

Environmental greenwashing in Japan: the roles of corporate governance and assurance

Frendy

Business School, Nagoya University of Commerce and Business, Nagoya, Japan

Tomoki Oshika

School of Commerce, Waseda University, Tokyo, Japan, and

Masayuki Koike

Graduate School of Commerce, Waseda University, Tokyo, Japan

Abstract

Purpose – Greenwashing is defined as the overstatement of companies' environmental disclosures relative to their performance. This paper aims to develop a greenwashing measure, examines its relationship with environmental performance and investigates the mitigating effects of Japanese firm-level corporate governance characteristics (corporate structure, board leadership, foreign share ownership, ratio of independent directors and ratio of directors' variable compensation) and third-party assurance of environmental information on the extent of greenwashing.

Design/methodology/approach – This paper analyzes a sample of 420 firm-year observations from the period between 2018 and 2019 from Japanese listed companies that responded to the CDP Climate Change survey via probit/logit and multivariate panel data regression models.

Findings – This paper finds that the probability of engaging in greenwashing is negatively associated with environmental performance, which supports the reliability of the study's greenwashing measure. Japanese firm-level corporate governance characteristics are ineffective at mitigating greenwashing. This paper also finds that assurance carries a significant risk of being exploited by companies involved in greenwashing to increase the degree of their overstatement.

Practical implications – The findings have significant implications for investors, who should increase scrutiny and skepticism of environmental disclosures, particularly from companies with poor environmental

© Frendy, Tomoki Oshika and Masayuki Koike. Published by Emerald Publishing Limited. This article is published under the Creative Commons Attribution (CC BY 4.0) licence. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this licence may be seen at <http://creativecommons.org/licences/by/4.0/legalcode>

The authors would like to express their sincere gratitude to the anonymous referees for their insightful comments and suggestions that have significantly improved this paper. The authors are also deeply grateful to the editor, Warren Maroun, for the efficient handling of the manuscript and valuable guidance throughout the review process. The authors would like to especially thank Kentaro Koga, participants of the 2023 International Session of the Japan Accounting Association Annual Meeting, the 32nd Asian-Pacific Conference on International Accounting Issues and the 2023 NUCB Finance Research Workshop for their valuable comments on the manuscript.

Funding and Declaration of Interest: This work was supported by JSPS KAKENHI Grant-in-Aid for Early-Career Scientists Grant Number JP22K13518. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the author(s)' organization, JSPS or MEXT.



track records. Japanese companies should consider strengthening their corporate governance to ensure the effective oversight of environmental disclosure and performance. Regulators and standard setters should implement stricter guidelines for and oversight of environmental information assurance.

Originality/value – No empirical study has examined the effectiveness of Japanese corporate governance characteristics and environmental disclosure assurance on the mitigation of greenwashing.

Keywords Climate change, Disclosures, CDP, Nonfinancial

Paper type Research paper

I. Introduction

Almost all (99%) of the Japanese companies listed in the Nikkei 225 index disclosed sustainability information (KPMG, 2022). However, although many companies have pledged to support the Task Force on Climate-Related Financial Disclosures (TCFD), few have provided TCFD-recommended disclosures in their statutory securities reports (KPMG, 2021). A comparative analysis of integrated reports from 50 global companies across 10 countries revealed significant variation in report quality in countries where companies from Japan have relatively lower quality reports than in other developed countries (Eccles *et al.*, 2019). This gap between stated support and actual disclosure of environmental information among Japanese firms provides an opportunity to empirically examine the potential disclosure–performance gaps.

The deviation between environmental disclosure and performance can be represented as greenwashing, which is defined as a practice in which companies engage in strategic environmental disclosures that present a “greener” impression relative to their actual environmental performance (Aroui *et al.*, 2021; Marquis *et al.*, 2016; Yu *et al.*, 2020). A survey performed by Refinitiv revealed that approximately 60% of 250 institutional investors polled with over \$10tn of managed assets believe that companies engage in greenwashing practices, and 84% of the surveyed investors expect greenwashing to increase in the future (Ko, 2020). Considering that the availability and completeness of the environmental disclosures published by Japanese companies are more extensive than those of their social and governance disclosures (Nikko Research Center, 2016), our study’s investigation of the drivers of this environmental disclosure–performance gap could yield valuable insights.

The International Sustainability Standards Board (ISSB) established by the IFRS Foundation stated that the initial focus of the board will be on creating sustainability reporting standards that address climate-related risks (IFRS Foundation, 2020). In June 2023, the ISSB released its foundational sustainability reporting standards, IFRS S1 and S2. These standards aim to enhance the comparability of environmental disclosures worldwide, and these disclosure standards are set to be adopted by many countries in the future, including Japan. In March 2024, the Sustainability Standards Board of Japan (SSBJ) released exposure drafts of the Sustainability Disclosure Universal Standards and the Sustainability Disclosure Theme-specific Standards, which aim to establish Japanese standards that are comparable to IFRS S1 and S2 (SSBJ, 2024). Given the imminent adoption of these standards, our timely investigation of the effects of Japanese corporate governance structures and assurance on corporate environmental disclosure–performance gaps will provide valuable insights into the challenges and opportunities for enhancing the reliability of sustainability reporting.

This study contributes to the theoretical understanding of greenwashing behavior by building on stakeholder theory (Gray *et al.*, 1995; Holder-Webb *et al.*, 2009; Nishitani *et al.*, 2021) and the cost–benefit factors of greenwashing (Lyon and Maxwell, 2011). Stakeholder theory suggests that management’s environmental disclosures and practices are influenced by

the balance between stakeholders' demands for environmental sustainability and financial performance. The discrepancy between environmental disclosures and practices could arise when management attempts to satisfy these conflicting stakeholder demands. The cost–benefit factors of greenwashing suggest that the likelihood of greenwashing is determined by the expected costs (e.g. penalties, litigation risk) and potential benefits (e.g. protecting reputation, misleading public perception) of engaging in such behavior. By examining the relationship between environmental performance and the likelihood of greenwashing, this study aims to provide empirical evidence to support the theoretical propositions of the cost–benefit drivers of greenwashing.

Companies with good corporate governance practices are more likely to reduce agency problems, and firms with more effective governance characteristics have been shown to mitigate greenwashing (Luo and Wu, 2019). Luo and Tang (2016) find that national and cultural characteristics affect the propensity of corporations to disclose environmental reporting. Ioannou and Serafeim (2012) argued that firms are more likely to make explicit CSR decisions and initiatives that could improve corporate social performance disclosures in more individualistic cultures. However, as a collectivist society, environmental disclosures may take a more implicit form in Japan, potentially resulting in greater disclosure–performance gaps. Japan has a high ESG disclosure score relative to other countries but has an overall low governance performance score (Yu *et al.*, 2020). This gap suggests that Japanese companies may be more prone to greenwashing due to weaker governance factors. Our study aims to contribute to prior studies that focused primarily on Western countries (Ioannou and Serafeim, 2012; Marquis *et al.*, 2016) by examining the greenwashing behavior of Japanese firms that operate in different cultural, regulatory and corporate governance regimes.

Investors are particularly concerned with the reliability of corporate sustainability disclosures, as 97% of the surveyed investors replied that sustainability disclosures should be audited, and 67% agreed that sustainability audits should be as rigorous as financial audits (Bernow *et al.*, 2019). Although the International Auditing and Assurance Standards Board (IAASB) has revised the International Standard on Assurance Engagements (ISAE) 3000 to guide assurance on the disclosure of information in nonfinancial statements, there is no specific pronouncement in the standard that discusses the risk of greenwashing (IFAC and IIRC, 2020). The 2022 KPMG survey revealed that only 62% of the Japanese companies listed in the Nikkei 225 received third-party assurance for the disclosed sustainability metrics (KPMG, 2022). Considering that the relative value of assurance may depend on country-specific factors (Knechel, 2021), examining the effectiveness of the assurance of environmental disclosures in mitigating greenwashing in the Japanese context could provide novel insights.

This study expands upon prior work by Hummel and Schlick (2016) and Yu *et al.* (2020) by quantitatively measuring the extent of corporate greenwashing through the calculation of the Environmental Disclosure and Performance Gap (*DPG*). The *DPG* captures the difference between a firm's environmental disclosure (*EDS*) and performance (*EPS*) scores. A firm's *EDS* is derived from the CDP Climate Change Survey responses, whereas its *EPS* is based on emissions and energy consumption data normalized within industry peer groups. A positive *DPG* value is an indicator of greenwashing, where disclosures overstate actual performance, and the absolute value of the *DPG* represents the extent of the disclosure–performance gap. The originality of this approach lies in establishing a measure of greenwashing that is consistent with stakeholder theory and employing the probit/logit regression model to accommodate the probability-driven cost–benefit drivers of greenwashing proposed by Lyon and Maxwell (2011). Furthermore, this research explores

the roles of corporate governance mechanisms (Yu *et al.*, 2020; Li *et al.*, 2023) and external assurance (Brown-Liburd and Zamora, 2015; Hoang and Trotman, 2021) in mitigating greenwashing behavior within the unique Japanese context, thereby contributing to the understanding of how these factors could enhance the reliability of environmental disclosures.

This study's findings suggest that companies with poor environmental performance are more likely to engage in greenwashing, highlighting the need for investors and regulators to apply increased scrutiny to the environmental disclosures issued by those companies. The study also reveals that current Japanese corporate governance characteristics are ineffective in mitigating greenwashing, suggesting the need for Japanese companies to diversify their board compositions, select directors who possess expertise in sustainability, and create specialized committees focused on sustainability initiatives (Li *et al.*, 2023). Furthermore, companies indicated with greenwashing have been shown to utilize environmental information assurance to magnify the degree of their environmental disclosure and performance gap, potentially misleading stakeholders (Casey and Grenier, 2015; Datt *et al.*, 2018). Assurance providers should employ rigorous verification procedures and maintain professional skepticism, particularly when dealing with companies that have a history of poor environmental performance. Simultaneously, standard setters such as the IAASB should implement stricter guidelines and update assurance standards (ISAE 3000) to address the risks of greenwashing explicitly.

The paper is organized as follows. In Section 2, we conduct a literature review and develop hypotheses concerning environmental disclosure, performance, and the potential influence of Japanese corporate governance characteristics and assurance on mitigating greenwashing. Section 3 describes our research methodology, which includes the *environmental disclosure and performance gap (DGP)* and greenwashing measurements, the sample selection process, and the panel data regression model employed. The empirical findings are presented in Section 4, followed by a discussion of these results in Section 5. Finally, Section 6 concludes the paper by providing a summary of the key insights, implications, and limitations of the study, as well as suggestions for future research directions.

2. Literature review and hypothesis development

2.1 Environmental disclosures, performance and greenwashing

The disclosure of environmental information can represent either an honest effort to signal good sustainability practices or an attempt to misrepresent environmental performance (Brown *et al.*, 2009). Environmental disclosures represent companies' attempts to strategically manage the relationships among stakeholders concerned with environmental issues (Gray *et al.*, 1995). Stakeholder theory posits that management has a moral obligation to fulfill the interests of not only shareholders but also all stakeholders who have a relationship with the company (Holder-Webb *et al.*, 2009). In particular, growing firms are more likely to have increased interactions with stakeholders, which increases the need of these firms to maintain legitimacy with their stakeholders (Kim and Lyon, 2015).

Owing to the wide-ranging interests of stakeholders, companies are pressured to incorporate the externalities of business operations into corporate reporting. However, not all stakeholders are equally important, and the stakeholder theory considers that managerial decision-making, including environmental disclosure reporting, is expected to serve the interest of the management's most significant stakeholders (Nishitani *et al.*, 2021). Assuming that major stakeholders are interested in promoting and practicing sustainability, management, in turn, is incentivized to allocate resources to develop existing organizational

structures, procedures, and information collection and reporting systems that enable management to fulfill stakeholders' interests. Faithfully providing reports that represent real performance encourages high-quality communication with stakeholders, increases enterprise value and improves social well-being (KPMG, 2022).

However, shareholders may perceive environmental initiatives as costly (Kim and Lyon, 2015). Stakeholders whose primary interest lies in earning high financial returns consider the perceived high cost of the environmental cost undesirable and pressure management to deprioritize environmental projects. In this scenario, management may be less likely to align environmental business practices and disclosures, as companies with poorer environmental performance are more likely to use incomplete disclosures to protect their legitimacy and manage public perceptions (Hummel and Schlick, 2016). In summary, stakeholder theory suggests that firms' environmental disclosure and performance are shaped by balancing stakeholders' demands for environmental sustainability and financial performance.

Greenwashing occurs when companies disclose large amounts of environmental information but perform poorly on environmental metrics (Yu *et al.*, 2020). Companies that engage in greenwashing are unlikely to adjust their managerial decisions to mitigate the negative externalities of their poor environmental performance. The prevalence of greenwashing has increased significantly in recent years as more firms seek to reap the benefits of growing consumer and capital markets for green products and services (Delmas and Burbano, 2011). In particular, environmental disclosure tends to highlight areas where the company is performing well and is aimed at forestalling regulations (Holder-Webb *et al.*, 2009). Greenwashing reduces the reliability of CSR information, which in turn decreases its usefulness in decision-making (Hoang and Trotman, 2021).

Lyon and Maxwell (2011) explore the cost–benefit drivers of greenwashing, where the expected cost (penalty) and the potential benefits of greenwashing are important factors in explaining greenwashing behavior. The expected cost/penalty element of the equation could represent the likelihood that a whistleblower or auditor assessed the firm's environmental disclosures and detected greenwashing. Companies that disclose sustainability reports without assurances are more likely to exhibit poor environmental performance (Peters and Romi, 2015). Disclosures are costly for firms, and managers need to allocate limited corporate resources to align internal structures and processes to reduce the risk of greenwashing. Firms also need to consider the cost of the punishment imposed on the firm if greenwashing is detected. Corporations engaging in greenwashing are exposed to litigation risks from consumers, regulators and nongovernment organizations (NGOs) due to false environmental advertising (Delmas and Burbano, 2011).

The benefits element of greenwashing represents the potential benefits the firm could gain from successful greenwashing. Birkey *et al.* (2017) find that companies with low CSR performance employ CSR reports as a tool for presenting an image of social responsibility that lessens the social and political pressures from stakeholders. Companies with less-than-average environmental performance are motivated to greenwash their disclosures to protect their reputations and mislead public perception (Gödker and Mertins, 2018; Mahoney *et al.*, 2013). In the long run, however, a company engaging in environmental reporting that is not supported by the actual implementation of those disclosures might adversely affect its legitimacy (Uyar *et al.*, 2020). As the expected cost of greenwashing increases relative to the potential benefits, greenwashing becomes less attractive to firms.

Lyon and Maxwell (2011) argued that the probability that a firm will engage in greenwashing (selective positive disclosure) is negatively associated with the likelihood that the firm's actions will benefit the environment. Firms that perform policies with a low probability of beneficial outcomes are more likely to fully disclose their environmental

outcomes, as they have little to lose by revealing failures and much to gain by publicizing successes. Firms with a high probability that a given activity will have a positive environmental outcome are less likely to disclose any information about their environmental outcomes, as they have little to gain by revealing successes (which are already expected) and much to lose by disclosing failures. Firms that are uncertain whether their actions will either benefit or harm the environment are more likely to engage in partial disclosures of success, where they can significantly improve public perception.

On the basis of the discussions of [Lyon and Maxwell's \(2011\)](#) cost–benefit drivers of greenwashing in the preceding paragraphs, the following alternative hypothesis *H1* posits that a company's environmental performance is negatively associated with its likelihood of engaging in greenwashing after controlling for factors that influence the expected cost and benefits of greenwashing:

- H1.* A company's environmental performance is negatively associated with the likelihood of engaging in greenwashing, which is defined as the company overstating its environmental disclosure relative to its actual environmental performance.

2.2 Japanese corporate governance characteristics

Effective governance is essential for companies to execute strategies that underpin their business models and sustainably increase corporate value ([METI, 2017](#)). Corporate governance functions such as board monitoring have been shown to complement ESG assurance in mitigating agency-related costs ([Maroun, 2022](#)). Previous studies have examined whether corporate governance practices are effective in reducing greenwashing. Firms with higher governance performance levels have been shown to exhibit lower degrees of greenwashing ([Luo and Wu, 2019](#)). Firm-level corporate governance characteristics, such as independent directors, can reduce greenwashing ([Yu et al., 2020](#)). For Australian firms, a positive relationship between the presence of a sustainability committee and a firm's environmental performance has been observed ([Li et al., 2023](#)).

However, surveys of directors and executives have shown that only two-thirds of directors say that ESG performance is linked to their corporate strategy, and over half have little confidence in their ESG programs ([Larcker et al., 2022](#)). Furthermore, the 2020 Survey of Integrated Reporting in Japan reported that only 3% of a sample of Nikkei 225 companies disclosed information related to the board's oversight of climate-related risks and opportunities in their securities reports ([KPMG, 2021](#)). This low level of awareness regarding environmental information among Japanese boards might indicate that the current corporate governance structures in Japan are ineffective in mitigating greenwashing practices.

The 2002 revisions to the Commercial Code gave Japanese firms the option of adopting a committee system with outside directors ([Itami, 2005](#)). Japanese corporations could select three corporate governance structures, namely, audit committees, corporate or statutory auditors and nomination committees. The audit and nomination committee models are based on the focus of board of directors being on the monitoring role, whereas the corporate or statutory auditor model emphasizes the dual functions of monitoring and decision-making ([METI, 2022](#)). Although the choice of governance structure should be independently decided by each company, considering governance structures that emphasize a monitoring function may be beneficial ([METI, 2022](#)). Thus, governance structures that focus on the monitoring role (audit committees and nomination committees) might be more effective in mitigating greenwashing.

The corporate governance guidelines published by Japanese regulators suggest that the election of the leader/chairperson of a board of directors should align with the characteristics of the board (METI, 2022). A board that emphasizes the monitoring function should have a nonexecutive director, such as an independent director, serving as the chairperson. [Mardawi et al. \(2024\)](#) reported that employing CEO duality and separation of duties could be effective for the adoption of ESG assurance when combined with other governance characteristics.

When the president (CEO) holds the role of the chairperson of the board, a potential conflict of interest can occur between the responsibility of the president as the leader of the management team and the duty of the board chairperson to facilitate board discussions and set meeting agendas. This conflict of interest might weaken the effectiveness of the board's monitoring role in minimizing the asymmetry between environmental disclosure and performance.

Prior studies have employed business exposure to foreign markets as a proxy for pressure from institutional stakeholders ([Marquis et al., 2016](#)). Foreign investors are likely to face greater information asymmetry than domestic investors when they invest in Japanese companies because of language and cultural barriers. Companies with a high ratio of foreign shareholders are expected to attract and retain foreign investors by actively reducing the level of information asymmetry, including that of the gap between environmental disclosure and performance.

The corporate governance guidelines suggest that a board of directors should appoint a larger proportion of outside directors to ensure the effective monitoring role of the board (METI, 2022). Independent nonexecutive directors on boards were found to be significantly associated with companies that align their ESG disclosures with the UN SDGs ([Ng et al., 2023](#)). [Yu et al. \(2020\)](#) suggested that boards that employ stricter monitoring, proxied by a board with a higher proportion of independent directors, are effective in mitigating greenwashing behavior. Board variable compensation could incentivize better interest alignment between management and shareholders. Assuming that shareholders rely on ESG information to make investment decisions ([Leva, 2020](#)), the increased synergy between management and shareholders might suggest that environmental information and performance asymmetry, such as overstatement (greenwashing), could be reduced.

Stakeholder theory acknowledges that not all stakeholders are equally important and suggests that managerial decisions, including corporate governance, are likely to prioritize the interests of the most influential stakeholders ([Nishitani et al., 2021](#)). Therefore, if a company's primary stakeholders are motivated to enhance its environmental performance and disclosure, the firm's corporate governance would be effective in reducing the asymmetry between the company's actual environmental performance and its potentially overstated disclosure.

However, shareholders may perceive environmental initiatives as costly and view these endeavors as unnecessary drains on company resources ([Kim and Lyon, 2015](#)). Furthermore, there is an argument that CSR activities may benefit other stakeholders at the expense of shareholders ([Sun et al., 2023](#)), creating potential conflicts within the board and management. These conflicts could render corporate governance structure ineffective in mitigating the gap between overstated environmental reporting and actual environmental performance.

Given the lack of prior empirical findings and theoretical predictions to explain the associations between Japanese corporate governance characteristics (corporate structure, board leadership, foreign share ownership, the independent director ratio and director variable compensation) and the extent of environmental greenwashing, the following null hypotheses *H2* are proposed:

-
- H2-1. Corporate structure (audit committees, corporate or statutory auditors and nomination committees) is not associated with the magnitude of the overstatement gap between environmental disclosure and performance (greenwashing).
- H2-2. Board leadership (chairperson, president/CEO or other directors) is not associated with the magnitude of the overstatement gap between environmental disclosure and performance (greenwashing).
- H2-3. The foreign shareholding ratio is not associated with the magnitude of the overstatement gap between environmental disclosure and performance (greenwashing).
- H2-4. The ratio of independent directors is not associated with the magnitude of the overstatement gap between environmental disclosure and performance (greenwashing).
- H2-5. Board variable compensation is not associated with the magnitude of the overstatement gap between environmental disclosure and performance (greenwashing).

2.3 External assurance of environmental disclosures

Over 50% of large and mid-cap firms invested in third-party assurance of sustainability information as of 2020, suggesting a growing demand for CSR assurance (Tsang *et al.*, 2023). Assuming that shareholders rely on disclosed information to make investment decisions, shareholders are incentivized to safeguard the reliability of the information disclosed by management (Bernow *et al.*, 2019; Ko, 2020; Leva, 2020). Nearly all investors surveyed (97%) in the 2019 McKinsey report on sustainability reporting stated that sustainability reports should be audited in some way, and 67% of the investors surveyed stated that these audits should be as rigorous as financial audits (Bernow *et al.*, 2019). Companies are motivated to assure their sustainability and integrated reports to gain legitimacy and improve their reputations, signal their sustainability performance and maintain good relationships with stakeholders (De Villiers *et al.*, 2022; Simoni *et al.*, 2020). The lack of assurance and disclosure standards for environmental disclosure enables greenwashing behavior to present a barrier for investors trying to integrate ESG factors into investment decisions (Yu *et al.*, 2020).

Investors can mitigate the risk of greenwashing by expanding their CSR assurance services (Brown-Liburd and Zamora, 2015). Regardless of a corporation's explicit performance assessment, the assurance of CSR information increases investors' perceptions of its reliability (Hoang and Trotman, 2021). Assurance services can minimize a firm's engagement in CSR activities that are performed merely for public relations purposes (Cohen and Simnett, 2015). Ballou *et al.* (2018) reported that CSR assurance improves reporting quality by identifying inaccuracies via restatements. Using three CSR disclosure assurance models, Maroun (2019) concluded that a higher frequency of assurance services, assurance engagements, and the use of Big 4 assurance firms are associated with higher-quality integrated reports.

However, the providers of assurance services still rely on the firm's management to provide evidence of environmental claims to verify the assertions made by the firm's management team, and assurance providers have difficulty verifying the completeness of CSR reporting. Prinsloo and Maroun (2021) developed a firm-level combined assurance quality measure and observed that although there was a slight improvement in quality from

2013 to 2017, the overall level of assurance quality was still relatively low. Thus, there is a risk that assurance providers may express misleading statements of assurance when the environmental disclosure information is materially misstated. The assurance services for nonfinancial information disclosure could be misused by companies committing greenwashing to earn illegitimate reputational capital (Casey and Grenier, 2015). Companies may engage an independent assurance provider to verify a carbon emissions report that significantly underestimates their actual emissions, potentially using the assurance received as a means to conceal subpar environmental performance instead of increasing transparency and reducing information asymmetry between the company and its stakeholders (Datt et al., 2018). High-quality assurance services could also be exploited to repair company legitimacy after media coverage of ESG misconduct (Emma et al., 2024).

Given the mixed empirical findings of studies examining the relationship between the assurance of environmental information and the extent to which it could mitigate the extent of greenwashing (overstatement of a firm's environmental disclosure relative to its environmental performance), the following null hypothesis *H3* is formed:

H3. Environmental disclosure assurance is not associated with the magnitude of the overstatement gap between environmental disclosure and performance (greenwashing).

3. Research method

3.1 *A measure of the environmental disclosure and performance gap and greenwashing*
Stakeholder theory posits that companies have a moral obligation to fulfill the interests of all stakeholders, not just shareholders, and that growing firms face increased pressure to maintain legitimacy with stakeholders (Holder-Webb et al., 2009; Kim and Lyon, 2015). Companies prioritize the interests of their most significant stakeholders when making decisions, including those related to environmental disclosures (Nishitani et al., 2021). Assuming that major stakeholders are interested in promoting sustainability, management is incentivized to allocate resources to develop systems that enable them to fulfill stakeholders' interests and provide reports that faithfully represent real performance (KPMG, 2022).

However, when stakeholders prioritize financial performance over environmental sustainability because of the perceived high costs of environmental initiatives (Kim and Lyon, 2015), management may engage in corporate reporting that does not accurately reflect their actual environmental practices. This discrepancy between environmental disclosures and practices can be attributed to management's desire to gain legitimacy and meet stakeholders' expectations regarding environmental responsibility, even when their actions do not substantially improve the company's environmental performance (Ramanna, 2013). Consequently, the gap between environmental disclosures and practices arises when management attempts to satisfy conflicting stakeholder demands between environmental sustainability and financial performance.

In line with stakeholder theory, our study employs the measure proposed by Yu et al. (2020) to calculate the magnitude of the environmental disclosure and performance gap. This measure, as shown in equation (1), is used to indicate the propensity and magnitude of greenwashing:

$$\begin{aligned} & \text{Environmental Disclosure and Performance Gap (DPG}_{it}) = \\ & \text{Environmental Disclosure Score (EDS}_{it}) - \text{Environmental Performance Score (EPS}_{it}) \end{aligned} \tag{1}$$

A positive *DPG* score for a firm indicates the extent of that firm's greenwashing behavior, where these companies overstated their environmental disclosures relative to their performance. This classification is consistent with the definition of greenwashing, in which a company's environmental performance is negatively associated with its environmental disclosure (Delmas and Burbano, 2011; Lyon and Maxwell, 2011). Accordingly, the greenwashing (GS) dummy variable is set to one if a company has a positive *DPG* value, and 0 otherwise.

3.2 Environmental disclosure score

Disclosures of environmental information for listed companies in statutory securities reports have not been widely mandated because capital market investors have shown negative market reactions when disclosures are mandated (Healy and Serafeim, 2020). This study employed climate change disclosure scores published by the CDP Climate Change Survey (formerly known as the Carbon Disclosure Project) as a measure of corporate environmental disclosure. Saka and Oshika (2014) employed the CDP response data of Japanese firms as a proxy for the disclosure of carbon management practices. The disclosure of environmental performance as measured by the CDP Climate Change Survey is voluntary, thus mitigating concerns regarding specific regulatory reporting requirements that might exist in certain industries (Marquis et al., 2016). The CDP scoring methodology is based on the responses of individual companies to a standardized threshold.

The CDP climate change score is an assessment of the comprehensiveness of the disclosure information of the responding companies designed to measure the company's awareness, management methods, and action on climate change issues (CDP, 2018). The CDP climate change score measures a company's progress toward establishing environmental issue leadership (CDP, 2019). The final letter grade (A, A –, B, B –, C, C –, D and D –) is awarded on the basis of the score obtained at the highest achieved level. The CDP disclosure scores are based on the results of standardized questionnaires, which have several advantages over other ESG rating providers compiled from publicly available sources. These benefits include more consistent data, greater comparability and consistency, reduced self-selection bias, and greater homogeneity in within-country studies (Luo and Tang, 2016). Prior studies have employed CDP scores as a proxy for carbon disclosure transparency, which measures the magnitude and details of the disclosed carbon emission information (Luo and Wu, 2019).

In our study, corporate environmental disclosure is measured by calculating the environmental disclosure score (EDS) variable adapted from Hummel and Schlick (2016). The EDS represents the normalized value of a company's environmental information disclosure relative to other companies in the same industry in the same fiscal year. The steps involved in the EDS calculation are as follows. First, a minimum of five companies per industry per fiscal year are needed to define reasonable peer groups. Second, the CDP climate change scores of individual companies are arranged by industry group and fiscal year. Third, the EDS value is calculated by transforming the CDP climate change letter grades into a continuous [0, 1] scale per industry group and fiscal year. To this end, we assign 0 to the worst (D- grade) and 1 to the best (A grade) CDP climate change scores and proportionally rescale the other grades. The rescaling of the EDS into a continuous variable allows for comparison and aggregation of the disclosure performance levels of companies across different industry groups and fiscal years. An illustration of the EDS calculations is provided in Appendix 2.

3.3 Environmental performance score

In our study, environmental performance is measured via information published in the Nikkei ESG database. The Nikkei ESG database confirms, records and maintains companies’ nonfinancial information publicly disclosed from sources such as integrated reports and sustainability reports (Nikkei, 2022). Since the 2006 fiscal year, Japanese legislation has mandated the public disclosure of company-specific greenhouse gas emission data. This mandatory reporting provides emission data that are free from the sampling bias and endogeneity issues that may affect voluntarily disclosed emission information (Saka and Oshika, 2014). The environmental performance of a company is measured by calculating the environmental performance score (EPS) variable adapted from Hummel and Schlick (2016). The EPS denotes the normalized value of the company’s environmental performance relative to other companies in the same industry in the same fiscal year.

The steps for calculating the EPS are as follows. First, a minimum of five companies per industry per fiscal year are needed to define reasonable peer groups. Second, two relevant environmental performance indicators for each company are employed: emissions (the sum of Scope 1 and 2 greenhouse gas emissions measured in tons of carbon dioxide) and energy consumption (measured in terajoules). The environmental performance indicators for water and waste are excluded because of the unavailability of water and waste-specific questions in the CDP climate change survey. Third, environmental performance indicators are scaled by total assets and used as a proxy for company size. Fourth, the emission and energy consumption performance values of individual companies are normalized into continuous [0, 1] scales per industry group and fiscal year, where 0 is assigned to the highest emission and energy consumption indicator value and 1 is assigned to the lowest emission and energy consumption indicator value, while all other values are rescaled proportionally. Firms with missing emission and energy consumption indicators are assigned a value of 0. Fifth, the EPS value was calculated as the arithmetic mean of the normalized GHG and ENE indicators. Consistent with the EDS variable, rescaling the EPS variable enables comparison and aggregation of companies’ environmental performance levels across different industry groups and fiscal years. Appendix 3 illustrates the EPS calculations.

3.4 Sample selection

Our sample consists of 455 firm-year observations of Japanese companies listed on the Tokyo Stock Exchange (TSE) that responded to the 2018 and 2019 CDP Climate Change survey. We exclude 35 observations with missing financial statements and corporate governance variables to arrive at 420 firm-year observations for the final sample. The final sample comprises 234 unique companies distributed across 19 industries. The numbers of samples for the 2018 and 2019 fiscal years were 190 and 230, respectively. The sample selection process is shown in Table 1.

Table 1. Sample selection

Firms listed on the TSE that responded to the 2018 and 2019 CDP Climate Change surveys	455
– Firms missing financial variables and corporate governance variables	–35
Final sample (firm-years)	420
Distribution of final sample per fiscal year: 2018 = 190 firm-years, 2019 = 230 firm-years	

Notes: Number of unique companies within the 420 firm-years final sample (fiscal year 2018 and 2019): 234 firms

We employ samples from the 2018 and 2019 fiscal years to control for the changes in the CDP climate change scoring methodology in 2016 and 2018 and the effects of COVID-19 on disclosures from 2020. In 2016, the CDP fundamentally changed the scoring approach; thus, the scores before 2016 are not directly comparable to those after 2016 (CDP, 2016). Starting from the 2018 questionnaires, the CDP implemented the TCFD's recommendations to develop sector-specific questions relevant to high-impact sectors [1] (CDP, 2017, 2019). In addition, the CDP adjusted the thresholds for the questionnaire scoring criteria in 2018, 2020, and 2021, which affected the ranking of the disclosure scores (CDP, 2018, 2020, 2021). An analysis of the CDP climate change scoring methodology in the 2019 report revealed that the general scoring thresholds are comparable to those of the 2018 scores (CDP, 2019, 2020).

3.5 Empirical model

We examined the relationship between the probability of greenwashing and environmental performance, as described in hypothesis *H1*, by estimating the probit/logit regression model described in equation (2). The probit/logit model is appropriate for testing binary response data, ensuring that the estimated probabilities lie between zero and one (Wooldridge, 2020). Lyon and Maxwell (2011) argued that firms with an uncertain probability of beneficial environmental outcomes are more likely to engage in partial disclosures. This study estimates the *DPG* [equation (1)] variable to model a firm's propensity to engage in greenwashing as a binary choice, making the probit/logit model appropriate for testing *H1*, which is based on Lyon and Maxwell's (2011) probability-driven cost–benefit drivers of greenwashing.

The dependent variable employs a greenwashing classification dummy variable (*GS*) that is set to 1 if the company engages in greenwashing behavior and 0 otherwise. We employed the maximum likelihood estimation of a probit/logit regression model because values of the dependent variable are binary. Probit specification is more commonly employed in multivariate contexts because the flexibility of a multivariate normal distribution is attractive and useful compared with a multivariate logistic distribution (Verbeek, 2022). We also employ the logit model to ensure the robustness of our estimation results since the logit and probit models provide similar results (Wooldridge, 2020). The inclusion of firm fixed effects in the probit/logit model controls for a time-invariant source of endogeneity under the assumption that firms change status over time within the sample period (Verbeek, 2022). Random effects are employed in equation (2) because there is minimal variation in the outcome variable (*GS* variable) for the sampled firms.

The variable of interest is the *EPS* variable, which is aimed at evaluating alternative hypothesis *H1*, which argues for a negative association between the probability of *GS* and the extent of *EPS*. Both variables are discussed in Section 3. Appendix 1 summarizes the definitions and measurements of the variables used in equation (2):

$$\begin{aligned} \Pr(GS_{it} = 1 | \cdot) = \Phi[& \alpha_0 + \alpha_1 EPS_{it} + \alpha_2 ASR_{it} + \alpha_3 ORG_{it} + \alpha_4 LEV_{it} + \alpha_5 CAP_{it} \\ & + \alpha_6 FORN_{it} + \alpha_7 R\&D_{it} + \alpha_8 GAAP_{it} + \alpha_9 IMP_{it} + e_{it}] \end{aligned} \quad (2)$$

The following independent variables control for factors that affect the expected cost and benefits of greenwashing (Lyon and Maxwell, 2011). Companies planning to engage in greenwashing must consider the risk that the market is aware that such disclosures can be overly optimistic or present positive environmental news that is typically not assured (Peters and Romi, 2015). When CSR reports do not receive third-party assurance, the extent of a

firm's CSR disclosure is not associated with that firm's higher CSR performance (Du and Wu, 2019). Thus, the ASR variable controls for the availability of third-party assurance on environmental (emission) disclosures. The ORG variable controls the extent to which a company's organizational structure can support climate-related goals through a four-point rating scale, following the work of Ruhnke and Gabriel (2013) [2]. Companies with low ORG ratings represent organizations with low strategic priority toward environmental concerns and are thus more likely to commit greenwashing. The LEV (leverage) variable controls the demand for nonfinancial information disclosure from creditors (Clarkson et al., 2011). Companies with a higher LEV receive greater pressure from creditors and are thus less likely to commit greenwashing.

Prior studies have employed business exposure to foreign markets as a proxy for pressure from institutional stakeholders, which could affect the potential for selective disclosure (Marquis et al., 2016). Capital intensity (CAP) and the foreign sales ratio (FORN) are used to control for environmental impact, pressure from institutional stakeholders and intraindustry variation, which affect the likelihood of selective disclosure. The research and development (R&D) variable proxies for a company's agency and monitoring costs and thus represents the pressure to engage in selective disclosure (Yu et al., 2020). The international accounting standards (GAAP) variable proxies for international stakeholder pressure, as companies listed on foreign exchanges are less likely to conduct greenwashing than companies listed only in the domestic capital market (Marquis et al., 2016).

Companies operating in more environmentally sensitive industries face greater pressure from stakeholders and regulators to limit the negative externalities of their business operations. When these companies disclose sustainability reports, their motivations are likely to be perceived as disingenuous and self-serving (Brown et al., 2009). Stakeholders consider external assurance by third parties for companies in environmentally sensitive industries to improve the reliability of sustainability reporting (Herremans and Nazari, 2016). Marquis et al. (2016) find that firms that engage in environmentally damaging industries that operate in countries with strict regulations are less likely to engage in greenwashing. The IMP (environmental impact) variable controls for 11 industries with high environmental impact, namely, the chemical; cement; transport engine part manufacturers; electric utilities; food, beverage, and tobacco; metals and mining; oil and gas; transport original equipment manufacturers; paper and forestry; transport services; and steel industries (CDP, 2019, 2020).

We examine the relationships among the magnitude of greenwashing/positive environmental disclosure, the performance gap (DPG), a vector of firm-level corporate governance factors (CGStr, CGLed, CGFor, CGDir, and CGVar), and third-party assurance on emission disclosures (ASR), as shown in equation (3), to evaluate the second set of hypotheses (H2). The greenwashing classification dummy variable (GS) identifies companies with positive (overstated) environmental disclosures and performance gaps. The interaction variable between GS and ASR measures whether the greenwashing indicator is affected by the third-party assurance received by a company. The regression model illustrated in equation (3) incorporates fixed-effects estimators to control for time-invariant unobserved heterogeneity between firms (Verbeek, 2022). Thus, firm and time fixed effects estimators are employed to control for unobservable differences in individual firm characteristics and changes in regulatory or macroeconomic conditions, respectively. Heteroscedasticity-robust standard errors are employed in the estimation of fixed effects (Torres-Reyna, 2007). The definitions and measurements of the variables included in equation (3) are summarized in Appendix 1:

$$\begin{aligned} DPG_{it} = & \alpha_0 + \alpha_n CG_{factors_{it}} + \alpha_2 ASR_{it} + \alpha_3 GS_{it} + \alpha_4 GS_{it} \times ASR_{it} + \alpha_5 ORG_{it} \\ & + \alpha_6 SIZE_{it} + \alpha_7 LEV_{it} + \alpha_8 LIQ_{it} + \alpha_9 ROA_{it} + \alpha_{10} CAP_{it} \\ & + \alpha_{11} FORN_{it} + \alpha_{12} R\&D_{it} + e_{it} \end{aligned} \quad (3)$$

We include several control variables taken from prior empirical studies as determinants of the extent of greenwashing (Aroui *et al.*, 2021; Marquis *et al.*, 2016; Yu *et al.*, 2020). Several firm-level control variables, such as *ASR*, *ORG*, *LEV*, *CAP*, *FORN*, and *R&D*, are also employed as control variables in the probit/logit model (equation (2)). The interaction term between *GS* and *ASR* is employed to estimate whether the greenwashing indicator can affect the moderating relationship between assurance and the magnitude of the gap between disclosure and performance. The *SIZE* variable controls for firm size, as prior empirical studies show a positive association between company size and sustainability disclosure (Aroui *et al.*, 2021; Hummel and Schlick, 2016; Marquis *et al.*, 2016; Yu *et al.*, 2020). The liquidity (*LIQ*) and profitability (*ROA*) variables measure the ability to fulfill short-term obligations and the efficiency of assets in generating profit, respectively. These two variables represent the firm-level characteristics that can influence a company's strategic decisions, cost–benefit considerations, and capacity for responding to stakeholder pressure to engage in greenwashing (Delmas and Burbano, 2011).

We performed the Shapiro–Wilk *W* test to evaluate whether the residual of the regression model [equation (3)] was normally distributed. The *p* value results of the tests using the sample employed to estimate the results presented in Tables 4 and 5 are 0.01945 and 0.22098, respectively. The findings are not significant at the 1% level (*p*-value > 1%), indicating that we are unable to reject the null hypothesis that the data are from a normally distributed population. We also calculate the variance inflation factor (VIF) for the regression model, and the mean values of the VIF for Tables 4 and 5 are 1.85 and 1.37, respectively. These VIF values indicate a lack of correlation among the independent variables.

Since the Shapiro–Wilk *W* test is appropriate for the normality distribution assumption for regressions that employ continuous data, we performed Hosmer–Lemeshow tests to evaluate the goodness of fit of the probit/logit model and checked for specification errors via the link test. The Prob > chi2 values of the Hosmer–Lemeshow test for the probit and logit models are 0.7780 and 0.3490, respectively, and the insignificant statistical test results indicate a good fit of our model (Stata, 2023a). The link test's *p* value results for the probit model for each of the test coefficients are *_hat* = 0.000, *_hatsq* = 0.445, and *_cons* = 0.812. The statistically significant values of these coefficients indicate that the logistic model is correctly specified (Stata, 2023b). When the same link test is performed for the logit model, the results are consistent with those of the probit model (*_hat* = 0.000, *_hatsq* = 0.390, and *_cons* = 0.800).

4. Results

Descriptive statistics regarding environmental disclosures, performance, the disclosure performance gap and other firm-level control variables are presented in Table 2. The table displays the results for observations with equal or understated environmental disclosures relative to their actual environmental performance levels (Column 1), those that indicate greenwashing and show higher environmental disclosures than their environmental performance levels (Column 2), and the results from all observations (Column 3). The overall sample shows that 322 firm-years of observations in the sample (76.7% of the total

Table 2 Descriptive statistics

Variables	Observations with equal or understated environmental disclosure to performance gap (98 firm years) (1)		Observations with overstated environmental disclosure to performance gap (322 firm years) (2)		Total observations (420 firm years) (3)		Two-sample <i>t</i> test <i>p</i> -value
	Mean	SD	Mean	SD	Mean	SD	
<i>EDS</i>	0.212	0.310	0.731	0.204	0.610	0.320	0.000***
<i>EPS</i>	0.428	0.356	0.174	0.186	0.233	0.259	0.000***
<i>DPG</i>	0.216	0.250	0.557	0.256	0.477	0.293	0.000***
<i>CGStr</i>	0.724	0.449	0.767	0.423	0.757	0.429	0.406
<i>CGLed</i>	0.480	0.502	0.370	0.483	0.395	0.489	0.057
<i>CGFor</i>	0.500	0.503	0.484	0.501	0.488	0.500	0.789
<i>CGDir</i>	0.318	0.128	0.345	0.123	0.339	0.125	0.065
<i>CGVar</i>	0.288	0.159	0.305	0.145	0.301	0.148	0.357
<i>ASR</i>	0.378	0.487	0.711	0.454	0.633	0.482	0.000***
<i>ORG</i>	1.816	1.271	2.264	1.086	2.160	1.146	0.002**
<i>LEV</i>	2.198	5.888	1.703	16.860	1.819	15.028	0.657
<i>CAP</i>	0.340	0.202	0.351	0.207	0.348	0.205	0.640
<i>FORN</i>	0.722	1.713	1.349	3.527	1.203	3.206	0.017*
<i>R&D</i>	0.023	0.028	0.028	0.036	0.026	0.034	0.186
<i>GAAP</i>	0.235	0.426	0.484	0.501	0.426	0.495	0.000***
<i>IMP</i>	0.214	0.412	0.264	0.441	0.252	0.435	0.306
<i>SIZE</i>	13.569	1.147	13.893	0.966	13.817	1.019	0.012*
<i>LIQ</i>	2.059	1.049	1.899	0.987	1.937	1.003	0.183
<i>ROA</i>	0.046	0.038	0.050	0.051	0.049	0.049	0.382

Notes: *, **, and *** represent statistical significance at the 10, 5 and 1% levels, respectively

sample) indicate firms' engagement in positive greenwashing, which is reflected in their higher *EDSs* relative to their *EPSs*.

The untabulated Pearson correlation coefficient between *EDS* and *EPS* is very low (−0.02). The results displayed in Table 2 show that the mean value of the *DPG* variable (which measures the extent of greenwashing) indicates that the disclosure and performance gap is greater for firms with an indication of greenwashing (0.557) than for those without an indication of greenwashing (0.216). Of the 98 firm-years (23.3% of the total sample) of observations that do not indicate greenwashing, nine (2.1% of the total sample) show indications of equal environmental disclosure and performance ratios (companies with zero *DPG* variables).

The mean differences between the observations that indicate greenwashing (Column 2) and those that indicate no greenwashing (Column 1) are calculated via the two-sample *t* test. There are no significant differences in the mean values for the corporate governance variables (*CGStr*, *CGLed*, *CGFor*, *CGDir* and *CGVar*). The mean values of the assurance (*ASR*) and international accounting standards (*GAAP*) dummy variables are significantly greater for companies with indications of greenwashing than for those without such indications. Without the *ceteris paribus* assumption, these results suggest that greenwashing companies are more likely to obtain third-party assurance for their environmental disclosures and to implement non-Japanese accounting standards.

Table 3 presents the probit/logit regression estimation results of equation (2) to evaluate *H1*, where the greenwashing dummy variable (*GS*) is regressed on the *EPS* for all companies. The results displayed in Table 3 show that the environmental performance score is statistically significant and negatively associated with the predicted probability of greenwashing, providing evidence that we are unable to reject the alternative hypothesis *H1*. Our findings show that the greenwashing measure employed in our study behaves in a manner consistent with prior empirical findings (Birkey *et al.*, 2017; Doan and Sassen, 2020; Gödker and Mertins, 2018; Mahoney *et al.*, 2013), which posit that companies with poor environmental performance are more likely to commit greenwashing. The statistically

Table 3 Greenwashing dummy variable (*GS* as the dependent variable) and environmental performance score (*EPS*) probit and logit regression estimation results

Variables	Probit model		Logit model	
	Coef.	<i>p</i> -value	Coef.	<i>p</i> -value
<i>Constant</i>	1.699	0.012**	3.032	0.012**
<i>EPS</i>	−4.749	0.000***	−8.556	0.000***
<i>ASR</i>	1.483	0.002***	2.659	0.003***
<i>ORG</i>	−0.058	0.733	−0.099	0.744
<i>LEV</i>	−0.005	0.587	−0.009	0.572
<i>CAP</i>	−1.625	0.108	−2.906	0.112
<i>FORN</i>	0.031	0.678	0.058	0.666
<i>R&D</i>	5.316	0.442	9.820	0.436
<i>GAAP</i>	1.116	0.017**	2.006	0.020**
<i>IMP</i>	0.425	0.384	0.764	0.387
Obs.	420			
Random effects	Yes			

Notes: *, ** and *** represent statistical significance at the 10, 5 and 1% levels, respectively

significant positive estimate of the *ASR* variable implies that companies with third-party assurance have a greater probability of engaging in greenwashing.

Table 4 presents the regression estimation results of equation (3) for all observations to test Hypothesis *H2*, where the magnitude of the greenwashing/positive environmental disclosure and performance gap (*DPG*) is regressed on corporate governance variables (*CGStr*, *CGLed*, *CGFor*, *CGDir* and *CGVar*), environmental information assurance (*ASR*) and other control variables. The statistically significant and positive coefficients of the *GS* dummy variable show that companies with greenwashing indications have greater environmental disclosure and performance gaps, *ceteris paribus*. This interpretation is consistent with the higher mean value of *DPG* for greenwashing companies, as shown in Table 4. The statistically nonsignificant interaction coefficient between *GS* and *ASR* suggests that the presence of assurance does not affect or moderate the relationship between greenwashing indications and the magnitude of the disclosure and performance gap.

Table 5 presents the estimation results of equation (3) for observations with overstated environmental disclosure-to-performance ratios or for companies with greenwashing indications. The results show that 322 observations (76.7% of the total sample) had implications for greenwashing. This result confirms the anecdotal evidence from Refinitiv's survey of institutional investors regarding the widespread prevalence of greenwashing behavior (Ko, 2020). The estimated coefficient results in Table 5 show that the relationships between all corporate governance variables and the magnitude of the environmental disclosure and performance gap (*DPG* as the dependent variable) are statistically nonsignificant for observations indicating greenwashing. These results suggest that Japanese corporate governance characteristics are ineffective at mitigating greenwashing and provide evidence that we are unable to reject the null hypothesis *H2*. The positive and statistically significant coefficient of the assurance on emissions variable (*ASR*) suggests that the magnitude of environmental disclosure overstatement (greenwashing) increases for companies that receive such third-party assurance. This result provides evidence for rejecting the null hypothesis *H3*.

5. Discussion of the results

The empirical results show that environmental performance has a negative relationship with the probability of engaging in greenwashing after controlling for the expected cost and benefits of greenwashing. This finding aligns with Lyon and Maxwell's (2011) argument that firms with poor environmental performance are more likely to engage in greenwashing. These companies tend to participate in environmental actions that harm the environment, making them more inclined to engage in partial disclosures of success through greenwashing to improve their public perception. The results confirm the reliability of the greenwashing measure used in the study, which captures the extent to which companies overstate their environmental disclosures relative to their actual performance. This interpretation is consistent with prior studies, which have shown that companies with below-average environmental performance are more likely to greenwash their disclosures to protect their reputations and mislead public perception (Birkey *et al.*, 2017; Doan and Sassen, 2020; Gödker and Mertins, 2018; Mahoney *et al.*, 2013).

We find that Japanese firm-level corporate governance characteristics—corporate structure, board leadership, foreign share ownership, the ratio of the board's independent directors and the ratio of directors' variable compensation—are not associated with the magnitude of the environmental disclosure and performance overstatement gap. Thus, we can infer that the existing corporate governance structures implemented by Japanese firms are ineffective in mitigating greenwashing behavior. The ineffective role of Japanese

Table 4. The environmental disclosure and performance gap (*DPG* as the dependent variable), corporate governance variables and assurance (*ASR*) regression estimates results for all observations

Variables	<i>CGStr</i>		<i>CGLed</i>		<i>CGFor</i>		<i>CGDir</i>		<i>CGVar</i>		<i>All CG vars.</i>	
	Coef.	p-val.	Coef.	p-val.	Coef.	p-val.	Coef.	p-val.	Coef.	p-val.	Coef.	p-val.
<i>Constant</i>	1.125	0.720	1.694	0.596	1.152	0.720	0.786	0.796	1.133	0.719	1.054	0.732
<i>CGStr</i>	0.098	0.079*									0.159	0.026**
<i>CGLed</i>			0.097	0.172							0.084	0.241
<i>CGFor</i>					-0.036	0.556					-0.051	0.381
<i>CGDir</i>							0.388	0.159			0.599	0.029**
<i>CGVar</i>									-0.051	0.706	-0.028	0.835
<i>ASR</i>	-0.021	0.842	-0.000	0.997	0.004	0.966	0.010	0.928	-0.001	0.989	-0.025	0.816
<i>GS</i>	0.153	0.035**	0.154	0.037**	0.159	0.027**	0.162	0.022**	0.160	0.026**	0.143	0.049**
<i>GS × ASR</i>	0.104	0.262	0.089	0.338	0.081	0.375	0.076	0.413	0.085	0.354	0.109	0.239
<i>ORG</i>	-0.008	0.753	-0.004	0.887	-0.009	0.718	-0.004	0.862	-0.007	0.778	-0.002	0.915
<i>SIZE</i>	-0.070	0.746	-0.108	0.624	-0.066	0.766	-0.052	0.807	-0.064	0.766	-0.083	0.698
<i>LEV</i>	0.001	0.003***	0.001	0.002***	0.001	0.002***	0.001	0.008***	0.001	0.003***	0.001	0.020**
<i>Liq</i>	0.037	0.360	0.031	0.449	0.032	0.428	0.031	0.464	0.030	0.450	0.039	0.334
<i>ROA</i>	-0.163	0.566	-0.143	0.608	-0.115	0.694	0.004	0.989	-0.115	0.694	-0.028	0.923
<i>CAP</i>	0.020	0.961	-0.019	0.961	0.055	0.894	0.078	0.840	0.048	0.904	-0.002	0.996
<i>FORN</i>	0.016	0.004***	0.016	0.004***	0.015	0.009***	0.016	0.004***	0.015	0.008***	0.018	0.000***
<i>R&D</i>	0.012	0.994	0.080	0.957	-0.074	0.963	-0.110	0.943	0.033	0.983	-0.137	0.925
Obs.	420		420		420		420		420		420	
Adj. <i>R</i> ²	0.206		0.214		0.201		0.208		0.199		0.241	
Firm FE	Yes											
Year FE	Yes											

Notes: *, ** and *** represent statistical significance at the 10, 5 and 1% levels, respectively

Table 5 The environmental disclosure and performance gap (DPG as the dependent variable), corporate governance variables and assurance (ASR) regression estimates results for observations with overstated environmental disclosure to performance gap (greenwashing)

Variables	CGStr		CGLed		CGFor		CGDir		CGVar		All CG vars.	
	Coef.	p-val.	Coef.	p-val.	Coef.	p-val.	Coef.	p-val.	Coef.	p-val.	Coef.	p-val.
Constant	-1.121	0.689	-0.618	0.824	-1.097	0.700	-1.094	0.702	-0.785	0.780	-0.858	0.768
CGStr	0.067	0.351									0.114	0.184
CGLed			0.061	0.228							0.051	0.296
CGFor					-0.045	0.346					-0.055	0.278
CGDir							0.082	0.736			0.322	0.300
CGVar									0.184	0.214	0.199	0.176
ASR	0.097	0.031**	0.099	0.029**	0.100	0.028**	0.098	0.031**	0.102	0.023**	0.099	0.034**
ORG	-0.012	0.633	-0.007	0.793	-0.010	0.682	-0.011	0.658	-0.012	0.605	-0.006	0.814
SIZE	0.101	0.602	0.068	0.725	0.104	0.596	0.101	0.607	0.077	0.691	0.066	0.740
LEV	0.001	0.018**	0.001	0.015**	0.001	0.014**	0.001	0.018**	0.001	0.004***	0.001	0.013**
Liq	0.052	0.214	0.045	0.280	0.048	0.252	0.045	0.282	0.047	0.271	0.057	0.180
ROA	-0.059	0.811	-0.049	0.843	-0.035	0.890	-0.010	0.971	-0.027	0.916	-0.014	0.960
CAP	0.059	0.877	0.023	0.950	0.097	0.803	0.073	0.848	0.047	0.902	0.041	0.915
FORN	0.007	0.338	0.007	0.328	0.006	0.414	0.007	0.368	0.007	0.326	0.010	0.157
R&D	1.292	0.272	1.239	0.293	1.172	0.338	1.234	0.293	1.139	0.345	0.886	0.455
Obs.	322		322		322		322		322		322	
Adj. R ²	0.132		0.137		0.132		0.129		0.134		0.156	
Firm FE	Yes											
Year FE	Yes											

Notes: *, **and ***represent statistical significance at the 10, 5 and 1% levels, respectively

corporate governance in mitigating greenwashing suggests that Japanese firms indicated as being involved in greenwashing are unlikely to face significant domestic pressure to representatively report adverse performance. Several factors might contribute to this outcome. Japanese institutional, political and regulatory characteristics contribute to more intense market competition, which in turn adversely affects Japanese companies' motivation to improve their ESG performance (Ioannou and Serafeim, 2012). Compared with US companies, Japanese companies do not seem to take the interests of a wide range of stakeholders into account when measuring and evaluating ESG indicators and performance, which contributes to the insufficient monitoring of disclosed ESG information (Otomasa *et al.*, 2022). Environmentally damaging firms are likely to engage in selective disclosure when headquartered in countries with weaker civil society activism (Marquis *et al.*, 2016).

Third-party assurance of environmental information, particularly emissions data, aims to minimize the information asymmetry gap between companies and stakeholders (Du and Wu, 2019). However, firms might hire an external assurer to certify a carbon emissions report that is substantially understated, in which case the assurance might hide poor performance rather than narrow the information asymmetry (Datt *et al.*, 2018). Our study reveals that companies with assurance have a greater probability of engaging in greenwashing and that assurance carries the risk of being exploited as a tool for amplifying the extent of their environmental disclosure and performance overstatement gap (greenwashing). Assurances regarding emission disclosures that are intended to promote the credibility of environmental information are likely to be exploited by companies with a greater propensity for using greenwashing as a tool for earning illegitimate credibility or a reputation for being environmentally responsible.

6. Conclusions

Regulators have argued that the disclosure of sustainability information should be subject to external assurance (IFRS Foundation, 2020). A firm's engagement in greenwashing does not constitute illegal behavior because current environmental disclosure regulations provide a large degree of discretion for companies on how they choose to report such information. Although Japan is among the countries with the fastest growth and has the highest number of companies that issue ESG information in the world (KPMG, 2021), no study has investigated the effects of Japanese corporate governance characteristics and third-party environmental disclosure assurance on greenwashing in the literature. This study investigated how the relationships among environmental performance, the probability of greenwashing and the effectiveness of corporate governance characteristics and assurance mitigate greenwashing among Japanese firms. The three main findings of this research and their implications are as follows.

First, our study provides empirical evidence that the probability of committing greenwashing is negatively associated with environmental performance, which is consistent with Lyon and Maxwell's (2011) cost-benefit factors of greenwashing. The practical implications of this conclusion are significant for regulators and investors who rely on environmental disclosures to make informed decisions. The finding that companies with poor environmental performance are more likely to engage in greenwashing highlights the need for increased scrutiny and skepticism from investors when evaluating environmental disclosures, particularly from companies with a history of poor environmental performance. This is particularly important given the increasing demand for ESG investments and the potential for using greenwashing to mislead investors (Yu *et al.*, 2020). In the context of Japanese regulators in particular, the imminent adoption of the Sustainability Disclosure Universal Standards and the Sustainability Disclosure Theme-specific Standards in Japan

(SSBJ, 2024) presents an opportunity to incorporate measures to mitigate greenwashing and enhance the reliability of environmental disclosures.

Second, the study revealed that Japanese corporate governance characteristics—corporate structure, board leadership, foreign share ownership, the board's independent director ratio and the director's variable compensation ratio—are ineffective in mitigating greenwashing. The ineffectiveness of current corporate governance characteristics in reducing greenwashing could reduce the reliability and usefulness of sustainability information in decision-making (Hoang and Trotman, 2021). This can lead to the misallocation of resources and hinder the ability of stakeholders to hold companies accountable for their environmental performance. Japanese companies should consider strengthening their corporate governance frameworks to ensure the effective oversight of environmental disclosure and performance. This can include measures such as increasing board diversity, appointing directors with sustainability expertise, and establishing dedicated sustainability committees (Li *et al.*, 2023). Additionally, companies should prioritize stakeholder engagement and consider their interests in decision-making processes to align their environmental practices with societal expectations (Nishitani *et al.*, 2021).

Third, our study reveals that companies indicated as engaging in greenwashing have been shown to utilize environmental information assurance to magnify the degree of their environmental disclosure and performance gap. Stakeholders, including investors, customers and regulators, may place undue trust in assured environmental information, assuming that it has undergone rigorous verification. However, if assurance can be misused to legitimize greenwashing, stakeholders may be misled into making decisions on the basis of inaccurate or overstated environmental performance (Casey and Grenier, 2015). This finding highlights the need for more robust and independent assurance processes. Assurance providers should employ more rigorous verification procedures and maintain a high level of professional skepticism to detect and prevent the misuse of assurance (Datt *et al.*, 2018). In particular, assurance providers should consider assigning a greater risk of greenwashing when providing services to companies with a history of poor environmental performance. Regulators and standard setters should consider implementing stricter guidelines and oversight mechanisms for environmental information assurance. The International Auditing and Assurance Standards Board (IAASB) should consider updating its assurance standards (ISAE 3000) to specifically address the risk of greenwashing. Stakeholders should also be more proactive in demanding greater transparency in assurance processes, questioning the independence of assurance providers, and advocating for stricter regulations and penalties for greenwashing (Datt *et al.*, 2018).

Prior research has reported weak correlations among the raters of companies' nonfinancial performance (Chatterji *et al.*, 2015). Although our study strived to ensure the internal consistency of the environmental disclosure measures published by the CDP, the EDS measure used in this study might be sensitive to changes in the data sets used as proxies for environmental disclosures. While this study aims to mitigate endogeneity concerns through the use of firm fixed effects to control for unobserved heterogeneity, we acknowledge that our analysis does not comprehensively address other potential sources of endogeneity, such as simultaneity or omitted variable bias. Furthermore, our study does not directly compare the relative strength or effectiveness of corporate governance mechanisms versus third-party assurance in preventing greenwashing. Third-party assurance and corporate governance need not be mutually exclusive and can serve as complementary forces in efforts to mitigate greenwashing. Future research could seek to further isolate the causality of greenwashing by exploiting exogenous shocks or utilizing instrumental variable approaches, although finding suitable instruments is nontrivial.

Notes

1. The high-impact sectors identified by the CDP survey are as follow: Chemicals; Cement; Transport Engine Part Manufacturers; Electric Utilities; Food, Beverage & Tobacco; Metals & Mining; Oil & Gas; Transport Original Equipment Manufacturer; Paper & Forestry; Transport Services; and Steel (CDP, 2019, 2020).
2. The highest-level management position(s) or committee(s) of company i 's total assets in year t with responsibility for climate-related issues, measured on a four-point rating scale: (0) data is not available; (1) a specialized manager or management meeting; (2) a specialized committee; (3) at least one member is a C-Suite officer, including an executive officer.

References

- Arouri, M., El Ghouli, S. and Gomes, M. (2021), "Greenwashing and product market competition", *Finance Research Letters*, Vol. 42, p. 101927, doi: [10.1016/j.frl.2021.101927](https://doi.org/10.1016/j.frl.2021.101927).
- Ballou, B., Chen, P.C., Grenier, J.H. and Heitger, D.L. (2018), "Corporate social responsibility assurance and reporting quality: Evidence from restatements", *Journal of Accounting and Public Policy*, Vol. 37 No. 2, pp. 167-188, doi: [10.1016/j.jaccpubpol.2018.02.001](https://doi.org/10.1016/j.jaccpubpol.2018.02.001).
- Bernow, S., Godsall, J., Klempner, B. and Merten, C. (2019), *More than Values: The Value-Based Sustainability Reporting That Investors Want*, McKinsey and Company, p. 9.
- Birkey, R.N., Guidry, R.P. and Patten, D.M. (2017), "Does CSR reporting really impact FERCs?", *Accounting and the Public Interest*, Vol. 17 No. 1, pp. 144-162, doi: [10.2308/apin-51921](https://doi.org/10.2308/apin-51921).
- Brown, D.L., Guidry, R.P. and Patten, D.M. (2009), "Sustainability reporting and perceptions of corporate reputation: an analysis using fortune", in Freedman, M. and Jaggi, B. (Eds), *Advances in Environmental Accounting and Management*, Vol. 4, Emerald Group Publishing Limited, pp. 83-104, doi: [10.1108/S1479-3598\(2010\)0000004007](https://doi.org/10.1108/S1479-3598(2010)0000004007).
- Brown-Liburd, H. and Zamora, V.L. (2015), "The role of corporate social responsibility (CSR) assurance in investors' judgments when managerial pay is explicitly tied to CSR performance", *AUDITING: A Journal of Practice and Theory*, Vol. 34 No. 1, pp. 75-96, doi: [10.2308/ajpt-50813](https://doi.org/10.2308/ajpt-50813).
- Casey, R.J. and Grenier, J.H. (2015), "Understanding and contributing to the enigma of corporate social responsibility (CSR) assurance in the United States", *AUDITING: A Journal of Practice and Theory*, Vol. 34 No. 1, pp. 97-130, doi: [10.2308/ajpt-50736](https://doi.org/10.2308/ajpt-50736).
- CDP (2016), *CDP Japan 500 Climate Change Report 2016*, Tokyo.
- CDP (2017), *CDP Climate Change Report 2017: Japan (in Japanese)*, Tokyo.
- CDP (2018), "CDP climate change 2018 scoring methodology".
- CDP (2019), *CDP Japan 500 Climate Change Report 2018*, Tokyo.
- CDP (2020), *CDP Japan 500 Climate Change Report 2019*, Tokyo.
- CDP (2021), *CDP Climate Change Report 2020: Japan (in Japanese)*, Tokyo.
- Chatterji, A.K., Durand, R., Levine, D.I. and Touboul, S. (2015), "Do ratings of firms converge? Implications for managers, investors and strategy researchers", p. 18.
- Clarkson, P.M., Overell, M.B. and Chapple, L. (2011), "Environmental reporting and its relation to corporate environmental performance", *Abacus*, Vol. 47 No. 1, pp. 27-60, doi: [10.1111/j.1467-6281.2011.00330.x](https://doi.org/10.1111/j.1467-6281.2011.00330.x).
- Cohen, J.R. and Simnett, R. (2015), "CSR and assurance services: a research agenda", *AUDITING: A Journal of Practice and Theory*, Vol. 34 No. 1, pp. 59-74, doi: [10.2308/ajpt-50876](https://doi.org/10.2308/ajpt-50876).
- Datt, R., Luo, L., Tang, Q. and Mallik, G. (2018), "An international study of determinants of voluntary carbon assurance", *Journal of International Accounting Research*, Vol. 17 No. 3, pp. 1-20, doi: [10.2308/jiar-52221](https://doi.org/10.2308/jiar-52221).

- De Villiers, C., Hsiao, P.-C.K., Zambon, S. and Magnaghi, E. (2022), "Sustainability, non-financial, integrated, and value reporting (extended external reporting): a conceptual framework and an agenda for future research", *Meditari Accountancy Research*, Vol. 30 No. 3, pp. 453-471, doi: [10.1108/MEDAR-04-2022-1640](https://doi.org/10.1108/MEDAR-04-2022-1640).
- Delmas, M.A. and Burbano, V.C. (2011), "The drivers of greenwashing", *California Management Review*, Vol. 54 No. 1, pp. 64-87, doi: [10.1525/cmr.2011.54.1.64](https://doi.org/10.1525/cmr.2011.54.1.64).
- Doan, M.H. and Sassen, R. (2020), "The relationship between environmental performance and environmental disclosure: a meta-analysis", *Journal of Industrial Ecology*, Vol. 24 No. 5, pp. 1140-1157, doi: [10.1111/jiec.13002](https://doi.org/10.1111/jiec.13002).
- Du, K. and Wu, S.-J. (2019), "Does external assurance enhance the credibility of CSR reports? Evidence from CSR-Related misconduct events in Taiwan", *Auditing: A Journal of Practice and Theory*, Vol. 38 No. 4, pp. 101-130, doi: [10.2308/ajpt-52418](https://doi.org/10.2308/ajpt-52418).
- Eccles, R.G., Krzus, M.P. and Solano, C. (2019), "A comparative analysis of integrated reporting in ten countries", *SSRN Electronic Journal*, doi: [10.2139/ssrn.3345590](https://doi.org/10.2139/ssrn.3345590).
- Emma, G.-M., Emiliano, R.-B. and Jennifer, M.-F. (2024), "High-quality assurance, ESG legitimacy threats and board effectiveness", *The British Accounting Review*, p. 101385, doi: [10.1016/j.bar.2024.101385](https://doi.org/10.1016/j.bar.2024.101385).
- Gödker, K. and Mertins, L. (2018), "CSR disclosure and investor behavior: a proposed framework and research agenda", *Behavioral Research in Accounting*, Vol. 30 No. 2, pp. 37-53, doi: [10.2308/bria-51976](https://doi.org/10.2308/bria-51976).
- Gray, R., Kouhy, R. and Lavers, S. (1995), "Corporate social and environmental reporting: a review of the literature and a longitudinal study of UK disclosure", *Accounting, Auditing and Accountability Journal*, Vol. 8 No. 2, pp. 47-77, doi: [10.1108/09513579510146996](https://doi.org/10.1108/09513579510146996).
- Healy, P.M. and Serafeim, G. (2020), "Voluntary, self-regulatory, and mandatory disclosure of oil and gas company payments to foreign governments", *Accounting Horizons*, Vol. 34 No. 1, pp. 111-129, doi: [10.2308/horizons-17-133](https://doi.org/10.2308/horizons-17-133).
- Herremans, I.M. and Nazari, J.A. (2016), "Sustainability reporting driving forces and management control systems", *Journal of Management Accounting Research*, Vol. 28 No. 2, pp. 103-124, doi: [10.2308/jmar-51470](https://doi.org/10.2308/jmar-51470).
- Hoang, H. and Trotman, K.T. (2021), "The effect of CSR assurance and explicit assessment on investor valuation judgments", *Auditing: A Journal of Practice and Theory*, Vol. 40 No. 1, pp. 19-33, doi: [10.2308/AJPT-18-092](https://doi.org/10.2308/AJPT-18-092).
- Holder-Webb, L., Cohen, J.R., Nath, L. and Wood, D. (2009), "The supply of corporate social responsibility disclosures among U.S. Firms", *Journal of Business Ethics*, Vol. 84 No. 4, pp. 497-527, doi: [10.1007/s10551-008-9721-4](https://doi.org/10.1007/s10551-008-9721-4).
- Hummel, K. and Schlick, C. (2016), "The relationship between sustainability performance and sustainability disclosure – reconciling voluntary disclosure theory and legitimacy theory", *Journal of Accounting and Public Policy*, Vol. 35 No. 5, pp. 455-476, doi: [10.1016/j.jaccpubpol.2016.06.001](https://doi.org/10.1016/j.jaccpubpol.2016.06.001).
- IFAC and IIRC (2020), *Accelerating Integrated Reporting Assurance in the Public Interest – IFAC and the IIRC Support Pathway to Integrated Reporting Assurance*.
- IFRS Foundation (2020), *Consultation Paper on Sustainability Reporting*, p. 22.
- Ioannou, I. and Serafeim, G. (2012), "What drives corporate social performance? The role of nation-level institutions", *Journal of International Business Studies*, Vol. 43 No. 9, pp. 834-864, doi: [10.1057/jibs.2012.26](https://doi.org/10.1057/jibs.2012.26).
- Itami, H. (2005), "Revision of the commercial code and reform of the Japanese corporate governance", *Japan Labor Review*, Vol. 2 No. 1.
- Kim, E.-H. and Lyon, T.P. (2015), "Greenwash vs. Brownwash: exaggeration and undue modesty in corporate sustainability disclosure", *Organization Science*, Vol. 26 No. 3, pp. 705-723, doi: [10.1287/orsc.2014.0949](https://doi.org/10.1287/orsc.2014.0949).

- Knechel, W.R. (2021), "The future of assurance in capital markets: reclaiming the economic imperative of the auditing profession", *Accounting Horizons*, Vol. 35 No. 1, pp. 133-151, doi: [10.2308/HORIZONS-19-182](https://doi.org/10.2308/HORIZONS-19-182).
- Ko, T. (2020), "Greenwashing leaves a stain the world must not tolerate", *Nikkei Asia*, Vol. 23 October, pp. 5.
- KPMG (2021), "Survey of Integrated Reporting in Japan 2020", p. 52.
- KPMG (2022), *Survey of Corporate Reports in Japan 2021*, p. 80.
- Larcker, D.F., Tayan, B. and Watts, E.M. (2022), "Seven myths of ESG", *European Financial Management*, Vol. 28 No. 4, pp. 869-882, doi: [10.1111/eufm.12378](https://doi.org/10.1111/eufm.12378).
- Leva, L. (2020), "Larry leva, IFRS foundation trustee, calls on investment professionals to share their views on global sustainability reporting", p. 4.
- Li, Z., Jia, J. and Chapple, L.E. (2023), "The corporate sustainability committee and its relation to corporate environmental performance", *Meditari Accountancy Research*, Vol. 31 No. 5, pp. 1292-1324, doi: [10.1108/MEDAR-06-2021-1341](https://doi.org/10.1108/MEDAR-06-2021-1341).
- Luo, L. and Wu, H. (2019), "Voluntary carbon transparency: a substitute for or complement to financial transparency?", *Journal of International Accounting Research*, Vol. 18 No. 2, pp. 65-88, doi: [10.2308/jiar-52421](https://doi.org/10.2308/jiar-52421).
- Luo, L.L. and Tang, Q. (2016), "Does national culture influence corporate carbon disclosure propensity?", *Journal of International Accounting Research*, Vol. 15 No. 1, pp. 17-47, doi: [10.2308/jiar-51131](https://doi.org/10.2308/jiar-51131).
- Lyon, T.P. and Maxwell, J.W. (2011), "Greenwash: corporate environmental disclosure under threat of audit", *Journal of Economics and Management Strategy*, Vol. 20 No. 1, pp. 3-41, doi: [10.1111/j.1530-9134.2010.00282.x](https://doi.org/10.1111/j.1530-9134.2010.00282.x).
- Mahoney, L.S., Thorne, L., Cecil, L. and LaGore, W. (2013), "A research note on standalone corporate social responsibility reports: Signaling or greenwashing?", *Critical Perspectives on Accounting*, Vol. 24 Nos 4/5, pp. 350-359, doi: [10.1016/j.cpa.2012.09.008](https://doi.org/10.1016/j.cpa.2012.09.008).
- Mardawi, Z., Dwekat, A., Meqbel, R. and Carmona Ibáñez, P. (2024), "Configurational analysis of corporate governance and corporate social responsibility reporting assurance: understanding the role of board and CSR committee", *Meditari Accountancy Research*, Vol. 32 No. 2, pp. 512-542, doi: [10.1108/MEDAR-04-2022-1654](https://doi.org/10.1108/MEDAR-04-2022-1654).
- Maroun, W. (2019), "Does external assurance contribute to higher quality integrated reports?", *Journal of Accounting and Public Policy*, Vol. 38 No. 4, p. 106670, doi: [10.1016/j.jaccpubpol.2019.06.002](https://doi.org/10.1016/j.jaccpubpol.2019.06.002).
- Maroun, W. (2022), "Corporate governance and the use of external assurance for integrated reports", *Corporate Governance: An International Review*, Vol. 30 No. 5, pp. 584-607, doi: [10.1111/corg.12430](https://doi.org/10.1111/corg.12430).
- Marquis, C., Toffel, M.W. and Zhou, Y. (2016), "Scrutiny, norms, and selective disclosure: a global study of greenwashing", *Organization Science*, Vol. 27 No. 2, pp. 483-504, doi: [10.1287/orsc.2015.1039](https://doi.org/10.1287/orsc.2015.1039).
- METI (2017), "Guidance for integrated corporate disclosure and Company-Investor dialogue for collaborative value creation".
- Ng, A.W., Leung, T.C.H., Yu, T.W., Cho, C.H. and Wut, T.M. (2023), "Disparities in ESG reporting by emerging chinese enterprises: evidence from a global financial center", *Sustainability Accounting, Management and Policy Journal*, Vol. 14 No. 2, pp. 343-368, doi: [10.1108/SAMPJ-08-2021-0323](https://doi.org/10.1108/SAMPJ-08-2021-0323).
- Nikkei (2022), *Diversifying ESG Investments: Corporate Bond Issuance Exceeds 2 Trillion Yen, Explored in "Nikkei ESG Data" (in Japanese)*, Tokyo.
- Nikko Research Center (2016), *FY 2015 Project: "Visualization" of Women's Activities in Capital Markets and Survey Report on the Use of Non-Financial Information, Focusing on Information on Women's Activities, in Investment (in Japanese)*.

- Nishitani, K., Nguyen, T.B.H., Trinh, T.Q., Wu, Q. and Kokubu, K. (2021), "Are corporate environmental activities to meet sustainable development goals (SDGs) simply greenwashing? An empirical study of environmental management control systems in Vietnamese companies from the stakeholder management perspective", *Journal of Environmental Management*, Vol. 296, p. 113364, doi: [10.1016/j.jenvman.2021.113364](https://doi.org/10.1016/j.jenvman.2021.113364).
- Otomasa, S., Kuang, W. and Shiiba, A. (2022), "A basic research on management compensation based on ESG indicators: analyses based on information disclosed in securities reports (in Japanese)", *Kansai University Business Review*, Vol. 67 No. 3, pp. 37-61, doi: [10.32286/00027700](https://doi.org/10.32286/00027700).
- Peters, G.F. and Romi, A.M. (2015), "The association between sustainability governance characteristics and the assurance of corporate sustainability reports", *AUDITING: A Journal of Practice and Theory*, Vol. 34 No. 1, pp. 163-198, doi: [10.2308/ajpt-50849](https://doi.org/10.2308/ajpt-50849).
- Prinsloo, A. and Maroun, W. (2021), "An exploratory study on the components and quality of combined assurance in an integrated or a sustainability reporting setting", *Sustainability Accounting, Management and Policy Journal*, Vol. 12 No. 1, pp. 1-29, doi: [10.1108/SAMPJ-05-2019-0205](https://doi.org/10.1108/SAMPJ-05-2019-0205).
- Ramanna, K. (2013), "A framework for research on corporate accountability reporting", *Accounting Horizons*, Vol. 27 No. 2, pp. 409-432, doi: [10.2308/acch-50412](https://doi.org/10.2308/acch-50412).
- Ruhnke, K. and Gabriel, A. (2013), "Determinants of voluntary assurance on sustainability reports: an empirical analysis", *Journal of Business Economics*, Vol. 83 No. 9, pp. 1063-1091, doi: [10.1007/s11573-013-0686-0](https://doi.org/10.1007/s11573-013-0686-0).
- Saka, C. and Oshika, T. (2014), "Disclosure effects, carbon emissions and corporate value", *Sustainability Accounting, Management and Policy Journal*, Vol. 5 No. 1, pp. 22-45, doi: [10.1108/SAMPJ-09-2012-0030](https://doi.org/10.1108/SAMPJ-09-2012-0030).
- Simoni, L., Bini, L. and Bellucci, M. (2020), "Effects of social, environmental, and institutional factors on sustainability report assurance: evidence from european countries", *Meditari Accountancy Research*, Vol. 28 No. 6, pp. 1059-1087, doi: [10.1108/MEDAR-03-2019-0462](https://doi.org/10.1108/MEDAR-03-2019-0462).
- SSBJ (2024), "Sustainability standards board publishes exposure drafts of sustainability disclosure standards (in Japanese)", 29 March, available at: www.ssb-j.jp/jp/domestic_standards/exposure_draft/y2024/2024-0329.html (accessed 17 May 2024).
- Stata (2023a), "Estat Gof—pearson or Hosmer—Lemeshow goodness-of-fit test".
- Stata (2023b), "Linktest—specification link test for single-equation models".
- Sun, X., Zhou, C. and Gan, Z. (2023), "Green finance policy and ESG performance: evidence from Chinese manufacturing firms", *Sustainability*, Vol. 15 No. 8, p. 6781, doi: [10.3390/su15086781](https://doi.org/10.3390/su15086781).
- Torres-Reyna, O. (2007), *Panel Data Analysis Fixed and Random Effects Using Stata*, Princeton University, December.
- Tsang, A., Frost, T. and Cao, H. (2023), "Environmental, social, and governance (ESG) disclosure: a literature review", *The British Accounting Review*, Vol. 55 No. 1, p. 101149, doi: [10.1016/j.bar.2022.101149](https://doi.org/10.1016/j.bar.2022.101149).
- Uyar, A., Karaman, A.S. and Kilic, M. (2020), "Is corporate social responsibility reporting a tool of signaling or greenwashing? Evidence from the worldwide logistics sector", *Journal of Cleaner Production*, Vol. 253, p. 119997, doi: [10.1016/j.jclepro.2020.119997](https://doi.org/10.1016/j.jclepro.2020.119997).
- Verbeek, M. (2022), *Panel Methods for Finance: A Guide to Panel Data Econometrics for Financial Applications*, De Gruyter, Berlin ; Boston.
- Wooldridge, J.M. (2020), *Introductory Econometrics: A Modern Approach*, (7th Ed.), Cengage, Boston, MA.
- Yu, E.P., Luu, B.V. and Chen, C.H. (2020), "Greenwashing in environmental, social and governance disclosures", *Research in International Business and Finance*, Vol. 52, p. 101192, doi: [10.1016/j.ribaf.2020.101192](https://doi.org/10.1016/j.ribaf.2020.101192).

Further reading

CDP (2022), “CDP climate change report 2021: Japan (in Japanese)”.

Norton Rose Fulbright (2022), “Climate change and sustainability disputes: Greenwashing”, February, available at: <https://www.Nortonrosefulbright.Com/En-Jp/Knowledge/Publications/Recurring-Series>, available at: www.nortonrosefulbright.com/en-jp/knowledge/publications/aaa46f8f/climate-change-and-sustainability-disputes-greenwashing (accessed 14 April 2022).

Rostoum, M. (2018), *The Environmental, Social, and Governance (ESG) Ratings Industry: How Can Publicly-Traded Companies Improve Their Overall ESG Scores?*, Columbia University, Department of Economics Barnard College.

Meditari
Accountancy
Research

Appendix 1

Table A1. Definition and measurement of variables

Variable	Definition and measurement
EDS_{it}	Environmental Disclosure Score of firm i in year t that is derived from the CDP Climate Change score, as described in Section 3.2
EPS_{it}	Environmental Performance Score of firm i in year t that is derived from emission and energy consumption data published in the Nikkei ESG database, as described in Section 3.3
DPG_{it}	A continuous measure of the extent of greenwashing/positive environmental disclosure and performance gap of firm i in year t that is calculated as the positive difference between EDS and EPS , as described in equation (1) of Section 3.1
GS_{it}	A dummy variable that equals to 1, indicating greenwashing, if the difference between the Environmental Disclosure Score (EDS) and Environmental Performance Score (EPS) of firm i in year t is positive, and 0 otherwise
$CGStr_{it}$	An indication of company's board of directors structure in year t . The dummy variable $CGStr$ equals 1 if the company's board has corporate auditors, and 0 otherwise (audit committee or nomination committee)
$CGLed_{it}$	An indication of company i 's leadership of the board of directors in year t . The dummy variable $CGLed$ equals 1 if the company's board is led by the president, and 0 otherwise (chairperson or other directors)
$CGFor_{it}$	An indication of company's ratio of foreign shareholdings in year t . The dummy variable $CGFor$ equals 1 if the company's foreign shareholdings ratio is more than 30%, and 0 otherwise
$CGDir_{it}$	A measure of the board of director's independence, which is calculated as the ratio of company i 's number of independent directors to the total number of directors in year t
$CGVar_{it}$	A measure of the board of director's variable compensation ratio, which is calculated as the ratio of the total variable compensation of company i 's directors to the total compensation of the directors in year t
ASR_{it}	A dummy variable that equals to 1 if the emission disclosures of company i 's received third-party assurance or verification in year t according to the company's response to the CDP survey, and 0 otherwise
ORG_{it}	The highest-level management position(s) or committee(s) of company i 's total assets in year t with responsibility for climate-related issues, measured on a four-point rating scale: (0) data is not available; (1) a specialized manager or management meeting; (2) a specialized committee; or (3) at least one member of the C-Suite is an officer, including an executive officer
LEV_{it}	Financial leverage, measured as the ratio of company i 's total assets to total net assets in year t
CAP_{it}	Capital intensity, measured as the net property, plant, and equipment; deflated by total assets of company i in year t
$FORN_{it}$	Foreign sales, measured as the ratio of company i 's overseas sales to net sales for year t
$R\&D_{it}$	Research and development intensity, measured as the research and development expenses, deflated by the total assets of company i in year t
$GAAP_{it}$	International accounting standards, measured as a dummy variable equal to 1 if company i adopts IFRS or US GAAP in year t , and 0 otherwise
IMP_{it}	A dummy variable that equals to 1 if the industry in which company i operates belongs to one of the high impact sectors identified by the CDP (Chemicals; Cement; Transport Engine Part Manufacturers; Electric Utilities; Food, Beverage and Tobacco; Metals and Mining; Oil and Gas; Transport Original Equipment Manufacturer; Paper and Forestry; Transport Services; and Steel) in year t , and 0 otherwise
$SIZE_{it}$	Firm size, measured as a natural log of company i 's total assets in year t .
LIQ_{it}	Liquidity, measured as the ratio of company i 's current assets to its current liabilities in year t
ROA_{it}	Return on assets, measured as the ratio of company i 's net income to total assets in year t

Appendix 2. Illustration of the environmental disclosure score (EDS) calculation

The steps involved in the EDS calculations are as follows:

- 1) A minimum of five companies per industry per fiscal year are needed to define reasonable peer groups. Companies that belong to an industry group with fewer than five firm-years were removed.
- 2) The CDP climate change scores of individual companies are arranged by industry group and fiscal year.

Table A2. Step 2 of Appendix 2

Code	FY	Company	CDP climate change score	Industry
54X1	2018	Company X1	B	Iron and steel
54X2	2018	Company X2	D	Iron and steel
54X3	2018	Company X3	D	Iron and steel
54X4	2018	Company X4	A-	Iron and steel
54X5	2018	Company X5	B	Iron and steel
54X1	2019	Company X1	B	Iron and steel
54X2	2019	Company X2	D	Iron and steel
54X3	2019	Company X3	B	Iron and steel
54X4	2019	Company X4	A	Iron and steel
54X5	2019	Company X5	B-	Iron and steel

- 3) The EDS value is calculated by transforming the CDP climate change letter grades into a continuous [0, 1] scale per industry group and fiscal year by assigning 0 to the worst (D-grade) and 1 to the best (A grade) CDP climate change scores. All other grades are rescaled proportionally.

Table A3. Step 3 of Appendix 2

Code	FY	Company	CDP climate change score	Industry	EDS
54X1	2018	Company X1	B	Iron and steel	0.79972
54X2	2018	Company X2	D	Iron and steel	0
54X3	2018	Company X3	D	Iron and steel	0
54X4	2018	Company X4	A-	Iron and steel	1
54X5	2018	Company X5	B	Iron and steel	0.79972
54X1	2019	Company X1	B	Iron and steel	0.666278
54X2	2019	Company X2	D	Iron and steel	0
54X3	2019	Company X3	B	Iron and steel	0.666278
54X4	2019	Company X4	A	Iron and steel	1
54X5	2019	Company X5	B-	Iron and steel	0.499417

Appendix 3. Illustration of the environmental performance score (EPS) calculation

The steps involved in the EPS calculations are as follows:

- 1) A minimum of five companies per industry per fiscal year are required to define reasonable peer groups. Companies that belong to an industry group with fewer than five firm-years were removed.
- 2) Two relevant environmental performance indicators for each company were employed: emissions (the sum of Scope 1 and 2 greenhouse gas emissions measured in tons of carbon dioxide) and energy consumption (measured in terajoules). The environmental performance indicators for water and waste were excluded because of the unavailability of water and waste-specific questions in the CDP climate change surveys.
- 3) The environmental performance indicators are scaled by total assets as a proxy for company size.

Table A4. Step 3 of Appendix 3

Code	FY	Company	Industry	GHG	ENE	Total assets (TA)	GHG/TA	ENE/TA
54X1	2018	Company X1	Iron and steel	93,662,000	1,131,000	5,462,897	17.15	0.21
54X2	2018	Company X2	Iron and steel	17,400,000		2,384,973	7.30	
54X3	2018	Company X3	Iron and steel	59,900,000		4,648,635	12.89	
54X4	2018	Company X4	Iron and steel			185,673		
54X5	2018	Company X5	Iron and steel	2,630,000	42,973.07	739,578	3.56	0.06
54X1	2019	Company X1	Iron and steel	90,261,000	1,092,000	5,009,656	18.02	0.22
54X2	2019	Company X2	Iron and steel	16,500,000		2,411,191	6.84	
54X3	2019	Company X3	Iron and steel	60,400,000	670,000	2,676,515	22.57	0.25
54X4	2019	Company X4	Iron and steel			178,313		
54X5	2019	Company X5	Iron and steel	2,319,000	40,078.29	664,712	3.49	0.06

- 4) The emission (GHG) and energy (ENE) consumption performance values of individual companies are normalized into continuous [0, 1] scales per industry group and fiscal year, where 0 is assigned to the highest and 1 is assigned to the lowest emission and energy consumption indicator values, while all other values are rescaled proportionally. Firms with missing emission and energy consumption indicators are assigned a value of 0.

Table A5. Step 4 of Appendix 3

Code	FY	Company	Industry	GHG/TA	ENE/TA	GHG_Norm	ENE_Norm
54X1	2018	Company X1	Iron and steel	17.14511	0.207033	0	0
54X2	2018	Company X2	Iron and steel	7.29568		0.3532878	0
54X3	2018	Company X3	Iron and steel	12.8855		0.0865071	0
54X4	2018	Company X4	Iron and steel			0	0
54X5	2018	Company X5	Iron and steel	3.556082	0.058105	1	1
54X1	2019	Company X1	Iron and steel	18.0174	0.217979	0.0461726	0.0470829
54X2	2019	Company X2	Iron and steel	6.843091		0.4201794	0
54X3	2019	Company X3	Iron and steel	22.56666	0.250326	0	0
54X4	2019	Company X4	Iron and steel			0	0
54X5	2019	Company X5	Iron and steel	3.488729	0.060294	1	1

-
- 5) The EPS value was calculated as the arithmetic mean of the normalized GHG and ENE indicators.

Table A6. Step 5 of Appendix 3

Code	FY	Company	Industry	GHG_Norm	ENE_Norm	EPS
54X1	2018	Company X1	Iron and steel	0	0	0
54X2	2018	Company X2	Iron and steel	0.3532878	0	0.176644
54X3	2018	Company X3	Iron and steel	0.0865071	0	0.043254
54X4	2018	Company X4	Iron and steel	0	0	0
54X5	2018	Company X5	Iron and steel	1	1	1
54X1	2019	Company X1	Iron and steel	0.0461726	0.0470829	0.046628
54X2	2019	Company X2	Iron and steel	0.4201794	0	0.21009
54X3	2019	Company X3	Iron and steel	0	0	0
54X4	2019	Company X4	Iron and steel	0	0	0
54X5	2019	Company X5	Iron and steel	1	1	1

Corresponding author

Frendy can be contacted at: frendy_f@gsm.nucba.ac.jp