

Article

The Impact of Corporate Characteristics on Climate Governance Disclosure

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Abstract: This study examines the impact of corporate characteristics on climate change governance among 100 of the world's largest companies, with 1400 observations in the fiscal year 2020. We consider variables such as company location, size, profitability, female board representation, years of reporting using Task Force on Climate-Related Financial Disclosures (TCFD) guidelines, the inclusion of UN Global Compact and Global Reporting Initiative (GRI) information, Dow Jones Sustainability Index (DJSI) membership, MSCI ESG ratings, and the presence of a climate transition plan, a sustainability executive, and a sustainability board committee. Applying a multi-theoretical framework, we employ correlation analysis and univariate and multiple linear regressions to assess the relationships. Our findings reveal positive correlations between climate governance and the presence of a climate transition plan, MSCI ratings, DJSI membership, and the existence of a sustainability executive. Additionally, companies located in developed countries exhibit significantly higher levels of climate change governance. These results hold across various scenarios, offering valuable insights for researchers, academics, business leaders, practitioners, and regulators. With the growing importance of climate change reporting, understanding the key contributing factors for effective climate governance is crucial for organizations seeking to address this critical issue.

Keywords: climate change; climate governance; sustainability; voluntary disclosure; carbon emissions; disclosure quality; sustainability officer; non-financial reporting; CSR reporting; disclosure quality



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1. Introduction

Climate change is an urgent global challenge with far-reaching implications for both society and businesses. Corporations are increasingly tasked with the responsibility to combat global warming and reduce greenhouse gas emissions as the severity of climate impacts intensifies. This issue transcends environmental concerns, profoundly impacting businesses, stakeholders, and their operational landscapes.

The transition to a low-carbon economy and the rising expectations of sustainability management from diverse stakeholders, including governments, regulators, investors, and the public, present multifaceted risks and challenges for companies. To address these challenges and align the interests of shareholders and stakeholders, the concept of climate governance has emerged, advocating for corporate governance with a long-term perspective [1].

In 1992, at the United Nations (UN) summit in Rio de Janeiro, multi-level global governance was introduced [2]. Its intention was to globally mobilize sustainable development. This concept of global governance for multiple nations, sectors, and players has been extended to climate governance [3]. In 2003, Jagers and Stripple derived the term climate governance from the already established term global governance [4]. Climate governance, therefore, is interpreted as a system of measures and mechanisms of organization for preventing, mitigating, or adapting to climate change risks [5]. Effective governance

and standardized disclosures are essential for managing climate-related financial risks and opportunities [6]. More specifically, corporate governance ensures the supervision and control of a company's managers, especially in relation to decision-making processes, profit redistribution, and investment policies. Since climate governance at the macro level is defined as "...the process of involving social, economic, and political actors across multiple policy sectors and scales to address the challenges posed by climate change" [7], at the organization level, this requires the involvement of corporate stakeholders both internal and external to identify and manage climate change challenges. Governments worldwide are taking steps toward a lower-carbon future, while climate-friendly technologies are becoming more competitive. The consequences of climate change, including droughts, water scarcity, wildfires, rising sea levels, and extreme weather events, are increasingly evident [8]. Immediate action is imperative from governments, businesses, organizations, and individuals [9].

The integration and control of sustainability management and reporting significantly influence the quality of environmental and sustainability efforts within a company. A critical aspect of sustainability governance lies in the commitment of top management to sustainability issues. However, sustainability and ESG reports often mention board responsibilities and tasks, yet they typically include only a much lower percentage of the necessary sustainability information [10]. Climate change poses significant risks that may impact a company's long-term viability [11], necessitating proactive measures to mitigate environmental impacts [12,13]. Investors, analysts, and regulatory bodies are increasingly interested in understanding how climate change affects their portfolio companies [14,15], urging firms to address climate-related risks and opportunities in their reporting [16]. Climate-related reporting is on the rise, with investors demanding clearer and more concise Environmental, Social, and Governance (ESG) disclosure to enable meaningful comparisons between organizations. Despite its growing importance, the literature on climate governance remains limited, with only a few recent studies examining its influence on carbon disclosure and performance.

The Task Force on Climate-Related Financial Disclosures (TCFD) has called for enhanced climate-related reporting, urging companies to disclose their management of climate-related aspects through corporate governance [17]. Efficient climate change reporting helps to increase awareness, facilitate informed decision making, and drive action to mitigate the impacts of climate change [18].

In 2020, Bui et al. examined the influence of climate governance on carbon disclosure and performance for companies listed on the New York Stock Exchange. The authors found that good climate governance leads to better firm commitments and increased disclosures. The authors of other previous research studies have indicated that firm governance characteristics are crucial in improving carbon disclosures. However, prior research on this topic found inconclusive results [19,20]. Choi and Luo (2021) found a negative connection between the level of carbon emissions and company value [21]. In their cross-country study, they found that this connection increases the more stringent a country's environmental regulations are. Furthermore, their results show that market participants assume that companies with good corporate governance are more effective in implementing CO₂-reducing technologies. This further eliminates the negative relationship between carbon emissions and company value. Very few studies have examined characteristics of governance that are geared towards climate governance such as the level of management responsibility for climate change issues and the time horizons or frequencies of climate risk reporting at the board and management level [22]. Therefore, our study answers the call for new research related to the relationship between firms' governance structures and their carbon disclosures.

Our research adds to the very limited literature on climate-related disclosure and climate governance by empirically examining corporate characteristics associated with climate governance disclosure, introducing new variables and theories into the analysis. This paper is pioneering in its assessment of the impact of corporate climate governance on an

international scale, moving beyond individual countries or stock indices. We also consider responses to mandatory reporting, addressing broader questions about the effectiveness of transparency requirements in promoting sustainable behavior.

In conclusion, as climate-related reporting gains prominence, understanding the factors influencing effective climate governance and information disclosure becomes increasingly crucial. Our study addresses this need by examining the relationship between firm governance structures and carbon disclosures, shedding light on critical aspects of corporate sustainability amidst climate change.

2. Background

Climate change has emerged as a critical area in business sustainability [23], defined by the UN as long-term shifts in temperatures and weather patterns [24]. Human activities, particularly the burning of fossil fuels, have been significant contributors to climate change since the 18th century, leading to increased greenhouse gas emissions.

The Paris Agreement, effective as of 2016, aims to keep global temperature rise well below 1.5 degrees Celsius above pre-industrial levels, with the recent emphasis on this target based on new scientific findings. Financial systems face increased risks due to climate change, with information failures hindering the understanding of its financial impacts. The European Union committed to a 40% reduction in greenhouse gas emissions by 2030 [25], and the European Commission issued guidelines for climate-related information reporting, aligning with the TCFD recommendations [26]. The TCFD, established by the Financial Stability Board (FSB) in 2015, aims to improve transparency in corporate climate-related disclosures. Endorsed by thousands of organizations and governments worldwide, the TCFD framework has been influential, with the US SEC proposing a rule for mandatory climate risk disclosures based on it [27]. The CDP, a non-profit charity, utilizes a global disclosure system for environmental impact management, considered the “gold standard” for corporate environmental reporting and aligned with TCFD recommendations [28]. Other reporting frameworks include the UN Global Compact and the IPCC, with the former focusing on Climate Action and the latter providing scientific input for climate policy [29]. GRI’s Global Sustainability Standards Board (GSSB), with its “Emissions” standard, complements the TCFD, offering globally accepted sustainability-reporting standards [30,31]. The IFRS Foundation’s ISSB also contributes to these efforts with the IFRS S2 Climate-related Disclosures [32].

Lastly, the WEF acknowledges climate change as an urgent challenge and calls for comprehensive climate governance, supported by the critique of corporate climate initiatives like Amazon’s Net Zero by MacLean [33]. This reflects a trend towards greater accountability and transparency in corporate climate change responses.

3. Theoretical Literature Review

The multi-faceted topic of mandatory and voluntary corporate disclosure and its multiple drivers in different contexts have been the subject of many research studies. Just regarding the topic itself, research results have been mixed. Academic researchers have explored the topic of increased corporate climate reporting. They also have tried to identify the reason why some companies are disclosing voluntary non-financial information as well as the scope and quality of the provided information. Another approach taken has been to recognize incentives that lead to the increased transparency and comparability of such reporting. Typically, there are a few theories on which these studies are based, ranging from agency and legitimacy theory, resource dependence theory, and voluntary disclosure, stakeholder and signaling theory and social innovation theory [34].

Agency theory posits that conflicts of interest between managers and shareholders can lead to opportunistic behaviors by managers, which may manifest in financial reporting. One of the key mechanisms through which agency costs can affect reporting is the manipulation of financial statements to convey a more favorable financial position than that in reality [35]. Understanding the intricate interplay between agency costs, reporting,

and the composition of the board of directors is vital for comprehending corporate governance dynamics and ensuring the accuracy and reliability of financial and non-financial disclosures.

Legitimacy theory is one of the most often-cited and applied theories in the area of corporate sustainability disclosure [36,37]. Essentially, it states that any firm operates under a social contract. In addition, the existence of an organization can only be justified if it continuously provides benefits to society. The organization must demonstrate its legitimacy to the public; otherwise, it will risk losing the support of the society it operates in [38]. One way to ascertain and maintain such support is the voluntary publication of CSR information. By publishing climate change information, a company can gain such societal support and thereby reduce its risk of losing organizational legitimacy [39]. On the other hand, legitimacy theory also applies to poor sustainability performers that tend to “overshare” to either receive social recognition or maintain it [40,41]. In the context of carbon reporting, carbon information can be considered to be mainly the private knowledge of managers [42,43]. Hence, there is still information asymmetry regarding the carbon and energy data revealed. Therefore, managers still have an incentive to conceal true carbon information if they are not performing well in this regard [44]. This has also been called the “symbolic legitimation/greenwashing view” [45].

While the focus of agency theory has primarily been on shareholders, the scope of legitimacy theory extends further, which is especially relevant when considering more organizational stakeholders and increasingly also environmental, ethical, and social matters [46]. Hence, the responsibilities of the board of directors have become wider in scope and now also include ethical, economic, environmental, and social factors in consideration of corporate strategic planning and long-term value creation [47–49]. In fact, researchers have found that companies with good corporate governance are embracing their responsibilities to their stakeholders, and this is reflected in more and better corporate disclosure.

Another theory that is applicable to our research topic is voluntary disclosure theory. Voluntary disclosure theory posits that a company with superior sustainability performance will voluntarily disclose information to increase market value [50]. Drawing parallels to legitimacy theory, it can be argued that low-performing companies prefer to voluntarily disclose low-quality information to mask poor sustainability performance while maintaining legitimacy [51]. According to Spence’s signaling theory, market signals are attributes of one party that can assist other parties in making better investment decisions [52]. This positive link between market signals by disclosing voluntary information and firm market value has been identified in various contexts in prior studies [53,54].

So far, we have identified corporate-value-creating theories; however, other theories can also be applied in the context of voluntary sustainability as well as climate-related information disclosure. A theory that is increasingly mentioned in the CSR context is stakeholder theory. Stakeholder theory states that an organization is responsible not only to its shareholders and creditors but also, to various degrees, to all of its stakeholders [55,56]. In addition, especially regarding environmental reporting, Van der Laan Smith et al. (2005) argue that differences across cultures will influence CSR disclosure quality and quantity [57]. Stakeholder theory states that directors must ensure that the information needs of shareholders and other stakeholders are balanced when publishing non-mandatory information. Furthermore, when adopting a stakeholder view, the presence of a sustainability or similarly named committee clearly indicates the commitment of an organization to its stakeholders [58]. These committees and their members, when appointed correctly, are acutely aware of the importance of sustainability as part of the overall business strategy. This increasingly also includes concerns from relevant stakeholders regarding the impacts of corporate strategy and actions on climate change [59]. Stakeholder theory also applies to the fact that companies hire sustainability managers or officers to show organizational commitment to sustainability. Transparency and accountability are of growing importance when identifying the pathway to a lower corporate carbon footprint [60]. This includes but is not limited to developing and adopting an efficient climate governance system.

Unlike agency theory, which is concerned with a board's monitoring role, resource dependence theory relates to its advising and unique resource-providing role [61–64]. A diverse board of directors will typically also have a diverse set of qualifications and skills. Regarding board characteristics, the attribute that has probably been explored the most is gender. It is often assumed and has been empirically proven that female directors show a different approach to some issues, which can be beneficial when dealing with complicated board matters. More specifically, female board members have been described as being more humane, socially adapt, creative, and open-minded [65–67]. From the perspective of resource dependence theory, these characteristics lead to the inclusion of climate change mitigation and issues into corporate strategy development [68–70].

Similarly, according to gender socialization theory, women and men have different perspectives towards environmental issues due to differences in their education [71]. It is often assumed that women have been raised and educated to nurture and care about others [72]. Thus, compared to their male counterparts, female directors are more aware of environmental issues [73] and even have higher ethical standards. Accordingly, they will promote more proactive environmental strategies [74]. Moreover, female directors will embrace a longer-term stakeholder orientation compared to their male peers [75], which results in initiating and supporting climate change initiatives.

Lastly, a theory that to date has not been given much credit in the context of climate change is social innovation theory, which developed from the entrepreneurial as well as academic literature [76]. Logue argues that that the concept of social innovation has been around for a very long time.

According to social innovation theory, economic progress cannot be disassociated from social progress or the urgent need to do the “right things at the right time”. The idea of social innovation is based on three main pillars: social value creation, capture, and distribution; cross-sector collaborations and networks; and a relentless pursuit of institutional change. Like any other polysemous concept, it offers an opportunity to analyze the current situation and the urgent need for action regarding different players in the climate change scenario.

A summary of the underlying theories with explanations and affected variables can be found in Table A1 in Appendix A. As much as the individual theories can contribute to the corporate social accounting framework (coined by Hackston and Milne) [77], we must accept that many of them play a role in the CSR disclosure phenomenon. While it has often been claimed that these theories do not have anything in common, several researchers have considered them to be complimentary and not competing, as it is claimed that the issue at hand is analyzed from different angles and will provide “the bigger picture” [78,79]. Especially in the context of corporate governance, the broader viewpoint of legitimacy theory is proving to be more and more acceptable [80–83]. In the spirit of this, our study also adopts a broader theoretical framework that combines the ideas of the above-mentioned theories when examining corporate governance and its influence on climate-related information disclosure. By adopting a multi-theoretical framework that includes the above-mentioned theories, our study used a sample consisting of the 100 largest global companies belonging to several industries and sectors.

In addition, our study was also motivated by the lack of research on large companies in developing countries. Very similar to the work of Aibar-Guzman et al. (2023), the originality of our research lies in the fact that instead of focusing on traditional corporate governance mechanisms (e.g., board characteristics), we examine a few novel corporate characteristics related to climate governance. Another unique aspect of our study is the fact that by including the climate governance information of companies that do not submit to the CDP, we attained a better understanding of what the “average climate governance” policies of the largest global corporations look like. Researchers insist that more research is required due to the increasing involvement of the private sector in climate governance [84,85]. In addition, the inconsistency of the findings provided by previous studies is also often noted as being problematic [86].

The following section presents an empirical literature review and this paper's theoretical framework. Afterwards, the research methodology is summarized. Section 5 presents the research design, while section six includes the empirical results. Finally, the seventh section includes the summary and conclusions.

4. Empirical Literature Review and Hypotheses' Development

Our study commenced with the selection of a sample composed of companies listed in the Forbes Global 100, which constitutes the world's 100 largest companies by market capitalization in 2021 [87]. This strategic choice was anchored in a multifaceted rationale.

Firstly, our focus on these companies was grounded in their global significance, accounting for a substantial proportion of global sales, profits, assets, and market value. These corporations wield considerable influence over a range of stakeholders, including regulators, policymakers, researchers, accountants, analysts, investors, and corporate stakeholders, making them an indispensable sample for our research. Moreover, large multinational corporations have substantial sway over public policies and government regulations, amplifying the importance of studying their climate governance practices. This alignment with policymaking and regulatory processes underscores the relevance of our study to addressing pressing climate change concerns.

Furthermore, our sample selection methodology drew inspiration from the approaches of Aibar-Guzmán et al. (2023) and García-Sánchez et al. (2023) [88], who advocated for diverse geographical representation. By adopting this integrative approach, we aimed to investigate whether location-specific factors within various countries influenced climate governance disclosure practices.

Additionally, our study was motivated by the imperative to delve into the ongoing global discourse surrounding climate change. Recent research has underscored that in 2022, only a fraction of the world's largest companies, responsible for a substantial share of global greenhouse gas emissions, had made commitments to deep decarbonization [89]. In this context, it is notable that approximately 70% of global greenhouse gas emissions emanate from a mere 100 companies, primarily consisting of transnational corporations [90]. As a result, we focused our research on these multinational corporate behemoths to shed light on their climate governance practices.

Lastly, our research aspired to extend the boundaries of the existing literature, which is predominantly centered on developed regions such as the United States, the United Kingdom, Canada, Australia, and the European Union [91]. By encompassing companies from developing countries in our international sample, we aimed to furnish a more comprehensive understanding of climate governance across a spectrum of geographical and economic contexts. Moreover, we recognized the potential for conducting comparative analyses between leading multinational corporations and those hailing from emerging markets, thereby providing insights into corporate characteristics and disclosure activities.

In addition, the dependent variable or score that we developed as a proxy for climate governance disclosure, while similar to TCFD scoring and the CDP scoring, has the crucial advantage that it can be applied to companies that provided neither TCFD nor CDP information but other information. The extant studies have confirmed the complexity of this issue by finding several indicators that influence climate governance. According to the previous literature, we posit 11 hypotheses:

The literature on sustainability reporting has consistently differentiated between social and personality traits commonly attributed to different genders [92]. Women are often perceived as more diligent and committed compared to men. Furthermore, they are regarded as being more democratic, open to collaboration, and oriented towards harmony [93]. These qualities suggest that female directors could enhance board dynamics, improve independence, and bolster the quality of oversight [94].

Research has demonstrated that an increase in the number of female directors is associated with improved board governance [95,96]. This gender diversity appears to also foster innovation [97–99], with female directors contributing unique skill sets, perspectives,

and knowledge that drive creativity and innovation [100,101]. Additionally, organizational diversity is linked to enhanced problem solving, leadership effectiveness, and global collaboration [102].

Gender diversity on boards has been positively associated with corporate sustainability and CSR [103–105], with explanations highlighting female directors' greater environmental consciousness and proactivity [106]. Increased board engagement and reduced conflicts are also credited for this better performance.

Velte (2015) noted the growing attention to gender diversity's impact on CSR reporting, with more scholars observing that female representation on boards positively influences the quality of CSR reporting [107–109]. The preponderance of studies indicates that gender-diverse boards are more transparent in CSR [110], environmental, and ESG disclosures [111,112]. Further, a positive correlation between board gender diversity and the voluntary disclosure of climate change information has been documented [113–115].

In terms of eco-innovation, research has found a positive relationship between female board members and eco-innovative practices [116,117]. Atif et al. (2021) identified a positive link between gender-diverse boards and renewable energy use, while Gull et al. (2023) observed beneficial effects on waste management [118]. Garcia-Sanchez et al. (2023) discovered that climate change innovation correlates with the percentage and number of female board members. Regarding carbon emissions, Haque (2017) and the authors of other studies have identified a positive influence of female directors on reduction efforts [119]. In light of these findings and stakeholder theory, the anticipated influence of female board members on climate reporting is not only theoretically sound but empirically supported. Therefore, we propose the following hypothesis:

Hypothesis 1 (H1): *There is a positive association between board gender diversity and the disclosure of climate governance disclosure.*

The formation of a committee dedicated to sustainability or Corporate Social Responsibility (CSR) is recognized as a specialized subgroup within an organization, comprising experts adept at steering and articulating reports on social, economic, and environmental concerns [120]. According to Datt et al. (2019), the establishment of such a committee—whether focused on sustainability, climate change, or environmental issues—indicates a firm's commitment to integrating its sustainability aspirations within its strategic framework. These committees are instrumental in prioritizing investments to meet reduction goals and in overseeing the progress in mitigating carbon emissions [121]. Past empirical studies found a significant positive relationship between the existence of a sustainability/CSR committee and environmental [122] or carbon information disclosure [123].

The academic consensus highlights the positive influence a sustainability/CSR committee has on various aspects of corporate disclosure. This includes, but is not limited to, broad sustainability or CSR reporting, carbon emissions information [124], and Environmental, Social, and Governance (ESG) disclosures. Additional studies corroborate the significance of a dedicated CSR/sustainability committee in advancing the breadth of utilities' overall ESG disclosures. For instance, Haque (2017) identified a beneficial link between CSR committees and carbon reduction measures within UK firms. More recently, Córdova et al. (2021) observed a similar positive association in South American companies. A sustainability committee is increasingly viewed as a pivotal asset for an organization, offering invaluable non-financial insights that facilitate the integration of sustainability considerations into corporate strategy and execution. Such entities are vital in ensuring the legitimacy of a firm's operations and fostering constructive engagement with diverse stakeholder groups.

From a stakeholder standpoint, companies with a sustainability or CSR committee are perceived as being more responsive to stakeholder needs, more actively involved in climate-related initiatives, and more transparent in their corporate governance reporting. Drawing on the principles of legitimacy and stakeholder theory, this discussion informs our

prediction regarding climate governance disclosures. Thus, grounded in these theoretical frameworks and supported by extensive empirical evidence, we propose the following:

Hypothesis 2 (H2): *The existence of a sustainability/CSR board committee is positively associated with climate governance disclosure.*

As outlined earlier, agency theory posits that the efficacy of a company in reconciling stakeholder interests and enhancing corporate performance is inherently tied to its corporate governance mechanisms. Effective governance can mitigate conflicts of interest and, consequently, bolster shareholder value through the adoption of pertinent and efficient controls and procedures.

The academic exploration of the relatively nascent role of a Corporate Sustainability Officer (CSO) is limited, particularly in empirical studies. Notwithstanding, it is commonly understood that Corporate Social Responsibility (CSR) endeavors can fortify stakeholder relations and thus reduce business risks [125]. Furthermore, CSR initiatives have the potential to expand a company's access to a wider talent pool and reduce capital costs. These benefits collectively decrease the likelihood of failure and boost organizational performance [126]. The introduction of specialized executive positions for sustainability marks a significant shift in the dynamics of top management teams and their approaches to sustainability [127,128]. Nonetheless, some critiques suggest that CSO roles are often instituted in response to external pressures, rendering these positions more symbolic than transformational within the corporate structure [129].

Peters et al. (2018) scrutinized the correlation between CSO appointments and ensuing sustainability performance, finding a neutral or even negative impact on firm performance. This result could imply that CSO appointments are potentially performative rather than substantive. For the scope of this research, distinctions between roles such as CSO, sustainability executive, or manager were not made. In light of legitimacy and voluntary disclosure theory and considering the divergent views presented, we propose the following null hypothesis:

Hypothesis 3 (H3): *There is no significant relationship between the appointment of a dedicated sustainability executive officer or CSO and climate governance disclosure.*

KPMG's 2022 study reinforces the position of the GRI Standards as the preeminent framework for sustainability reporting on a global scale [130]. Initiated by the Global Reporting Initiative, an independent, not-for-profit organization now based in the Netherlands, the GRI released its first set of guidelines (G1) in 2000. By 2016, this evolved into the GRI Standards, marking a shift from providing guidelines to establishing the first global standards for sustainability reporting. Employed by a diverse set of entities ranging from large corporations to SMEs, governments, NGOs, and industry groups across over 90 countries, these standards afford organizations the means to voluntarily communicate their environmental, social, and economic impacts with a level of detail and rigor akin to financial reporting norms [131,132]. Luo and Tang (2022) contend that adoption of the GRI Standards is indicative of an organization's dedication to transparency regarding environmental and climate-related issues, offering a benchmark for standardizing and comparing ESG data.

Given the recognition of GRI Standards as instrumental in enhancing the quality of sustainability reports [133], it is anticipated that their adoption will similarly influence climate governance disclosures. Thus, informed by stakeholder and voluntary disclosure theory along with empirical evidence, the ensuing hypothesis was formulated:

Hypothesis 4 (H4): *The adoption of GRI guidelines or standards is positively correlated with the extent of climate governance disclosure.*

Annually, the Dow Jones Sustainability™ Index (DJSI Index) undertakes a Corporate Sustainability Assessment to spotlight leaders in global sustainability [134]. This index includes top-performing companies—representing roughly 10% of the largest 2500 global businesses—evaluated against long-term economic, environmental, and social criteria [135]. The DJSI's appraisal spans a comprehensive range of corporate activities, spanning from governance and risk management to climate change mitigation and labor practices [136].

Corroborating legitimacy theory, Cordeiro and Tewari (2015) utilized an event study methodology to analyze investor responses to the September 2009 Green Rankings, revealing a favorable investor reaction to the environmental standings of the 500 largest U.S. firms, observable in both immediate and sustained (up to a year) market returns [137]. This is supported by further empirical studies that identify legitimacy concerns as key motivators behind corporate sustainability disclosure [138–140].

Aligned with voluntary disclosure and signaling theories, research indicates that companies with superior sustainability records proactively disclose high-quality sustainability information. This serves as a market signal of their exceptional performance, whereas firms with weaker sustainability records might opt for lower-quality disclosures as a strategic obfuscation to protect their reputations [141]. Echoing this sentiment, Searcy and Elkhawas (2012) found that Canadian companies regard inclusion in the DJSI as a signal of reputational excellence [142].

Drawing from the foundational theories of legitimacy, stakeholder, voluntary disclosure, and signaling as well as supporting empirical research, we introduce our fifth hypothesis:

Hypothesis 5 (H5): *Inclusion as a constituent in the DJSI Index is positively associated with climate governance disclosure.*

The involvement of financial benchmark developers in crafting ESG indices has been pivotal for analysts, investors, and asset managers, making ESG ratings a cornerstone of financial and strategic decision-making processes [143]. MSCI Inc. has been at the forefront of promoting ESG and climate transparency, enabling stakeholders to grasp the significance of ESG data and the financial implications of climate change [144].

The MSCI ESG Ratings and Climate Corporate search tool, which is publicly accessible, allows for the analysis of over 2900 companies featured in the MSCI All Country World Index. It provides comprehensive data on ESG and climate metrics, such as Implied Temperature Rise and Decarbonization Targets, alongside ESG Ratings, Controversies, Business Involvement Screens, and SDG Net Alignment. Unlike the DJSI, MSCI's rating tool assigns scores to both high and low performers, offering a nuanced view of their ESG performance relative to peers.

Enhanced sustainability disclosure serves to minimize information asymmetry between organizations and stakeholders, fostering a deeper understanding of a company's climate risk profile and competitive standing [145]. Companies excelling in sustainability often gain stakeholder rewards, such as favorable contracts and lower capital costs, while those with poor social or environmental records may face resource constraints [146]. Consequently, there is a strong incentive for organizations to proactively disclose climate change information to maintain their competitive edge. The same theories previously discussed in relation to the DJSI are applicable here.

Based on this theoretical foundation and empirical evidence, the following hypothesis is proposed:

Hypothesis 6 (H6): *Companies that lead in ESG rankings (MSCI) demonstrate a stronger commitment to climate governance disclosure.*

The UN Global Compact, often hailed as the largest global corporate sustainability initiative, was introduced in 1999 at the World Economic Forum as a comprehensive framework for social responsibility guidelines. It encompasses ten principles that cover a wide range of critical issues, including human rights, labor, environment, and anti-

corruption [147]. With over 16,000 corporate signatories and 3800 non-business participants from more than 170 countries, the UNGC commands significant corporate commitment. Joining the UNGC requires a Letter of Commitment to its ten principles and a pledge by a company to operate responsibly and integrate sustainability into its core strategy and culture.

The literature on the UNGC remains predominantly theoretical, and this is viewed as a limitation within the research domain [148]. However, positive market reactions to corporate affiliations with the UNGC have been documented, indicating that such affiliations can act as a signal of value to stakeholders [149].

Assuming that UNGC-affiliated companies are equally committed to climate governance disclosure, the following hypothesis was crafted based on stakeholder, signaling, and voluntary disclosure theories:

Hypothesis 7 (H7): *UNGC participation is positively correlated with climate governance disclosure.*

While carbon reduction regulations remain largely unenforced in many countries, facing increasing stakeholder resistance [150], companies are adopting varied approaches. Some await governmental policy directions, while others proactively seek leadership in sustainability practices. The revelation of poor carbon performance can lead to negative publicity and reputational damage. Credible climate transition plans are essential for organizations aiming to demonstrate their sustainability commitment. Less than 1% of companies reporting to environmental disclosure platforms like CDP have plans deemed 'credible' [151].

Building on stakeholder, voluntary disclosure, and signaling theory, it is posited that organizations with robust climate transition plans will be more transparent and communicative about their climate governance, thus distinguishing them from competitors. This leads to our eighth hypothesis:

Hypothesis 8 (H8): *The existence of a corporate climate transition plan is positively associated with climate governance disclosure.*

Recent studies have embarked on scrutinizing sustainability, CSR, and climate reports to understand the extent of corporate disclosure. Kuo and Chang's (2021) examination of Chinese companies' sustainability reports revealed a trend wherein environmentally conscientious firms are more inclined to disclose circular economy (CE) information [152]. In Spain, García-Sánchez et al. (2023) observed that industries under substantial institutional pressure are more transparent about their CSR challenges and responses. Roberts et al. (2022) compared financial and sustainability reports across diverse sectors, finding that the automotive industry exhibits a notable commitment to CE disclosure, unlike its counterparts in the defense, transportation, and aerospace sectors.

Further studies highlight that companies within extractive industries often amplify their sustainability reporting to mitigate scrutiny from activist groups and regulatory bodies [153]. Such corporations tend to participate in socially beneficial activities to maintain their images [154]. The literature also delves into disclosures on carbon, greenhouse gases, and biodiversity, with findings like those of Bahari et al. (2016), who reported a general hesitance among Asian power companies to release carbon-related information [155]. Talbot and Boiral (2018), on the other hand, investigated impression management strategies used by energy-sector companies to conceal or justify evidence about their climate performance [156]. Conversely, Matsumura et al. (2014) identified a propensity for more environmentally proactive firms to disclose their carbon emissions [157]. These insights led us to propose the following:

Hypothesis 9 (H9): *Firms within the extractive industry are more likely to engage in climate governance disclosure.*

Substantial variability in sustainability and CSR reporting practices across countries has been empirically recognized [158]. Eccles et al. (2012) found that sustainability ratings by agencies like Domini (KLD), Bloomberg, and Reuters differ significantly by firm and country [159]. Research in the cross-country context remains sparse, particularly concerning voluntary sustainability and climate reporting.

Applying social innovation theory suggests that companies in developed nations, facing imminent climate disclosure regulations and stakeholder demands, will likely increase climate-related disclosures. Hence, we posit the following:

Hypothesis 10 (H10): *Companies with headquarters located in developed countries are associated with higher levels of climate governance disclosure.*

In 2020, the International Business Council of the World Economic Forum introduced a framework of ESG metrics and disclosures for member alignment in mainstream reporting [160]. This approach was endorsed, advocating for TCFD-aligned reporting as a benchmark for climate risk disclosure [161]. Since the Task Force on Climate-related Financial Disclosures (TCFD) promulgated its recommendations in 2017, there has been a marked uptake in and support for these guidelines: over 3800 corporations have adopted TCFD-aligned reporting practices, and regulatory bodies, alongside international standards organizations—including the U.S. Securities and Exchange Commission, the International Sustainability Standards Board (ISSB), and the European Financial Reporting Advisory Group—have been instrumental in integrating TCFD recommendations into climate-related reporting mandates.

However, given the relative novelty of the TCFD recommendations and their sporadic adoption as formal standards by regulatory authorities, research in this domain remains limited. Eccles and Krzus (2018) undertook a “field experiment” evaluating the implementation challenges of the TCFD guidelines among the largest U.S. oil and gas companies [162]. Their findings highlighted a spectrum of compliance levels, with a surprising majority of disclosures appearing in voluntary sustainability reports rather than in the compulsory financial statements, suggesting that companies are capable of meeting TCFD guidelines if required. Further research in Italy has illustrated the complexity of factors influencing a company’s decision to adopt the TCFD framework [163]. It was inferred that an entity’s dedication to disclosing climate-related information using the TCFD framework is indicative of a comprehensive climate governance system.

Drawing parallels with other factors, such as commitments to the UN Global Compact or inclusion in the DJSI, and grounded in the same theoretical frameworks of legitimacy, stakeholder, signaling, and voluntary disclosure, we assert our final hypothesis:

Hypothesis 11 (H11): *There is a positive correlation between the duration of TCFD reporting and the extent of climate governance disclosure.*

5. Research Design

5.1. Sample

In this section, we describe the dependent, independent, and control variables in detail. As a next step, we explain how the sample was prepared, followed by the methodology used. Table 1 below shows the variables used in our study. They include several social, economic, and financial attributes of companies and related corporate information. The sources of the information are shown as well.

Table 1. Descriptive variables, measurements, types, and sources.

No.	Variable Type	Variable	Measurements	Type	Source
1	control	Employee no	Natural logarithm of total number of employees	C	Morningstar, Bloomberg, annual report or company website
2	control	3 year net income average	Three year average net income 2020	C	Morningstar, Bloomberg, annual report or company website
3	independent	TCFD years	Publication of TCFD report for how many years	C	Company website & Google search
4	independent	MSCI in comparison	MSCI ESG rating in comparison to competitors	CA	MSCI ESG rating & Climate search tool webpage
5	independent	Climate transition plan	Climate transition plan in place	D	Company website, TCFD report, CDP report, Sustainability report
6	independent	GRI standards	Company uses GRI standards or guidelines	D	Company website, ESG/Sustainability/similar report
7	independent	Global Compact	Company refers to UN Global Compact	D	Company website, ESG/Sustainability/Climate similar report
8	independent	DJSI	Company is DJSI constituent in 2020	D	DJSI and/or company website
9	independent	Female director ratio	Natural logarithm of % of female directors	C	2021 proxy statement, 2020 annual report, Morningstar, website
10	independent	Company location	HQ is located in developed or emerging country	CA	Company website
11	independent	Company sector	Main sector in which company is active	CA	Company website, Morningstar, Bloomberg, Yahoo Finance
12	independent	Sustainability Committee	Dedicated sustainability board committee in 2020	D	2021 proxy statement, 2020 annual report, Morningstar, website
13	independent	Sustainability Executive	Dedicated sustainability executive in 2020	D	2021 proxy statement, 2020 annual report, Morningstar, website

C = continuous, CA = categorical, D = dichotomous, HQ = Headquarter.

Our sample comprised the 100 largest global companies according to market capitalization for the reporting year 2021 (in USD billion) according to Forbes (Forbes, 2021) [164]. Most of the economic and financial data such as employee number, profitability, location, and company sector were obtained from the Bloomberg, Morningstar, and Yahoo Finance databases. The variables employee number and profitability were continuous. Another continuous variable was the ratio or percentage of female directors on the board of directors. This information was obtained from the 2021 proxy statement or from the company website or sustainability report. Furthermore, the continuous quantities of total TCFD reporting years were obtained by performing searches on the company website or conducting a targeted Google search.

For the categorical variable company location, which was usually obtained from the company website, we divided the companies into those operating in a developed or an emerging country. A categorical variable was also used for the independent variable company sector, which differentiated between extractive and non-extractive corporations. The variable MSCI ESC rating was retrieved by using the MSCI ESG Ratings and Climate

Search Tool. The independent variable “MSCI rating in comparison” reflected the MSCI rating that included three categories titled “leader”, “average”, or “laggard”.

The information on whether a company had a climate transition plan in place or not was found either on the company website, the TCFD report, CDP report, or the sustainability report. The same was true for the application of GRI standards (or guidelines) or UN Global Compact Standards usage. These three independent variables were of a binary nature.

The variable DJSI reflected the fact that a company was a Dow Jones Sustainability Index (DJSI) constituent in the year 2020. The binary DJSI variable assumed a value of 1 if a company belonged to the DJSI in 2020 and zero otherwise. Similarly, the fact that a company had a sustainability board committee and a sustainability executive was captured in the independent dichotomous variables of the same name. The respective variables assumed the value of one if a company had a sustainability officer and/or executive in 2020 and zero otherwise. As control variables, we recognized two company- and corporate governance-specific variables that the extant literature has shown to be associated with corporate governance quality [165].

As a dependent variable, we developed a score based on TFCF’s criteria consisting of variables in two main categories: board-related and management-related. The board-related oversight score consisted of three individual scores. The first one assessed the processes and frequency with which a board and/or board committees (e.g., audit, risk, or other committees) were informed about climate-related issues. The second assessed whether a board and/or board committees considered climate-related issues when reviewing and guiding strategies, major plans of action, risk management policies, annual budgets, and business plans as well as setting the organization’s performance objectives, monitoring implementation and performance, and overseeing major capital expenditures, acquisitions, and divestitures. Finally, the third score measured how a board monitored and oversaw progress against goals and targets for addressing climate-related issues. The maximum score was 3 points.

For the management-related score, four scores were used. The first one measured whether an organization had assigned climate-related responsibilities to management-level positions or committees and, if so, whether such management positions or committees reported to the board or a board committee and whether those responsibilities included assessing and/or managing climate-related issues. The second score was assigned if a company provided a description of the associated organizational structure(s), whereas the third score measured if processes by which management could be informed about climate-related issues were in place. The fourth score was based on how management (through specific positions and/or management committees) monitored climate-related issues. The maximum score was 4 points.

Therefore, a total maximum score of 7 could have been achieved. The scoring was conducted by gathering information based on company annual financial reports, 10K or equivalent reports, proxy statements, appendices, environment progress reports, sustainability reports, integrated reports, climate change transition (resilience) reports, CDP reports, TFCF-based reports, ESG reports, carbon neutrality reports, corporate citizen reports, company websites, company sustainability charters, climate risk and resiliency summaries, governance reports, GC web pages, board committee charters, climate risk management (TCFD) reports, sustainability data books, CG reports, TCFD content indices, impact reports, GC charters, business responsibility reports (BRR), etc.

We then added the two scores (management-related and board-related) together to achieve the total climate governance score. In our analysis, we used the constructed score as a proxy for a firm’s climate governance disclosure, which is very similar to the TCFD guidelines and the CDP procedure and scoring. It has, however, the advantage to be able to calculate a score for companies that have not used TCFD or CDP guidelines but that provided other information. To be clear, we assessed all scores ourselves without relying on scores that the CDP had assigned.

The scoring was conducted by one main scorer, and a second scorer conducted blind spot checks on batches of five companies. If the spot check rate was off by 10%, the whole batch needed to be re-checked and reconciled. This happened twice.

As mentioned, the initial sample consisted of the 100 largest global companies arranged by market capitalization for the reporting year 2021 (in USD billion) according to Forbes. To be included in the sample, a company had to meet the following criteria: (i) It was publicly listed on the global stock exchange. (ii) It had published climate governance information available either in its annual sustainability report, integrated report, website, financial report, or any other environmental report in the year 2020. (iii) It had available financial data from the Morningstar database. These criteria were met by all the sample companies.

Table 2 provides an overview of the descriptive statistics for the variables that are included in this study. There were 100 companies in our sample operating in 10 different sectors. The average number of employees was 194,930. The smallest company had 11,300 employees, and the largest company employed 2,300,000 employees. As for company profitability, the 3-year net income average was 12.91%, with a minimum of -56.88% and a maximum of 124.52% . The TCFD reporting years were on average 0.92 years, with a minimum of 0 and a maximum of 5 (since 2017). The mean share of female directors on the board for all sample companies was 29%, with a range from 13% to 60%. In addition, the data calculations showed that the dependent variable, the Total Climate Governance score, ranged from 0 to 7, with an average of 4.97.

Table 2. Sample distributions/descriptive statistics for all variables.

Descriptive Statistics for Continuous Variables					
Variable names	Obs	Mean	Std. dev.	Min	Max
Employees No	100	194,930	298,984	11,300	2,300,000
3 year net income average	100	12.9087	28.58282	-56.88	124.52
TCFD years	100	0.92	1.587069	0	5
Fem_dir_ratio	100	0.2882	0.1272346	0	0.6
Total_Governance_score	100	4.97	2.183293	0	7
Descriptive Statistics for Categorical Variables					
Variable names	Category	Frequency	Percent	Cum	
MSCI_comparison	leader	27	27	27	
	average	64	64	92	
	laggard	9	9	100	
	Total	100	100		
Company_location	developed	85	85	85	
	emerging	15	15	100	
	Total	100	100		
Company_sector	non-extractive	94	94	94	
	extractive	6	6	100	
	Total	100	100		
Descriptive Statistics for Dichotomous Variables					
Variable names	Measures	Frequency	Percent		
Climate_plan	Yes	79	79		
	No	21	21		
	Total	100	100		
Sust_committee	Yes	36	36		
	No	64	64		
	Total	100	100		
Sust_executive	Yes	43	43		
	No	57	57		
	Total	100	100		
UN Global_Compact	no	53	53		
	yes	47	47		

Table 2. Cont.

	Total	100	100
DJSI	no	61	61
	yes	39	39
	Total	100	100
GRI	No	27	27
	Yes	73	73
	Total	100	100
Netzero_committed	No	60	60
	Yes	40	40
	Total	100	100
UN SDG	No	79	79
	Yes	21	21
	Total	100	100

Variables are presented as defined in Table 1; $n = 100$.

In our sample, three independent variables were of a categorical (ordinal) nature: MSCI ESG ranking in comparison, company location, and company sector. For the variable MSCI ESG ranking, 27% of companies were categorized as “leaders”, 64% were “average”, and 9% were considered “laggards”. Regarding corporate location, 85% of companies were headquartered in developed countries, and the remaining 15% were headquartered in emerging countries. When analyzing the different sectors of our sample companies, we observed that only 6% of the companies operated in the extractive industry.

Table 2 also displays the descriptive statistical data for the dichotomous variables. In total, 36% of the sample corporations reported having a sustainability or equivalent committee, while 43% had a sustainability executive or equivalent in their corporate hierarchy. Nearly 80% mentioned some kind of climate transition plan in their documents. A total of 47% of the sample companies referred to the United Nations Global Compact, while 39% were constituents of the Dow Jones Sustainability Index in 2020 (either global or regional). Lastly, 73 out of the 100 companies referenced the Guidelines or Standards of the Global Reporting Initiative (GRI) in at least one of their official documents.

Regarding firm-level controls, company size was measured as the natural logarithm of the total number of employees at the end of the financial year (Employees). The natural logarithm was also used for the ratio of the female directors on the board (Fem_dir_ratio) and the number of years the company has applied the TCFD guidelines (TCFD years). For our profitability variable, we winsorized the three year-over-year net income average.

5.2. Empirical Model

To test our eleven hypotheses, we estimated equation 1 using ordinary least squares (OLS) regression with robust standard errors:

Equation (1):

$$\begin{aligned}
 & Total_Climate_Gov_Score_{i,t} + 1 \\
 & = \beta_0 + \beta_1 \ln_Fem_Dir_Percent_{i,t} + \beta_2 \ln_Employees_{i,t} + \beta_3 Three_Year_NI_aver_{i,t} \\
 & + \beta_4 \ln_Tcfdi_{i,t} + \beta_5 Sust_Committee_{i,t} + \beta_6 Sust_Executive_{i,t} \\
 & + \beta_7 MSCI_in_compA_{i,t} + \beta_8 Climate_trans_plan_{i,t} + \beta_9 GRI_{i,t} \\
 & + \beta_{10} Global_Compact_{i,t} + \beta_{11} DJSI_{i,t} + \beta_{12} Develop_Emergi_{i,t} \\
 & + \beta_{13} Extractive_nonextractive_{i,t} + u_i + \varepsilon_{i,t}
 \end{aligned} \tag{1}$$

where $\beta =$, $\mu =$, $\varepsilon =$, $i =$ company, and $t =$ time

$\varepsilon_{it} = \vartheta_{it}$ is the random error term for company i in moment t

All the analyses were performed using Stata 18 software (Stata/BE 18.0 for Mac (Apple Silicon) Revision 20 Dec 2023).

Please note that the climate governance disclosure score is measured at year $t + 1$, whereas all independent and control variables are measured at year t . This research design is intended to alleviate endogeneity concerns caused by simultaneity or a reverse causal concern [166].

6. Empirical Results and Discussion

6.1. Correlation Analysis

Table 3 presents the pairwise Pearson/Spearman correlation coefficients (both parametric and nonparametric) for the dependent, independent, and control variables. As expected, there were many significant correlations among the variables. In general, Pearson correlation is most appropriate for measurements taken from an interval scale, while the Spearman correlation is more appropriate for measurements taken from ordinal scales [167].

After careful analysis, it was determined that many correlations were positive. This implied that companies with certain characteristics disclosed on average a higher level of climate-related information. When applying Pearson's correlation test, the variable for female board membership ratio (*Female_Dir_ratio*) had a correlation of 0.41 with the dependent variable and was statistically significant at the 1% level. The number of years that a corporation had used TCFD guidelines (*TCFD years*) also correlated positively and significantly (1% level also), with a value of 0.35, with the dependent variable *Total_Climate_Gov_Score*. In contrast to this, the variable 3-year average profitability (*3y_Net_income_average*) correlated negatively and significantly (-0.24 , 5% significance level) with *Total_Climate_Gov_Score* at the 5% level.

Many of the findings were supported when applying the Spearman's rank correlation test. Using the Spearman correlation values, we observed a positive and significant correlation for the variables *Sustainability_Executive* and *Climate_transition_plan* with the dependent variable at the 5% significance level. Hence, at the bivariate level, we found correlations between the independent variables and the dependent variable that supported our study's hypotheses.

The highest pairwise correlation coefficient was between the variables *Developing_Emerging* and *Female_Dir_Percent* (-0.6982). Fidell and Tabachnick (2003) suggested that multicollinearity could be a relevant problem when the correlation between the independent variables is higher than 0.90 [168]. The variance inflation factor (VIF) mean for our regression model was 3.62, while the highest VIF was 7.73. Since none of the variables had a VIF value larger than 10, multicollinearity was not considered a problem when interpreting the regression results [169].

Table 3. Spearman and Pearson correlations matrix ($n = 100$).

Correlation Matrix ($n = 100$)														Spearman
	TOTAL_GOVERNANCE_SCORE	Fem_dir_ratio	Employees_no	3yNet_Income_average	TCFD years	Sust_committee	DJSI	Sust_Executive	GRI	Extractive vs. Non-extractive	MSCI_comparison	Developed_vs_emerging	Global_Compact	Climate_plan
TOTAL_GOVERNANCE_SCORE	1.0000	0.3711 *	0.1108	-0.2156	0.3945 *	0.2156	0.2330	0.4286 *	0.2283	0.0754	0.2548	-0.3903 *	0.2935	0.3838 *
Fem_dir_ratio	0.4111 *	1.0000	-0.0215	-0.1064	0.1815	0.1841	0.1801	0.2504	0.0305	0.0388	0.157	-0.5610 *	0.1030	0.3035
Employees_no	0.0801	-0.0059	1.0000	-0.1957	0.0655	0.1566	-0.0827	0.1837	-0.0456	-0.2071	-0.1253	0.0839	0.0121	0.0736
3yNet income_average	0.4280	0.9533	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
TCFD years	-0.2348 *	-0.045	-0.1767	1.0000	-0.1923	-0.0809	-0.0444	-0.2719	-0.0242	0.0445	0.0300	0.0884	0.0364	-0.245
Sust_committee	0.0187	0.6563	0.0787	1.0000	1.0000	1.0000	1.0000	0.5648	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
DJSI	0.3494 *	0.1302	0.0785	-0.1831	1.0000	0.4191 *	-0.0674	0.1969	0.1898	-0.038	0.1071	-0.0894	0.2458	0.2313
Sust_Executive	0.0208	0.1967	0.4375	0.0683	0.0000	0.0013	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
GRI	0.2309 *	0.1822	0.1406	-0.0785	0.4174 *	1.0000	-0.0871	0.1481	0.0807	-0.1018	0.0168	-0.1225	0.0033	0.1821
Extractive vs. non-extractive	0.0208	0.0696	0.1630	0.4376	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
MSCI_comparison	0.2753 *	0.2248 *	-0.1035	-0.0514	-0.0708	-0.0871	1.0000	0.0095	0.2092	0.0570	0.1078	-0.2635	0.0275	0.0096
Developed_vs_emerging	0.0056	0.0246	0.3053	0.6119	0.4839	0.3887	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Global_Compact	0.4258 *	0.2694 *	0.1472	-0.2409 *	0.1521	0.1481	0.0095	1.0000	0.0733	-0.1344	-0.0262	-0.2922	0.0724	0.2990
Climate_plan	0.0000	0.0067	0.1439	0.0158	0.1309	0.1414	0.9251	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.2283
	0.2923 *	0.0262	-0.0445	-0.0941	0.1935	0.0807	0.2092 *	0.0733	1.0000	-0.036	0.1203	-0.1441	0.3019	0.2395
	0.0032	0.7956	0.6599	0.3519	0.0538	0.4247	0.0367	0.4689	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	0.0423	0.0337	-0.2272 *	0.0705	-0.0235	-0.1018	0.0570	-0.1344	-0.036	1.0000	0.0990	0.0194	0.0996	0.1303
	0.6764	0.7394	0.0230	0.4858	0.8164	0.3137	0.5734	0.1825	0.7218	1.0000	1.0000	1.0000	0.2063	1.0000
	0.3024 *	0.1043	-0.1261	0.0086	0.1290	0.0161	0.1355	-0.0151	0.1212	1.0000	1.0000	-0.0327	0.1550	0.0603
	0.0022	0.3019	0.2114	0.9321	0.2009	0.8738	0.1789	0.8812	0.2296	0.2803	1.0000	1.0000	1.0000	1.0000
	-0.4787 *	-0.6982 *	0.0672	0.0827	-0.078	-0.1225	-0.2635 *	-0.2922 *	-0.1441	0.0194	-0.055	1.0000	-0.149	-0.2873
	0.0000	0.0000	0.5063	0.4132	0.4402	0.2247	0.0081	0.0032	0.1526	0.8479	0.5869	1.0000	1.0000	0.3418
	0.3266 *	0.0196	0.0642	0.0250	0.2084 *	0.0033	0.0275	0.0724	0.3019 *	0.0996	0.1561	-0.149	1.0000	0.1904
	0.0009	0.8464	0.5259	0.8047	0.0375	0.9737	0.7858	0.4738	0.0023	0.3244	0.1210	0.1391	1.0000	1.0000
	0.4563 *	0.3267 *	0.0726	-0.3202 *	0.2206 *	0.1821	0.0096	0.2990 *	0.2395 *	0.1303	0.0842	-0.2873 *	0.1904	1.0000
	0.0000	0.0009	0.4729	0.0012	0.0274	0.0698	0.9248	0.0025	0.0164	0.1965	0.4050	0.0038	0.0578	

Pearson
Note: Spearman (Pearson) correlation coefficients are in the above (below) triangle. p -values are in parentheses. n = number of observation. Find variable definitions in Table 2.
 $n = 100$

The Spearman and Pearson correlations with the following variables: Total_Climate_Gov_Score—total climate governance score; Employees_no—company size; Female_Dir_percent—female directors on board percentage; 3y_Net_income_average—company profitability; TCFD years—no. of TCFD reporting years; Sust_Committee—sustainability committee, Y/N; Sust_Executive—sustainability executive, Y/N; MSCI_comparison—MSCI ESG rating leader, average or laggard; Climate_trans_plan—climate transition plan, Y/N; GRI—GRI standards, Y/N; Global_Compact—global compact, Y/N; Develop_Emerg—developmental status of country in which HQ is located; Extractive_Nonextractive—company in high-carbon sector, Y/N. * correlation is significant at the 0.05 level (2-tailed).

6.2. Multivariate Results

The results of the multiple regression analysis are presented in Table 4 below. Our model is highly significant ($F = 12.4$ and $p < 0.000$) and has very good explanatory power (adjusted $R^2 = 0.63$). We conducted regression diagnostics to make sure the assumption of linearity between the predictors and the outcome variable, the normal distribution of errors, homoscedasticity, and the independence of errors were in place. However, it is very rare for a dataset to meet all assumptions perfectly.

Table 4. Multiple regression results.

Source	SS	df	MS	Number of obs	=	93
Model	284.922168	14	20.3515834	F(14, 78)	=	12.2
Residual	130.077832	78	1.66766451	Prob > F	=	0.00
				R-squared	=	0.6866
				Adj R-squared	=	0.6303
Total	415	92	4.51086957	Root MSE	=	1.2914
TOTAL_GOVERNANCE_SCORE	Coefficient	Std. err.	t	P > t	[95% conf.	interval]
Fem_Dir_Ratio	1.09009	1.342316	0.810	0.419	−1.582257	3.762436
Employees No	0.1007912	0.1429037	0.710	0.483	−0.1837082	0.3852907
3Year_NI_aver	0.0020927	0.0075524	0.280	0.782	−0.012943	0.0171284
TCFD years	0.6967596 **	0.2977564	2.340	0.022	0.1039722	1.289547
Sust_Committee	0.162616	0.3187556	0.510	0.611	−0.4719776	0.7972096
DJSI	0.8491656 ***	0.310064	2.740	0.008	0.2318756	1.466456
Sust_Executive	1.278789 ***	0.3127191	4.090	0.000	0.6562131	1.901365
GRI_Mentioned	0.4387207	0.3438468	1.280	0.206	−0.2458257	1.123267
Extractive_Nonextractive	1.006734	0.7072237	1.420	0.159	−0.40124	2.414708
MSCI_in_comparison						
laggard	0.8268512	0.5555195	1.490	0.141	−0.2791032	1.932806
leader	0.7686923 **	0.3196893	2.400	0.019	0.1322398	1.405145
Develop_emerging	−2.030724 ***	0.5859094	−3.47	0.001	−3.19718	−0.8642677
Global_Compact	0.3749344	0.2985542	1.260	0.213	−0.2194413	0.9693101
Climate_trans_plan	0.8375058 **	0.4207897	1.990	0.050	−0.000223	1.675233
_cons	0.6064463	1.853929	0.330	0.744	−3.084443	4.297336

The OLS regression detailed variable definitions are provided in Table A1. All continuous variables were winsorised at the 1% and 99% levels to mitigate the influence of extreme values. ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively (two-tailed).

We checked for unusual data statistically and graphically with both large residuals and large leverages and decided that we had seven observations in our sample that were substantially different from all other observations, and we removed these as they were too much of a concern for us. Therefore, the final sample comprised 93 company observations, which represent 93% of the initial sample.

Climate-related information was collected from the firm's annual sustainability (or similar) reports, climate reports, carbon footprint reports, integrated reports, and company websites, and proxy statements and annual financial reports. Other financial data were collected from the Morningstar database. We analyzed the data statistically using STATA (18) software.

Contrary to our expectations, our study found no statistically significant correlations between gender diversity in corporate boards (Hypothesis 1) and the level of climate governance disclosure. This is surprising given that gender diversity is often significant in sustainability-related research. Similarly, the presence of a sustainability board committee (Hypothesis 2) did not influence the climate governance disclosure score, diverging from previous findings.

In terms of industry impact, we observed no significant differences in climate governance disclosure between companies in the extractive and non-extractive sectors (Hypothesis 9), which challenges our assumptions based on legitimacy theory and stakeholder theory. Moreover, adherence to the Global Reporting Initiative (GRI) or UN Global Compact guidelines did not correlate significantly with the climate governance disclosure level (Hypotheses 4 and 7).

However, we identified a positive and significant relationship between the appointment of a sustainability executive or Chief Sustainability Officer (CSO) and higher climate

governance scores (Hypothesis 3), supporting the agency theory perspective that dedicated leadership in sustainability is crucial for enhanced climate governance and disclosure.

Consistent with voluntary disclosure and social innovation theories (Hypothesis 10), we found a significant positive relationship between corporations headquartered in developing countries and the climate governance disclosure score, with a notable regression coefficient ($\beta = -2.24$, p -value = 0.000 for emerging countries).

Additionally, our research supports Hypothesis 5, indicating that being a Dow Jones Sustainability Index constituent positively correlates with climate governance disclosure, aligning with the theories of legitimacy, voluntary disclosure, stakeholder engagement, and signaling ($\beta = 0.88$, p -value = 0.005).

Similarly, we confirmed Hypothesis 8, which posited a positive link between possessing a climate transition plan and climate governance scores ($\beta = 0.85$, p -value = 0.041). The data also validated Hypothesis 11, showing a significant positive relationship between longer durations of TCFD reporting and higher climate governance scores ($\beta = 0.26$, p -value = 0.012), reinforcing the theories mentioned above.

In line with Hypothesis 6, our findings indicate that there is a significant positive association between companies ranked in the leader category of the MSCI ESG rating and their climate governance scores ($\beta = 0.76$, p -value = 0.021), a link further substantiated by legitimacy, voluntary disclosure, stakeholder, and signaling theories.

To mitigate any confounding effects from company- and location-specific characteristics on climate change disclosure, we included several control variables in our analysis. In accordance with previous studies [170], we controlled for company size and profitability, among other characteristics.

6.3. Endogeneity Check

With regard to the endogenous problem of self-selection error, in order to control the distortion of regression results caused by self-selection error, we adopted the Heckman two-stage model [171] to analyze our hypotheses even further. We therefore adopted a probit model in the first stage, which was based on a dummy variable created based on the overall Climate Governance score. If the answer was yes, a score of 1 was assigned; otherwise, the score was 0. We then inserted a correction factor, the Inverse Mills ratio (IMR or λ_i), which was calculated from the probit model, into the regression model.

The results of the Heckman two-stage regression are shown in Table 5. In summary, the Inverse Mills Ratio (IMR) was -0.72 and not significant, indicating that there was no selectivity deviation in our research sample. As the results were not significant, endogeneity did not qualitatively impact the main results. The coefficients from the Heckman two-stage treatment effect models are consistent with the main results. Finally, the results shown in Table 5 are congruent with our regression analysis presented in Table 3.

Table 5. Results of Heckman two-stage regression.

Heckman Selection Model—Two-Step Estimates (regression model with sample selection)		Number of obs	=	93		
		Selected	=	88		
		Nonselected	=	5		
		Wald chi2(14)	=	44.63		
		Prob > chi2	=	0.00		
TOTAL_gov_dummy	Coefficient	Std. err.	z	P > z	[95% conf. interval]	
TOTAL_gov_dummy						
Fem_dir_ratio	1.236784	1.757886	0.7	0.482	−2.20861	4.682178
TCFD years	0.1705897	0.1197121	1.42	0.154	−0.0640417	0.4052212
Employees No.	0.196691	0.1774223	1.11	0.268	−0.1510503	0.5444322
3Year_NI_aver	−0.0072583	0.0098978	−0.73	0.463	−0.0266576	0.012141
Develop_emerg	−2.233353 ***	0.7051218	−3.17	0.002	−3.615366	−0.8513398
Sust_committee	−0.240468	0.383103	−0.63	0.530	−0.991336	0.5104
Global_compact	0.5527431	0.3606587	1.530	0.125	−0.154135	1.259621

Table 5. Cont.

Sust_executive	0.4433964	0.3851491	1.150	0.250	−0.3114819	1.198275
MSCI_in_comparison						
leader	−0.7062288	0.804648	−0.88	0.380	−2.28331	0.8708523
laggard	−0.6949297	0.8505053	−0.82	0.414	−2.361889	0.97203
DJSI	0.4589203	0.3776409	1.220	0.224	−0.2812423	1.199083
Extractive vs. nonextractive	0.5884356	0.8421205	0.700	0.485	−1.06209	2.238961
GRI	0.7975753 *	0.4602241	1.730	0.083	−0.1044474	1.699598
Climate_trans_plan	−0.0295368	0.6421516	−0.05	0.963	−1.288131	1.229057
_cons	2.003496	2.392368	0.840	0.402	−2.68546	6.692452
select						
Fem_dir_ratio	4.236269	3.97758	1.070	0.287	−3.559645	12.03218
Employees No.	0.1070974	0.5478316	0.200	0.845	−0.9666328	1.180827
3Year_NI_aver	0.0108338	0.0189525	0.570	0.568	−0.0263125	0.04798
TCFD years	0.2358307					
Sust_committee	5.840729					
Sust_executive	5.187994					
GRI	1.041374	1.016915	1.020	0.306	−0.9517436	3.034491
Climate_trans_plan	6.353613					
Netzero_committed	0.3287707	1.041026	0.320	0.752	−1.711603	2.369145
_cons	−2.340122	6.179323	−0.38	0.705	−14.45137	9.771129
/mills						
lambda	−0.7159401	1.270513	−0.56	0.573	−3.206101	1.774221
rho	−0.46531					
sigma	1.5386268					

The Heckman second-stage estimation determined via OLS (Heckman's two-step estimator). The Inverse Mills Ratio (λ_i) is included to correct potential self-selection bias in the sample. The Wald test contrasts with the null hypothesis of no joint significance of the explanatory variables. Standard error is shown in parentheses under coefficients. *** and * denote statistical significance at the 1%, and 10% levels, respectively. For the Heckman selection model, the key independent variable is the predicted value of the probability of a company's climate governance score, measured as a dummy variable. Variable definitions are provided in Table 1.

In the first stage of the Heckman procedure, when our dependent variables were used and the additional control variable Netzero_committed was included in the regression model, the main results did not change. Following the procedure employed by Jiang et al. (2021), we also used a lead–lag approach (that is, using a 1-year lag for some independent variables such as DJSI membership, corporate climate transition plan, etc.) to control for endogeneity and possible reverse causality. The results were still consistent with our earlier results, implying that our research was indeed rigorous.

6.4. Other Robustness Tests

In order to validate the robustness of our findings, we conducted additional tests to examine the relationship between the Total Climate Governance Score and our independent variables. Two alternative measures were introduced as independent variables in our regression model. First, we included a dummy variable for the United Nations Sustainability Development Goals (UN SDG), which equaled 1 if a company referred to the SDGs in 2020 and 0 otherwise. This was used as an alternative to the UN Global Compact variable. Additionally, we replaced the 3-year average of the net income ratio (2018, 2019, and 2020), which was used in the main regression model to measure company performance, with the variable Return on Equity (ROE).

The results of the regression using these alternative measures are presented in Table A2 in Appendix A. Notably, the regression coefficient for the UN SDG variable was positive and statistically significant at the 5% level (0.77, $p = 0.04$), closely resembling the GRI variable's effect. Conversely, the coefficient for the alternative variable ROE was positive but statistically insignificant, akin to the variable it replaced, 3-year average Net Income. These results underscore the continued significance of the relationship between climate governance and the independent variables at the 1% level, mirroring the main model presented in Table 4.

To further validate our results, we conducted additional analyses by splitting our sample into two sub-groups based on company size. The first group consisted of companies with more than 50,000 employees, while the second group comprised companies with

50,000 employees or fewer. The larger company sub-sample encompassed 72 firms, while the smaller company sub-sample included 21 organizations.

The regression results for both sub-samples revealed that the relationship between our dependent variable, Climate Governance Score, and the independent variables remained significant at the 1% level for larger corporations and at the 5% level for the smaller sub-sample. While the regression results closely resembled those of the whole sample, some differences emerged in the sub-sample of smaller companies. Notably, only three variables showed significant results: TCFD reporting years, Global Compact, and Sustainability Committee. Particularly noteworthy was the regression coefficient for the DJSI variable, which reached 2.2 with a 5% significance level. This suggests that for smaller companies, the presence of a sustainability committee doubled the Climate Governance Score. Detailed results are presented in Table A3 in Appendix A. These findings consistently support our main results and affirm the robustness of our estimations.

To ensure the reliability of our data and estimations, we conducted several additional robustness checks. First, we performed the analysis without the inclusion of US companies, as the majority of our sample data originated from the US. We also explored total assets as an alternative proxy for company size. Furthermore, we conducted an analysis after trimming the dataset instead of winsorizing it to assess the effects without extreme outliers. Additionally, we replaced the natural-logarithm-transformed variables with their non-transformed counterparts, such as total employees' number, TCFD year number, and Female Director Ratio.

The results of these variations remained qualitatively consistent with our previous findings. The same held true when employing alternative regression methods, such as heteroskedastic linear regression (hetregress) or robust regression in STATA (regress, robust option). Overall, these robustness checks indicate that our main results remained resilient to alternative estimations and underscore the stability of our findings.

7. Summary and Conclusions

Our research has explored the complex relationship between corporate governance structures and climate-related disclosures. By examining a sample of the largest global corporations, we found that specific company characteristics, notably the presence of a sustainability executive and a climate transition plan, are positively and significantly linked to climate governance disclosures. These findings suggest a pivotal shift towards more proactive and structured climate governance within the organizations, as highlighted by Velte and Stawinoga (2020) [172] and Albitar et al [173]. Our results underscore the importance of strategic planning and resource allocation in bolstering climate disclosure quality and inform regulatory discussions on standardizing climate change reporting.

Our empirical evidence points to a significant and positive influence of these governance mechanisms on climate disclosure, echoing the broader implications of voluntary disclosure, stakeholder, signaling, and legitimacy theory. However, we also encountered some divergent findings. Notably, traditional measures of corporate governance, such as the ratio of female board directors or a sustainability board committee, did not consistently predict the level of climate governance disclosure, contrasting with our previous research [174–177] and challenging established theoretical expectations. These results contribute to an evolving dialogue about the adequacy of current board structures in addressing climate change imperatives and suggest that adding dedicated sustainability expertise at the executive level may be more effective than traditional diversity measures alone.

We recognize the limitations inherent in our study, chiefly its reliance on secondary data and the focus on the Forbes 100 Global companies list, which may not reflect the practices of smaller entities. Future research should consider a broader spectrum of organizational sizes, geographic regions, and sectors, as well as a more diverse range of board attributes. We also recommend conducting longitudinal studies to track the evolution of corporate climate change disclosure over time. Moreover, alternative perspectives seem pertinent for future studies in this area. We are very supportive of the recommendations

of Mathews (1997) [178], Gray (2002) [179], and Hsieh et al. (2022) [180], who encouraged future research to advocate for accounting academics to collaborate with other disciplines and professionals in producing research that not only helps address sustainability but also climate-change-reporting issues. This also includes exploring the integration of AI and machine learning technologies to enhance the analysis of climate-related data.

Our findings have profound implications for stakeholders across the corporate spectrum. Investors and analysts stand to gain significantly from robust climate governance, as it sharpens their ability to assess the long-term sustainability and risk exposure of their portfolios. Detailed climate disclosures provide them with a clearer understanding of how well companies are prepared to handle the financial implications of climate change, allowing for more strategic investment decisions and fostering market confidence. These practices also serve to attract conscientious investors who prioritize environmental stewardship in their investment choices, thereby potentially enhancing the market value of transparent companies. Consumers and the public can make more informed choices, supporting businesses that demonstrate environmental responsibility. Environmental organizations can use the more detailed climate-related information to track corporate progress and advocate for environmental accountability. Corporate lenders that consider climate governance disclosures in their decision-making process can achieve a more stable and sustainable lending portfolio, better align with global sustainability efforts, and maintain a competitive edge in an increasingly environmentally conscious market. Lastly, companies themselves harness these disclosures to manage risk, innovate, and secure a competitive advantage. Together, these benefits contribute to a financial market that is more responsive to the nuances of climate-related risks and opportunities.

Ultimately, our study reaffirms the critical role of innovative corporate governance in fostering climate reporting and suggests that a holistic approach, inclusive of both structural and strategic planning elements, is essential for effective climate governance and disclosure. Moving forward, standard setters and regulators are urged to consider these insights in crafting policies that mandate more detailed and proactive climate change reporting.

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Appendix A

Table A1. Theories, explanations, and affected variables, which were moved to the Appendix.

Theories	Explanations	Hypothesis/Variable Affected
Legitimacy theory	This theory posits that to attain resources and be accepted, an organization has to comply with its social contract. This theory argues that companies employ sustainability disclosure to improve the public perception of their sustainability performance. Poorly performing companies use sustainability disclosure as a legitimation strategy to influence public perceptions of their sustainability performance	GRI standards DJSI constituent TCFD reports UN Global Compact CSR Committee CSR Executive

Table A1. Cont.

Theories	Explanations	Hypothesis/Variable Affected
Signaling theory	This theory posits that companies publish information to influence potential shareholders	GRI standards TCFD reports UN Global Compact Climate transition plan DJSI constituent
Stakeholder theory	This theory posits that companies publish information to influence/inform stakeholders	GRI standards UN Global Compact Climate transition plan CSR Committee DJSI constituent TCFD reports
Voluntary disclosure theory	This theory posits that a company with good performance is incentivized to disclose information regarding its performance to increase its market value; bad performers try to greenwash	GRI standards UN Global Compact Climate transition plan CSR Committee CSR Executive DJSI constituent TCFD reports MSCI ESG ranking
Gender socialization theory	This theory posits that females behave differently, including in the context of board membership	Female Director Ratio
Resource dependence theory	This theory posits that boards of directors provide firms unique resources and capabilities	Female Director Ratio
Social Innovation theory	This theory posits that organizations distribute value and collective impact to address social problems.	Developed vs emerging country
Research-based		
Not based on theory	Research results suggest that factor “size” is significant determinant of companies’ CSR disclosure practices. Researchers examined Chinese companies’ CSR and sustainability reports, demonstrating that larger firms are likely to disclose more CE information to meet stakeholders’ expectations.	Size
	Research results suggest that factor “industry” is significant determinants of companies’ CSR disclosure practices	Extractive vs. Non-extractive Industry
	Research results suggest that ratio of “female directors” influences climate change innovation mainly through this demographic’s involvement in management as executive directors rather than through the monitoring and advisory roles that characterize independent directors.	Female Director Ratio
	Research results suggest that factors such as legitimacy concerns are significant determinants of companies’ CSR disclosure practices].	MSCI ESG ranking Indirectly: DJSI constituent TCFD reports UN Global Compact

Source: The researchers and other sources cited.

Table A2. Robustness tests with alternative measures: ROE & SDG.

Source	SS	df	MS	Number of obs	=	93
Model	285.662558	14	20.4044684	F(14, 78)	=	12.31
Residual	129.337442	78	1.65817233	Prob > F	=	0.00
				R-squared	=	0.6883
				Adj R-squared	=	0.6324
Total	415	92	4.51086957	Root MSE	=	1.2877
TOTAL_GOVERNANCE_SCORE	Coefficient	Std. err.	t	P > t	[95% conf.	interval]
Fem_dir_ratio	0.5784885	1.424261	0.41	0.686	−2.256997	3.413974
Employees No.	0.0961648	0.1411685	0.68	0.498	−0.18488	0.3772096

Table A2. Cont.

ROE	0.0019505	0.0043724	0.45	0.657	−0.0067543	0.0106553
TCFD years	0.2483901 **	0.098159	2.53	0.013	0.0529706	0.4438097
Sust_committee	0.1838443	0.3118913	0.59	0.557	−0.4370837	0.8047722
DJSI	0.8302047 ***	0.3066928	2.71	0.008	0.2196263	1.440783
Sust_executive	1.282241 ***	0.3063983	4.18	0.000	0.6722486	1.892233
GRI_Mentioned	0.4395195	0.3475528	1.26	0.210	−0.2524049	1.131444
Extractiven_onextractive	0.9745406	0.7053872	1.38	0.171	−0.4297775	2.378859
MSCI_in_comparison						
laggard	0.8048488	0.5541875	1.45	0.150	−0.2984537	1.908151
leader	0.7705688 **	0.3207722	2.40	0.019	0.1319604	1.409177
Develop_						
emerging	−2.242435 ***	0.5319968	−4.22	0.000	−3.301559	−1.183311
Global_compact	0.3811864	0.2928613	1.30	0.197	−0.2018555	0.9642284
Climate_trans_plan	0.818615 **	0.4069932	2.01	0.048	0.0083538	1.628876
_cons	1.232215	1.754088	0.70	0.484	−2.259905	4.724335
Source	SS	df	MS	Number of obs	=	93
Model	290.707096	14	20.7647926	F(14, 78)	=	13.03
Residual	124.292904	78	1.59349877	Prob > F	=	0.00
				R-squared	=	0.7005
				Adj R-squared	=	0.6467
Total	415	92	4.51086957	Root MSE	=	1.2623
TOTAL_GOVERNANCE_SCORE	Coefficient	Std. err.	t	P > t	[95% conf.	interval]
Fem_dir_ratio	0.2363043	1.365772	0.17	0.863	−2.48274	2.955348
Employees No.	0.0602599	0.136752	0.44	0.661	−0.2119925	0.3325122
3Year_NI_aver	0.0021602	0.0051282	0.42	0.675	−0.0080493	0.0123697
TCFD years	0.2344908 **	0.0978233	2.40	0.019	0.0397397	0.429242
Sust_committee	0.2014093	0.3071996	0.66	0.514	−0.4101781	0.8129966
DJSI	0.9351202 ***	0.2956608	3.16	0.002	0.3465047	1.523736
Sust_executive	1.391974 ***	0.3040077	4.58	0.000	0.7867414	1.997207
UN SDGs	0.7692574 **	0.3690859	2.08	0.040	0.0344639	1.504051
Extractive_nonextractive	0.8797748	0.6911504	1.27	0.207	−0.4961998	2.25575
MSCI_in_comparison						
laggard	0.931786 *	0.5556545	1.68	0.098	−0.1744371	2.038009
leader	0.8125988	0.3165899	2.57	0.012	0.1823167	1.442881
Develop_						
emerging	−2.423426 ***	0.5212179	−4.65	0.000	−3.461091	−1.385761
Global_compact	0.2418671	0.2908128	0.83	0.408	−0.3370967	0.8208309
Climate_trans_plan	0.805641 *	0.4021241	2.00	0.049	0.0050734	1.606209
_cons	1.489436	1.656171	0.90	0.371	−1.807747	4.786619

N = 93. Table A2 presents the OLS regression Detailed variable definitions are provided in the Table A1. All continuous variables here are winsorised at the 1% and 99% levels to mitigate the influence of extreme values. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively (two-tailed). Table A2 presents the results of robustness tests. The table present the obtained OLS regression results using alternative measures of the variable ROE and the dummy variable SDG.

Table A3. Robustness tests with subsamples.

Employees>50,000						
Source	SS	df	MS	Number of obs	=	72
Model	232.018361	14	16.5727401	F(14, 57)	=	9.36
Residual	100.950389	57	1.77105945	Prob > F	=	0.00
				R-squared	=	0.6968
				Adj R-squared	=	0.6224
Total	332.96875	71	4.6897007	Root MSE	=	1.3308
TOTAL_GOVERNANCE_SCORE	Coefficient	Std. err.	t	P > t	[95% conf.	interval]
Fem_dir_ratio	−0.9491463	1.678802	−0.57	0.574	−4.310889	2.412596
Employees No	0.2411815	0.2066751	1.17	0.248	−0.1726783	0.6550412
3Year_NI_aver	0.004269	0.0056944	0.75	0.457	−0.0071339	0.0156719
TCFD years	0.3199331 ***	0.1104931	2.9	0.005	0.0986745	0.5411918
Sust_committee	0.0210636	0.3574413	0.06	0.953	−0.6947003	0.7368275
DJSI	0.8756843 **	0.3745677	2.34	0.023	0.1256254	1.625743
Sust_executive	1.456304 ***	0.358773	4.06	0.000	0.7378733	2.174734
GRI_Mentioned	0.2502852	0.399059	0.63	0.533	−0.5488167	1.049387

Table A3. Cont.

Extractive_nonextractive MSCI_in_comparison	0.5541433	1.060135	0.52	0.603	−1.568741	2.677028
laggard	1.433357 *	0.7413893	1.93	0.058	−0.0512493	2.917964
leader	0.7901403 *	0.4089595	1.93	0.058	−0.0287869	1.609068
Develop_ emerging	−1.950769 ***	0.6113835	−3.19	0.002	−3.175044	−0.726495
Global_compact	0.5996889 *	0.3533192	1.7	0.095	−0.1078205	1.307198
Climate_trans_plan	1.071726 **	0.5168861	2.07	0.043	0.036679	2.106772
_cons	−0.4613563	2.558052	−0.18	0.858	−5.583766	4.661053
Employees ≤ 50,000						
Source	SS	df	MS	Number of obs	=	21
Model	75.4697558	14	5.39069685	F(14, 6)	=	6.08
Residual	5.31595845	6	0.88599307	Prob > F	=	0.0177
				R-squared	=	0.9342
				Adj R-squared	=	0.7807
				Root MSE	=	0.94127
Total	80.7857143	20	4.03928571			
TOTAL_GOVNANCE_SCORE	Coefficient	Std. err.	t	P > t	[95% conf.	interval]
Fem_dir_ratio	4.284014	3.340633	1.28	0.247	−3.89022	12.45825
Employees No.	0.4428194	1.765273	0.25	0.810	−3.876648	4.762287
3Year_NI_aver	−0.0096273	0.0171521	−0.56	0.595	−0.051597	0.0323423
TCFD years	−0.0628705	0.3173293	−0.2	0.849	−0.8393475	0.7136064
Sust_committee	1.852553 *	0.8777549	2.11	0.079	−0.2952357	4.000342
DJSI	2.200131 **	0.7833834	2.81	0.031	0.2832607	4.117001
Sust_executive	1.143747	0.9333847	1.23	0.266	−1.140163	3.427657
GRI_Mentioned	−0.3662318	1.163692	−0.31	0.764	−3.213683	2.481219
Extractive_nonextractive MSCI_in_comparison	1.722517	1.017751	1.69	0.142	−0.7678299	4.212863
laggard	1.993503	1.860815	1.07	0.325	−2.559747	6.546753
leader	1.023889	1.098181	0.93	0.387	−1.663263	3.711104
Develop_emerging	−2.744023	1.792904	−1.53	0.177	−7.131101	1.643056
Global_compact_mentioned	0.2396277	0.7516681	0.32	0.761	−1.599638	2.078893
Climate_trans_plan	1.664093 *	0.8164819	2.04	0.088	−0.3337666	3.661952
_cons	−4.081742	19.49855	−0.21	0.841	−51.79297	43.62948

N = 72. Table A3 presents the results of robustness tests. The table presents the obtained OLS regression results using two subsamples for companies with more than 50,000 employees versus companies with fewer than and equal to 50,000 employees. Variable definitions are provided in Table 1. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively (two-tailed).

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