



The impact of ESG disclosure on firm value: The moderating influence of board size within the Singaporean context

Difa Rhiskya Hutabarat, Hersugondo Hersugondo

Department of Management, Faculty of Economics and Business, Diponegoro University
Jl. Prof. Soedarto, SH, Tembalang, Semarang, Central Java 50275, Indonesia

ABSTRACT

This research examines the relationship between Environmental, Social, and Governance (ESG) disclosure and firm value while investigating the moderating role of board size. The sample includes 20 companies listed on the Singapore Exchange for the period 2019 to 2024, utilizing secondary data from Bloomberg. Data analysis was performed using panel data multiple linear regression via Stata 17 software. Following model selection tests, the Fixed Effect Model was implemented with robust standard errors to mitigate heteroscedasticity. ESG disclosure was evaluated both aggregately and through its individual pillars, with moderation analysis conducted by generating interaction terms between ESG metrics and board size. The empirical results demonstrate that total ESG disclosure and its constituent pillars do not significantly influence firm value. However, moderation testing reveals that board size negatively moderates the impact of total ESG, environmental, and governance disclosures on firm value, whereas no moderating effect was detected concerning the relationship between social disclosure and firm value. These findings highlight the critical importance of board size optimization in ensuring that ESG transparency effectively contributes to the enhancement of firm value.

Keywords: Board size, ESG disclosure, Firm value, Panel data, Singapore

JEL Classification: G34, M14, Q56

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1. Introduction

In a global market that increasingly emphasizes sustainability, Environmental, Social, and Governance (ESG) criteria have become essential for the long-term success of organizations (Hussain et al., 2025). These criteria, which evaluate ethical behavior, social responsibility, and environmental impact, play a decisive role in shaping investment decisions, shareholder activism, and public perception (Bukari et al., 2024). Consequently, a growing number of businesses have integrated ESG practices into their core corporate strategies.

Beyond implementing ESG initiatives, organizations must disclose relevant information to the public and their stakeholders. Most stakeholders perceive ESG disclosure as a catalyst for enhanced

performance, effective risk management, and improved corporate reputation (El-Deeb et al., 2023). However, ESG disclosures often vary significantly because they constitute non-financial information and lack a standardized reporting format (Mutiah & Rusmanto, 2023). A sustainability reporting survey conducted by KPMG (2022) examined two distinct samples: the 250 largest companies by revenue from the 2021 Fortune 500 (G250) and the top 100 companies by revenue across 58 countries and jurisdictions (N100). The findings revealed a significant upward trend in sustainability reporting from 1993 to 2022, indicating a heightened corporate awareness regarding the necessity of sustainability implementation and disclosure.

Providing transparent information to stakeholders represents a critical implementation of Stakeholder Theory within corporate practices. Sustainability reports are issued as a form of transparency and commitment to social and environmental issues, while serving as a mechanism to obtain feedback on how effectively the company meets stakeholder information demands (Hardiningsih et al., 2024). Furthermore, ESG disclosures used by stakeholders to evaluate sustainability commitments significantly influence their support for the company (Ardiansyah & Hersugondo, 2024). According to Signaling Theory, ESG transparency acts as a signal to external stakeholders, demonstrating corporate credibility and long-term commitment to sustainability (Hamdouni, 2025). Based on these two theories, ESG disclosure facilitates the delivery of transparent information that enhances investor trust and positive perception, which ultimately correlates with an increase in firm value.

By 2025, numerous researchers have analyzed the relationship between ESG disclosure and firm value, yet the results remain inconsistent. Studies conducted by El-Deeb et al. (2023) and Mahmood et al. (2025) indicate that ESG disclosure and its individual pillars are positively related to firm value. Conversely, research by Rohendi et al. (2024) suggests that ESG disclosure has no significant correlation with firm value. Furthermore, a study by P. & Busru (2021) analyzing CSR disclosure through total ESG scores and individual pillars found that ESG disclosure and each of its components are actually negatively related to firm value.

Furthermore, Hardiningsih et al. (2024) demonstrate that environmental and governance disclosures are positively related to firm value, while social disclosure shows no significant relationship. In contrast, Aditya & Hasnawati (2025) find that total ESG disclosure has a positive correlation with firm value. However, their partial analysis reveals that only social disclosure is positively associated with firm value, whereas environmental and governance disclosures show no relationship. These findings indicate that inconsistencies exist not only in total ESG disclosure results but also within each individual pillar. Consequently, it is necessary to analyze ESG disclosure through both simultaneous and partial approaches.

This study also incorporates board size as a moderating variable in the relationship between ESG disclosure and firm value. Based on Agency Theory, the separation between principals (shareholders) and agents (managers) can lead to conflicting relationships, such as information asymmetry and opportunistic behavior by management (Yakob & Hasan, 2021). Within this framework, the oversight and strategic guidance functions of the board of directors are emphasized. Board size directly relates to the effectiveness of these functions, thereby influencing how stakeholders respond to ESG disclosure and ultimately affecting firm value. Therefore, board size has the potential to moderate the link between ESG disclosure and firm value. Empirically, Awad et al. (2023) find that board size is positively related to firm value. Meanwhile, Meeprom et al. (2024) demonstrate that board size negatively moderates the relationship between aggregate ESG scores, environmental scores, and social scores with firm performance, yet shows no significant effect on the governance pillar. Research specifically examining the moderating role of board size in the relationship between ESG disclosure and firm value remains relatively limited, providing an opportunity for further investigation.

This study focuses on companies in Singapore, a nation with a highly advanced economy. According to the Global Financial Centres Index 39, Singapore ranks fourth as a global financial hub, a reputation that plays a vital role in attracting international investors (Z/Yen Group & China Development Institute, 2026).

Based on the Singapore Exchange (n.d.), all listed companies are mandated to publish annual sustainability reports covering key components, including material ESG factors, climate-related disclosures, policies, practices, and performance, targets, sustainability reporting frameworks, and board statements regarding sustainability governance structures. The Singapore Exchange (2023) introduced “Core ESG Metrics” to provide issuers with a standardized reference for common ESG disclosures, aiming to improve alignment between users and reporters of ESG information. Nevertheless, ESG reporting is not limited to these core metrics, as materiality assessments remain essential to ensure that reported metrics are relevant and comprehensive (Singapore Exchange, 2023).

The 2024 KPMG Sustainability Reporting Survey indicates that 84% of the 100 largest companies in Singapore have integrated ESG information into their annual reports. This percentage represents an increase from 68% in 2022 and significantly exceeds the 2024 global average of 62% (KPMG, 2024). These figures signify that ESG disclosure among Singaporean firms is well-institutionalized and has experienced substantial growth.

The advanced and reliable characteristics of the Singaporean market, supported by mandatory sustainability reporting regulations and high ESG adoption rates, provide a relevant context for analyzing the link between ESG disclosure and firm value. However, this relationship remains under-researched within the Singaporean context. Building on current phenomena and gaps in previous literature, this study investigates how ESG disclosure correlates with firm value and explores the moderating role of board size in this relationship.

This research is expected to offer empirical contributions by expanding evidence on the nexus between ESG transparency and firm value in the Singaporean market. Furthermore, incorporating board size as a moderating variable is intended to provide a deeper understanding of the board’s role in strengthening or weakening the impact of ESG disclosure on firm value. Ultimately, the findings are expected to serve as a reference for companies in formulating effective sustainability strategies and assist investors in making informed investment decisions.

2. Theoretical Framework and Hypotheses Development

ESG Disclosure and Firm Values

One effective form of ESG communication is ESG disclosure, which refers to the transparent reporting of a company’s achievements in environmental, social, and governance aspects. This disclosure provides stakeholders with information beyond traditional financial indicators, allowing them to understand a firm’s sustainability practices and performance (Hamdouni, 2025).

According to Stakeholder Theory, companies are responsible for creating value for all interested parties. From this perspective, ESG disclosure reflects a corporate commitment to sustainability and social responsibility, contributing to the development of trust and reputation among stakeholders (El-Deeb et al., 2023). Consequently, a positive corporate reputation enhances investment attractiveness, leading to increased demand for shares and ultimately resulting in higher share prices (Hardiningsih et al., 2024). Such an increase in share price reflects an improved market perception of firm value.

From the lens of Signaling Theory, ESG disclosure serves as a signal to the market regarding a company’s commitment to sustainability and responsible business activities (Sundarasan et al., 2024).

Corporate transparency concerning sustainable development commitments can bridge information asymmetry for investors, enabling the reduction of stock-related risks and enhancing valuations in the stock market (Hussain et al., 2025).

Empirical findings regarding the relationship between ESG disclosure and firm value have shown diverse results. Studies by Mutiah & Rusmanto (2023), El-Deeb et al. (2023), An et al. (2025), Aditya & Hasnawati (2025), and Mahmood et al. (2025) demonstrate a positive relationship between ESG disclosure and firm value. Conversely, Rohendi et al. (2024) provide evidence that ESG disclosure has no direct correlation with firm value. Other research by P. & Busru (2021) and Dihadjo & Hersugondo (2023) suggests that ESG disclosure is negatively related to firm value. Despite these mixed findings, this study anticipates a positive relationship based on the underlying theoretical framework.

H₁: ESG disclosure is positively related to firm value.

Environmental Disclosure and Firm Value

The environmental pillar describes how a company manages impacts, risks, and opportunities related to ecological issues (Hussain et al., 2025). Within the frameworks of Stakeholder Theory and Signaling Theory, the disclosure of environmental information can strengthen stakeholder trust and serve as a signal that the company manages environmental risks responsibly. This transparency has the potential to enhance corporate reputation and reduce risk perception, which ultimately leads to an increase in firm value.

Research by Mutiah & Rusmanto (2023), El-Deeb et al. (2023), Hardiningsih et al. (2024), An et al. (2025), and Mahmood et al. (2025) demonstrates that environmental disclosure is positively related to firm value. Conversely, results from Aditya & Hasnawati (2025) indicate that environmental disclosure shows no significant relationship with firm value. Furthermore, P. & Busru (2021), Fadmaulida & Putra (2024), and Cipto & Hersugondo (2024) provide evidence that environmental disclosure is negatively associated with firm value. Despite these varied findings, this study anticipates a positive relationship based on the theoretical arguments employed.

H₂: Environmental disclosure is positively related to firm value.

Social Disclosure and Firm Value

The social pillar is the second component of ESG, reflecting how a company manages its relationships with various stakeholders and its commitment to fostering a fair work environment, respecting diversity, prioritizing health and well-being, upholding fundamental human rights, and conducting ethical business operations (Angela & Rusmanto, 2025). Within the frameworks of Stakeholder Theory and Signaling Theory, social disclosure serves as a medium for firms to communicate their commitment to social responsibility to the public. Such transparency provides positive indicators that can enhance stakeholder trust, thereby building a positive reputation and reducing risk perception. Ultimately, these conditions can drive an increase in firm value.

El-Deeb et al. (2023), Mutiah & Rusmanto (2023), Fadmaulida & Putra (2024), Cipto & Hersugondo (2024), An et al. (2025), Aditya & Hasnawati (2025), and Mahmood et al. (2025) find that social disclosure is positively related to firm value. Conversely, Hardiningsih et al. (2024) demonstrate that social disclosure has no significant relationship with firm value, while P. & Busru (2021) find a negative relationship between social disclosure and firm value. Despite the varied results in previous literature, a positive relationship is anticipated in this study based on the underlying theoretical foundations.

H₃: Social disclosure is positively related to firm value.

Governance Disclosure and Firm Value

The governance pillar is the third component of ESG, referring to corporate management in accordance with sound governance principles. This includes compliance with regulations and ethical standards, anti-bribery and corruption efforts, transparency, risk management, and incentive systems (Angela & Rusmanto, 2025). Governance disclosure provides stakeholders with an overview of a company's management quality. Within the framework of Stakeholder Theory, such transparency demonstrates a firm's responsibility in protecting the interests of various parties. From the perspective of Signaling Theory, governance disclosure serves as an indicator of management quality, enhancing investor confidence in the company's stability and prospects. Consequently, corporate reputation improves and risk perception decreases, which in turn increases firm value.

Numerous previous studies have analyzed the relationship between governance disclosure and firm value. El-Deeb et al. (2023), Hardiningsih et al. (2024), Cipto & Hersugondo (2024), and Mahmood et al. (2025) find that governance disclosure is positively related to firm value. Conversely, Fadmaulida & Putra (2024), An et al. (2025), and Aditya & Hasnawati (2025) find no significant correlation between these variables. On the other hand, P. & Busru (2021) and Mutiah & Rusmanto (2023) find a negative relationship between governance disclosure and firm value. Despite these mixed empirical results, a positive relationship is anticipated in this study based on the established theoretical framework.

H₄: Governance disclosure is positively related to firm value.

Moderation in ESG Disclosure

Agency Theory, as introduced by Jensen and Meckling, suggests the potential for conflicts of interest between management and shareholders arising from the separation of corporate ownership and control (Zheng et al., 2025). Musa et al. (2025) assert that the board of directors serves as the foundation of the corporate governance system, responsible for protecting shareholder interests by monitoring corporate activities and providing strategic guidance in decision-making.

In the context of the relationship between ESG disclosure and firm value, board size influences the extent to which disclosed ESG information is perceived as credible and responded to by the market, which ultimately contributes to firm value. Meeprom et al. (2024) explain that under certain conditions, a larger board may enhance performance through diverse expertise, improved monitoring mechanisms, reduced agency costs, and increased accountability. However, larger boards can also face constraints, such as coordination difficulties, miscommunication, less effective decision-making processes, and the emergence of conflicting interest groups among board members (Meeprom et al., 2024). Such conditions may weaken the board's role in ensuring the quality and credibility of ESG disclosures. Consequently, a larger board size does not always strengthen the link between ESG disclosure and firm value.

Empirical findings by Awad et al. (2023) demonstrate that board size is significantly and positively related to firm value. Conversely, research by Ben Fatma & Chouaibi (2023) indicates that board size is negatively associated with firm value. Furthermore, Meeprom et al. (2024), in a study on ESG activities and the performance of Thai listed firms, found that board size negatively moderates the relationship between aggregate ESG scores and firm performance (Tobin's Q).

In this study, board size is treated as a governance mechanism with the potential to influence the effectiveness and credibility of ESG disclosure in enhancing firm value. While governance disclosure is related to board characteristics, it is essential to distinguish that governance disclosure within the ESG framework reflects transparency in reporting practices, whereas board size is a structural governance characteristic reflecting the capacity for oversight and strategic direction. Thus, they represent distinct aspects: reporting versus governance structure.

Based on the theoretical and empirical reviews presented, board size possesses a dual potential to either strengthen or weaken the relationship between ESG disclosure and firm value. Therefore, the moderating role of board size in this study is tested without specifying a directional influence.

H₅: Board size moderates the relationship between ESG disclosure and firm value.

Moderation in Environmental Disclosure

Based on Agency Theory, the conflict of interest between management and shareholders can be mitigated through the presence of a board of directors. A larger board size with diverse expertise may enhance the understanding and oversight of complex and technical environmental policies. Consequently, a larger board has the potential to strengthen the quality and credibility of environmental disclosures, thereby increasing positive investor response to such information.

Conversely, a large board size may lead to coordination constraints, divergent perspectives that are more difficult to align, and less efficient decision-making processes. These conditions potentially diminish the board's effectiveness in maximizing environmental disclosure to enhance firm value. This is supported by research from [Meeprom et al. \(2024\)](#), which demonstrates that board size negatively moderates the relationship between environmental pillar scores and firm performance (Tobin's Q). Thus, board size possesses a dual potential to either strengthen or weaken the relationship between environmental disclosure and firm value. Therefore, the moderating role of board size in this study is tested without specifying a directional influence.

H₆: Board size moderates the relationship between environmental disclosure and firm value.

Moderation in Social Disclosure

In the social aspect, which requires sensitivity and a comprehensive understanding of diverse social interests, a larger board size allows for a broader range of experiences and perspectives. This diversity can support a thorough assessment of corporate social policies, potentially improve the quality of social disclosures and strengthen investor trust.

However, a large number of board members may also trigger conflicting interests, prolong discussions, and hinder effective decision-making. Such a situation can reduce the board's ability to respond promptly to social issues, thereby diminishing the effectiveness of social disclosure in enhancing firm value. Research by [Meeprom et al. \(2024\)](#) indicates that board size negatively moderates the relationship between social pillar scores and firm performance, proxied by Tobin's Q. Based on these theoretical and empirical reviews, board size has the potential to either strengthen or weaken the relationship between social disclosure and firm value. Therefore, the moderating role is tested without specifying a directional influence.

H₇: Board size moderates the relationship between social disclosure and firm value.

Moderation in Governance Disclosure

Governance disclosure pertains to a company's internal governance structure; thus, a larger board size may enhance oversight capacity and the credibility of such disclosures. Conversely, a high number of board members can lead to coordination inefficiencies and decelerate strategic decision-making processes. These conditions potentially diminish the board's effectiveness in ensuring the quality of both governance implementation and its subsequent disclosure.

Empirical research by [Meeprom et al. \(2024\)](#) indicates that board size does not significantly moderate the relationship between governance pillar scores and firm performance, as measured by Tobin's Q. This finding suggests that the moderating effect of board size on the link between governance disclosure and firm value lacks strong empirical evidence. Nevertheless, from a theoretical standpoint, board size possesses the potential to either strengthen or weaken this relationship. Consequently, the moderating role is tested without specifying a directional influence.

H₈: Board size moderates the relationship between governance disclosure and firm value.

3. Methodology

Data Types and Sources

The data utilized in this study consist of secondary data, which refer to processed primary data provided by specific sources ([Cerar et al., 2021](#)). The secondary data employed are quantitative and sourced from the Bloomberg database. In a broad sense, quantitative data encompass all information measured through numerical values used to identify patterns, trends, relationships, and differences between variables via objective and verified measurements and the application of statistical analysis ([Slater & Hasson, 2025](#)).

Population and Sample

The population for this study includes all publicly traded companies listed on the Singapore Exchange (SGX) between 2019 and 2024. The research sample was selected using a purposive sampling technique, which allows the researcher to obtain data aligned with established criteria, context, and research objectives ([Memon et al., 2025](#)).

The specific sample selection criteria for this study are as follows: (1) Publicly traded companies listed on the Singapore Exchange during the 2019–2024 period; (2) Companies with complete data in the Bloomberg database for all variables under investigation throughout the 2019–2024 observation period.

Based on these criteria, 20 public companies on the Singapore Exchange qualified as the research sample. The total observation data obtained amounted to 120 data points from the 2019 to 2024 research period. Although the Singapore Exchange features a wide range of sector classifications, the companies in this sample originate from only five sectors: communications, consumer staples, finance, industrials, and real estate. This concentration is due to limitations in the completeness of data required for testing all research variables. The relatively small sample size represents a limitation that may influence statistical power.

Data Collection Method

The data for this study were obtained from the Bloomberg database. Data collection was conducted using the documentation method, which involved extracting relevant data points from Bloomberg and organizing them into Microsoft Excel. Companies with incomplete data were excluded from the research sample; consequently, their records were removed and omitted from the analysis process.

Research Variables and Operational Definitions

The independent variables in this study are Environmental, Social, and Governance (ESG) disclosure, both as an aggregate and by each individual pillar. ESG disclosure reflects the level of

transparency a company maintains in communicating information regarding its sustainability practices. The analysis of total ESG disclosure and its respective pillars is conducted separately to allow for a more comprehensive understanding.

Next, firm value is used as the dependent variable. Firm value signifies a company’s achievement in terms of public trust since its inception, indicates its future prospects, and reflects the total assets owned by the firm (Hardiningsih et al., 2024). In this research, the measure of firm value used is the Tobin’s Q ratio obtained from Bloomberg. The Q ratio, commonly referred to as Tobin’s Q, is the ratio between a firm’s market value and the replacement cost of its assets (Njoku & Lee, 2025).

Table 1. Variables operationalization

Variable	Operational Definition	Formula	References
ESG Disclosure	Bloomberg score reflecting the total level of environmental, social, and governance disclosure by company (i) in year (t).	ESG Disclosure = ESG disclosure score of company (i) in year (t)	Mutiah & Rusmanto (2023)
Environmental Disclosure	Bloomberg score reflecting the level of environmental disclosure by company (i) in year (t).	Environmental Disclosure = Environmental disclosure score of company (i) in year (t).	Mutiah & Rusmanto (2023)
Social Disclosure	Bloomberg score reflecting the level of social disclosure by company (i) in year (t).	Social Disclosure = Social disclosure score of company (i) in year (t).	Mutiah & Rusmanto (2023)
Governance Disclosure	Bloomberg score reflecting the level of governance disclosure by company (i) in year (t).	Governance Disclosure = Governance disclosure score of company (i) in year (t).	Mutiah & Rusmanto (2023)
Firm Value	Tobin’s Q Ratio: The ratio of the sum of market capitalization, total liabilities, preferred equity, and minority interests to the company’s total assets.	Tobin’s Q = $\frac{\text{Market Capitalization} + \text{Total Liabilities} + \text{Preferred Equity} + \text{Minority Interest}}{\text{Total Assets}}$	El-Deeb et al. (2023)
Board Size	Total number of directors.	Board Size = Total number of directors	Awad et al. (2023)
Female Representation	Total number of female board members divided by the total number of board members, multiplied by 100%.	Female Representation = $\frac{\text{Total Female Board Members}}{\text{Total Board Members}} \times 100$ Note: The percentage value of female board members used in data processing is converted into a proportion (0-1).	Babiker et al. (2025)
Firm Age	The difference between the observation year and the year the company was founded.	Company Age = Observation Year – Year of Incorporation	Triwacana-ningrum & Probodono (2024)

The moderating variable proposed in this study is board size. In Singaporean companies that implement a one-tier system in their board structure, board size is directly related to the effectiveness of oversight and the capacity to provide strategic direction to management, thereby potentially strengthening or weakening the relationship between ESG disclosure and firm value.

Furthermore, this study utilizes two control variables: female representation and company age. The female representation variable measures the presence of women within the company's board membership. Several previous studies show that female representation is related to ESG disclosure (Alkhawaja et al., 2023; Babiker et al., 2025; Omenihu et al., 2025) and firm value (Huang, 2024; Tamararizki et al., 2026). Meanwhile, several studies that use company age as a control variable in investigating the relationship between ESG disclosure and firm value include research by Triwacananingrum & Probahudono (2024), Hamdouni (2025), and Msomi et al. (2025).

Analysis Technique

The research data is analyzed using panel data linear regression with Stata 17 software. The regression models used to test each hypothesis in this study are in Equation 1-4.

Regression equation for the ESG disclosure model:

$$\begin{aligned} FV_{it} &= \beta_0 + \beta_1ESGD_{it} + \beta_2FR_{it} + \beta_3AGE_{it} + \varepsilon_{it} \\ FV_{it} &= \beta_0 + \beta_1ESGD_{it} + \beta_2BS_{it} + \beta_3FR_{it} + \beta_4AGE_{it} + \varepsilon_{it} \\ FV_{it} &= \beta_0 + \beta_1ESGD_{it} + \beta_2BS_{it} + \hat{\alpha}3ESGD*BS_{it} + \beta_4FR_{it} + \beta_5AGE_{it} + \varepsilon_{it} \end{aligned} \quad (1)$$

Regression equation for the environmental disclosure model:

$$\begin{aligned} FV_{it} &= \beta_0 + \beta_1ENVD_{it} + \beta_2FR_{it} + \beta_3AGE_{it} + \varepsilon_{it} \\ FV_{it} &= \beta_0 + \beta_1ENVD_{it} + \beta_2BS_{it} + \beta_3FR_{it} + \beta_4AGE_{it} + \varepsilon_{it} \\ FV_{it} &= \beta_0 + \beta_1ENVD_{it} + \beta_2BS_{it} + \beta_3ENVD*BS_{it} + \beta_4FR_{it} + \beta_5AGE_{it} + \varepsilon_{it} \end{aligned} \quad (2)$$

Regression equation for the ESG social model:

$$\begin{aligned} FV_{it} &= \beta_0 + \beta_1SOCD_{it} + \beta_2FR_{it} + \beta_3AGE_{it} + \varepsilon_{it} \\ FV_{it} &= \beta_0 + \beta_1SOCD_{it} + \beta_2BS_{it} + \beta_3FR_{it} + \hat{\alpha}4AGE_{it} + \varepsilon_{it} \\ FV_{it} &= \beta_0 + \beta_1SOCD_{it} + \beta_2BS_{it} + \beta_3SOCD*BS_{it} + \beta_4FR_{it} + \beta_5AGE_{it} + \varepsilon_{it} \end{aligned} \quad (3)$$

Regression equation for the governance disclosure model:

$$\begin{aligned} FV_{it} &= \beta_0 + \beta_1GOVD_{it} + \beta_2FR_{it} + \beta_3AGE_{it} + \varepsilon_{it} \\ FV_{it} &= \beta_0 + \beta_1GOVD_{it} + \beta_2BS_{it} + \beta_3FR_{it} + \beta_4AGE_{it} + \varepsilon_{it} \\ FV_{it} &= \beta_0 + \beta_1GOVD_{it} + \beta_2BS_{it} + \beta_3GOVD*BS_{it} + \beta_4FR_{it} + \beta_5AGE_{it} + \varepsilon_{it} \end{aligned} \quad (4)$$

Note:

FV_{it} = Firm value of company (i) in time period (t)

β_0 = Constant

$ESGD_{it}$ = ESG disclosure of company (i) in time period (t)

$ENVD_{it}$ = Environmental disclosure of company (i) in time period (t)

- SOCD_{it} = Social disclosure of company (i) in time period (t)
 GOVD_{it} = Governance disclosure of company (i) in time period (t)
 BS_{it} = Board size of company (i) in time period (t)
 FR_{it} = Female representation of company (i) in time period (t)
 AGE_{it} = Company age of company (i) in time period (t)
 ε_{it} = Error

4. Results

Descriptive Statistical Analysis

Based on Table 2, the average Tobin's Q value is 1.1878 (Tobin's Q > 1), indicating that companies in the sample tend to be perceived as having positive growth opportunities and future performance, despite considerable variation in market valuation (standard deviation of 0.6786). Meanwhile, the average ESG disclosure of 44.9441 is still considered low (below the midpoint of the 0-100 measurement scale), with low variation as well (standard deviation of 8.9680 or approximately 19.95% of the mean). This condition can be considered reasonable within the Singaporean context, given the strong regulations from the Singapore Exchange (SGX) that mandate sustainability reporting, making ESG disclosure practices relatively uniform across companies. Furthermore, the analysis of each individual ESG pillar shows that the primary focus of disclosure is on the governance aspect (average value of 78.2342).

Table 2. Descriptive statistics

Variable	Average	Min.	Max.	Std. Dev.
Tobin's Q	1.1878	0.4775	4.4955	0.6786
ESGD	44.9441	14.4553	68.7557	8.9680
ENVD	29.9849	0.0000	68.8916	14.1317
SOCD	26.4858	5.3507	48.9722	8.9114
GOVD	78.2342	37.9290	91.2402	8.6463
BS	8.9750	4.0000	14.0000	2.4476
FR	0.2044	0.0000	0.5556	0.1257
AGE	34.8500	2.0000	126.0000	26.6451

Table 3. Correlation matrix

	Tobin's Q	ESGD	ENVD	SOCD	GOVD	BS	FR	AGE
Tobin's Q	1.0000							
ESGD	-0.0532	1.0000						
ENVD	-0.1141	0.9038	1.0000					
SOCD	0.0219	0.8448	0.6521	1.0000				
GOVD	-0.0018	0.7646	0.5068	0.5334	1.0000			
BS	0.3046	0.1921	0.1273	0.3026	0.0784	1.0000		
FR	0.1844	0.1841	0.0894	0.2322	0.1874	0.3581	1.0000	
AGE	-0.2027	0.5098	0.4821	0.3541	0.4334	0.2341	0.0646	1.0000

Furthermore, the results of the descriptive statistical analysis show that board size has an average of 8.9750 (approximately 9 members) with relatively low variation. In contrast, female representation on the board, with an average value of 0.2044 (approximately 20%), and company age, with an average of 34.85 years, exhibit relatively high variation across companies. These differences in characteristics potentially influence the effectiveness of ESG disclosure and the market's valuation of the firms.

Based on the correlation matrix in Table 3, the correlation values between the aggregate ESG disclosure variable and its individual pillar disclosures are classified as high. However, this does not pose a multicollinearity issue as each of these variables is tested separately within the regression models. Additionally, the variance inflation factor (VIF) for each research variable is less than 5, which remains within the tolerance limit. Consequently, none of the regression models in this study suffer from multicollinearity problems.

Model Determination Test

In panel data analysis, the most appropriate regression model is determined through the Chow Test, Hausman Test, and Lagrange Multiplier Test. The Chow and Hausman tests confirmed that the Fixed Effect Model (FEM) is the most suitable model for all regression equations in this study (probability values below 0.05); therefore, the Lagrange Multiplier Test was not conducted. Details of the model selection test results are provided in Table 4.

Table 4. Model determination test

Types of Disclosure	Chow Test (p value)	Hausman Test (p value)	Selected Model
ESG Disclosure	0.0000	0.0132	FEM
Environmental Disclosure	0.0000	0.0171	FEM
Social Disclosure	0.0000	0.0292	FEM
Governance Disclosure	0.0000	0.0045	FEM

Based on the heteroscedasticity test using the Modified Wald Test, all regression models in this study exhibit heteroscedasticity issues (probability values below 0.05). This problem is addressed by applying robust standard errors to obtain valid estimation results.

Table 5. Determinants of firm value: Tobin's Q, ESG disclosure model

Variable	Model 1a FEM Robust	Model 1b FEM Robust	Model 1c FEM Robust
ESGD	-0.0007 (0.0057)	-0.0020 (0.0057)	0.0330** (0.0154)
BS		-0.0175 (0.0301)	0.1086** (0.0383)
ESGD_BS			-0.0029** (0.0013)
FR	0.2277 (0.2372)	0.2098 (0.2331)	0.4410* (0.2438)
AGE	-0.0505* (0.0271)	-0.0488* (0.0249)	-0.0669** (0.0288)
Constant	2.9319*** (0.7619)	3.0931*** (0.9633)	2.1576*** (0.5911)
R ² (Within)	0.1809	0.1868	0.2272
F-statistic	2.5400	2.3200	3.1600
Prob > F	0.0873	0.0940	0.0306
Observation	120	120	120

The results of the Shapiro–Wilk test demonstrate that the residuals in all panel data regression models are not normally distributed (probability values below 0.05). In panel data settings with a relatively short time period and a moderate number of cross-sectional units, the consistency and asymptotic normality of FEM estimators do not depend on the assumption of normally distributed errors (Muliani et al., 2025). Therefore, the estimation results in this study remain valid, especially since robust standard errors have been implemented. However, the inference of the research results must still be conducted carefully due to the relatively limited sample size.

Based on Model 1b in Table 5, total ESG disclosure is not proven to be related to firm value; therefore, the first hypothesis is rejected. Simultaneously, the independent variables in Model 1b are related to firm value, albeit with a relatively weak significance level (F-test probability value = 0.0940) and an explanatory power of 18.68%. Furthermore, Model 1c in Table 5 demonstrates that board size negatively moderates the relationship between ESG disclosure and firm value (interaction coefficient of -0.0029), thus the fifth hypothesis is accepted. This model is simultaneously significant (F-test probability value = 0.0306), with an explanatory power of 22.72%.

Table 6. Determinants of firm value: Tobin's Q, environmental disclosure model

Variable	Model 2a FEM Robust	Model 2b FEM Robust	Model 2c FEM Robust
ENV D	0.0016 (0.0028)	0.0013 (0.0027)	0.0152* (0.0085)
BS		-0.0146 (0.0305)	0.0218 (0.0238)
ENV D_BS			-0.0015* (0.0008)
FR	0.2365 (0.2453)	0.2238 (0.2414)	0.4336 (0.2528)
AGE	-0.0581** (0.0267)	-0.0582** (0.0266)	-0.0615** (0.0269)
Constant	3.1152*** (0.8473)	3.2609*** (1.0659)	2.9884*** (0.9435)
R ² (Within)	0.1831	0.1874	0.2160
F-statistic	2.4400	2.1500	2.3100
Prob > F	0.0958	0.1142	0.0841
Observation	120	120	120

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Figures in parentheses represent standard errors.

Based on Model 2b in Table 6, environmental disclosure is not proven to be related to firm value; therefore, the second hypothesis is rejected. Simultaneously, the model is also not significant (F-test probability value of 0.1142), with an explanatory power of 18.74%. Meanwhile, Model 2c in Table 6 demonstrates that board size provides a negative moderating effect on the relationship between environmental disclosure and firm value (interaction coefficient of -0.0015), thus the sixth hypothesis is accepted, albeit with a relatively weak significance level (significant at the 10% level). This model is simultaneously significant (F-test probability value = 0.0841), with an explanatory power of 21.60%.

Based on Model 3b in Table 7, social disclosure is not related to firm value; therefore, the third hypothesis is rejected. Simultaneously, the independent variables in Model 3b are related to firm value at the 10% significance level (F-test probability value = 0.0710), with an explanatory power of 18.62%. Furthermore, Model 3c in Table 7 demonstrates that board size does not provide a moderating effect on the relationship between social disclosure and firm value, thus the seventh hypothesis is also rejected. Simultaneously, this model is also not significant (F-test probability value of 0.1021), with an explanatory power of 19.63%.

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Table 7. Determinants of firm value: Tobin's Q, social disclosure model

Variable	Model 3a FEM Robust	Model 3b FEM Robust	Model 3c FEM Robust
SOCD	-0.0001 (0.0041)	-0.0010 (0.0041)	0.0108 (0.0114)
BS		-0.0166 (0.0309)	0.0152 (0.0334)
SOCD_BS			-0.0012 (0.0011)
FR	0.2287 (0.2535)	0.2105 (0.2544)	0.2392 (0.2304)
AGE	-0.0517* (0.0265)	-0.0511* (0.0256)	-0.0526* (0.0258)
Constant	2.9471*** (0.8094)	3.1017*** (0.9955)	2.8428*** (0.9203)
R ² (Within)	0.1808	0.1862	0.1963
F-statistic	3.4500	2.5700	2.1600
Prob > F	0.0374	0.0710	0.1021
Observation	120	120	120

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Numbers in parentheses indicate standard error.

Table 8. Determinants of firm value: Tobin's Q, governance disclosure model

Variable	Model 4a FEM Robust	Model 4b FEM Robust	Model 4c FEM Robust
GOVD	-0.0072 (0.0074)	-0.0094 (0.0092)	0.0309 (0.0273)
BS		-0.0256 (0.0330)	0.2038 (0.1252)
GOVD_BS			-0.0030* (0.0016)
FR	0.2411 (0.2207)	0.2243 (0.2114)	0.3504 (0.2121)
AGE	-0.0461** (0.0185)	-0.0463** (0.0179)	-0.0527** (0.0184)
Constant	3.3089*** (0.8877)	3.7184** (1.3426)	0.8388 (2.1696)
R ² (Within)	0.1941	0.2063	0.2328
F-statistic	2.3000	3.3900	8.5900
Prob > F	0.1100	0.0298	0.0002
Observation	120	120	120

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Numbers in parentheses indicate standard error.

Based on Model 4b in Table 8, governance disclosure is not proven to be related to firm value; therefore, the fourth hypothesis is rejected. Simultaneously, the independent variables in Model 4b are related to firm value (F-test probability value of 0.0298), with an explanatory power of 20.63%. Furthermore, Model 4c in Table 8 demonstrates that board size provides a negative moderating effect on the relationship between governance disclosure and firm value (interaction coefficient of -0.0030), thus the eighth hypothesis is accepted, although the significance level is relatively low. This model is simultaneously significant (F-test probability value of 0.0002), with an explanatory power of 23.28%.

Table 9. Robustness test

Variable	ESGD	ENVD	SOCD	GOVD
TOBINS L1.	1.6970 (2.3879)	1.0636 (4.2476)	3.4689 (2.4058)	0.5638 (1.4507)
BS	-0.1480 (0.5775)	-0.2277 (1.0451)	-0.4296 (0.7219)	0.2119 (0.3682)
FR	-6.2072 (4.8154)	-7.2086 (9.4890)	-6.2387 (7.1528)	-5.1781 (4.4977)
AGE	2.3670*** (0.2864)	4.1005*** (0.6446)	2.2633*** (0.3437)	0.7425** (0.2730)
Constant	-37.0224*** (11.8268)	-110.9653*** (23.5818)	-51.5002*** (13.3947)	51.0922*** (11.9427)
R ² (Within)	0.5906	0.5153	0.4137	0.1784
F-statistic	17.2700	10.6200	11.0900	2.0200
Prob > F	0.0000	0.0001	0.0001	0.1328
Observation	100	100	100	100

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Numbers in parentheses indicate standard error.

The robustness test was conducted by examining reverse causality through the use of one-period lagged variables (t-1). As presented in Table 9, the results indicate that firm value does not maintain a significant relationship with ESG disclosure, whether assessed through the aggregate score or its individual pillars. Consequently, the research model exhibits no evidence of reverse causality.

5. Discussion

The hypothesis testing results prove that there is no relationship between ESG disclosure and firm value. These results are consistent with the study by [Rohendi et al. \(2024\)](#), which also states that ESG disclosure does not have a direct link to firm value. Furthermore, [Rohendi et al. \(2024\)](#) found that a positive relationship between ESG disclosure and firm value emerges when mediated by competitive advantage. This indicates that ESG disclosure alone is insufficient to increase firm value; therefore, other mechanisms are required ([Rohendi et al., 2024](#)).

Partially, it was found that environmental disclosure is not related to firm value, which is consistent with the research of [Aditya & Hasnawati \(2025\)](#). Furthermore, the analysis indicates that social disclosure is also not related to firm value. This finding aligns with the study by [Hardiningsih et al. \(2024\)](#). Consequently, disclosures regarding the environmental and social pillars do not provide significant added value in investor valuations. This is because such information is not perceived as a relevant new signal for investment decision-making.

Empirical evidence obtained from testing the governance pillar also confirms that governance disclosure is not related to firm value. This finding is consistent with the research of [Fadmaulida & Putra \(2024\)](#), [An et al. \(2025\)](#), and [Aditya & Hasnawati \(2025\)](#). Such insignificance suggests that stakeholders may view governance practices as a routine corporate responsibility rather than a strategic benefit ([Aditya & Hasnawati, 2025](#)).

Furthermore, the results of the moderation model testing indicate that board size negatively moderates the relationship between ESG disclosure and firm value. This finding aligns with the research of [Meeprom et al. \(2024\)](#), which found that board size negatively moderates the relationship between ESG scores and firm performance as measured by the Tobin's Q ratio. The negative interaction coefficient indicates that an increase in board size weakens the strength of the relationship between ESG disclosure and firm value.

When moderated by board size, a significant positive relationship was found between ESG disclosure and firm value, supporting Stakeholder Theory and Signaling Theory. This change in significance reflects the moderation effect, where board size influences the strength of the relationship between ESG disclosure and firm value. Thus, it can be concluded that ESG disclosure is not directly related to firm value; instead, it requires the support of effective governance mechanisms to be positively received by the market. This is consistent with Agency Theory, which emphasizes the importance of oversight mechanisms and strategic direction from the board of directors to reduce conflicts of interest between management and shareholders.

The test results show that board size moderates the relationship between environmental disclosure and firm value, albeit with a relatively weak significance level. The negative moderation coefficient indicates that an increase in board size tends to weaken the strength of the relationship between environmental disclosure and firm value.

Additionally, the research findings show that environmental disclosure is positively related to firm value when moderated by board size, in line with Stakeholder Theory and Signaling Theory, which state that ESG disclosure, including environmental disclosure, is a means for companies to demonstrate their commitment to sustainability. Such commitment builds a positive reputation and risk reduction, which ultimately enhances firm value. Nonetheless, the results of this study prove that this relationship does not occur directly but depends on the effectiveness of the board's role, as explained by Agency Theory.

Furthermore, the results of the analysis indicate that board size does not possess moderating capabilities in the relationship between social disclosure and firm value. Social disclosure is often perceived as a mere compliance or symbolic activity rather than a substantive mechanism capable of strengthening relationships and enhancing performance or firm value ([Angela & Rusmanto, 2025](#)). Consequently, the effectiveness of the board of directors in social disclosure is limited, rendering board size unable to moderate the relationship between such disclosure and firm value.

The study findings research findings prove that board size negatively moderates the relationship between governance disclosure and firm value. This finding indicates that an increase in board size weakens the relationship between governance disclosure and firm value. Although the direction of the relationship between governance disclosure and firm value becomes positive in the model with the moderating variable, the relationship remains statistically insignificant. This condition is consistent with the findings without moderation, suggesting that governance disclosure is still perceived as a routine responsibility. Therefore, companies first need to integrate governance disclosure as part of corporate strategy and consider the appropriate board size so that such disclosure can optimally contribute to increasing firm value.

This study show that ESG disclosure, both in total and for each individual pillar, is not related to firm value. This condition indicates that the high level of ESG disclosure in Singapore does not necessarily increase firm value. As a global financial hub with a high level of market efficiency, ESG information has likely been fully reflected in stock prices, thus not generating a significant additional valuation premium for firm value. This aligns with the characteristics of an efficient market, where information that is public, standardized, and easily accessible tends to be quickly absorbed by investors. Such information

does not trigger a significant market reaction because it has been previously anticipated by investors. Furthermore, ESG disclosure in Singapore has become a part of common and standardized reporting, meaning it is no longer a competitive advantage capable of boosting firm value.

The findings also indicate that ESG disclosure is not always directly related to firm value. ESG disclosure is more accurately understood as a strategic corporate instrument that creates strategic value, such as risk management and strengthening relationships with stakeholders. Therefore, the benefits of ESG disclosure are not always directly reflected in firm value measured by market approaches; instead, they are more long-term in nature. The relationship between ESG disclosure and firm value requires the support of other factors, such as the effectiveness of corporate governance, to be optimally responded to by the market.

6. Conclusion

The results indicate that ESG disclosure, both in total and for each individual pillar, is not related to firm value. Furthermore, the findings show that board size negatively moderates the relationship between total ESG disclosure, environmental disclosure, and governance disclosure. However, board size does not demonstrate a moderating effect on the relationship between social disclosure and firm value. These results highlight the importance of considering board size to enhance the effectiveness of ESG disclosure in generating added value for the company. This study contributes theoretically by complementing existing literature on the relationship between ESG disclosure and firm value. Practically, the results reveal an important mechanism in the relationship between ESG disclosure and firm value: the moderating role of board size. Therefore, companies need to consider an appropriate board size when designing and implementing ESG disclosure to ensure a positive contribution to firm value. On the other hand, investors should utilize information regarding board size as an additional consideration in investment decision-making.

Despite being conducted systematically, this study has several limitations. First, the sample size is limited to 20 companies listed on the Singapore Exchange with a 6-year observation period (2019–2024). Second, the observation period includes the COVID-19 pandemic, which could potentially influence the research results. Third, the coefficient of determination (R^2) in this study is relatively low. Based on these limitations, future research is suggested to increase the sample size to ensure more representative results. Future studies could also consider separating the periods before, during, and after a crisis, such as the COVID-19 pandemic. Additionally, future research should incorporate other variables potentially related to firm value, such as profitability, leverage, ownership structure, and macroeconomic variables.

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