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Corporate governance, national governance quality, and biodiversity reporting: Global evidence

Nurlan S. Orazalin [a,b,*], Collins G. Ntim [c,d,e,f], John Kalimilo Malagila [g]

[a] Bang College of Business, KIMEP University, Kazakhstan, Almaty 050010, Kazakhstan
[b] Southampton Business School, University of Southampton, UK, Southampton SO17 1BJ, UK
[c] Centre for Research in Accounting, Accountability and Governance (CRAAG), Department of Accounting, Southampton Business School, University of Southampton, Southampton, UK
[d] UNEC Accounting and Finance Research Center, Azerbaijan State University of Economics (UNEC), Istiqlaliyyat 6, AZ1001 Baku, Azerbaijan
[e] Department of Accounting, UDS School of Business, University for Development Studies, Tamale, Ghana
[f] Department of Accounting, Taylor's Business School, Taylor's University, No. 1, Jalan Taylor's, 47500 Subang Jaya, Selangor, Malaysia
[g] Essex Accounting Centre (EAC), Centre for Environment and Society (CES), Centre for Accountability and Global Development (CAGD), Essex Business School, University of Essex, Colchester Campus, UK

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ABSTRACT

We explore the effects of corporate governance and national governance quality on corporate biodiversity reporting and investigate whether national governance quality moderates the relationship between corporate governance and biodiversity reporting practices. Using a sample of global firms across 36 countries over the 2009 to 2020 period, we find that the overall quality of corporate governance and individual governance dimensions, such as management effectiveness, corporate social responsibility (CSR) practices, and shareholder treatment are positively associated with biodiversity reporting. Our results suggest that firms operating in countries with strong national governance systems tend to disseminate extensive biodiversity information. We also find that national governance quality positively moderates the relationships of CSR practices and shareholder treatment with biodiversity reporting practices, but has no impact on the link between management effectiveness and biodiversity reporting. Our findings have several implications for regulators, policymakers, and organizational stakeholders. Overall, our results support the dynamic capabilities view in that internal and external governance mechanisms and systems can motivate and compel boards of directors and management teams to develop dynamic capabilities, engage in sustainability practices, and enhance biodiversity transparency.

1. Introduction

The current model of the world's economic development is recognized as the main cause of biodiversity destruction and species extinction (Ceballos et al., 2015; Cuckston, 2019). In this regard, business activities, such as deforestation and exploitation of natural resources are causing climate change, global warming, and rapid ecological degradation, often resulting in a continuous decline in biodiversity and species abundance (Bebbington et al., 2020; Cuckston, 2019; Maroun & Atkins, 2018). At the same time, the biodiversity crisis poses several serious risks and threats that might be detrimental to a firm's competitiveness, prosperity, and sustainability (Haque & Jones, 2020; United Nations Global Compact (UNGC), 2012). Additionally, businesses now face heightened pressures from various stakeholders, such as investors and regulators, to engage in climate change mitigation and undertake proactive efforts in enhancing transparency and accountability toward preserving biodiversity (Baboukardos et al., 2023; Carvajal et al., 2022). Therefore, growing concerns over global climate change and biodiversity loss have led to a significant paradigm shift from traditional financial reporting to also include corporate transparency on biodiversity threats and risks (Haque & Jones, 2020; Islam & van Staden, 2018). As an emerging body of research, biodiversity reporting refers to disclosing a firm's impacts on biodiversity and threatened species and its activities, initiatives, and practices to conserve biodiversity and ecosystems (Haque & Jones, 2020). In this work, we explore the effects of corporate governance and national governance quality on biodiversity reporting

* Corresponding author at: Bang College of Business, KIMEP University, Kazakhstan, Almaty 050010, Kazakhstan.
E-mail addresses: N.Orazalin@soton.ac.uk, orazalin@kimep.kz (N.S. Orazalin), C.G.Ntim@soton.ac.uk (C.G. Ntim), j.k.malagila@essex.ac.uk (J. Kalimilo Malagila).

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and investigate whether national governance quality moderates the relationship between corporate governance and biodiversity reporting practices.

However, despite the growing awareness that preserving biodiversity is a global challenge, corporate efforts to enhance transparency and accountability through environmental reporting have received limited academic attention (Gaia & Jones, 2017; Talbot & Boiral, 2021; Weir, 2019). In particular, research on biodiversity accounting is a relatively understudied area, especially with regard to corporate accountability for species extinction and biodiversity transparency (Atkins & Maroun, 2018; Gaia & Jones, 2017; Weir, 2019). Hence, and given the global ecological crises, there is a need for nascent research to explore corporate efforts to mitigate climate change, minimize biodiversity risks, and improve biodiversity reporting (Baboukardos et al., 2023; Haque & Jones, 2020). Furthermore, Roberts et al. (2021) assert that the roles of corporate commitments and responsibilities towards biodiversity preservation and reporting have been overlooked in biodiversity accounting research. As noted by Carvajal et al. (2022), firms are committed not only to protect biodiversity for sustainable development, but also to improve stakeholder relationships through biodiversity reporting. In this case, investigating the effects of governance practices on a firm's biodiversity reporting offers important insights into sustainable business practices across multiple economies with diverse regulatory systems.

Although corporate governance has long been widely recognized as playing critical roles in disseminating social and environmental information (Adnan et al., 2018; Bui et al., 2020; Gerged, 2021; Haque & Jones, 2020; Mahmood & Orazalin, 2017), there is still limited understanding about whether corporate biodiversity reporting practices are influenced by an aggregate measure of corporate governance and individual governance dimensions. Past investigations (Gerged, 2021; Liao et al., 2015; Samaha et al., 2015; Tingbani et al., 2020) have provided evidence that internal governance mechanisms and structures, including board characteristics, executive compensation, and ownership structures, determine the level of environmental disclosures. However, the current literature has not fully addressed the role of overall corporate governance quality in shaping a firm's biodiversity reporting practices. In particular, existing biodiversity-related studies (Carvajal et al., 2022; Haque & Jones, 2020) have assessed whether board characteristics, such as board gender diversity, affect biodiversity-related information, without considering the overall quality of corporate governance. In addition, while prior biodiversity reporting studies have been limited to single countries or specific regions, empirical evidence from global cross-country data is relatively limited. Recently, Haque and Jones (2020) and Roberts et al. (2021) highlighted the need for innovative research on biodiversity reporting practices in the context of diverse and multiple countries. Individual governance dimensions can have different impacts on corporate practices and outcomes due to differing country-level settings (Luo & Tang, 2021; Zattoni et al., 2020). Therefore, it is essential to explore whether overall corporate governance quality, in addition to individual governance dimensions, influences biodiversity reporting in a multi-country context.

Prior research (Luo, 2019; Zattoni et al., 2020) also suggests that national institutions can interact with internal governance practices to affect corporate outcomes. In this regard, national governance, which represents country-level governance systems, may explain the variations in corporate governance practices and voluntary disclosures across different markets (Elamer et al., 2020; Guenther et al., 2016; Kaufmann et al., 2011). Nevertheless, empirical evidence on whether national governance quality influences firm-level governance practices and biodiversity reporting is nearly non-existent. The few studies examining the links among national governance systems, corporate governance, and disclosures have provided mixed results. For example, Ernstberger and Grüning (2013) reveal that the positive impact of corporate governance on disclosures is more pronounced for firms operating in countries with weak national governance systems. In contrast, Elamer et al. (2020) report that effective national governance structures can reinforce the positive impacts of internal governance mechanisms on risk disclosures. These studies focused on other forms of corporate disclosures and ignored the moderating impact of national governance quality on the relationship between corporate governance and biodiversity reporting. Moreover, as indicated above, available research has not assessed the relationships among corporate governance, biodiversity reporting, and national governance quality in an international setting. Hence, our study aims to address these gaps within the governance and biodiversity literature by analyzing whether national governance systems influence the association between corporate governance and biodiversity reporting practices across multiple nations.

Using a panel dataset of 6,515 firm-year observations from 599 publicly listed firms across 36 countries over the 2009 to 2020 period, we assess the effects of corporate governance and national governance quality on biodiversity reporting and investigate whether national governance quality moderates the relationship between corporate governance and biodiversity reporting practices. According to the dynamic capabilities (DCs) concept (Akhtar et al., 2020; Augier & Teece, 2009; Teece et al., 1997; Zahra et al., 2022), factors and pressures at the firm-level, internal corporate governance practices, and country-level, national governance systems and structures, are key to developing and utilizing DCs that are instrumental for achieving competitive advantage, improving corporate sustainability, and enhancing environmental transparency. Consistent with this theoretical perspective, we provide evidence that the overall quality of corporate governance and individual governance dimensions, such as management effectiveness, corporate social responsibility (CSR) practices, and shareholder treatment improve a firm's biodiversity reporting practices. Further, our empirical results reveal that firms operating in countries with strong national governance regulations and systems tend to disseminate extensive biodiversity information. We also find that national governance quality positively moderates the relationships of shareholder treatment and CSR practices with biodiversity reporting, but has no impact on the relationship between management effectiveness and biodiversity reporting. Overall, our findings lend support for the DCs view in that internal and external governance mechanisms and systems can motivate and force management teams to develop DCs, engage in sustainability practices, and enhance biodiversity transparency in order to promote sustainable development. This is especially true in constantly changing environments relating to global challenges and threats, such as biodiversity loss.

Our study makes several fundamental contributions to the extant literature. First, it extends the corporate governance and biodiversity accounting research (Adler et al., 2018; Carvajal et al., 2022; Haque & Jones, 2020) by investigating whether and how corporate governance arrangements influence biodiversity reporting. We utilize a comprehensive measure of corporate governance, as well as the individual governance dimensions of management effectiveness, CSR practices, and shareholder treatment to see if internal governance practices are associated with biodiversity reporting. Our findings suggest that both the individual dimensions and the overall quality of firm-level governance play a crucial role in enhancing biodiversity transparency.

Second, our study contributes to the national governance and corporate reporting research by emphasizing the role of national governance systems in influencing corporate efforts and decisions to improve biodiversity reporting. Although past studies (e.g., Elamer et al., 2020; Luo, 2019) documented that national institutions influence corporate disclosures, further research is still necessary to understand how complex national governance systems affect firm-level reporting (Zattoni et al., 2020). Our findings complement this past research by providing evidence that national governance quality is an important driver of biodiversity reporting practices.

Third, our study is one of the first empirical studies to assess the moderating role of national governance quality on the relationship between corporate governance and biodiversity reporting. Prior research (e.g., Elamer et al., 2020; Jiang et al., 2021) argues that the effects of internal governance mechanisms on voluntary disclosures may vary depending on the type of disclosures, contexts, and country-level factors. Nevertheless, there are still avenues to further investigate the complex effects of national institutional contexts and internal governance practices on firm-level reporting practices (Luo, 2019; Zattoni et al., 2020). Our study extends the governance and biodiversity literature by offering first-time evidence on the moderating role of national governance on the relationship between corporate governance and biodiversity reporting.

Finally, our study adds to the governance and biodiversity accounting literature by analyzing a relatively large international dataset. As mentioned before, while prior biodiversity-related investigations (e.g., Carvajal et al., 2022; Gaia & Jones, 2017; Haque & Jones, 2020) have studied single countries or regions, evidence from a multi-country setting is still limited. Thus, our work responds to the recent call for cross-country empirical research on biodiversity reporting (Roberts et al., 2021) by offering worldwide evidence based on a broad sample of firms operating in multiple economies.

The rest of this paper is organized as follows. Section 2 discusses the research context, presents the theoretical framework, reviews prior literature, and develops hypotheses. Section 3 outlines the research design. Section 4 discusses the empirical findings, and the final section concludes the paper.

2. Literature review

2.1. Research context

In the past few decades, several global and regional initiatives have been implemented to preserve biodiversity and ecosystems (Gaia & Jones, 2017; Haque & Jones, 2020). For example, the Convention on Biological Diversity (CBD), introduced in 1992 by the United Nations (UN) and with effect from 1993, is the first international accord to tackle climate change, conserve biodiversity, and restore ecosystems. The primary objectives of the CBD are to protect biodiversity, promote sustainable use of genetic resources, and share the benefits of their use across the globe in a fair and equitable manner (Secretariat of the Convention on Biological Diversity, 2020). In 2010, the CBD released a Strategic Plan for Biodiversity for 2011 to 2020, with an updated and revised version afterwards, to encourage biodiversity-related initiatives and reforms, as well as to restore biodiversity and ecosystems around the world. The CBD's plan also presented the Aichi Biodiversity Targets, consisting of a set of goals pertaining to addressing the main causes of biodiversity loss, reducing the impacts on biodiversity, conserving biodiversity and ecosystems, increasing their benefits, and implementing initiatives and strategies to protect biodiversity. Nevertheless, the CBD and its initiatives have so far failed to address the biodiversity crisis globally as the majority of their targets and goals had not been achieved by the year 2020 (Secretariat of the Convention on Biological Diversity, 2020). As a result, the 2020 Global Risks Report presented at the World Economic Forum still included biodiversity loss as a top global environmental threat (World Economic Forum, 2020). Additionally, the Global Reporting Initiative (GRI) and Sustainable Development Goals (SDGs), particularly those related to SDG 14: Life below Water and SDG 15: Life on Land, recognized the biodiversity crisis as a major challenge for sustainable development and called for urgent corporate actions to protect biodiversity and ecosystems (Roberts et al., 2021).

The International Union for Conservation of Nature (IUCN), the UNGC, several national governments, and various international non-government organizations (NGOs) have also introduced several initiatives, reforms, and practices to preserve and protect biodiversity and ecosystems. Founded in 1948, the IUCN is the first global authority committed to safeguarding the natural world, and has more than 1,400 members, including national governments and NGOs. Its fundamental mission is to encourage and assist societies to preserve global biodiversity and ensure that any use of natural resources is environmentally sustainable (IUCN, 2021). Formed in 2000, the UNGC aims to promote socially responsible corporate policies and practices, encourage businesses worldwide to align their business strategies and operations with the UNGC principles related to the environment, human rights, labor, and anticorruption, and support the UN's societal goals (UNGC, 2021). The IUCN and UNGC have designed and introduced a framework for business entities to explore and manage challenges and issues related to biodiversity conservation and ecosystems restoration. The main objective of this framework is to encourage business entities to formulate, implement, and disclose initiatives and practices for preserving biodiversity and ecosystems in order to minimize biodiversity risks, manage related impacts, and promote sustainable development (UNGC, 2012).

Some industry groups have also been dedicated to the conservation of biodiversity and ecosystems. More than 100 financial institutions operating in 37 countries have adopted the Equator Principles as a risk management framework for evaluating projects in all industries and sectors. Adopted in 2003 and updated in 2013 and 2020, this framework is intended to identify, evaluate, and manage environmental and social risks related to climate change, biodiversity, and human rights. It provides applicable standards for due diligence, and supports responsible decision-making in all stages of projects (Equator Principles Association (EPA), 2021). In 2013, the International Petroleum Industry Environmental Conservation Association (IPIECA), the EPA, and the International Council on Mining and Metals formed the Cross-Sector Biodiversity Initiative (CSBI) partnership to provide good practices and tools for preserving biodiversity and ecosystem services in extractive industries (CSBI, 2021). This partnership has introduced three initiatives: the Mitigation Hierarchy guide for managing biodiversity risks, the Good Practices guide for collecting biodiversity baseline data, and the Timeline Tool for aligning project development timelines, biodiversity management schedules, and financing timelines.

Nevertheless, despite the increasing efforts to protect biodiversity and ecosystems worldwide, there is a lack of evidence on how corporate governance arrangements, global and national biodiversity initiatives, as well as national regulatory frameworks and systems influence corporate biodiversity reporting practices. Therefore, our study seeks to explore the relationships among corporate governance, national governance quality, and biodiversity reporting in the context of multiple economies and industries.

2.2. Theoretical framework

The concept of dynamic capabilities (DCs) is an extension of the resource-based view (RBV) and natural resource-based view (NRBV), and suggests that business entities should adjust their capabilities in dynamic and constantly changing environments (Teece et al., 1997). The RBV accentuates the importance of a firm's internal resources and capabilities in creating the basis of competitive advantage (Barney, 1991), whereas the NRBV posits that a firm's competitive advantage depends on its interaction with the natural environment (Hart, 1995; Hart & Dowell, 2011). Proponents of DCs extend these views and argue that firms seeking to sustain competitive advantage should constantly develop new resources and capabilities, especially in dynamic and fast-changing environments (Teece et al., 1997). Originally, DCs are described as the subset of competences that enable a firm to respond to fluctuating market conditions by developing new products and services (Teece & Pisano, 1994). Consistent with this notion, Helfat (1997) provides evidence that the accumulation of DCs depends on a firm's resources, including technological assets and knowledge, and argues that DCs may lead to the creation of new products, processes, and services, especially in volatile environments. Further, Teece et al. (1997) emphasize the importance of DCs, defined as the firm's ability to integrate, develop, and reconfigure competences to gain competitive advantage in fast-changing environments.

However, subsequent theorization notes that these descriptions of DCs are vague and tautological, neglecting the need to develop and adapt a firm's specific resources, processes, and routines in the context of emerging industries and divergent economies (Cepeda & Vera, 2007; Li & Liu, 2014; Zahra et al., 2006). For example, Eisenhardt and Martin (2000) view DCs as specific and identifiable processes, including alliance relationships, production development and innovation, and strategic decision-making, that enable business entities to manage their resources and ultimately create new values in changing environments. In turn, Zahra et al. (2006) propose that DCs are the firm's abilities to revise existing resources and routines in accordance with the needs and expectations of its primary decision makers. Further, Li and Liu (2014) explain DCs as three different capacities that can be used by a company in dynamic markets to promote strategic decisions, such as identifying new opportunities and potential threats, make timely decisions, such as developing appropriate reporting systems, and implement strategic changes, such as carrying out managerial processes to adapt to changing environment.

It is acknowledged that the investment in the development of DCs for adaptation is more beneficial for firms operating in fast-changing environments than for those operating in stable environments, as the costs of development may exceed the benefits from adaptation (Hart & Dowell, 2011). This is consistent with the argument that DCs can discover and avoid possible threats, seize potential opportunities, implement necessary strategic changes, adapt to environmental changes and challenges, and ultimately, sustain competitive advantage in both developed and developing economies (Cepeda & Vera, 2007; Li & Liu, 2014). Hence, critical resources, strategic routines, and effective corporate governance practices are important assets that can create and sustain competitive advantage (Augier & Teece, 2009; Chen & Chang, 2013; Li & Liu, 2014), especially in dynamic, volatile, and fast-changing environments affected by global climate change and biodiversity degradation. The related literature posits that the adoption of best corporate governance practices can provide vital resources and create unique capabilities for corporate survival and sustainability (Luo & Tang, 2021). In other words, firms with sound corporate governance arrangements have better resources and capabilities to engage in sustainability practices and greater capacities to disclose relevant environmental information.

Further, country-level DCs, such as national governance systems and structures, may have direct and/or indirect effects on corporate sustainability (Akhtar et al., 2020). Thus, indicating that strong national governance quality may improve biodiversity reporting practices. These external DCs are also associated with firm-level capabilities, such as board and management characteristics, CSR strategies and initiatives, and environmental management systems and practices. Thus, from the DCs perspective, it is argued that both internal and external governance structures and systems can motivate and force corporate managers to develop DCs, engage in green initiatives, and enhance environmental transparency in order to sustain competitive advantage. This is especially true in quickly and constantly changing environments relating to global challenges, such as climate change, ecosystems degradation, and biodiversity loss. Given that firm- and country-level factors are key to building DCs that are instrumental for improving corporate sustainability and enhancing environmental transparency (Akhtar et al., 2020; Zahra et al., 2022), the concept of DCs is a relevant framework for our study in explaining the links among corporate governance, national governance quality, and biodiversity reporting.

2.3. Related literature and hypotheses development

2.3.1. Corporate governance and biodiversity reporting

Prior research suggests that businesses facing complex demands and increasing pressures from various stakeholders are more likely to adopt good corporate governance to combat climate change and promote sustainability (Luo & Tang, 2021; Toms, 2002). Especially in the light of global climate change, effective corporate governance has the potential to balance the company's economic and social goals, satisfy the conflicting interests of stakeholders, and ultimately enhance corporate sustainability (Gerged, 2021; Luo & Tang, 2021). This supports the notion that firms with strong corporate governance are more responsive to the requests from different stakeholder groups by proactively engaging in sustainability activities and climate change mitigation initiatives (Chan et al., 2014; Haque, 2017). Different corporate governance practices can facilitate access to critical resources, promote sustainability activities, and improve decision-making (Gerged, 2021; Hillman & Dalziel, 2003; Rupley et al., 2012). For example, effective board governance and incentive-based mechanisms play a crucial role in introducing green projects, implementing carbon mitigation initiatives, and developing reporting practices (Ben-Amar & McIlkenny, 2015; Haque & Ntim, 2020; Mahmood & Orazalin, 2017). Moreover, such governance arrangements may improve transparency and mitigate information asymmetry by providing relevant environmental information to stakeholders (Bui et al., 2020; Peters & Romi, 2014; Tingbani et al., 2020).

Prior empirical studies (e.g., Abdelfattah & Aboud, 2020; Chithambo et al., 2020; Haque & Ntim, 2018; Rupley et al., 2012) have provided evidence that improved internal governance mechanisms tend to increase environmental disclosures. In particular, firms with sound board governance, effective management structures, and improved CSR practices disclose more climate-related information (Adler et al., 2018; Daradkeh et al., 2023; Haque & Jones, 2020). In addition, firms ensuring equal treatment of all shareholders provide more extensive environmental information (Zattoni et al., 2020). Distinct from prior research, our study investigates the effects of composite corporate governance quality and individual governance dimensions on biodiversity reporting in a multi-country context.

According to the DCs view (Augier & Teece, 2009; Li & Liu, 2014; Teece et al., 1997), effective corporate governance practices and systems are key to accumulating and utilizing critical resources that are instrumental for achieving competitive advantage, improving corporate sustainability, and enhancing transparency. The related literature (e.g., Akhtar et al., 2020; Luo & Tang, 2021) suggests that the adoption of effective corporate governance practices can create unique DCs for corporate survival and sustainability. In other words, firms with sound corporate governance practices have better resources and capabilities to engage in sustainability initiatives and greater capacities to disclose relevant biodiversity-related information. Based on the DCs view and past studies, we expect that effective corporate governance mechanisms, such as equal shareholder treatment, improved CSR strategies and initiatives, and effective board and management structures, improve biodiversity reporting. This also suggests that firms with higher composite corporate governance quality are more likely to disclose extensive biodiversity information. Accordingly, we formulate the following hypotheses:

Hypothesis 1a. *There is a positive association between shareholder treatment and biodiversity reporting.*

Hypothesis 1b. *There is a positive association between CSR practices and biodiversity reporting.*

Hypothesis 1c. *There is a positive association between management effectiveness and biodiversity reporting.*

Hypothesis 1d. *There is a positive association between the overall quality of corporate governance and biodiversity reporting.*

2.3.2. Corporate governance, biodiversity reporting, and national governance quality

The contemporary literature suggests that national governance quality, which represents country-level governance systems, may explain the variations in corporate governance practices and structures, environmental performance, and voluntary disclosures across different markets (Adnan et al., 2018; Elamer et al., 2020; Guenther et al., 2016; Hamed et al., 2022; Orazalin & Mahmood, 2021). Several empirical studies have explored the effect of national governance quality on various corporate outcomes. For example, Hartmann and Uhlenbruck

(2015) provide evidence that national institutions are positively related to corporate environmental performance based on data from 42 countries. Ortas et al. (2015) compare CSR initiatives across France, Japan, and Spain, and find that institutional pressures affect corporate sustainability performance because companies from different countries with different institutional systems adopt and implement different CSR and sustainability-related practices and initiatives. Further, Orazalin and Mahmood (2021) find that country governance quality has a positive impact on corporate environmental performance in the context of European companies. This supports the view that the positive effect of corporate governance on organizational performance increases as national governance quality increases (Nguyen et al., 2021).

Prior research also suggests that the link between corporate governance and reporting is highly sensitive to the effectiveness of national institutions (Zattoni et al., 2020). Nevertheless, the few studies (e.g., Elamer et al., 2020; Ernstberger & Grüning, 2013) examining the moderating role of national governance quality on the association between corporate governance and disclosures have been limited to specific regions. Most importantly, they failed to assess the links among corporate governance, national governance quality, and biodiversity reporting. We expect that national governance systems play a key role in increasing corporate efforts and practices towards biodiversity conservation, which in turn, may improve a firm's biodiversity reporting practices.

According to the DCs view, business contexts and realities require organizations to build and deploy DCs to achieve evolutionary fitness, adapt to evolving challenges, exploit potential opportunities, and minimize possible threats, resulting from social, ecological, geopolitical, and intuitional factors and changes (Kor & Mesko, 2013; Teece et al., 1997; Zahra et al., 2006). For example, firms can co-evolve along with their institutional and legal environments by developing innovative business models, adapting competitive strategies, and re-thinking governance structures to cope with uncertainties/risks, especially in their external environments (Adhikari et al., 2021; Zahra et al., 2022). Akhtar et al. (2020) also suggest that corporate sustainability is affected not only by firm-level DCs, but also by country-level DCs that are shaped by external factors, such as national government policies and systems, political changes, laws and regulations, market requirements and expectations, and economic capabilities of the country. This implies that national governance quality is an important factor that may contribute to improved corporate governance practices and increased biodiversity disclosures. Thus, based on the DCs view and the discussion above, we develop the following hypotheses:

Hypothesis 2. *Strong national governance quality has a positive impact on biodiversity reporting.*

Hypothesis 2a. *National governance quality moderates the relationship between shareholder treatment and biodiversity reporting.*

Hypothesis 2b. *National governance quality moderates the relationship between CSR practices and biodiversity reporting.*

Hypothesis 2c. *National governance quality moderates the relationship between management effectiveness and biodiversity reporting.*

Hypothesis 2d. *National governance quality moderates the relationship between the overall quality of corporate governance and biodiversity reporting.*

3. Data and methodology

3.1. Sample and data

Our empirical analysis focuses on all public firms with available biodiversity data required to develop the biodiversity reporting index. Therefore, we constructed our sample based on the availability of biodiversity-related data of global firms in the LSEG database (formerly known as Refinitiv ESG and ASSET4) over a 12-year period between 2009 and 2020. Our sample starts from 2009 due to the limited biodiversity data before this fiscal year. Unlike past biodiversity-related research (e.g. Adler et al., 2018; Haque & Jones, 2020; Talbot & Boiral, 2021), our study uses a relatively large dataset to assess corporate biodiversity reporting at the international level. We obtained biodiversity and internal governance data from the LSEG database, which provides objective, comprehensive, and systematic information on environmental performance and internal governance indicators of publicly listed firms (Baboukardos et al., 2021; Haque & Ntim, 2022; Orazalin, 2020). To account for firm-level characteristics, we also extracted accounting and financial data from the Worldscope and Datastream databases. To assess the impact of national governance systems, we obtained national governance data from the Worldwide Governance Indicators. In addition, to consider potential effects of country-level factors, we collected national cultural dimensions and downloaded macroeconomic indicators (gross domestic product (GDP) growth and inflation rates) from the World Bank database.

Our initial sample comprised 6,895 firm-year observations from 618 listed firms located in 39 countries. After eliminating firms with missing data on other key variables, our final sample contained 6,515 firm-year observations from 599 firms across 11 industries and 36 countries for the 2009 to 2020 period. The distribution of the sampled firms and firm-year observations by industry and country is summarized in Appendix A.

3.2. Measurement of biodiversity reporting

We measure biodiversity reporting based on extensive biodiversity data points drawn from the environmental category of the LSEG. Following prior research (Adler et al., 2018; Boiral & Heras-Saizarbitoria, 2017; Haque & Jones, 2020), we identify 21 biodiversity-related items, which reflect (i) a firm's impacts on biodiversity and threatened species, (ii) a firm's initiatives/polices/actions to protect biodiversity and combat climate change, and (iii) a firm's efforts and practices to reduce the damaging effects of its business operations and activities on ecosystems. Each item is coded 1 if disclosed by the reporting firm, and 0 otherwise. All the reported items are combined to determine the preliminary overall biodiversity score for each firm. The Cronbach's alpha is utilized to measure the internal consistency of the score. The obtained alpha is substantially higher than the minimum value of 0.70, thus, indicating that the score is reliable and valid (Elamer et al., 2020). Although, the maximum possible score is 21, the highest number of items disclosed is 20. LSEG uses the Business Classification industry group as its benchmark because environmental performance indicators are more relevant to firms operating in the same industry (LSEG, 2023). It calculates a firm's reporting index by comparing its reporting practices with those of its industry peers and weighting them against the industry average. If a firm's reporting practices are normalized within its industry, the index assigned reflects how extensively the firm has disclosed biodiversity information compared to its peers. Therefore, in line with previous studies (Orazalin et al., 2024; Zaman et al., 2021), we calculate each firm's *BIORPX* index using the percentile rank methodology.[1] The weighted average industry adjusted-index takes values from 0 % to 100 %, where the highest value indicates a higher level of reporting practices. Table 1 lists all the reporting items used to develop the *BIORPX* variable.

3.3. Measurement of corporate governance variables

Following past research (e.g., Baboukardos et al., 2021; Rajesh & Rajendran, 2020), we employ the individual and composite scores of the

[1] The *BIORPX* index is calculated based on the following formula: *BIORPX* = (number of firms with a worse value + (number of firms with the same value as the focal firm's value/2))/total number of firms*100.

Table 1
Variable definitions.

Variable	Symbol	Definition/measurement
Dependent variable		
Biodiversity reporting index	BIORPX	The index is determined based on 21 reporting items, which reflect (i) a firm's impacts on biodiversity and threatened species, (ii) a firm's initiatives/polices/actions to protect biodiversity and combat climate change, and (iii) a firm's efforts/practices to reduce the damaging effects of its business operations/activities on ecosystems. They are biodiversity impacts, waste reduction, nitrogen/sulfur oxides emissions reduction, volatile organic compounds emissions reduction, e-waste reduction, land environmental impact reduction, toxic chemicals reduction, particulate matter emissions reduction, environmental restoration, policy emissions, target emissions, environmental management team, employee training, environmental expenditures investments, green sites/buildings, environmental investments initiatives, climate change risks/opportunities, participation in emissions trading, environmental performance of suppliers, environmental partnerships, and partnership with sourcing partners. Each item is coded 1 if reported, and 0 otherwise. All the items are combined to determine the preliminary overall biodiversity score for each firm. Then, based on the LSEG's percentile rank methodology, the *BIORPX* index is calculated as follows: *BIORPX* = (number of firms with a worse value + (number of firms with the same value as the focal firm's value/2))/total number of firms*100. This weighted average industry-adjusted index varies between 0 % and 100 %.
Independent and moderating variables		
Shareholder treatment	SHLGOV	The score assesses whether and how a reporting firm ensures equal treatment of all shareholders, facilitates shareholder engagement, and uses anti-takeover devices to protect shareholder wealth. The score varies between 0 % and 100 %, with 100 % as the highest value.
CSR practices	CSRGOV	The score relates to a reporting firm's CSR initiatives/practices toward broad and systematic strategic visions by integrating social, environmental, and economic/financial aspects of sustainable development into its regular decision-making. The score varies between 0 % and 100 %, with 100 % as the highest value.
Management effectiveness	MGTGOV	The score assesses the quality of corporate governance related to board structures (diversity, independence, and committees), their functions, roles, responsibilities, and executive compensation. The score varies between 0 % and 100 %, with 100 % as the highest value.
Composite corporate governance quality	CCGOVQ	The composite score is based on the three internal governance dimensions of (1) stakeholder treatment, (2) CSR practices, and (3) management effectiveness. The score varies between 0 % and 100 %, with 100 % as the highest value.
National governance quality	NLGOVQ	The score is calculated based on the Worldwide Governance Indicators including voice and accountability (VCACC), political stability and no violence (PSNVE), government effectiveness (GOVEF), regulatory quality (REGUL), control of corruption (CORUP), and rule of law (RULAW).
Firm-level control variables		
Firm size	FRSIZE	Natural logarithm of total assets.
Firm profitability	FRPROF	Net income divided by total assets.
Financial leverage	FRLEVG	Total debts divided by total assets.
Firm slack	FSLACK	The ratio of cash and cash equivalents to total assets.
Capital intensity	CAPINT	The ratio of fixed assets to total assets.
Country-level control variables		
Culture (individualism)	INDLSM	This dimension measures a preference for a loosely-knit social framework in which people are expected to take care of only themselves and their immediate families (versus a preference for a tightly-knit social framework in which people expect their relatives or members of a particular in-group to look after them in exchange for unquestioning loyalty) and ranges from 0 to 100.
Culture (masculinity)	MASCLN	This dimension measures societal preferences for achievement, assertiveness, heroism, and material rewards (versus modesty, cooperation, caring for the weak, and quality of life) and ranges from 0 to 100.
Culture (Uncertainty and avoidance)	UNCAVD	This dimension measures whether society members feel threatened by ambiguity and uncertainty, and ranges from 0 to 100.
GDP growth	GDPGRW	Percentage change in GDP between two years.
Inflation rate	INFLTN	Percentage change in retail prices of goods/products/services that can be changed between two years.
Additional variables		
Average biodiversity reporting	AVBIOR	The sum of the reported items divided by the maximum number of items (21 items) and multiplied by 100.
Local shareholder treatment	SHL_HEAD	The median value of shareholder treatment at the location where the firm is headquartered.
Local CSR practices	CSR_HEAD	The median value of CSR practices at the location where the firm is headquartered.
Local management effectiveness	MGT_HEAD	The median value of management effectiveness at the location where the firm is headquartered.
Local corporate governance quality	CCG_HEAD	The median value of composite corporate governance at the location where the firm is headquartered.
Biodiversity reporting propensity	MEDBRP	A dummy variable coded 1 if the level of biodiversity reporting practices exceeds the sample median, and 0 otherwise.
Board size	BDSIZE	Natural logarithm of the total number of board directors.
Board independence	BDINDR	Proportion of independent directors on boards.
Board gender diversity	BDGEND	Proportion of female directors on boards.
Sustainability committee	BDSCOM	A dummy variable coded 1 if a board sustainability committee exists, and 0 otherwise.
Separate CSR reports	CSRREP	A dummy variable coded 1 if a firm issues separate CSR reports, and 0 otherwise.
External assurance of CSR reports	CSRAUD	A dummy variable coded 1 if a firm obtains external assurance of its CSR reports, and 0 otherwise.
GRI-based CSR reports	GRIREP	A dummy variable coded 1 if a firm publishes its CSR reports following GRI guidelines, and 0 otherwise.

governance pillar of the LSEG to measure corporate governance (CORGOV). The individual scores represent shareholder (*SHLGOV*), CSR (*CSRGOV*), and management (*MGTGOV*) governance dimensions and are developed based on a wide range of indicators that assess the quality of CORGOV by providing comprehensive scores along a scale ranging between 0 % and 100 % (LSEG, 2023).

The *SHLGOV* score measures a firm's effectiveness in treating all shareholders equally and protecting their rights. This score reflects a firm's commitment towards adopting and implementing policies and practices aimed at ensuring equal treatment of all shareholders, maintaining equal and fair voting rights, facilitating shareholder engagement, and using anti-takeover devices and restrictive clauses to protect shareholder wealth.

The *CSRGOV* score relates to a reporting firm's CSR initiatives and practices toward broad and systematic strategic visions by integrating social, environmental, economic, and financial aspects of sustainable development into its regular decision-making. This score captures a firm's decisions and efforts to formulate a board-level CSR/sustainability committee, adopt the GRI reporting guidelines, obtain external assurance for CSR/sustainability reporting, engage with CSR/sustainability-related global initiatives, and bring together financial and non-financial reporting practices.

The *MGTGOV* score measures a firm's commitment and effectiveness toward the adoption and implementation of best CORGOV practices and principles. This score is based on a wide range of indicators that assess the quality of corporate governance related to board structures, the diversity of board members, board member independence, and working subcommittees, as well as the board's functions, roles, responsibilities, and involvement in determining executive compensation.

Finally, the composite corporate governance quality (*CCGOVQ*) is based on *SHLGOV*, *CSRGOV*, and *MGTGOV*. To develop individual and composite governance scores, LSEG uses a firm's country of incorporation as a benchmark since the best governance practices are more consistent and relevant within a country (LSEG, 2023). Thus, the scores vary between 0 % and 100 %, where higher values indicate effective principles and practices related to individual aspects of CORGOV and *CCGOVQ* is an overall CORGOV quality.

3.4. Measurement of national governance quality

Prior research (Elamer et al., 2020; Kaufmann et al., 2011) suggests that national governance quality (*NLGOVQ*) may explain the variations in corporate disclosures across different markets. Therefore, we collect data from the Worldwide Governance Indicators produced by the World Bank to assess *NLGOVQ*. Kaufmann et al. (2011) propose six country governance dimensions, including voice and accountability (*VCACC*), political stability and no violence (*PSNVE*), government effectiveness (*GOVEF*), regulatory quality (*REGUL*), control of corruption (*CORUP*), and rule of law (*RULAW*). However, given that these dimensions are highly correlated with one another, their inclusion in the same regression analysis may lead to serious multicollinearity (Nguyen et al., 2015; Orazalin & Mahmood, 2021). Thus, consistent with related research (Elamer et al., 2020; Nguyen et al., 2021; Tunyi & Ntim, 2016), we perform a principal component analysis to construct an aggregate *NLGOVQ* index for the overall quality of national governance systems and structures. Table 2 displays that the first component has an eigenvalue of 5.338 while the remaining components have eigenvalues below 1. The estimates also show that the first component explains about 89 % of the variations. Hence, we include all the governance dimensions in our model and calculate the aggregate score, which represents the overall *NLGOVQ*. Finally, we estimate the Kaiser–Meyer–Olkin (KMO) value to measure sampling adequacy. The obtained KMO value of 0.883 is higher than a minimum value of 0.500 (Elamer et al., 2020), indicating that our sampling is adequate.

3.5. Empirical model

To examine the direct effects of individual corporate governance dimensions, overall CORGOV quality, and *NLGOVQ* on *BIORPX* and assess the moderating role of *NLGOVQ*, we employ the following model:

$$\begin{aligned} BIORPX_{ikt} = {} & \beta_0 + \beta_1 CORGOV_{ikt} + \beta_2 NLGOVQ_{kt} \\ & + \beta_3 CORGOV_{ikt}{*}NLGOVQ_{kt} + \beta_4 FRSIZE_{ikt} + \beta_5 FRPROF_{ikt} \\ & + \beta_6 FRLEVG_{ikt} + \beta_7 FSLACK_{ikt} + \beta_8 CAPINT_{ikt} + \beta_9 INDLSM_{kt} \\ & + \beta_{10} MASCLN_{kt} + \beta_{11} UNCAVD_{kt} + \beta_{12} GDPGRW_{kt} \\ & + \beta_{13} INFLTN_{kt} + year, industry, and\ country\ effects + \varepsilon_{it} \end{aligned} \quad (1)$$

where, $BIORPX_{ikt}$ is biodiversity reporting of firm i from country k in year t; *CORGOV* represents *SHLGOV*, *CSRGOV*, *MGTGOV*, or *CCGOVQ*; *NLGOVQ* is national governance quality, *CORGOV*NLGOVQ* is the interaction between *CORGOV* variables and *NLGOVQ*. Following prior literature (Carvajal et al., 2022; Elamer et al., 2020; Haque & Jones, 2020; Hassan & Romilly, 2018; Luo & Tang, 2016; Mahmood & Orazalin, 2017; Vithana et al., 2021), we also include control variables that may affect *BIORPX*. We control firm-specific characteristics, including firm size (*FRSIZE*), firm profitability (*FRPROF*), financial leverage (*FRLEVG*), firm slack (*FSLACK*), and capital intensity (*CAPINT*). Further, to control for country-level cultural factors, we include from Hofstede (2001) the cultural dimensions of individualism (*INDLSM*), masculinity (*MASCLN*), and uncertainty and avoidance (*UNCAVD*).[2] We also control for the macroeconomic factors of GDP growth (*GDPGRW*) and inflation rates (*INFLTN*). We include year, industry, and country effects to account for possible variations across years, industries, and countries. All the continuous variables are winsorized at the 1 % and 99 % levels. Table 1 presents the detailed definitions and measurements and computations of all the variables.

4. Results

4.1. Descriptive statistics

Table 3 presents the descriptive statistics. The mean value of *BIORPX* is 50.00 % and ranges from 2.27 % to 97.97 %. The average score of the *CCGOVQ* stands at 61.04 % on a range of 9.36 % and 95.56 %. The average scores of *SHLGOV*, *CSRGOV*, and *MGTGOV* are 56.47 %, 63.07 %, and 61.98 %, respectively. Also, the distribution of *NLGOVQ* ranges from −6.88 to 2.47, which is generally comparable to that reported by Elamer et al. (2020) for the Middle East and North Africa.

Table 4 presents the Pearson correlation coefficients and displays that *SHLGOV*, *CSRGOV*, *MGTGOV*, and *CCGOVQ* are positively correlated with *BIORPX*, consistent with our expectations. Further, the matrix shows a positive, but non-significant correlation between *NLGOVQ* and *BIORPX*. The correlation coefficients among the independent and control variables do not exceed a value of 0.70 (Pallant, 2007), indicating that there is no multicollinearity. In addition, the variance inflation factor (VIF) values show no signs of multicollinearity, as the VIF values reported in Appendix B do not exceed a value of 10 (Hair et al., 2019). Hence, our models are not subject to serious multicollinearity.

4.2. Regression results

Table 5 reports our regression analysis for the effects of *CORGOV* variables and *NLGOVQ* on *BIORPX*. The coefficient of *SHLGOV* is positive and significant ($p < 0.01$) in Column (1), implying that ensuring

[2] Other cultural dimensions, including power distance, long-term orientation, and indulgence, are highly correlated with *NLGOVQ*; hence, they are not included in the model.

Table 2
Principal components analysis of the national governance quality (NLGOVQ) dimensions.

Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6	Unexplained	KMO
VCACC	0.391	−0.502	0.668	−0.117	0.317	0.186	0	0.835
PSNVE	0.371	0.809	0.441	0.094	−0.035	−0.060	0	0.943
GOVEF	0.414	0.158	−0.527	−0.151	0.684	0.186	0	0.838
REGUL	0.420	−0.184	−0.185	0.823	−0.220	0.176	0	0.939
CORUP	0.425	−0.033	−0.182	−0.511	−0.609	0.391	0	0.914
RULAW	0.426	−0.183	−0.121	−0.129	−0.103	−0.862	0	0.850
Eigenvalue	5.338	0.342	0.209	0.058	0.033	0.021	—	—
Proportion	0.889	0.057	0.035	0.010	0.006	0.003	—	—
KMO	—	—	—	—	—	—	—	**0.883**

Notes: National governance quality (*NLGOVQ*) consists of six dimensions, namely voice and accountability (*VCACC*), political stability and no violence (*PSNVE*), government effectiveness (*GOVEF*), regulatory quality (*REGUL*), control of corruption (*CORUP*), and rule of law (*RULAW*). KMO is the Kaiser-Meyer-Olkin test, which measures sampling adequacy.

Table 3
Descriptive statistics of main variables.

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
BIORPX (%)	6515	50.00	28.27	2.27	97.97
SHLGOV (%)	6515	56.47	28.73	1.24	99.14
CSRGOV (%)	6515	63.07	29.24	0.00	99.23
MGTGOV (%)	6515	61.98	27.87	2.53	99.51
CCGOVQ (%)	6515	61.04	21.51	9.36	95.56
NLGOVQ (score)	6515	0.00	2.31	−6.88	2.47
FRSIZE (ln)	6515	24.69	1.40	21.93	28.53
FRPROF (%)	6515	4.32	4.95	−8.28	22.50
FRLEVG (%)	6515	24.88	14.82	0.05	66.19
FSLACK (ratio)	6515	0.06	0.07	0.00	0.32
CAPINT (ratio)	6515	0.25	0.21	0.00	0.84
INDLSM (%)	6515	63.48	26.45	17.00	91.00
MASCLN (%)	6515	62.35	18.12	8.00	95.00
UNCAVD (%)	6515	59.02	22.35	29.00	95.00
GDPGRW (%)	6515	1.89	3.10	−8.11	10.60
INFLTN (%)	6515	1.64	1.67	−1.35	8.89

Notes: The definitions of all variables are presented in Table 1.

equal shareholder treatment has a positive impact on biodiversity disclosures. This evidence is consistent with *Hypothesis 1a*. Similarly, the coefficient of *CSRGOV* is positive in Column (2) and significant ($p < 0.01$), indicating that CSR practices increase biodiversity disclosures. This finding supports *Hypothesis 1b* and corroborates past studies (e.g., Adler et al., 2018; Haque & Jones, 2020) that firms with improved CSR practices tend to issue more climate-related information. Further, the coefficient of *MGTGOV* is positively significant ($p < 0.01$) in Column (3) and highlights the role of management effectiveness in increasing biodiversity information, supporting *Hypothesis 1c*. This result is line with prior research (e.g., Daradkeh et al., 2023; Tingbani et al., 2020).

The coefficient of *CCGOVQ* is also positively significant ($p < 0.01$) in Column (4), indicating that the overall quality of corporate governance has a positive impact on biodiversity information. This finding supports *Hypothesis 1d*, in which firms with higher *CCGOVQ* disclose more extensive biodiversity information. Taken together, these results support prior studies (Bui et al., 2020; Gerged, 2021; Peters & Romi, 2014).

NLGOVQ also has an expected positive relationship with *BIORPX* ($p < 0.01$) in Columns (1)-(4). This evidence supports Hypothesis 2. This finding generally supports the view that strong country-level governance quality can motivate and force business entities to increase their voluntary disclosures, thus, mitigating information asymmetry (Elamer et al., 2020; Ernstberger & Grüning, 2013). Theoretically, the above results support the DCs perspective (Akhtar et al., 2020; Augier & Teece, 2009; Teece et al., 1997; Zahra et al., 2022) that both internal and external governance structures and systems can motivate and force corporate managers to develop DCs, engage in green initiatives, and enhance environmental transparency in order to sustain competitive advantage in quickly and constantly changing environments.

Table 6 displays the regression results of the moderating effects of *NLGOVQ* on the *CORGOV* variables and *BIORPX* links. The coefficients show that *SHLGOV*, *MGTGOV*, *CSRGOV*, *CCGOVQ*, and *NLGOVQ* are again significant and positively related to *BIORPX*, emphasizing the roles of CORGOV and *NLGOVQ* in increasing biodiversity disclosures. Further, the interaction item *SHLGOV*NLGOVQ* is positive and significant with *BIORPX* ($p < 0.05$), thus offering support for *Hypothesis 2a*. As illustrated in Fig. 1, the slopes of the two lines (a red line for high *NLGOVQ* and a blue line for low *NLGOVQ*) are different, verifying the positive moderating effect of *NLGOVQ* on the link between *SHLGOV* and *BIORPX*. Similarly, the coefficient of *CSRGOV*NLGOVQ* is positive ($p < 0.05$) and indicates that national governance positively moderates the relationship between CSR practices biodiversity reporting, thus, supporting *Hypothesis 2b*.

Fig. 2 demonstrates that the slope of the line for high *NLGOVQ* is steeper than that for low *NLGOVQ*, validating the moderating effect of *NLGOVQ* on the relationship between *CSRGOV* and *BIORPX*. Taken together, these results imply that the positive effects of improved CORGOV in terms of shareholder treatment and CSR practices on the level of biodiversity information are stronger for firms operating in effective national governance systems and regulations. This evidence supports the DCs view that national governance systems and structures are associated with firm-level capabilities, such as CSR strategies and initiatives and equal shareholder treatment, which in turn improve biodiversity reporting (Akhtar et al., 2020; Kor & Mesko, 2013; Zahra et al., 2006).

However, the interaction term *MGTGOV*NLGOVQ* is not significant with *BIORPX* ($p > 0.10$), indicating that *Hypothesis 2c* is not supported. As shown in Fig. 3, the slopes of the lines are not different, verifying that *NLGOVQ* does not moderate the association between *MGTGOV* and *BIORPX*. This evidence suggests that higher *NLGOVQ* is not sufficient to reinforce the positive effect of management and board effectiveness on biodiversity information, thus, implying that CORGOV related to board structures and management teams can increase biodiversity disclosures, irrespective of *NLGOVQ*. In other words, effective board governance, management structures, and executive compensation may act as important factors in increasing the level of biodiversity information, even in jurisdictions with weak national governance systems.

Table 4
Pearson correlations of main variables.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
BIORPX	1.00															
SHLGOV	0.09***	1.00														
CSRGOV	0.44***	0.10***	1.00													
MGTGOV	0.14***	0.15***	0.25***	1.00												
CCGOVQ	0.23***	0.41***	0.42***	0.95***	1.00											
NLGOVQ	0.01	0.16***	0.12***	0.14***	0.18***	1.00										
FRSIZE	0.23***	0.03***	0.27***	0.18***	0.21***	−0.03***	1.00									
FRPROF	0.03***	−0.04***	0.00	0.03**	0.01	0.01	−0.29***	1.00								
FRLEVG	0.00	0.08***	0.02	−0.06***	−0.03**	−0.03**	−0.12***	−0.15***	1.00							
FSLACK	−0.09***	0.01	−0.15***	−0.07***	−0.08***	−0.01	−0.34***	0.19***	−0.02**	1.00						
CAPINT	0.04***	−0.02	0.04***	−0.04***	−0.03**	−0.13***	−0.27***	0.10***	0.23***	−0.07***	1.00					
INDLSM	0.00	0.07***	0.10***	0.13***	0.14***	0.58***	0.03***	0.17***	0.01	−0.04***	−0.08***	1.00				
MASCLN	0.00	0.10***	0.01	0.00	0.03**	0.12***	−0.01	−0.10***	0.07***	0.18***	−0.09***	−0.07***	1.00			
UNCAVD	0.00	0.03**	0.04***	−0.02	0.00	0.15***	0.02	−0.19***	0.04***	0.02	0.02	−0.28***	0.23***	1.00		
GDPGRW	−0.06***	−0.06***	−0.11***	−0.06***	−0.09***	−0.45***	−0.03***	0.10***	−0.03**	0.03**	0.03**	−0.32***	−0.08***	−0.36***	1.00	
INFLTN	0.00	−0.12***	−0.04***	−0.08***	−0.10***	−0.53***	−0.01	0.11***	0.00	−0.07***	0.11***	−0.12***	−0.28***	−0.22***	0.30***	1.00

Notes: ** and *** indicate significance at the 5% and 1% levels, respectively. The definitions of all variables are presented in Table 1.

Table 5
Biodiversity reporting and corporate governance.

	(1)	(2)	(3)	(4)
	BIORPX	BIORPX	BIORPX	BIORPX
SHLGOV	0.094***			
	(0.026)			
CSRGOV		0.387***		
		(0.023)		
MGTGOV			0.088***	
			(0.025)	
CCGOVQ				0.223***
				(0.034)
NLGOVQ	7.203***	6.103***	7.222***	7.336***
	(2.177)	(1.991)	(2.130)	(2.108)
FRSIZE	10.323***	6.737***	10.048***	9.431***
	(0.792)	(0.772)	(0.808)	(0.811)
FRPROF	0.443***	0.273**	0.416***	0.391***
	(0.142)	(0.118)	(0.140)	(0.138)
FRLEVG	−0.125**	−0.102*	−0.100	−0.101
	(0.063)	(0.056)	(0.063)	(0.062)
FSLACK	−23.526*	−15.137	−21.834*	−20.214*
	(12.115)	(10.652)	(12.175)	(12.021)
CAPINT	7.058	5.105	7.241	6.527
	(5.182)	(4.481)	(5.203)	(5.113)
INDLSM	0.063	1.257***	0.221	0.407
	(0.414)	(0.433)	(0.434)	(0.433)
MASCLN	−12.932**	−25.981***	−14.427**	−17.393***
	(6.437)	(6.893)	(6.660)	(6.654)
UNCAVD	−3.985*	−8.405***	−4.528*	−5.548**
	(2.251)	(2.447)	(2.339)	(2.340)
GDPGRW	−0.797***	−0.610**	−0.799***	−0.777***
	(0.281)	(0.272)	(0.280)	(0.279)
INFLTN	−0.895*	−0.890*	−0.896*	−0.866*
	(0.542)	(0.503)	(0.531)	(0.525)
Constant	753.887	1734.166***	863.612*	1085.242**
	(475.629)	(510.454)	(492.569)	(492.218)
Year effects	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes
Observations	6515	6515	6515	6515
Adj. R-squared	0.178	0.291	0.177	0.194

Notes: This table reports the results from regressing the biodiversity reporting index (*BIORPX*) on shareholder treatment (*SHLGOV*), CSR practices (*CSRGOV*), management effectiveness (*MGTGOV*), the composite corporate governance quality (*CCGOVQ*), and national governance quality (*NLGOVQ*). Heteroskedasticity-corrected robust standard errors in brackets are clustered at the firm-year level. The definitions of all the variables are presented in Table 1. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

The results also show that the coefficient of *CCGOVQ*NLGOVQ* is not statistically significant, indicating that *Hypothesis 2d* is not supported. Fig. 4 also shows that *NLGOVQ* has no moderating effect on the link between *CCGOVQ* and *BIORPX*. This non-significant association suggests that board governance and management structures represent the major and most important dimensions of corporate governance. Overall, the results from Table 6 suggest that although the positive effects of shareholder treatment and CSR practices on biodiversity reporting are more prominent in countries with stronger national governance systems and regulations, effective internal governance in terms of board governance and management structures may substitute for national governance shortfalls.

Regarding the control variables, *FRSIZE* is positively related to *BIORPX*, supporting the view that large firms exposed to greater stakeholder pressures and demands disclose more environmental information (Haque & Jones, 2020). Similarly, *FRPROF* has a positive association with *BIORPX*, supporting the notion that profitable firms issue more environmental information to impress stakeholders (Islam & van Staden, 2018). The coefficient of *FRLEVG* is negative, indicating that highly leveraged firms are less likely to demonstrate greater commitment to environmental transparency. Further, the coefficient of *FSLACK* corroborates the finding of Haque and Jones (2020) that financial slack is

Table 6
Biodiversity reporting, corporate governance, and national governance quality.

	(1)	(2)	(3)	(4)
	BIORPX	**BIORPX**	**BIORPX**	**BIORPX**
SHLGOV	0.094***			
	(0.025)			
SHLGOV*NLGOVQ	0.025**			
	(0.010)			
CSRGOV		0.392***		
		(0.023)		
CSRGOV*NLGOVQ		0.015**		
		(0.007)		
MGTGOV			0.088***	
			(0.026)	
MGTGOV*NLGOVQ			−0.001	
			(0.008)	
CCGOVQ				0.224***
				(0.034)
CCGOVQ*NLGOVQ				0.007
				(0.011)
NLGOVQ	7.192***	6.717***	7.216***	7.395***
	(2.159)	(2.046)	(2.137)	(2.135)
FRSIZE	10.209***	6.707***	10.051***	9.415***
	(0.797)	(0.771)	(0.809)	(0.813)
FRPROF	0.440***	0.264**	0.417***	0.387***
	(0.142)	(0.118)	(0.140)	(0.138)
FRLEVG	−0.128**	−0.105*	−0.100	−0.101
	(0.063)	(0.056)	(0.063)	(0.062)
FSLACK	−24.051**	−16.730	−21.709*	−20.846*
	(12.089)	(10.573)	(12.256)	(12.109)
CAPINT	7.224	5.705	7.229	6.620
	(5.187)	(4.477)	(5.204)	(5.110)
INDLSM	0.136	1.352***	0.217	0.429
	(0.421)	(0.439)	(0.437)	(0.437)
MASCLN	−13.223**	−28.214***	−14.353**	−17.822***
	(6.466)	(7.224)	(6.753)	(6.819)
UNCAVD	−4.093*	−9.158***	−4.503*	−5.696**
	(2.264)	(2.563)	(2.369)	(2.396)
GDPGRW	−0.767***	−0.661**	−0.799***	−0.780***
	(0.278)	(0.275)	(0.280)	(0.280)
INFLTN	−0.888*	−0.921*	−0.894*	−0.876*
	(0.539)	(0.510)	(0.530)	(0.527)
Constant	778.489	1923.301***	863.484*	1130.814**
	(477.923)	(535.413)	(499.710)	(504.756)
Year effects	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes
Observations	6515.000	6515.000	6515.000	6515.000
Adj. R-squared	0.182	0.292	0.177	0.194

Notes: This table reports the results from regressing the biodiversity reporting index (*BIORPX*) on shareholder treatment (*SHLGOV*), CSR practices (*CSRGOV*), management effectiveness (*MGTGOV*), the composite corporate governance quality (*CCGOVQ*), and their interactions with national governance quality (*NLGOVQ*). Heteroskedasticity-corrected robust standard errors in brackets are clustered at the firm-year level. The definitions of all the variables are presented in Table 1. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

negatively associated with biodiversity disclosures. This evidence suggests that firms with more financial resources are in a stronger financial position to deviate from investing in biodiversity transparency. Finally, the coefficients of *UNCAVD*, *MASCLN*, *GDPGRW*, and *INFLTN* are negative, indicating that firms from societies with high uncertainty and avoidance, originating from masculine cultures, and operating in countries with higher GDP growth and inflation rates provide less biodiversity-related information.

4.3. Robustness checks

We perform several analyses to test the robustness of our findings. First, we re-estimate our baseline analysis by replacing the *BIORPX* variable with the average biodiversity reporting score (*AVBIOR*). We determine the composite *AVBIOR* score for each firm by dividing the sum of the reported items by the maximum number of items (21 items) and multiplying by 100. This measurement approach is used in past research (Elamer et al., 2020; Orazalin, 2019; Vithana et al., 2021) due to its appropriateness and simplicity. The *AVBIOR* score for each firm is a scale ranging from 0 % to 100 %. Table 7 displays the regression results for the effects of *CORGOV* variables and their interactions with *NLGOVQ* on *AVBIOR*. These results support the ones in Tables 5 and 6, suggesting that our original findings are robust to an alternative proxy for *BIORPX*.

Second, we run the two-stage least squares (2SLS) analysis to address possible endogeneity concerns relating to omitted variable bias. Although our model includes several firm-specific characteristics and country-level factors, there might be omitted variables that influence both CORGOV and *BIORPX*, leading to an erroneous positive association. For example, firms may implement sustainability strategies that determine not only environmental disclosure levels, but also internal governance characteristics (Peters & Romi, 2014). Following Bhandari and Javakhadze (2017), we include local CORGOV practices as instruments, measured by the median internal governance variables (*SHL_HEAD, CSR_HEAD, MGT_HEAD,* and *CCG_HEAD*) at the location where the firm is headquartered. Given that CORGOV practices of one particular firm can influence other firms in the same location, these local internal governance variables are likely to affect CORGOV characteristics, but cannot be correlated with our *BIORPX* dependent variable (Bhandari & Javakhadze, 2017). The Kleibergen-Paap rk LM statistic, Cragg-Donald Wald F-statistics, Stock-Yogo critical value, and Hansen J statistic reported in Panel A of Table 8 show that our instruments are relevant and valid. Further, Panel A reports the first-stage results from regressing *SHLGOV*, *CSRGOV*, *MGTGOV*, and *CCGOVQ* (in Columns (1), (2), (3), and (4), respectively) on our instrumental variables. The coefficients of all the instruments are positive and significant ($p < 0.01$), indicating that the median internal governance practices of other firms headquartered in the same location have a positive impact on the *CORGOV* variables. The second-stage regression results reported in Panel B of Table 8 show that our results from 2SLS analysis are qualitatively similar to the ones in Tables 5 and 6, thus, validating the original regression analysis.

Third, to mitigate possible self-selection bias issues, we adopt a matched sample analysis employing propensity score matching (PSM). For this purpose, we introduce a dummy variable (*MEDBRP*), coded 1 if the level of biodiversity reporting practices exceeds the sample median, and 0 otherwise. We use this variable to identify firm-year observations with *BIORPX* below the median (i.e., the control group) and firm-year observations with *BIORPX* above the median (i.e., the treatment group). We first estimate a probit model to explain the *MEDBRP* variable with the same repressors used in the second-stage regression, in line with past research (Atif et al., 2021; Harakeh et al., 2022). We then estimate propensity scores and utilize the nearest neighbor approach. Following Gull et al. (2022), we perform two diagnostic tests to assess the effectiveness of our matching procedure. The first test is based on the probit regression results for the pre-match sample reported in Columns (1) and (2) of Table 9. The pseudo *R*-square (0.002) in Column (2) is substantially lower than that (0.097) in Column (1) and the coefficients of all the regressors in Column (2) are not statistically significant, indicating that observable differences between the control and treatment groups are removed. The second test is based on the mean values of firm-level characteristics between the control and treatment groups. Appendix C shows that all the differences in the mean values for these groups are not significant ($p > 0.10$), confirming the effectiveness of the PSM procedure in eliminating all the differences between the two groups. Columns (3)-(10) present the results for the matched sample and show that the coefficients of *SHLGOV*, *CSRGOV*, MGTGOV, and *CCGOVQ* are positive and significant with *BIORPX* ($p < 0.01$), thus, confirming that our main results are not driven by self-selection bias.

Fourth, following related research (Carvajal et al., 2022; Haque & Ntim, 2022), we regress *BIORPX* on the first and second lags of *SHLGOV*, *CSRGOV*, *MGTGOV*, and *CCGOVQ* since they might need time to affect a

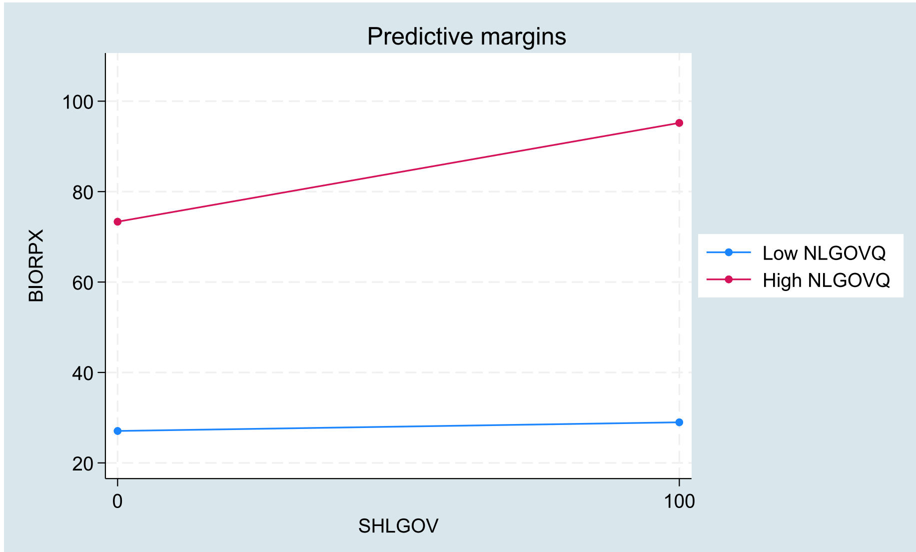

Fig. 1. Moderating effect of national governance quality on the relationship between shareholder treatment and biodiversity reporting.

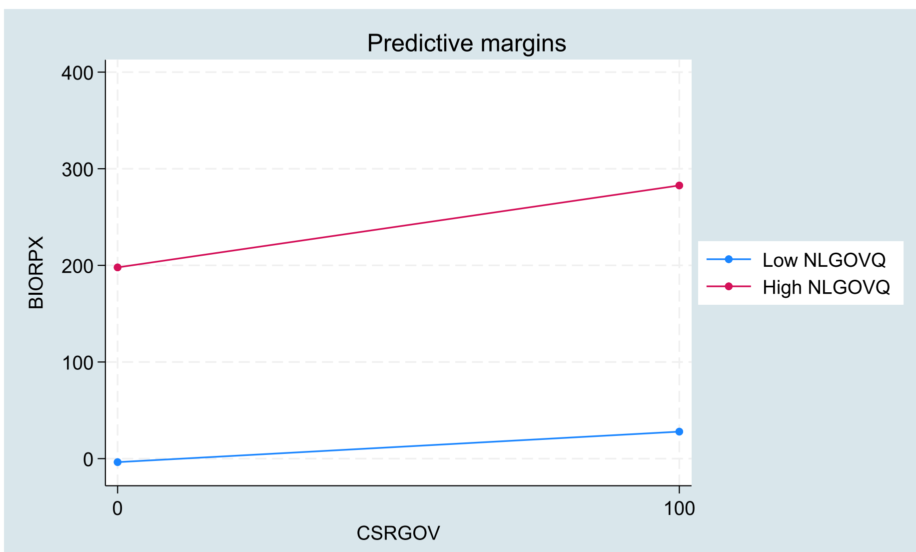

Fig. 2. Moderating effect of national governance quality on the relationship between CSR practices and biodiversity reporting.

firm's reporting practices. To some extent, this analysis alleviates serious endogeneity problems arising from reverse causality (Ye et al., 2019). Although CORGOV is likely to affect environmental disclosures, it is possible that firms with extensive environmental disclosures may adopt effective CORGOV practices, causing a reverse causality in this link (Daradkeh et al., 2023). Panel A of Table 10 shows that $SHLGOV_{t\text{-}1}$, $CSRGOV_{t\text{-}1}$, $MGTGOV_{t\text{-}1}$, and $CCGOVQ_{t\text{-}1}$ are positively connected to *BIORPX*. Similarly, Panel B shows that the second lags of these *CORGOV* variables have a positive association with *BIORPX*. Overall, the results from this analysis support the ones in Tables 5 and 6 and suggest that the initial findings are not subject to reverse causality issues.

Fifth, we repeat our analysis using four alternative samples. Although our dataset consists of listed firms from 36 countries, there is a possibility that countries with largest shares in the sample might drive our results. As shown in Appendix A, the majority of firm-year observations (52.45 %) come from three counties: the United States (US) with 1863 observations (28.60 %), Japan with 972 observations (14.92 %), and China with 582 observations (8.93 %). We exclude the US in Panel A of Table 11, Japan in Panel B, China in Panel C, and then all three countries in Panel D. The results from this analysis support our main inferences regarding the positive effects of *CORGOV* variables and *NLGOVQ* on *BIORPX*. However, the coefficient of *CSRGOV*NLGOVQ* is not significant when the US is excluded from the sample, indicating that the moderating effect of *NLGOVQ* on the *CSRGOV — BIORPX* link is largely driven by the US. This suggests that the positive impact of CSR on biodiversity reporting is more prominent in countries with stronger national governance systems and regulations, such as the US.

Further, we assess the predicted relationships excluding the

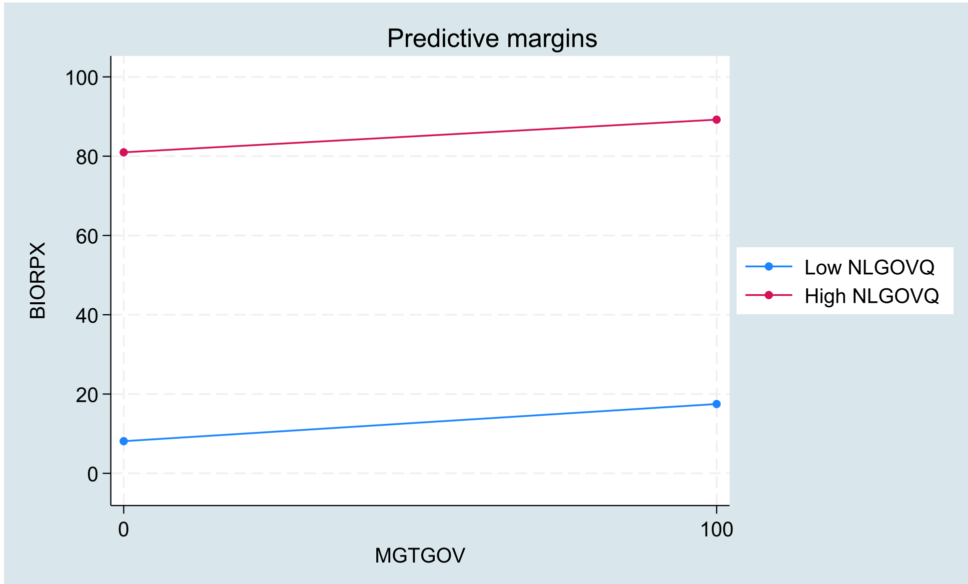

Fig. 3. Moderating effect of national governance quality on the relationship between management effectiveness and biodiversity reporting.

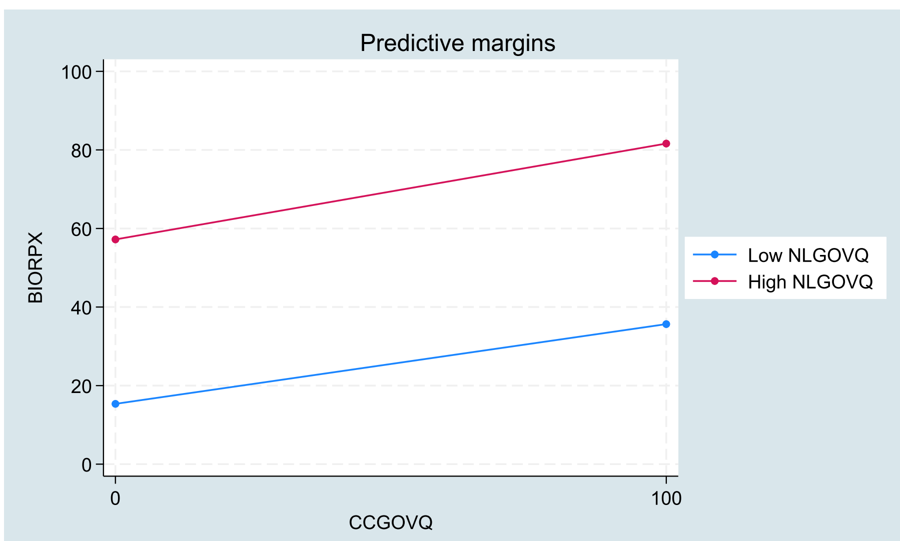

Fig. 4. Moderating effect of national governance quality on the relationship between composite corporate governance and biodiversity reporting.

financials industry. Due to their different regulatory pressures, CORGOV practices, and CSR/sustainability initiatives, financial sector firms may respond differently to climate change issues (Luo & Tang, 2021; Orazalin et al., 2024). The results reported in Table 12 support the evidence from the main analysis, indicating that our findings remain robust to the exclusion of the financial industry.

Finally, we test the sensitivity of our inferences to possible omitted variable bias using the impact threshold for a confounding variable (*ITCV*) analysis, as suggested by Busenbark et al. (2022) and Larcker and Rusticus (2010). The *ITCV* analysis estimates a pattern of partial correlations that an omitted variable must have with the dependent and independent variables in order to overturn the baseline results (Larcker & Rusticus, 2010). This analysis measures how large an omitted variable should be correlated with *CORGOV* variables and *BIORPX* in order to invalidate our findings. If the estimated *ITCV* value exceeds the square root of the multiplication of the correlation between the control and *CORGOV* variables and the correlation between the control and *BIORPX*, then our inferences are less likely to be invalidated by confounding omitted variables (Busenbark et al., 2022). The obtained *ITCV* value for *SHLGOV* is 0.021, indicating that the correlations between *BIORPX* and *SHLGOV* with the confounding omitted variable each only must be approximately 0.146 ($\sqrt{0.021}$) for the main result to be invalidated (for brevity not presented but can be provided upon request). None of the impacts of the control variables exceeds this *ITCV* value, suggesting that confounding variables are less likely to overturn our baseline results.[3] The estimates for *CSRGOV*, *MGTGOV*, *CCGOVQ*, and *NLGOVQ* also suggest that our original findings are unlikely to be influenced by confounding omitted variables.

[3] In line with Larcker and Rusticus (2010), the assumption that our baseline model includes a relatively broad range of relevant control variables provides some confidence in assessing the effects of *CORGOV* variables and *NLGOVQ* on *BIORPX*.

Table 7
Alternative measure of biodiversity reporting.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	AVBIOR	AVBIOR	AVBIOR	AVBIOR	AVBIOR	AVBIOR	AVBIOR	AVBIOR
SHLGOV	0.058***	0.058***						
	(0.018)	(0.018)						
SHLGOV*NLGOVQ		0.014**						
		(0.007)						
CSRGOV			0.334***	0.339***				
			(0.017)	(0.017)				
CSRGOV*NLGOVQ				0.013**				
				(0.005)				
MGTGOV					0.079***	0.079***		
					(0.019)	(0.019)		
MGTGOV*NLGOVQ						−0.004		
						(0.007)		
CCGOVQ							0.188***	0.188***
							(0.026)	(0.026)
CCGOVQ*NLGOVQ								−0.000
								(0.009)
NLGOVQ	2.905***	2.899***	1.989**	2.504**	2.962***	2.945***	3.049***	3.047***
	(1.120)	(1.106)	(0.968)	(1.010)	(1.087)	(1.085)	(1.067)	(1.073)
FRSIZE	8.238***	8.173***	5.105***	5.079***	7.956***	7.965***	7.460***	7.461***
	(0.591)	(0.591)	(0.519)	(0.519)	(0.602)	(0.601)	(0.596)	(0.595)
FRPROF	0.339***	0.337***	0.194**	0.185**	0.316***	0.318***	0.296***	0.297***
	(0.103)	(0.103)	(0.082)	(0.081)	(0.103)	(0.103)	(0.099)	(0.099)
FRLEVG	−0.105**	−0.107**	−0.089**	−0.091**	−0.087*	−0.087*	−0.088*	−0.088*
	(0.047)	(0.047)	(0.037)	(0.036)	(0.047)	(0.047)	(0.045)	(0.045)
FSLACK	−14.343	−14.640	−7.126	−8.464	−12.869	−12.480	−11.595	−11.572
	(9.124)	(9.146)	(6.974)	(6.874)	(9.103)	(9.077)	(8.860)	(8.849)
CAPINT	9.792***	9.887***	7.966***	8.469***	9.801***	9.765***	9.223**	9.219**
	(3.767)	(3.765)	(2.822)	(2.803)	(3.772)	(3.777)	(3.659)	(3.663)
INDLSM	−1.116***	−1.075***	−0.085	−0.005	−0.977***	−0.987***	−0.829***	−0.829***
	(0.307)	(0.307)	(0.269)	(0.267)	(0.307)	(0.310)	(0.298)	(0.301)
MASCLN	4.431	4.266	−7.048	−8.922*	2.871	3.102	0.508	0.524
	(5.408)	(5.386)	(4.785)	(4.826)	(5.331)	(5.387)	(5.184)	(5.244)
UNCAVD	1.190	1.129	−2.696	−3.328*	0.631	0.711	−0.181	−0.175
	(1.950)	(1.942)	(1.732)	(1.744)	(1.920)	(1.939)	(1.867)	(1.887)
GDPGRW	−0.345***	−0.328**	−0.181	−0.224*	−0.345***	−0.344***	−0.327***	−0.327***
	(0.128)	(0.127)	(0.121)	(0.121)	(0.125)	(0.125)	(0.124)	(0.125)
INFLTN	−0.202	−0.198	−0.192	−0.219	−0.196	−0.190	−0.173	−0.173
	(0.240)	(0.238)	(0.212)	(0.214)	(0.231)	(0.229)	(0.227)	(0.226)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6515	6515	6515	6515	6515	6515	6515	6515
Adj. R-squared	0.479	0.481	0.628	0.630	0.483	0.483	0.503	0.503

Notes: This table reports the results from regressing an alternative measure of biodiversity reporting (*AVBIOR*) on *CORGOV* variables and their interactions with national governance quality (*NLGOVQ*). Heteroskedasticity-corrected robust standard errors in brackets are clustered at the firm level. The definitions of all the variables are presented in Table 1. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

4.4. Additional analyses

We also perform several additional analyses. First, we estimate whether the relationships among *CORGOV* variables, *NLGOVQ*, and *BIORPX* differ between environmentally sensitive and non-sensitive industries. Related research (e.g., Choi & Luo, 2021; Orazalin et al., 2023) suggests that firms operating in environmentally sensitive industries proactively engage in climate change and carbon reduction initiatives due to their negative impacts on the environment. As argued by Ott et al. (2017), business entities operating in environmentally sensitive industries differ from those in non-sensitive industries in terms of their responses to climate change issues, sustainability practices, and reporting behavior. Hence, we assess the predicted relationships for these two groups of industries by splitting our dataset into two subsamples. Following prior environmental studies (Guenther et al., 2016; Lu & Herremans, 2019), the energy, industrials, materials, and utilities industries are classified as environmentally sensitive and all other industries are classified as non-sensitive industries. Panel A of Table 13 displays that *SHLGOV* and *CSRGOV* are significant and positive with *BIORPX* in all estimations.

Similarly, Panel B shows that *MGTGOV* and *CCGOVQ* are positively associated with *BIORPX*. These results suggest that individual and composite CORGOV mechanisms and practices have a positive impact on the level of biodiversity information in both sensitive and non-sensitive industries. Following Chantziaras et al. (2020), we apply the Wald test to compare the coefficients between the two groups. Although *NLGOVQ* is positively related to *BIORPX* in both subsamples, the estimated t-statistics from the Wald test are significant, indicating that *NLGOVQ* has a greater positive impact on biodiversity reporting in sensitive industries (for brevity not presented, but can be provided upon request). Further, the interaction term *SHLGOV*NLGOVQ* has a positive association with *BIORPX* ($p < 0.05$) in sensitive industries, but no significant association in non-sensitive industries. These results indicate that *NLGOVQ* reinforces the positive effects of shareholder treatment on biodiversity reporting practices of firms operating in sensitive industries. However, the coefficients of other interactions are not statistically significant, indicating that *CORGOV* variables in terms of board governance, management structures, executive compensation, and CSR practices continues to have a positive impact on biodiversity reporting in both environmentally sensitive and non-sensitive industries, irrespective of *NLGOVQ*. Overall, the results from the industry analysis imply that firms operating in sensitive industries face greater pressures

Table 8
Robustness test: Addressing endogeneity using 2SLS.

Panel A. First-stage regression

	(1) SHLGOV	(2) CSRGOV	(3) MGTGOV	(4) CCGOVQ
SHL_HEAD	0.446***			
	(0.071)			
CSR_HEAD		0.351***		
		(0.092)		
MGT_HEAD			0.395***	
			(0.072)	
CCG_HEAD				0.375***
				(0.077)
NLGOVQ	−1.516	2.640**	−1.795	−1.172
	(1.356)	(1.329)	(1.358)	(0.996)
FRSIZE	1.292***	9.536***	4.522***	4.543***
	(0.376)	(0.370)	(0.375)	(0.281)
FRPROF	−0.055	0.418***	0.237***	0.208***
	(0.078)	(0.081)	(0.076)	(0.057)
FRLEVG	0.159***	−0.020	−0.107***	−0.041*
	(0.028)	(0.029)	(0.027)	(0.021)
FSLACK	1.383	−21.153***	−17.075***	−14.094***
	(6.177)	(6.531)	(5.948)	(4.514)
CAPINT	5.785**	6.571***	4.500**	4.987***
	(2.250)	(2.142)	(2.120)	(1.601)
INDLSM	0.092	−3.072***	−1.679***	−1.501***
	(0.237)	(0.162)	(0.183)	(0.129)
MASCLN	8.159*	35.513***	25.596***	23.318***
	(4.220)	(2.717)	(2.965)	(2.103)
UNCAVD	2.686*	12.006***	9.005***	8.099***
	(1.516)	(0.936)	(1.030)	(0.725)
GDPGRW	−0.109	−0.479**	−0.094	−0.136
	(0.263)	(0.234)	(0.264)	(0.196)
INFLTN	−0.311	−0.156	−0.236	−0.244
	(0.415)	(0.385)	(0.409)	(0.308)
Year/Industry/Country effects	Yes	Yes	Yes	Yes
Observations	6515	6515	6515	6515
Partial R-squared	0.021	0.018	0.019	0.017
Kleibergen-Paap rk LM statistic	101.23***	118.73***	113.21***	97.75***
Cragg-Donald Wald F-stat.	135.94	123.61	122.61	107.73
Stock-Yogo critical value	16.38	16.38	16.38	16.38
Hansen J statistic	0.5856	0.7559	0.8213	0.1179

Panel B. Second-stage regression

	(1) BIORPX	(2) BIORPX	(3) BIORPX	(4) BIORPX	(5) BIORPX	(6) BIORPX	(7) BIORPX	(8) BIORPX
SHLGOV	0.094***	0.094***						
	(0.012)	(0.012)						
SHLGOV*NLGOVQ		0.025***						
		(0.005)						
CSRGOV			0.387***	0.392***				
			(0.011)	(0.011)				
CSRGOV*NLGOVQ				0.015***				
				(0.004)				
MGTGOV					0.088***	0.088***		
					(0.012)	(0.012)		
MGTGOV*NLGOVQ						−0.001		
						(0.005)		
CCGOVQ							0.223***	0.224***
							(0.016)	(0.016)
CCGOVQ*NLGOVQ								0.007
								(0.006)
NLGOVQ	7.203***	5.784***	6.103***	5.757***	7.222***	7.286***	7.336***	6.977***
	(1.293)	(1.316)	(1.225)	(1.215)	(1.283)	(1.289)	(1.267)	(1.282)
FRSIZE	10.323***	10.209***	6.737***	6.707***	10.048***	10.051***	9.431***	9.415***
	(0.341)	(0.344)	(0.342)	(0.342)	(0.345)	(0.346)	(0.347)	(0.348)
FRPROF	0.443***	0.440***	0.273***	0.264***	0.416***	0.417***	0.391***	0.387***
	(0.076)	(0.076)	(0.066)	(0.067)	(0.075)	(0.075)	(0.074)	(0.074)
FRLEVG	−0.125***	−0.128***	−0.102***	−0.105***	−0.100***	−0.100***	−0.101***	−0.101***
	(0.026)	(0.026)	(0.024)	(0.024)	(0.026)	(0.026)	(0.026)	(0.026)
FSLACK	–23.52***	–24.05***	−15.13***	−16.73***	−21.83***	−21.70***	−20.21***	−20.846***
	(5.811)	(5.796)	(5.291)	(5.301)	(5.811)	(5.855)	(5.744)	(5.802)
CAPINT	7.058***	7.224***	5.105***	5.705***	7.241***	7.229***	6.527***	6.620***
	(2.084)	(2.087)	(1.890)	(1.888)	(2.080)	(2.080)	(2.057)	(2.059)
INDLSM	0.063	0.136	1.257***	1.352***	0.221	0.217	0.407*	0.429*
	(0.236)	(0.237)	(0.237)	(0.239)	(0.239)	(0.240)	(0.239)	(0.240)
MASCLN	−12.93***	−13.22***	−25.98***	−28.21***	−14.42***	−14.35***	−17.39***	−17.82***

(continued on next page)

Table 8 (*continued*)

	(4.125)	(4.120)	(4.203)	(4.293)	(4.173)	(4.198)	(4.150)	(4.191)
UNCAVD	−3.985***	−4.093***	−8.405***	−9.158***	−4.528***	−4.503***	−5.548***	−5.696***
	(1.482)	(1.480)	(1.516)	(1.546)	(1.501)	(1.509)	(1.493)	(1.506)
GDPGRW	−0.797***	−0.767***	−0.610***	−0.661***	−0.799***	−0.799***	−0.777***	−0.780***
	(0.243)	(0.241)	(0.231)	(0.231)	(0.243)	(0.243)	(0.242)	(0.242)
INFLTN	−0.895**	−0.888**	−0.890**	−0.921**	−0.896**	−0.894**	−0.866**	−0.876**
	(0.402)	(0.396)	(0.379)	(0.378)	(0.396)	(0.396)	(0.394)	(0.394)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6515	6515	6515	6515	6515	6515	6515	6515
Adj. R-squared	0.178	0.182	0.291	0.292	0.177	0.177	0.194	0.194

Notes: This table reports the 2SLS results from regressing the biodiversity reporting index (*BIORPX*) on shareholder treatment (*SHLGOV*), CSR practices (*CSRGOV*), management effectiveness (*MGTGOV*), and the composite corporate governance quality (*CCGOVQ*). Panel A presents the first-stage regression results. Panel B presents the second-stage regression results. Heteroskedasticity-corrected robust standard errors in brackets are clustered at the firm level. The definitions of all the variables are presented in Table 1. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 9
Robustness test: Propensity score matching.

	Pre-match	Post-match	Matched	Matched	Matched	Matched	Matched	Matched	Matched	Matched
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	MEDBRP	MEDBRP	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX
SHLGOV			0.105***	0.102***						
			(0.029)	(0.029)						
SHLGOV*NLGOVQ				0.026**						
				(0.012)						
CSRGOV					0.430***	0.434***				
					(0.025)	(0.025)				
CSRGOV*NLGOVQ						0.014*				
						(0.008)				
MGTGOV							0.091***	0.091***		
							(0.030)	(0.030)		
MGTGOV*NLGOVQ								−0.004		
								(0.010)		
CCGOVQ									0.239***	0.239***
									(0.039)	(0.039)
CCGOVQ*NLGOVQ										0.002
										(0.014)
NLGOVQ			8.948***	9.055***	8.189***	8.437***	9.094***	9.105***	9.339***	9.342***
			(2.761)	(2.753)	(2.570)	(2.578)	(2.739)	(2.735)	(2.721)	(2.725)
FRSIZE	0.436***	−0.006	3.120***	3.044***	0.140	0.134	2.824***	2.830***	2.310**	2.307**
	(0.044)	(0.049)	(1.039)	(1.038)	(0.966)	(0.964)	(1.063)	(1.064)	(1.046)	(1.047)
FRPROF	0.021***	0.001	0.044	0.042	−0.088	−0.090	0.016	0.019	−0.006	−0.007
	(0.007)	(0.008)	(0.171)	(0.172)	(0.141)	(0.140)	(0.170)	(0.170)	(0.165)	(0.165)
FRLEVG	−0.005*	0.001	−0.028	−0.032	−0.024	−0.027	−0.002	−0.001	−0.006	−0.006
	(0.003)	(0.003)	(0.075)	(0.075)	(0.064)	(0.064)	(0.074)	(0.075)	(0.073)	(0.073)
FSLACK	−1.018*	0.147	−7.807	−8.543	−2.027	−3.691	−6.445	−5.882	−5.558	−5.827
	(0.591)	(0.630)	(14.035)	(14.020)	(12.378)	(12.308)	(14.109)	(14.247)	(13.885)	(14.033)
CAPINT	0.393	−0.024	0.207	0.381	−1.598	−0.961	0.415	0.371	−0.439	−0.403
	(0.246)	(0.267)	(6.124)	(6.143)	(5.016)	(5.024)	(6.111)	(6.122)	(5.933)	(5.940)
INDLSM	−0.012	−0.001	0.333	0.416	1.560***	1.636***	0.480	0.468	0.662	0.669
	(0.022)	(0.020)	(0.414)	(0.420)	(0.428)	(0.436)	(0.431)	(0.435)	(0.428)	(0.433)
MASCLN	−0.103	0.030	−14.144**	−14.643**	−28.384***	−29.898***	−15.884**	−15.656**	−19.179***	−19.306***
	(0.337)	(0.256)	(6.450)	(6.471)	(7.032)	(7.286)	(6.669)	(6.750)	(6.649)	(6.781)
UNCAVD	−0.027	0.009	−4.452**	−4.630**	−9.241***	−9.753***	−5.087**	−5.007**	−6.216***	−6.260***
	(0.121)	(0.090)	(2.202)	(2.210)	(2.457)	(2.548)	(2.289)	(2.316)	(2.285)	(2.331)
GDPGRW	−0.050***	0.005	0.074	0.104	0.147	0.123	0.034	0.031	0.024	0.025
	(0.014)	(0.017)	(0.374)	(0.375)	(0.357)	(0.358)	(0.379)	(0.380)	(0.381)	(0.381)
INFLTN	−0.049**	0.007	−0.024	0.039	−0.027	−0.053	−0.022	−0.021	−0.048	−0.047
	(0.025)	(0.029)	(0.686)	(0.676)	(0.643)	(0.646)	(0.671)	(0.670)	(0.665)	(0.666)
Year/Industry/Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6515	4372	4372	4372	4372	4372	4372	4372	4372	4372
Pseudo R-sq.	0.097	0.002	—	—	—	—	—	—	—	—
Adj. R-squared	—	—	0.020	0.023	0.166	0.167	0.017	0.017	0.039	0.039

Notes: This table presents the results from regressing the biodiversity reporting index (*BIORPX*) on corporate governance variables using propensity score matching. Columns (1) and (2) display the probit regression results explaining *MEDBRP* for the pre-match and post-match samples, respectively. Heteroskedasticity-corrected robust standard errors in brackets are clustered at the firm-year level. The definitions of all the variables are presented in Table 1. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 10
Robustness test: Biodiversity reporting and the lag values of corporate governance.

Panel A: Using the first lags of all the explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX
$SHLGOV_{t-1}$	0.100***	0.099***						
	(0.026)	(0.026)						
$SHLGOV_{t-1}$*$NLGOVQ_{t-1}$		0.025**						
		(0.010)						
$CSRGOV_{t-1}$			0.357***	0.362***				
			(0.024)	(0.024)				
$CSRGOV_{t-1}$*$NLGOVQ_{t-1}$				0.017**				
				(0.007)				
$MGTGOV_{t-1}$					0.078***	0.079***		
					(0.026)	(0.026)		
$MGTGOV_{t-1}$*$NLGOVQ_{t-1}$						0.002		
						(0.009)		
$CCGOVQ_{t-1}$							0.208***	0.208***
							(0.035)	(0.035)
$CCGOVQ_{t-1}$*$NLGOVQ_{t-1}$								0.012
								(0.012)
$NLGOVQ_{t-1}$	8.845***	8.845***	7.220***	7.808***	8.824***	8.833***	8.937***	9.023***
	(2.658)	(2.640)	(2.463)	(2.509)	(2.604)	(2.614)	(2.578)	(2.611)
Controls	Included	Included	Included	Included	Included	Included	Included	Included
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5916	5916	5916	5916	5916	5916	5916	5916
Adj. R-squared	0.176	0.179	0.273	0.275	0.172	0.172	0.188	0.188

Panel B: Using the second lags of all the explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX
$SHLGOV_{t-2}$	0.108***	0.106***						
	(0.026)	(0.026)						
$SHLGOV_{t-2}$*$NLGOVQ_{t-2}$		0.027***						
		(0.010)						
$CSRGOV_{t-2}$			0.326***	0.331***				
			(0.025)	(0.025)				
$CSRGOV_{t-2}$*$NLGOVQ_{t-2}$				0.018**				
				(0.008)				
$MGTGOV_{t-2}$					0.075***	0.075***		
					(0.027)	(0.027)		
$MGTGOV_{t-2}$*$NLGOVQ_{t-2}$						0.005		
						(0.010)		
$CCGOVQ_{t-2}$							0.200***	0.200***
							(0.036)	(0.036)
$CCGOVQ_{t-2}$*$NLGOVQ_{t-2}$								0.017
								(0.013)
$NLGOVQ_{t-2}$	9.934***	9.938***	8.351***	8.863***	9.867***	9.885***	9.940***	10.042***
	(2.718)	(2.686)	(2.527)	(2.572)	(2.660)	(2.673)	(2.644)	(2.678)
Controls	Included	Included	Included	Included	Included	Included	Included	Included
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5318	5318	5318	5318	5318	5318	5318	5318
Adj. R-squared	0.171	0.174	0.250	0.252	0.164	0.164	0.179	0.180

Notes: This table reports the results from regressing the biodiversity reporting index (*BIORPX*) on the first (Panel A) and the second (Panel B) lag values of shareholder treatment (*SHLGOV*), CSR practices (*CSRGOV*), management effectiveness (*MGTGOV*), and the composite corporate governance quality (*CCGOVQ*). Heteroskedasticity-corrected robust standard errors in brackets are clustered at the firm level. The definitions of all the variables are presented in Table 1. ** and *** denote significance at the 5% and 1% levels, respectively.

and scrutiny from stakeholders and more rigid regulations. Therefore, they are likely to adopt effective CORGOV arrangements and practices (Choi & Luo, 2021; Haque & Ntim, 2022; Moussa et al., 2020), thereby improving environmental transparency and mitigating information asymmetry.

Second, we examine whether the links among *CORGOV* variables, *NLGOVQ*, and *BIORPX* differ between developed countries and developing economies. Past research (e.g., Karaman et al., 2021; Ortas et al., 2015) reported that national economic development can greatly affect CORGOV practices and environmental and social disclosures. As noted by Zattoni et al. (2020), the complex relationships among national institutions, internal governance mechanisms, and firm outcomes are likely to differ between developed and developing countries. Hence, given that corporate climate change disclosures in developing economies are substantially different from those in developed countries (Luo et al., 2013), we separately estimate our baseline model by splitting the sample into the developed countries and developing countries subsamples. As shown in Table 14 Panel A, the coefficients of *SHLGOV* are positive and significant with *BIORPX* ($p < 0.01$) for developed countries, but not significant for developing economies. This indicates that shareholder treatment has a positive impact on biodiversity disclosures in developed countries, but no impact in developing countries. Although

Table 11
Robustness test: Alternative samples without US, Japan, and China.

	(1) BIORPX	(2) BIORPX	(3) BIORPX	(4) BIORPX	(5) BIORPX	(6) BIORPX	(7) BIORPX	(8) BIORPX
Panel A: Excluding the US								
SHLGOV	0.088***	0.095***						
	(0.028)	(0.028)						
SHLGOV*NLGOVQ		0.026**						
		(0.010)						
CSRGOV			0.313***	0.315***				
			(0.030)	(0.034)				
CSRGOV*NLGOVQ				0.002				
				(0.008)				
MGTGOV					0.092***	0.091***		
					(0.031)	(0.032)		
MGTGOV*NLGOVQ						−0.000		
						(0.009)		
CCGOVQ							0.207***	0.209***
							(0.041)	(0.043)
CCGOVQ*NLGOVQ								0.004
								(0.012)
NLGOVQ	8.229***	8.283***	6.524***	6.584**	8.345***	8.344***	8.436***	8.476***
	(2.707)	(2.692)	(2.518)	(2.547)	(2.649)	(2.658)	(2.631)	(2.656)
Controls	Included	Included	Included	Included	Included	Included	Included	Included
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4652	4652	4652	4652	4652	4652	4652	4652
Adj. R-squared	0.147	0.152	0.208	0.208	0.147	0.147	0.160	0.160
Panel B: Excluding Japan								
SHLGOV	0.089***	0.094***						
	(0.028)	(0.028)						
SHLGOV*NLGOVQ		0.024**						
		(0.010)						
CSRGOV			0.401***	0.411***				
			(0.023)	(0.024)				
CSRGOV*NLGOVQ				0.018**				
				(0.007)				
MGTGOV					0.085***	0.084***		
					(0.027)	(0.028)		
MGTGOV*NLGOVQ						−0.002		
						(0.009)		
CCGOVQ							0.222***	0.224***
							(0.035)	(0.036)
CCGOVQ*NLGOVQ								0.007
								(0.012)
NLGOVQ	7.353***	7.344***	5.557***	6.347***	7.301***	7.293***	7.328***	7.380***
	(2.291)	(2.271)	(2.088)	(2.150)	(2.241)	(2.245)	(2.216)	(2.242)
Controls	Included	Included	Included	Included	Included	Included	Included	Included
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5543	5543	5543	5543	5543	5543	5543	5543
Adj. R-squared	0.190	0.193	0.314	0.316	0.189	0.189	0.206	0.206
Panel C: Excluding China								
SHLGOV	0.108***	0.097***						
	(0.013)	(0.013)						
SHLGOV*NLGOVQ		0.023***						
		(0.008)						
CSRGOV			0.391***	0.382***				
			(0.012)	(0.012)				
CSRGOV*NLGOVQ				0.024***				
				(0.006)				
MGTGOV					0.090***	0.093***		
					(0.013)	(0.013)		
MGTGOV*NLGOVQ						−0.008		
						(0.006)		
CCGOVQ							0.227***	0.226***
							(0.017)	(0.017)
CCGOVQ*NLGOVQ								0.003
								(0.008)
NLGOVQ	3.424**	3.528**	4.679***	4.596***	3.543**	3.566**	3.789**	3.784**
	(1.683)	(1.685)	(1.631)	(1.617)	(1.679)	(1.676)	(1.661)	(1.660)
Controls	Included	Included	Included	Included	Included	Included	Included	Included
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

(*continued on next page*)

Table 11 (*continued*)

Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5933	5933	5933	5933	5933	5933	5933	5933
Adj. R-squared	0.164	0.166	0.271	0.273	0.160	0.160	0.178	0.178
Panel D: Excluding the US, Japan, and China								
SHLGOV	0.093***	0.090***						
	(0.018)	(0.018)						
SHLGOV*NLGOVQ		0.021***						
		(0.008)						
CSRGOV			0.295***	0.299***				
			(0.020)	(0.020)				
CSRGOV*NLGOVQ				0.011				
				(0.007)				
MGTGOV					0.098***	0.096***		
					(0.019)	(0.019)		
MGTGOV*NLGOVQ						−0.010		
						(0.007)		
CCGOVQ							0.206***	0.206***
							(0.025)	(0.025)
CCGOVQ*NLGOVQ								−0.003
								(0.009)
NLGOVQ	4.103*	4.284*	3.961*	3.850*	4.304*	4.397**	4.390**	4.409**
	(2.218)	(2.226)	(2.170)	(2.159)	(2.201)	(2.197)	(2.176)	(2.173)
Controls	Included	Included	Included	Included	Included	Included	Included	Included
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3098	3098	3098	3098	3098	3098	3098	3098
Adj. R-squared	0.125	0.127	0.170	0.171	0.124	0.124	0.135	0.135

Notes: This table presents the regression results for the alternative samples to assess the effects of corporate governance variables and national governance quality on biodiversity reporting. Panel A excludes firm-year observations from the USA. Panel B excludes firm-year observations from Japan. Panel C excludes firm-year observations from China. Panel D excludes firm-year observations from the USA, Japan, and China. Heteroskedasticity-corrected robust standard errors in brackets are clustered at the firm level. The definitions of all the variables are presented in Table 1. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 12
Robustness test: Alternative sample analysis without financial industry.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX
SHLGOV	0.092***	0.091***						
	(0.028)	(0.028)						
SHLGOV*NLGOVQ		0.022*						
		(0.011)						
CSRGOV			0.386***	0.390***				
			(0.024)	(0.025)				
CSRGOV*NLGOVQ				0.014*				
				(0.008)				
MGTGOV					0.086***	0.085***		
					(0.027)	(0.027)		
MGTGOV*NLGOVQ						−0.005		
						(0.009)		
CCGOVQ							0.217***	0.217***
							(0.036)	(0.036)
CCGOVQ*NLGOVQ								−0.002
								(0.012)
NLGOVQ	6.915***	6.930***	6.339***	6.840***	6.850***	6.804***	6.982***	6.965***
	(2.401)	(2.394)	(2.194)	(2.249)	(2.354)	(2.357)	(2.325)	(2.342)
Controls	Included	Included	Included	Included	Included	Included	Included	Included
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5559	5559	5559	5559	5559	5559	5559	5559
Adj. R-squared	0.178	0.180	0.292	0.293	0.177	0.177	0.194	0.193

Notes: This table presents the regression results for the alternative sample excluding firm-year observations from the financials industry to assess the effects of corporate governance variables and national governance quality on biodiversity reporting. Heteroskedasticity-corrected robust standard errors in brackets are clustered at the firm level. The definitions of all the variables are presented in Table 1. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

the coefficients of *CSRGOV* are positive and significant in both subsamples, the un-tabulated t-statistics from the Wald test suggest that *CSRGOV* has a greater positive impact on biodiversity reporting in developed countries. The coefficients of *NLGOVQ* in Columns (1)-(4) suggest that strong national governance systems in developed countries lead to higher biodiversity disclosures. These results support the notion that country-level economic factors, legal frameworks, and institutional systems play a key role in improving CORGOV practices and increasing

Table 13
Additional subsample analyses of sensitive and non-sensitive industries.

Panel A: Effects of SHLGOV, CSRGOV, and their interactions with NLGOVQ

	Sensitive industries				Non-sensitive industries			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX
SHLGOV	0.090**	0.099**			0.106***	0.102***		
	(0.044)	(0.044)			(0.032)	(0.032)		
SHLGOV*NLGOVQ		0.031**				0.018		
		(0.014)				(0.014)		
CSRGOV			0.348***	0.357***			0.419***	0.421***
			(0.043)	(0.046)			(0.027)	(0.027)
CSRGOV*NLGOVQ				0.011				0.018*
				(0.011)				(0.010)
NLGOVQ	10.529***	10.347***	8.523***	8.905***	4.968*	5.071*	4.741*	5.536**
	(3.407)	(3.395)	(3.207)	(3.229)	(2.726)	(2.719)	(2.466)	(2.577)
Controls	Included	Included	Included	Included	Included	Included	Included	Included
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2475	2475	2475	2475	4040	4040	4040	4040
Adj. R-squared	0.138	0.144	0.220	0.220	0.211	0.212	0.344	0.345

Panel B: Effects of MGTGOV, CCGOVQ, and their interactions with NLGOVQ

	Sensitive industries				Non-sensitive industries			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX
MGTGOV	0.092**	0.093**			0.094***	0.094***		
	(0.043)	(0.045)			(0.033)	(0.033)		
MGTGOV*NLGOVQ		0.001				−0.004		
		(0.013)				(0.012)		
CCGOVQ			0.213***	0.216***			0.246***	0.246***
			(0.059)	(0.061)			(0.042)	(0.042)
CCGOVQ*NLGOVQ				0.008				0.005
				(0.017)				(0.016)
NLGOVQ	10.409***	10.427***	10.466***	10.567***	5.188*	5.192*	5.422**	5.453**
	(3.364)	(3.371)	(3.350)	(3.358)	(2.661)	(2.651)	(2.619)	(2.657)
Controls	Included	Included	Included	Included	Included	Included	Included	Included
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2475	2475	2475	2475	4040	4040	4040	4040
Adj. R-squared	0.138	0.138	0.152	0.152	0.208	0.208	0.229	0.229

Notes: This table reports the results from regressing the biodiversity reporting index (*BIORPX*) on *CORGOV* variables and their interactions with national governance quality (*NLGOVQ*) in environmentally sensitive versus non-sensitive industries. Panel A shows the effects of shareholder treatment (*SHLGOV*), CSR practices (*CSRGOV*), and their interactions with national governance quality (*NLGOVQ*). Panel B shows the effects of management effectiveness (*MGTGOV*), the composite corporate governance quality (*CCGOVQ*), and their interactions with national governance quality (*NLGOVQ*). Heteroskedasticity-corrected robust standard errors in brackets are clustered at the firm level. The definitions of all the variables are presented in Table 1. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

environmental disclosures (Luo et al., 2013; Zattoni et al., 2020).

Further, Table 14 Panel B shows that the coefficients of *MGTGOV* and *CCGOVQ* are significantly positive in Columns (1)-(4), suggesting that well-governed firms in developed countries issue extensive biodiversity information. However, the coefficients of the interaction terms are not statistically significant, implying that effective CORGOV has a positive impact on *BIORPX*, irrespective of *NLGOVQ* in developed countries. Collectively, these findings suggest that high institutional pressures in developed nations are forcing reporting firms to enhance biodiversity transparency, although firms with strong CORGOV practices tend to provide more biodiversity-related information. Columns (5)-(8) show that the coefficients of *NLGOVQ* are not statistically significant for developing countries. These results indicate that the roles of national governance systems and structures in increasing biodiversity disclosures in the context of developing economies are limited. In other words, due to scarce economic resources at the country level, weak institutional systems may hinder firms in developing economies from committing to biodiversity reporting practices. Overall, the subsample analysis results suggest that both internal and external governance structures and systems have a greater positive impact on biodiversity transparency in developed countries than in developing economies. This highlights the importance of national economic development and growth.

Finally, we assess the effects of board characteristics, including board size (*BDSIZE*), board independence (*BDINDR*), gender diversity (*BDGEND*), and board-level sustainability committees (*BDSCOM*) on *BIORPX*. Past CORGOV literature (Bui et al., 2020; Tingbani et al., 2020) posits that board governance mechanisms play a crucial role in mitigating climate risks and threats and improving environmental transparency. So, it is essential to assess which governance mechanisms contribute to increased biodiversity disclosures. We explore the effectiveness of *BDSIZE*, *BDINDR*, *BDGEND*, and *BDSCOM* in improving *BIORPX*. We measure *BDSIZE* as the logarithm of the total number of board directors, *BDINDR* as the proportion of independent directors, *BDGEND* as the proportion of female directors, and *BDSCOM* as a dummy variable coded 1 if a firm has a board-level sustainability committee. We also include *CSRREP*, *CSRAUD*, and *GRIREP*, as they may influence biodiversity disclosures (Adler et al., 2018; Haque & Jones, 2020). *CSRREP* is a dummy variable coded 1 if a firm issues separate CSR reports. *CSRAUD* is a dummy variable coded 1 if a firm obtains external assurance of its CSR reports from independent auditors. *GRIREP* is a

Table 14
Additional subsample analyses of developed and developing countries.

Panel A: Effects of SHLGOV, CSRGOV, and their interactions with NLGOVQ

	Developed countries				Developing countries			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX
SHLGOV	0.126***	0.166***			−0.086	−0.058		
	(0.028)	(0.041)			(0.054)	(0.308)		
SHLGOV*NLGOVQ		−0.042				0.006		
		(0.029)				(0.066)		
CSRGOV			0.406***	0.396***			0.316***	0.246
			(0.026)	(0.036)			(0.050)	(0.190)
CSRGOV*NLGOVQ				0.012				−0.014
				(0.033)				(0.037)
NLGOVQ	8.352***	8.474***	9.616***	9.632***	1.721	1.790	0.420	0.395
	(2.350)	(2.351)	(2.213)	(2.212)	(4.443)	(4.462)	(4.324)	(4.353)
Controls	Included	Included	Included	Included	Included	Included	Included	Included
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5444	5444	5444	5444	1071	1071	1071	1071
Adj. R-squared	0.172	0.173	0.284	0.284	0.301	0.300	0.372	0.372

Panel B: Effects of MGTGOV, CCGOVQ, and their interactions with NLGOVQ

	Developed countries				Developing countries			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX	BIORPX
MGTGOV	0.085***	0.076***			0.101**	0.289		
	(0.014)	(0.023)			(0.044)	(0.206)		
MGTGOV*NLGOVQ		0.009				0.038		
		(0.020)				(0.041)		
CCGOVQ			0.232***	0.240***			0.170**	0.386
			(0.039)	(0.057)			(0.065)	(0.278)
CCGOVQ*NLGOVQ				−0.009				0.043
				(0.048)				(0.054)
NLGOVQ	8.389***	8.396***	8.595***	8.594***	2.068	2.041	2.026	2.133
	(2.031)	(2.032)	(2.344)	(2.344)	(4.393)	(4.373)	(4.387)	(4.366)
Controls	Included	Included	Included	Included	Included	Included	Included	Included
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5444	5444	5444	5444	1071	1071	1071	1071
Adj. R-squared	0.163	0.163	0.183	0.183	0.303	0.303	0.307	0.307

Notes: This table reports the results from regressing the biodiversity reporting index (*BIORPX*) on *CORGOV* variables and their interactions with national governance quality (*NLGOVQ*) in developed versus developing countries. Panel A shows the effects of shareholder treatment (*SHLGOV*), CSR practices (*CSRGOV*), and their interactions with national governance quality (*NLGOVQ*). Panel B shows the effects of management effectiveness (*MGTGOV*), the composite corporate governance quality (*CCGOVQ*), and their interactions with national governance quality (*NLGOVQ*). Heteroskedasticity-corrected robust standard errors in brackets are clustered at the firm level. The definitions of all the variables are presented in Table 1. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

dummy variable coded 1 if a firm publishes its CSR reports following GRI guidelines. Panel A of Table 15 reports the whole sample and shows that the coefficients of *BDSIZE*, *BDINDR*, and *BDSCOM* are positive ($p < 0.05$ in Columns (1) and (2) and $p < 0.01$ in Column (3), respectively). These results suggest that board size, independence, and sustainability committees have a positive impact on biodiversity disclosure levels. However, the coefficient of *BDGEND* is not significant and suggests that gender diversity has no impact on biodiversity reporting. Panel B displays the results for developed countries. The coefficients of *BDSIZE*, *BDGEND*, *BDSCOM*, and *BDINDR* are positive ($p < 0.01$ in Columns (1), (3), and (4) and $p < 0.05$ in Column (2), respectively). Thus, firms with larger boards, with more independent directors, with more female directors, and with sustainability committees publish more biodiversity-related information in developed nations.

Table 15 Panel C presents the results for developing economies. The coefficients of *BDSIZE* and *BDINDR* are not significant, suggesting that board size and independence have no impact on biodiversity reporting in developing economies. The results also show that *BDSCOM* has a positive association with *BIORPX* ($p < 0.01$) and *BDGEND* has a negative relationship with *BIORPX* ($p < 0.01$), indicating that sustainability committees increase biodiversity information whereas gender diversity decreases it in developing economies. The coefficients of *CSRREP* and *GRIREP* are positive and significant in both subsamples ($p < 0.01$), suggesting that separate CSR reports and GRI-based CSR reports provide more biodiversity information in both developed and developing countries. Further, the coefficients of *CSRAUD* indicate that external assurance of CSR reports increases biodiversity disclosures in developed nations, but has no impact in developing economies. Taken together, our results from this analysis specify that board characteristics and CSR reporting practices increase biodiversity information in developed countries, but have limited impact on biodiversity disclosures in developing economies, thus confirming the results for the impacts of *CORGOV* variables from the previous analysis.

5. Conclusion

Although prior research assessed the effects of specific firm-level factors on biodiversity performance and reporting practices, empirical evidence on the roles of corporate governance and national governance quality on biodiversity reporting is limited. Hence, the present study extends the governance and biodiversity literature by empirically examining (a) the relationships among corporate governance (both

Table 15
Extended analysis: Board characteristics in full sample, developed countries, and developing countries.

	(1)	(2)	(3)	(4)
Panel A. Full sample				
	BIORPX	BIORPX	BIORPX	BIORPX
BDSIZE	2.621**			
	(1.308)			
BDINDR		0.053**		
		(0.021)		
BDGEND			0.044	
			(0.037)	
BDSCOM				14.337***
				(0.871)
CSRREP	17.649***	17.643***	17.715***	13.704***
	(1.067)	(1.067)	(1.066)	(1.067)
CSRAUD	4.121***	4.149***	4.127***	4.119***
	(0.725)	(0.725)	(0.725)	(0.704)
GRIREP	13.071***	12.952***	13.083***	11.575***
	(0.842)	(0.843)	(0.842)	(0.835)
Controls	Included	Included	Included	Included
Year/Industry/Country effects	Yes	Yes	Yes	Yes
Observations	6515	6515	6515	6515
Adj. R-squared	0.281	0.281	0.281	0.305
Panel B. Developed countries				
BDSIZE	4.159***			
	(1.527)			
BDINDR		0.058**		
		(0.023)		
BDGEND			0.127***	
			(0.041)	
BDSCOM				16.029***
				(1.018)
CSRREP	17.722***	17.734***	17.684***	12.622***
	(1.215)	(1.216)	(1.211)	(1.228)
CSRAUD	5.372***	5.386***	5.373***	5.699***
	(0.807)	(0.807)	(0.806)	(0.781)
GRIREP	13.973***	13.811***	13.903***	12.635***
	(0.917)	(0.919)	(0.917)	(0.907)
Controls	Included	Included	Included	Included
Year/Industry/Country effects	Yes	Yes	Yes	Yes
Observations	5444	5444	5444	5444
Adj. R-squared	0.275	0.275	0.275	0.299
Panel C. Developing countries				
BDSIZE	−0.710			
	(2.697)			
BDINDR		−0.043		
		(0.060)		
BDGEND			−0.383***	
			(0.101)	
BDSCOM				11.164***
				(1.710)
CSRREP	17.813***	17.775***	16.887***	17.739***
	(2.354)	(2.336)	(2.286)	(2.308)
CSRAUD	−1.381	−1.342	−0.989	−2.232
	(1.654)	(1.651)	(1.650)	(1.610)
GRIREP	7.804***	7.777***	7.809***	5.507***
	(2.040)	(2.040)	(2.020)	(2.056)
Controls	Included	Included	Included	Included
Year/Industry/Country effects	Yes	Yes	Yes	Yes
Observations	1071	1071	1071	1071
Adj. R-squared	0.369	0.370	0.379	0.393

Notes: This table reports the results from regressing the biodiversity reporting index (*BIORPX*) on board characteristics for the full sample (Panel A), the developed countries subsample (Panel B), and the developing countries subsample (Panel C). Heteroskedasticity-corrected robust standard errors in brackets are clustered at the firm level. The definitions of all the variables are presented in Table 1. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

individual governance dimensions and the overall governance quality), national governance quality, and a firm's biodiversity reporting practices and (b) investigating the moderating role of national governance quality on the corporate governance — biodiversity reporting nexus. Drawing on the dynamic capabilities view and using a sample of 6,515 firm-year observations from 599 firms across 36 countries for the 2009 to 2020 period, our research offers several contributions to the governance and biodiversity literatures.

First, we find that the overall quality of corporate governance and each of the individual dimensions of internal governance (shareholder treatment, CSR practices, and management effectiveness) have a positive impact on biodiversity reporting practices. Second, we establish a positive association between national governance quality and biodiversity reporting, suggesting that strong national governance systems can increase the level of biodiversity information. Third, we provide new evidence that national governance quality has a moderating impact on the shareholder treatment — biodiversity reporting and CSR practices — biodiversity reporting links. Thus, indicating that firms operating in effective national governance systems and regulations are likely to ensure equal treatment of all shareholders and implement CSR practices, which in turn, may increase biodiversity information.

Finally, we document that corporate governance in terms of effective board governance and management structures continues to have a positive effect on biodiversity information, irrespective of the quality and effectiveness of national governance systems and regulations. Our evidence is largely robust to several sensitivity analyses, including an alternative measure of biodiversity reporting and different methods to address potential endogeneity. Overall, our findings broadly support the dynamic capabilities view in that both internal and external governance structures and systems can motivate and force corporate managers to develop dynamic capabilities, engage in green initiatives, and enhance environmental transparency in order to sustain competitive advantage. This is especially true in quickly and constantly changing environments relating to global challenges and threats, such as ecosystems degradation and biodiversity loss.

Our findings have several implications for regulators, policymakers, and organizational stakeholders, including board members, management teams, and investors. First, the positive effects of corporate governance variables on biodiversity reporting suggest that boards of directors and managers should pay careful consideration to the important governance dimensions of shareholder treatment, CSR practices, and board and management effectiveness to improve firms' biodiversity reporting practices. They also need to recognize both the damaging impacts of organizational activities on ecosystems and the detrimental consequences of biodiversity risks that can undermine corporate sustainability. Second, the positive association between national governance quality and biodiversity reporting offers regulators and policymakers additional incentives to develop and implement country-level governance reforms designed to enhance corporate accountability on biodiversity protection and reporting.

Third, the moderating role of national governance quality on the relationships of shareholder treatment, CSR practices, and management effectiveness with biodiversity reporting suggests that policymakers can enhance biodiversity accountability and transparency by aligning biodiversity protection initiatives with corporate reporting frameworks, governance reforms, and climate change policies on a national, regional, and global scale. For example, adopted policies and enacted regulations should not only motivate the dissemination of biodiversity reports to stakeholders but also encourage reporting firms to engage in substantive actions to preserve biodiversity and restore ecosystems. The findings also suggest that global investors concerned about biodiversity loss and species extinction need to pay considerable attention to the importance of internal and external governance systems in assessing biodiversity reporting before they select green technologies and invest in eco-friendly projects. Finally, the findings from the industry analysis may encourage policymakers and regulatory authorities to initiate enforceable policies and regulations with measurable targets for biodiversity preservation, governance practices, and climate mitigation activities in both environmentally sensitive and non-sensitive industries to broaden the role of corporate governance in disseminating biodiversity information.

We identify several limitations that could be addressed in future studies. For example, biodiversity reporting could be measured using alternative proxies. Although the reporting items used to proxy biodiversity reporting belong to biodiversity protection and reporting practices, we acknowledge that they may not fully capture them. Moreover, each reporting item, although used in related studies, reflects the quantity rather than the quality of biodiversity information. Future research in this vein could consider other alternative measures and offer new insights. Further, our empirical findings are based on data from large public firms, which may not be generalizable to small and medium-sized enterprises (SMEs). Therefore, future studies could employ data from SMEs to explore the links among corporate governance, national governance systems, and biodiversity reporting. Despite these limitations, our research enhances our understanding of the roles of internal and external governance characteristics and mechanisms in developing effective biodiversity reporting frameworks that convey important information on a firm's efforts to preserve ecosystems and prevent further biodiversity loss to relevant stakeholders. We hope that our study will inspire further work in this area and shape biodiversity accounting into an important and exciting body of research within business and environmental studies.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix

Appendix A. . Sample distribution by country and industry

Country/ Industry	Firm-year observations (n)	Percentage (%)
Panel A: Distribution by country		
United States	1863	28.60
Japan	972	14.92
China	582	8.93
France	435	6.68
United Kingdom	391	6.00
Germany	268	4.11
Canada	229	3.51
South Korea	225	3.45
Switzerland	164	2.52
Taiwan	129	1.98
India	122	1.87
Hong Kong	100	1.53
Russia	100	1.53
Spain	95	1.46
Netherlands	93	1.43
Italy	87	1.34
Australia	85	1.30
Brazil	80	1.23
Ireland	72	1.11
South Africa	50	0.77
Sweden	47	0.72
Mexico	35	0.54
Singapore	35	0.54
Thailand	32	0.49
Saudi Arabia	24	0.37
Belgium	24	0.37
Denmark	24	0.37
Norway	24	0.37
Austria	23	0.35
Portugal	23	0.35
Turkey	22	0.34
Finland	12	0.18
Hungary	12	0.18
Israel	12	0.18
Luxembourg	12	0.18
Malaysia	12	0.18
Total	**6515**	**100.00**
Panel A: Distribution by industry		

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(*continued*)

Country/ Industry	**Firm-year observations (n)**	**Percentage (%)**
Panel A: Distribution by country		
Industrials	1102	16.91
Consumer Discretionary	988	15.17
Financials	956	14.67
Consumer Staples	702	10.78
Energy	597	9.16
Information Technology	490	7.52
Materials	461	7.08
Healthcare	450	6.91
Communication Services	381	5.85
Utilities	315	4.83
Real Estate	73	1.12
Total	**6515**	**100.00**

Note: Countries and industries are listed in descending order of firm-year observations.

Appendix B. . Variance inflation factors (VIFs)

	VIF	1/VIF
Panel A. Model including SHLGOV as the main independent variable		
NLGOVQ	2.578	0.388
INDLSM	2.238	0.447
INFLTN	1.608	0.622
UNCAVD	1.585	0.631
GDPGRW	1.547	0.647
FRSIZE	1.378	0.726
FRPROF	1.261	0.793
FSLACK	1.245	0.803
CAPINT	1.205	0.830
MASCLN	1.185	0.844
FRLEVG	1.139	0.878
SHLGOV	1.045	0.957
Mean VIF	**1.501**	**.**
Panel B. Model including CSRGOV as the main independent variable		
NLGOVQ	2.573	0.389
INDLSM	2.238	0.447
INFLTN	1.611	0.621
UNCAVD	1.584	0.631
GDPGRW	1.551	0.645
FRSIZE	1.494	0.669
FRPROF	1.273	0.785
FSLACK	1.247	0.802
CAPINT	1.222	0.818
MASCLN	1.182	0.846
CSRGOV	1.142	0.876
FRLEVG	1.134	0.882
Mean VIF	**1.521**	**.**
Panel C. Model including MGTGOV as the main independent variable		
NLGOVQ	2.557	0.391
INDLSM	2.238	0.447
INFLTN	1.609	0.622
UNCAVD	1.585	0.631
GDPGRW	1.547	0.647
FRSIZE	1.420	0.704
FRPROF	1.266	0.790
FSLACK	1.244	0.804
CAPINT	1.207	0.828
MASCLN	1.181	0.847
FRLEVG	1.132	0.883
MGTGOV	1.066	0.938
Mean VIF	**1.504**	**.**
Panel D. Model including CCGOVQ as the main independent variable		
NLGOVQ	2.579	0.388
INDLSM	2.237	0.447
INFLTN	1.608	0.622
UNCAVD	1.585	0.631
GDPGRW	1.547	0.647

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(*continued*)

	VIF	1/VIF
Panel A. Model including SHLGOV as the main independent variable		
FRSIZE	1.445	0.692
FRPROF	1.267	0.789
FSLACK	1.244	0.804
CAPINT	1.209	0.827
MASCLN	1.182	0.846
FRLEVG	1.132	0.884
CCGOVQ	1.100	0.909
Mean VIF	**1.511**	.

Note: Variable definitions and measurements/computations of all the variables are presented in Table 1.

Appendix C. . Heterogeneities in the matched sample.

Variable	Treated (means)	Control (means)	Differences in means	p-value
FRSIZE	24.686	24.677	0.230	0.817
FRPROF	4.254	4.252	0.020	0.987
FRLEVG	25.014	25.074	−0.140	0.892
FSLACK	0.061	0.061	0.300	0.764
CAPINT	0.247	0.253	−0.870	0.385
INDLSM	63.928	64.010	−0.100	0.918
MASCLN	62.434	62.431	0.000	0.996
UNCAVD	59.525	59.318	0.300	0.761
GDPGRW	1.878	1.855	0.250	0.800
INFLTN	1.633	1.619	0.260	0.792

Notes: This table presents the mean values of firm-level characteristics used to derive the matched sample for firm-year observations with biodiversity reporting practices above the median and below the median. The differences in means and *p-values* for the differences are presented in the last two columns. The definitions of all the variables are presented in Table 1.

Data availability

The authors do not have permission to share data.

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