical study-from 2020 to 2023-is not arbitrary. It is an intentionally chosen 4-year interval, and that is because it is not simply another 4 years. Instead, it is chosen precisely because during this period we have observed one of the most turbulent economic cycles since the beginning of globalization. The period includes the emergence and transmission of the COVID-19 pandemic worldwide, as well as the resulting deep liquidity crises, and the bumpy post-pandemic macroeconomic adjustment process (Demirgüç-Kunt et al., 2020). The study therefore examines corporate capital structures during a period of shock and adjustment and thus tests a particularly challenging situation.

In times of overwhelming financial uncertainty, there are high incentives to boost capital market frictions, higher costs of external finance, and an emphasis on the reconfirmation of an internally financed optimum structure. At the same time, this also captures increased stringent regulations in Indonesia and the robust enforcement of POJK 51 regarding sustainable finance, along with the accelerated target on net-zero emissions and global climate commitments (Nareswari et al., 2023). This way, studying the capital structure-ESG nexus from 2020-2023 gives a strong and ultimate stress test on both trade-off and pecking order theories, i.e., whether sustainability expenditure is a

necessary or optional tool for Indonesian energy sectors during the critical time of crises or a mandatory part of management in a long-term risk management framework.

Since widely available ESG databases do not generally have full coverage for emerging market equities, the ESG Disclosure scores required for this study were developed based on content analysis of manually extracted data according to the GRI Standards. These scores were organized into a panel dataset with both time-series and cross-sectional information. The panel data design in this study addresses the issue by taking time-fixed effects over this highly dynamic period and so effectively isolates the "real" effects of financing decisions rather than time-specific macroeconomic disturbances on econometric estimates.

Variable Measurement

The independent variable is capital structure. It uses two different indicators introduced in the literature to study its impact on ESG disclosure, which are the ratio of short-term debt, the ratio of long-term debt, the aggregated leverage ratio, and the equity ratio, as described in Table 2. They represent a mix of hybrid financing features by exploring how a firm's different kinds of debt finance contribute to financial flexibility.

To ensure the net effect of funding choices is accurately measured, we incorporate corporate size, liquidity, profit margins, and asset growth as control mechanisms, given their well-documented roles in shaping a company's ability to execute sustainability programs.

Table 2. Variable Operationalization

Variable	Role	Measurement / Proxy	Source
Environmental, Social, and Governance (ESG)	Dependent Variable – Aggregate ESG Disclosure	Calculated using GRI indicators	Annual/Sustainability Reports
Environmental (ENV)	Dependent Variable – Environmental Dimension	Calculated using GRI Environmental indicators	Annual/Sustainability Reports
Social (SOC)	Dependent Variable – Social Dimension	Calculated using GRI Social indicators	Annual/Sustainability Reports
Governance (GOV)	Dependent Variable – Governance Dimension	Calculated using GRI Governance indicators	Annual/Sustainability Reports
Short-Term Debt (STDA)	Independent Variable	Short-Term Debt / Total Assets	Al Amosh et al. (2022)
Long-Term Debt (LTDA)	Independent Variable	Long-Term Debt / Total Assets	Benlemlih et al. (2021)
Total Debt (TDA)	Independent Variable	Total Debt / Total Assets	Huang & Ye (2021)
Shareholders' Equity Ratio (SER)	Independent Variable	Total Equity / Total Assets	Rahayu et al. (2020)

Firm Growth (GROWTH)	Control Variable	% change in total assets over one year	Salim & Yadav (2012)
Profitability (ROA)	Control Variable	Net Income / Total Assets	Al Amosh & Khatib (2022)
Liquidity (LIQR)	Control Variable	Total Current Assets / Total Current Liabilities	Al Amosh et al. (2022)
Firm Size (CSZE)	Control Variable	Natural logarithm of total assets	Al Amosh et al. (2022)

The ESG Disclosure measures were manually constructed through content analysis of the companies' annual reports and sustainability reports based on the relevant GRI disclosure indicators. At the individual disclosure-item level, a binary coding procedure was applied, whereby a score of 1 was assigned when a company disclosed the relevant GRI item and a score of 0 when the item was not disclosed. The binary scores were subsequently aggregated according to their respective ESG dimensions. Environmental Disclosure (ENV) was constructed using only GRI indicators classified under the environmental dimension, Social Disclosure (SOC) was constructed using indicators related to the social dimension, and Governance Disclosure (GOV) was constructed using governance-related indicators. Thus, the same binary coding principle was consistently applied across the three dimensions, while the final score for each dimension represented the aggregate disclosure score derived from the relevant GRI items. The overall ESG score was then constructed by aggregating the disclosure scores across the ESG dimensions. Consequently, higher ENV, SOC, GOV, and aggregate ESG scores indicate a greater extent of disclosure, whereas lower scores indicate more limited disclosure.

Econometric Models

Four regression models were created in this study as the econometric foundation utilized to evaluate how to evaluate the associations between funding configurations and sustainability disclosure, both individually and in combination:

$$ESG_{it} = \beta_0 + \beta_1 STDA_{it} + \beta_2 LTDA_{it} + \beta_3 TDA_{it} + \beta_4 SER_{it} + \beta_5 Growth_{it} + \beta_6 CSZE_{it} + \beta_7 LIQR_{it} + \beta_8 ROA_{it} + \epsilon_{it}$$

$$ENV_{it} = \beta_0 + \beta_1 STDA_{it} + \beta_2 LTDA_{it} + \beta_3 TDA_{it} + \beta_4 SER_{it} + \beta_5 Growth_{it} + \beta_6 CSZE_{it} + \beta_7 LIQR_{it} + \beta_8 ROA_{it} + \epsilon_{it}$$

$$SOC_{it} = \beta_0 + \beta_1 STDA_{it} + \beta_2 LTDA_{it} + \beta_3 TDA_{it} + \beta_4 SER_{it} + \beta_5 Growth_{it} + \beta_6 CSZE_{it} + \beta_7 LIQR_{it} + \beta_8 ROA_{it} + \epsilon_{it}$$

$$GOV_{it} = \beta_0 + \beta_1 STDA_{it} + \beta_2 LTDA_{it} + \beta_3 TDA_{it} + \beta_4 SER_{it} + \beta_5 Growth_{it} + \beta_6 CSZE_{it} + \beta_7 LIQR_{it} + \beta_8 ROA_{it} + \epsilon_{it}$$

Where: Environmental Disclosure is denoted by ENV, Social Disclosure by SOC, and Governance Disclosure by GOV. STDA-ratio is a measure of short-term debt; LTDA is a measure of long-term debt; TDA is a measure of total debt to total assets. The ratio of shareholders' equity is known as SER. Change in total assets serves as a measure of Growth. ROA is the measure of profitability. The liquidity ratio of a firm is known as LIQR. The measure of the size of the firm is termed CSZE. *i* denotes the firm; *t* denotes the year. ϵ denotes the residual error term.

RESULTS

Descriptive Statistics

Table 3. Descriptive Statistics

Item	N	Minimum	Maximum	Mean	S/D
Dependent Variable					
ESG	128	1.247863	5.62393	3.26630	1.362186
ENV	128	0.034483	7.000000	3.167764	2.885363
SOC	128	0.031250	5.000000	1.939837	1.814804
GOV	128	3.566667	4.866667	4.396255	0.325958
Independent Variable					
STDA	128	0.018822	1.769629	0.400019	0.357994
LTDA	128	0.010125	0.804471	0.262842	0.205392
TDA	128	0.055444	2.418443	0.662862	0.430737
SER	128	-1.418443	0.944556	0.343955	0.427102
Control Variable					
GROWTH	128	-0.528523	13.873800	1.660080	14.699630
ROA	128	-0.732940	0.616346	0.050984	0.154840
LIQR	128	0.012648	9.44517	1.548326	1.497999
CSZE	128	19.365550	31.445630	23.593050	3.272554

Note: Environmental, Social, and Governance (ESG), Environmental (ENV), Social (SOC), Governance (GOV), Short-Term Debt (STDA), Long-Term Debt (LTDA), Total Debt (TDA), Shareholders' Equity (SER), Firm Growth (GROWTH), Profitability (ROA), Liquidity (LIQR), Firm Size (CSZE)

The basic statistics of the sample are shown in Table 3 above for 128 firms for 2020-2023, based on Indonesian energy industry data. The average value for the dependent variable (the overall aggregated ESG) is 3.266 (SD = 1.362), which indicates overall moderate non-financial reporting within the sector. When analyzing the ESG separately from the three different components, it appears that GOV has the strongest level with an average value of 4.396 (SD = 0.326), followed by ENV at 3.168 (SD = 2.885), and SOC at 1.940 (SD = 1.815). It demonstrates that the average score on GOV is higher than on ENV and SOC.

For the independent variables, the highest average of the component of capital recorded by TDA is the largest (0.663; SD = 0.431), which corroborates that leverage is still the largest provider of financing for energy infrastructure. The figures of current and non-current liabilities in relation to the total assets give an average of 0.400 (SD = 0.358) and 0.263 (SD = 0.205), which represent a dependence on short-term credit facilities. SER provides an average figure of 0.344 (SD = 0.427). For the control variables, a mean of 23.593 (SD = 3.273) corresponds to CSZE, whereas a lower one (0.051; SD = 0.155) reflects ROA, implying that energy firms are characterized by low earnings during the period of the sample.

Correlation and Diagnostic Tests

Table 4. Correlation Matrix

	ESG	ENV	SOC	GOV	SER	TDA	LTDA	STDA	GROWTH	ROA	LIQR	CSZE
ESG	1											
ENV	0.943	1										
SOC	0.925	0.887	1									
GOV	0.286	0.199	0.245	1								
SER	0.034	-0.006	-0.168	0.101	1							
TDA	0.154	0.066	0.021	0.191	0.629	1						
LTDA	0.070	0.014	-0.142	0.097	0.737	0.706	1					
STDA	0.103	0.186	0.054	-0.209	-0.095	-0.406	-0.073	1				

GROWTH	0.134	0.150	0.140	0.169	0.006	0.016	0.016	0.005	1			
ROA	0.308	0.312	0.313	0.033	0.287	0.290	0.327	0.308	-0.044	1		
LIQR	0.102	0.085	0.077	0.047	0.237	0.359	0.209	0.185	-0.020	0.038	1	
CSZE	0.135	0.069	0.036	0.105	0.212	0.407	0.388	0.140	-0.039	0.066	0.108	1

The connections between all of the metrics reported can be observed from Table 4. The general ESG measure is strongly positively correlated with ENV ($r=0.943$) and SOC ($r=0.925$), and has a moderate positive correlation with the governance score ($r=0.286$). When looking at the independent variables, SER has positive correlations with general sustainability ($r=0.034$) and board transparency ($r=0.101$) while negatively correlating with social concerns ($r=-0.168$). TDA demonstrates positive correlations with ESG ($r = 0.154$), ENV ($r = 0.066$), and GOV ($r = 0.191$). Overall, the independent variables display low to moderate inter-correlations, with the highest coefficient observed between LTDA and TDA ($r = 0.706$). A correlation coefficient of 0.8 suggests a significant risk of linear multicollinearity. All inter-correlations between the explanatory metrics remain under the 0.8 threshold, indicating the absence of disruptive collinearity within the econometric specification.

Table 5. Variance Inflation Factor (VIF) and Tolerance Analysis

Variable		Statistic Collinearity	
		Tolerance	VIF
1	SER	0.637	1.571
2	TDA	0.329	3.035
3	LTDA	0.414	2.416
4	STDA	0.549	1.822
5	GROWTH	0.980	1.021
6	ROA	0.768	1.303
7	LIQR	0.838	1.193
8	CSZE	0.610	1.639

To formally evaluate potential multicollinearity concerns, Variance Inflation Factor (VIF) and tolerance statistics were computed, as presented in Table 5. The VIF values range from 1.021 (GROWTH) to 3.035 (TDA), both of which comfortably fall under the strict 5.0 limit as well as the conventional 10.0 boundary. Concurrently, the tolerance metrics span from 0.329 up to 0.980, significantly exceeding the 0.10 cutoff. These diagnostic results conclusively confirm the absence of multicollinearity issues in the empirical specification, ensuring that the regression estimates are reliable.

Panel Regression Analysis

Table 6. Baseline Regression Results

Variable		ESG	ENV	SOC	GOV
1	STDA	0.063189	-0.027947	-0.191056	-0.193274
		0.8789	0.9760	0.6751	0.7221
2	LTDA	-0.048366	0.018143	0.178538	-0.121356
		0.8101	0.9679	0.4063	0.6086
3	TDA	-0.594991	-1.508297	-1.108545	1.629415
		0.4750	0.4198	0.1828	0.0541
4	SER	1.434393	3.221475	-0.820338	-0.819632
		0.0006	0.0006	0.0327	0.0349
5	GROWTH	-0.226110	-0.435973	-0.028514	-0.398331
		0.2841	0.3568	0.8969	0.1509
6	ROA	0.407821	0.997509	0.967757	-0.349911

		0.5944	0.5616	0.2591	0.7397
7	LIQR	0.025603	0.054239	-2.040005	-0.087968
		0.7224	0.7372	0.9998	0.3359
8	CSZE	0.742083	1.838294	-0.014502	0.065399
		0.0016	0.0005	0.8734	0.2846
Adj. R square		0.757279	0.682451	0.081191	0.094430
Hausman Test					
Chi-square		22.493234	24.220331	12.764179	6.084441
P-value		0.0041	0.0021	0.1202	0.6378
No. of observation		128	128	128	128

Note: The first value reported for each variable represents the regression coefficient, and the value below it represents the corresponding p-value.

Table 6 summarizes the outcomes of the empirically derived estimates as panel regression models showing overall index (Model 1), ecological indexes (Model 2), societal indexes (Model 3), and governance indexes (Model 4). To assess which panel estimation approach is valid, i.e., FEM or REM, for each model, the Hausman specification test was implemented for all models. The outcomes of the test led us to discard the null hypothesis in Model 1 (Chi-sq = 22.493, $p = 0.0041$) and Model 2 (Chi-sq = 24.220, $p = 0.0021$), such that FEM can be chosen for the estimation of these two models. The null hypotheses in Model 3 (Chi-sq = 12.764, $p = 0.1202$) and Model 4 (Chi-sq = 6.084, $p = 0.6378$) failed to be rejected, such that the REM model is suitable.

In Model 1 (ESG), the SER has a significant positive association with aggregate ESG disclosure (coef. = 1.434, $p < 0.01$). Among the control variables, firm size (CSZE) also has a significant positive association with aggregate ESG disclosure (coef. = 0.742, $p < 0.01$). The model has an adjusted R-squared of 0.757.

In Model 2 (ENV), which tests H1a, SER has a significant positive association with environmental disclosure (coef. = 3.221, $p < 0.01$). In contrast, the debt-based capital structure measures—STDA, LTDA, and TDA—do not have significant associations with environmental disclosure. CSZE also has a significant positive association with environmental disclosure (coef. = 1.838, $p < 0.01$). Thus, H1a is partially supported, as SER is significantly associated with environmental disclosure, whereas the debt-based capital structure measures are not statistically significant.

In Model 3 (SOC), which tests H1b, SER has a significant negative association with social disclosure (coef. = -0.820, $p < 0.05$), whereas STDA, LTDA, and TDA do not have significant associations with social disclosure. The negative coefficient indicates that a higher SER is associated with lower social disclosure among the firms in the sample. Thus, the results provide partial support for H1b, as SER is significantly associated with social disclosure, although the direction of the association is negative, while none of the debt-based capital structure measures is statistically significant.

In Model 4 (GOV), which tests H1c, TDA has a significant positive association with governance disclosure (coef. = 1.629, $p < 0.10$), consistent with the agency-theory perspective regarding the disciplinary monitoring role of debt. SER, however, has a significant negative association with governance disclosure (coef. = -0.820, $p < 0.05$), while STDA and LTDA do not have significant associations with governance disclosure. Thus, H1c is partially supported, as TDA and SER are significantly associated with governance disclosure, but in opposite directions.

DISCUSSION

The Effect of Capital Structure on Environmental Disclosure

Hypothesis 1a stated that capital structure variables are of statistical significance on environmental disclosure. The capital structure variables of SER are very significant (positive direction), but the short-term, long-term, and total debt variables against assets are not significant. Thus, hypothesis 1a is partly accepted.

The positive association between SER and environmental disclosure is consistent with the financial-flexibility mechanism proposed by trade-off and financial-slack perspectives. Firms with greater equity-based flexibility may have greater capacity not only to support long-term environmental initiatives but also to establish the organizational systems required to collect, verify, and communicate environmental information. However, because this study measures disclosure rather than actual environmental investment, the result should be interpreted primarily as evidence of a relationship between financing structure and the extent of reported environmental information. Importantly, these green investments are 'long term oriented in nature and do not often offer immediate financial payoffs' (Flammer, 2021). A high proportion of equity financing gives a firm 'patient capital'. This means they have more fiscal freedom to plan over long horizons, and the stringent demand placed upon the organization of regular cash flow and bank loan covenants is lessened, at best. The existence of such flexibility is likely to facilitate long-run investments in the environment and in the firm's capacity to actually report on them (Bae et al., 2019). Such financial flexibility may support both long-term environmental initiatives and the organizational capacity required to document and communicate those initiatives through sustainability reporting (Benlemlih et al., 2021; Maharani, 2025).

The insignificance of the effects of the long-term, short-term, and total debt ratios shows that the effects of debt financing do not directly affect environmental disclosure in the observed firms, which is consistent with Chen et al. (2021) and Flammer (2021). Investment in the environment may be difficult due to strict rules, investment time horizons, Technological capacity, and other firm-specific factors, excluding the structure of finances; thus, this result is not proof that debt has a negative influence on environmental disclosure.

The Effect of Capital Structure on Social Disclosure

H1b was that the level of capital structure is related to social disclosure with no indication of direction. As with Model 3, H1b receives a split answer with regard to its validity. Looking at the table under Model 3, the percentage of SER affects social disclosure positively and is very significantly associated with it. However, each of the different forms of debt-based capital structure ratio (STDA, LTDA, and TDA) does not have any significant statistical effect on social disclosure. Consequently, although the company's structure is statistically related to social disclosure, it appears to be the percentage that is owned by shareholders that does the influencing, and its effect is negative.

The negative relation between SER and social disclosure offers a unique financing-sustainability relation in the energy industry in Indonesia. From an agency theory point of view, equity holders view that it is more worthy to invest in operations that directly relate to the regulatory requirements, coping with transitional risk, and maximizing shareholders' long-term value, but they may not view that various additional social expenses provide equivalent economic return to the company. By using more equity financing, management may be faced with greater pressure, say, to increase operating efficiencies, preserve liquidity, or distribute dividends, rather than discretionary spending on social activities. This differs from the result reported by Bhuiyan and Nguyen (2020),

who found that corporate social responsibility had financing gains from a developed market context. The opposite findings may occur due to different institutional settings, stakeholder pressures, and the environment the Indonesian energy firms have been experiencing over the period between 2020 and 2023. This, hence, leads to the negative SER coefficient that reflects a specific dynamic relationship between the debt component in capital structure and the disclosure of social activities, instead of refuting H1b.

The Effect of Capital Structure on Governance Disclosure

H1c predicted that capital structure exerts a substantial influence on governance disclosure. As evident from Model 4, it finds partial support for this hypothesis since total debt has a significant positive impact and the SER has a significant negative impact on governance disclosure.

This finding is supported by agency theory, which contends that debt can improve external monitoring and increase accountability (Al Amosh et al., 2022). According to the results, the positive correlation between total debt and governance disclosure implies that more total debt is also associated with larger governance disclosure in our sample. Creditors could be monitoring debt repayment, which may relate to governance disclosure (Villarón-Peramato et al., 2018).

The observed negative relationship between SER and governance disclosure, on the other hand, might relate to weaker external monitoring in firms more reliant on equity. When creditors fail to enforce stronger monitoring, outside demands may be weaker for additional governance information to be disclosed. Nevertheless, the model does not capture the mechanisms of this relationship and should be interpreted with care.

The Role of Firm Characteristics and Institutional Context

In addition to these main capital structure variables, the results reinforce the significance of firm-specific attributes, especially firm size. It exerts a consistent and significant positive influence on aggregate ESG disclosure and also the environmental column. This result is thoroughly explained by legitimacy and stakeholder theories (Al Amosh & Mansor, 2021). Given that large Indonesian energy firms are highly transparent in the eyes of the public and are subject to tremendous political/regulatory scrutiny, they will be subject to a high frequency of targeting by foreign institutional investors and foreign environmental movements (Ulfa & Rahman, 2024; Maharani, 2025). Therefore, extremely large conglomerates have a greater motivation to legitimize through credible sustainability reports. They achieve massive economies of scale, have greater organizational capabilities, including labor specialization and monetary resources for absorptive capacity, to compensate for the huge bureaucratic cost caused by in-depth GRI reporting and eco-innovation implementation (Chong & Loh, 2023).

On the contrary, it is interesting theoretically that none of the measures of profitability, liquidity, and growth showed any significant individual impact on CSR in any of the four regression equations in the model used. Most financial literature suggests that highly profitable and liquid firms possess the required "slack" to undertake any voluntary and discrete CSR investment (Bhuiyan & Nguyen, 2020). In this paper, the fact that these measures turned insignificant implies that a distinct pattern in the structure of Indonesia's energy companies during the years 2020 and 2023 must exist. This time period refers to both the huge economic shock resulting from COVID-19 and an unstable recovery phase, which has consistently and restrictively impacted every firm's liquidity in developing markets (Demirgüç-Kunt et al., 2020).

Overall, during these well-regulated and highly volatile market conditions, there is no statistically significant relationship between profit, liquidity, and firm growth and the investigated ESG reporting mechanisms, meaning they may not be sufficient in determining the differences in sustainability reports within Indonesia's energy sector companies during the 2020-2023 period. Instead, the significant associations observed for selected capital structure components and firm size indicate that financing composition and organizational scale may be more relevant to particular disclosure dimensions within the present sample. Nevertheless, these findings should not be interpreted as evidence that capital structure dominates other determinants of ESG disclosure, as sustainability reporting may also be shaped by regulatory requirements, governance characteristics, stakeholder pressures, and other factors not included in the empirical models.

CONCLUSION

This study examined the association between financing configurations and sustainability disclosures among publicly listed Indonesian energy companies over the 2020–2023 period. By disaggregating aggregate ESG disclosure into its ESG dimensions, the empirical analysis reveals heterogeneous and dimension-specific relationships. First, the SER has a significant positive correlation with aggregate ESG disclosure and environmental disclosure, suggesting that greater equity-based financial flexibility may support firms' capacity to maintain sustainability-related reporting and long-term environmental commitments. Second, total debt is positively linked to governance disclosure, maintaining statistical significance at the 10% threshold, a finding that is consistent with the disciplinary-monitoring role of debt proposed by agency theory. Third, the SER is negatively and significantly associated with social and governance disclosure, while short-term and long-term debt show no statistically significant associations with the ESG disclosure measures examined. Overall, these findings indicate that different components of capital structure are associated with different dimensions of ESG disclosure rather than exerting a uniform influence across ESG outcomes.

This study contributes to the sustainable finance literature by integrating agency, trade-off, and pecking order perspectives to state the heterogeneous relationships between capital structure and ESG disclosure. Rather than treating financing choices as a uniform determinant of ESG disclosure outcomes, the findings show that equity- and debt-based financing components are associated differently with specific disclosure dimensions. The positive association between SER and environmental disclosure is consistent with the financial-slack argument that greater equity-based flexibility may provide firms with greater capacity to support long-term sustainability commitments and related reporting activities. At the same time, the positive association between total debt and governance disclosure is consistent with the agency-theory proposition that creditor monitoring may encourage greater transparency and governance-related disclosure. These findings therefore underscore the critical need to analyze capital composition alongside individual ESG pillars being examined when assessing the financing–sustainability disclosure relationship in emerging-market energy firms.

From a practical perspective, the results provide significant implications for corporate managers and financial managers who are undertaking the process of energy transition. Specifically, managers should bear in mind that it is not only the cost of financing but potentially the internal financial flexibility which support the activities and disclosures on sustainability. It is remarkable to note that SER has a strong and significant positive relation to environmental disclosure, suggesting that perhaps firms with superior leverage of equity-based financial flexibility are capable of sustaining the level and quality of environmental disclosure on a long-term basis. Also importantly, the measures of debt-

based financing are not related to environmental disclosure; thus, it is not that the financial condition of leverage can have a direct, negative constraint on the practice of environmental reporting. Based on that, managers may aim for an appropriate and balanced mix of financing arrangements to maintain the access of the enough financial flexibility in carrying out the long-term and sustainable development or decarbonization strategy.

The evidence provides important implications for Indonesian regulatory agencies such as OJK and IDX in their efforts to implement the financial instruments necessary for firms to fulfill long-term environmental objectives. Given the fact that SER has a positively significant impact on environmental disclosure and the evidence has neither statistically significant direct link between debt-based financing measures and environmental disclosure, regulators should not infer that leverage is actually constraining environmental disclosure. However, instead, evidence reveals leverage may actually be facilitating firms' ability to maintain their environmental reporting and the initiatives involved. For instance, policymakers may endeavor to provide broader access to transition-finance instruments; equity financing is encouraged for projects focused on the sustainability-driven sector, and green credit facility schemes with structures that align with a long-term commitment horizon should be formulated. These policy suggestions can provide supplemental benefits with compulsory sustainability disclosure regulations, such as the ones provided under POJK 51, by lessening the financial constraints and granting more flexibility for energy sector companies to maintain their financial instruments strategy in order to contribute to Indonesia's long-term environmental and Net Zero Emission goals by 2060.

LIMITATION

This research is subject to a number of limitations that present potential directions for future research. First, the current sample consists of only 32 energy-sector companies from Indonesia across the 2020–2023 period, and this may affect the robustness to other sectors, institutional context, and countries. Future researchers should broaden the research to other carbon-intensive industries, including the manufacturing or mining sector, and investigate country comparisons within ASEAN or other developing countries to see if our results persist.

Secondly, content analysis has been carried out on the annual and sustainability reports of companies in order to develop content-based measures (ESG, ENV, SOC, GOV). Using the content-based measures allows for a systematically designed measurement of what and how much information about the firms has been published with respect to ESG factors on the basis of the GRI's disclosure indicators. However, using corporate data and content assumes that the latter would be unbiased due to its self-generated nature and may potentially involve selective disclosure and greenwashing, and measures only reflect the extensiveness of published ESG-related information but not the firms' fundamental ESG performance. In the future, combining the use of GRI-based disclosure with an externality perspective of ESG ratings or real sustainable and natural indicators, natural language analysis, and/or so on would help to measure both the number and the quality of ESG reporting information.

Third, we should consider the empirical results at the dimension level and without generalization over all dimensions of ESG disclosure. The capital structure at the debt-basis level does not have any relationship with the social dimension disclosure, and there is a positive relationship with total debt at the governance disclosure level at the 10% confidence level. Other financing dimensions at the SER level have a positive relationship with overall ESG disclosure level and environmental disclosure level and a negative relationship with social disclosure level and governance disclosure level.

Finally, since an observational panel data design was utilized, the reported estimations should not be seen as causal impacts. Future research could analyze the causal mechanisms that drive the association between capital structure and ESG disclosure by employing a higher degree of identification or longer panel data.

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DECLARATION OF CONFLICTING INTERESTS

The authors declare that they have no conflict of interest.

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