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Sustainable institutional investors and corporate biodiversity disclosure: Does sustainable board governance matter?

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Abstract

The purpose of this study is to examine the impact of sustainable institutional investors (SIIs), based on their signatory status to the UN Principles for Responsible Investment (PRI), on corporate biodiversity disclosure (BD). Moreover, the moderating influence of sustainable board governance (critical mass of female directors, sustainability committees, and sustainability-related executive compensation) as a possible channel of the link between SIIs and BD is analyzed. The study is based on a European sample consisting of 2319 firm-year observations between 2014 and 2020 (EUROSTOXX 600) and embedded in a stakeholder agency theoretical framework. The results are in line with prior research on sustainable corporate governance and indicate that SIIs have a positive impact on BD and that the included sustainability board governance index strengthens this link. Our results are robust to a battery of sensitivity analyses. This study makes a major contribution to prior analyses, as it appears to be the first study on the link between SIIs and BD and the moderating impact of sustainable board governance. The study has major implications for business practice, regulators and research.

KEYWORDS
biodiversity disclosure, institutional investor, sustainable corporate governance, sustainable investor

JEL CLASSIFICATION
M40, M42

1 | INTRODUCTION

Since the last decade, recognition of sustainability aspects in investment decisions has been growing in importance among institutional investors (e.g., Reverte, 2016; Utz, 2019). The current analysis focusses on sustainable institutional investors (SIIs) and disregards other kinds of equity ownership due to these reasons. First, SIIs have increased experience and resources, and these mainly influence corporate sustainability strategies. Second, SIIs are assumed to be active owners and monitors and should pressure management to increase its sustainability efforts. As sustainability topics (e.g., climate change or board gender diversity) represent global challenges, it is expected that investors, especially SIIs, are aware of stakeholder concerns. Based on Dyck et al. (2019), we differentiated institutions by whether or not they signed the UN Principles for Responsible Investment (PRI) as SIIs. Signing the PRI commits an investor to actively monitoring and considering sustainability aspects in their investment decision; these aspects include environmental and social issues in line with the interests of other stakeholder groups (e.g., customers, suppliers, or NGOs).

This analysis concentrates on the European capital market as a unique regulatory setting for this reason: in contrast to other regimes, the European Commission (EC) implemented an ambitious EU Green Deal project to reach climate neutrality by 2050. In more detail, increased sustainability reporting-, sustainable corporate governance-, and sustainable finance regulations were introduced. The EU Taxonomy Regulation 2020 represents the major content of the Green Deal project, as firms must classify whether their business activities are in line with six environmental goals (climate change mitigation; climate change adaption, sustainable use and protection of water and marine resources, transition to a circular economy, pollution prevention and control, and protection and restoration of biodiversity and ecosystems). Since the 2017 financial year, the EU Non-Financial Reporting Directive (NFRD) of 2014 has also required selected public interest entities (PIEs) to publish a non-financial declaration. As part of the European Green Deal project, a new EU Directive on Corporate Sustainability Reporting (CSRD) was finalized in 2022, which also refers explicitly to biodiversity. In 2022, the EC also published a draft version of a future Directive on Corporate Sustainability Due Diligence (CSDD), which addresses sustainable board expertise and sustainable board compensation. Consequently, we need more empirical research on this unique regulatory setting.

In line with the increased practical and regulatory awareness, some studies analyzed the specific impact of SIIs on corporate sustainability outputs in general (Dimson et al., 2015; Dyck et al., 2019; Hong & Kostovetsky, 2012; Li et al., 2021) and on environmental performance in particular (Alda, 2019; Kim et al., 2019, 2020; Kordsachia et al., 2022). Two studies explicitly relied on the UN PRI signatures and found a positive impact on sustainability performance (Dyck et al., 2019) and environmental performance (Kordsachia et al., 2022).

Our analysis contributes to the prior research on SIIs. First, in line with the specific environmental goals of the EU Taxonomy Regulation 2020 and the increased regulatory awareness of biodiversity, this study explicitly concentrates on the impact of SIIs on corporate biodiversity disclosure (BD) as a major part of environmental reporting. We are inspired by recent calls for papers on the impact of corporate governance variables on BD. We focus on this innovative disclosure topic because BD is related to massive management discretion and lacks comparability from an international perspective. Moreover, as biodiversity risks are dominant in comparison to other environmental risks and may be directly linked with future financial consequences, we assume that SII are sensitive to biodiversity issues as part of the sustainability report. The EU biodiversity strategy for 2030 and the latest global biodiversity conference can also be acknowledged for this increased awareness. Given that we are not yet aware of any comparable biodiversity performance measures, it seems useful to rely on some disclosure items. We contribute to the scarce research on the disclosure of a firm's biodiversity initiatives such as biodiversity-related policies, procedures, and activities, which are meant to protect native biodiversity.[1] BD research and the impact of corporate governance just started (e.g., Carvajal et al., 2021; Haque & Jones, 2020). Haque and Jones (2020) and Carvajal et al. (2021) focused on the impact of board gender diversity on BD and did not include other (sustainable) corporate governance variables.

As a major contribution to prior literature, we rely on SIIs as our main variable and assume a positive impact on BD. We are likewise interested in the moderating effect of sustainable board governance on this relationship as a possible channel of the monitoring function of SIIs. As prior research only included board gender diversity and its contribution to BD, we aim to recognize a sustainable board governance score with three key proxies, namely, critical mass of board gender diversity, sustainability board committees, and sustainability-related executive compensation. Our paper makes a clear contribution to the existing literature and assumes that the pressure of SIIs on corporate biodiversity strategies will be as important as on other environmental issues. Based on a sample of European listed firms (2319 firm-years observations; EUROSTOXX 600) for the business years 2014–2020, we find that SIIs have a positive impact on BD and that our included sustainable board governance score strengthens this relationship. Thus, there are indications that SIIs and sustainable boards are complementary sustainable board proxies, that promote BD. Sustainable board governance seems to be a major channel of SIIs to fulfill their goals of increased sustainability. Our results remain constant after robustness tests.

Our study has major *implications* for business practice, regulators, and research, especially in light of the recent EU Green Deal project and of future challenges on sustainable corporate governance and BD within EU member states. The interactions between sustainable corporate governance and BD should be included more often in future discussions in order to decrease the number of greenwashing policies.

Now, we present the agenda of our paper. First, we present a stakeholder agency theoretical foundation, a short literature review on the relationship between SIIs, sustainable boards, and BD and then our main hypotheses. The data and methodology of the empirical analysis will include the sample selection, the main variables, and our regression models. We will then focus on our research results from the correlation, regression, and robustness analyses. A summary and the limitations of the study will follow.

2 | THEORETICAL FRAMEWORK, LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 | The impact of SIIs on BD

Principal agent theory presents the dominant theory within prior empirical-quantitative research on SIIs and corporate sustainability (Bebchuk et al., 2017; Faller & Knyphausen-Aufseß, 2018). Central agency problems of information asymmetries and conflicts of interests can be found between managers (as agents) and SIIs (as principals) (Jensen & Meckling, 1976), resulting in moral hazard and self-serving actions. Those agency conflicts can be reduced by the implementation

[1]Biodiversity, as a term, refers to the variety of life on earth … it includes that vast array of genetically distinct populations within species, as well as the full variety of species and communities, and ecosystems of which they are parts (Earthwatch, 2002, 11).

of strong monitoring and incentive-alignment mechanisms within the firm. SIIs represent a major monitoring instrument as part of external corporate governance. Based on their exit and voice options, they pressure management to fulfill their preferences. As classical agency theory assumes that shareholders' preferences are homogeneous and mainly rely on financial outputs (Jensen & Meckling, 1976), we use the extended stakeholder agency theory (Hill & Jones, 1992) in this analysis. In line with stakeholder agency theory, firms must include a broad range of stakeholder interests to reduce agency conflicts. Environmental and social goals are major stakeholder needs, and these also relate to the information needs of SIIs. In comparison to stakeholder theory (Freeman, 1984), conflicts of interests between various stakeholder groups are not focused on. However, in line with principal agent theory, we assume significant conflicts of interest and information asymmetries between top managers and stakeholders. As stakeholders are mainly interested in the solid reporting on biodiversity issues, agency conflicts arise, because an opportunistic management behavior can be assumed. SIIs are a special type of institutional investors that incorporate the demands of other stakeholders in their investment decisions. Thus, the information needs of SIIs and other stakeholders regarding biodiversity may be similar. Consequently, extended stakeholder agency theory seems to be more appropriate in comparison to classical principal agent theory. This theoretical framework was also included in related empirical studies (e.g., Kordsachia et al., 2022; Velte, 2023).

As part of the overall sustainability management process, voluntary reporting on biodiversity efforts represents an important communication channel to shareholders and other groups of stakeholders (Velte et al., 2020). Information asymmetries and conflicts of interests will be lower if the top management has implemented an active biodiversity strategy and a sound BD. Otherwise, the going concern principle of the firm might be questioned. Investments in biodiversity strategies can be classified as a special form of strategic investment by the firm to realize long-term (non) financial success, and SIIs are assumed to be involved in such decisions. Owing to their voting power and ability to acquire useful information, SIIs engage in active oversight and push for improved biodiversity strategies. Monitoring efforts to increase biodiversity activities and BD may be beneficial for SIIs to the extent that such efforts secure additional investment inflow from their ethically motivated client base.

A growing body of research investigates the influence of SIIs on corporate sustainability outputs (e.g., Dyck et al., 2019; Gloßner, 2019; Kim et al., 2019). While early research assumed that institutional ownership is a homogeneous group with similar goals, more recently, institutional investor heterogeneity is highlighted (Kim et al., 2019). We recognize the results of a few studies on the impact of SIIs on corporate sustainability. For instance, Dyck et al. (2019) found that SII have greater influence on the environmental and social performance of invested firms in comparison to non-SIIs. Kim et al. (2019) stressed that local, socially responsible investment funds reduce the total quantity of toxic chemicals. Alda (2019) also found that socially responsible pension funds are linked with better environmental performance. More recently, Kordsachia et al. (2022) focused on a European sample and documented a positive impact of SIIs on environmental (climate) performance. Biodiversity represents a major part of environmental reporting and performance and should be included in the information needs of SIIs. In line with stakeholder agency theory and prior literature, we posit Hypothesis 1:

H1. The ratio of SIIs is positively associated with BD.

2.2 | Sustainable board governance as a possible moderator of the monitoring role of SIIs

In line with SIIs, sustainable board composition and incentives play key roles in corporate environmental protection to decrease agency conflicts (Hill & Jones, 1992). Sustainable boards may be an important moderator of the monitoring function of SIIs (Kordsachia et al., 2022). The inclusion of stakeholder interests and adequate knowledge within the boards of directors may promote environmental strategies in general and biodiversity efforts in particular. We identity three main sustainable board proxies that have been dominantly addressed in prior research on the impact on corporate sustainability outputs: (1) board gender diversity, (2) sustainability board committees, and (3) sustainability-related executive compensation (Adel et al., 2019; Velte, 2023). These proxies also represent a major monitoring and incentive-alignment function. Board gender diversity with a critical mass of female directors (Kanter, 1977) should lead to increased awareness of environmental topics and the need for increased investments in biodiversity strategies. This should lead to the increased quality of BD. Sustainability board committees should also support firms' sustainability awareness and may be helpful for consulting services or monitoring duties with regard to corporate environmental goals (Velte & Stawinoga, 2020). There are also key interdependencies between sustainability board expertise, board incentives, and BD. Incentive-based alignment between management and stakeholders can be stressed via the inclusion of sustainability indicators in executive compensation systems (Winschel & Stawinoga, 2019). Executives need strong incentives towards corporate sustainability. A common item is the pay-for-performance-sensitivity which indicates a money change in executive wealth connected with each money change in shareholder wealth. As a modification of this concept, the pay-for-sustainable-performance sensitivity is crucial for extrinsic motivations of top manager to increase corporate sustainability efforts (Winschel & Stawinoga, 2019).

In recent years, an increasing number of researchers have studied the impact of sustainable boards on overall corporate sustainability (e.g., Dixon-Fowler et al., 2017; Garcia Martin & Herrero, 2020). Prior literature reviews and meta-analyses stressed that having female directors in the board leads to increased environmental performance, but a critical mass of at least one third should be reached (Byron & Post, 2016). This finding also relates to European cross-country samples (e.g., Kyaw et al., 2017; Orazalin & Baydauletov, 2020; Velte, 2016a, 2016b) and environmental outputs (e.g., Bhuiyan

et al., 2021; Nuber & Velte, 2021). Haque and Jones (2020) and Carvajal et al. (2021) conducted the first studies addressing the positive impact of board gender diversity on BD.

Regarding sustainability board committees, Velte and Stawinoga (2020) reflected the empirical-quantitative research on that topic and stated an overall positive influence on corporate sustainability outputs. Some studies referred to a European cross-country setting and found a positive impact on sustainability reporting (Adel et al., 2019), sustainability performance (Baraibar-Diez et al., 2019), sustainability assurance (Ruhnke & Gabriel, 2013), and integrated reporting (Velte, 2018). There are also indications, that the presence of sustainability board committees leads to increased environmental investments (Bhuiyan et al., 2021), environmental and social expenses (Cancela et al., 2020), and environmental performance (Garcia Martin & Herrero, 2020).

During the last few years, some studies also analyzed the impact of sustainability-related executive compensation on CSR performance (e.g., Callan & Thomas, 2011; Winschel & Stawinoga, 2019). Among them, Velte (2016a, 2016b) and Maas (2018) found a positive impact of sustainable management compensation on CSR performance. However, we know very little about such impact in European cross-country studies (D'Apolito et al., 2019). Bhuiyan et al. (2021) stated that environmental-related CEO bonus and environmental investments are positively related. Haque (2017) referred to carbon performance and stressed a positive influence from sustainability-related executive compensation.

As SIIs and sustainable board governance may represent complementary proxies to decrease agency conflicts between managers and stakeholders, sustainable board composition and incentives may be the relevant channel of the monitoring function of SIIs. Thus, Hypothesis 2 states:

> **H2.** Sustainable board governance as a critical mass of female directors, sustainability board committees, and sustainability-related executive compensation strengthens the positive link between SIIs and BD.

3 | DATA AND METHODOLOGY

3.1 | Sample selection

We included firms listed in the EUROSTOXX 600 from 2014 to 2020. The UN PRI signatory statuses of investors were hand-collected from the UN PRI signatory and outreach. We researched the firm structure of each signatory and included subsidiaries as signatories if they also communicated their engagement with the UN PRI on the company website. This approach mitigated concerns over the applicability of UN PRI to lower-level units of parent companies. We retrieved detailed information about each company's 100 largest shareholders with a unique Investor PermID from the Thomson Reuters Eikon database, which collects ownership information from a variety of sources, such as SEC 13F filings, annual reports, mutual fund aggregates, IPO prospectuses and the UK Share Register. We manually matched the UN PRI signatory status based on the names of the individual shareholders. For each firm-year observation, we calculated the percentage of total shares outstanding owned by UN PRI signatories and matched this aggregated variable with the ASSET4 database using unique Reuters instrument codes.

As we already mentioned, the European capital market was chosen due to the increased regulations put on sustainable finance, corporate governance and reporting over the last few years. We began with the 2014 financial year, since that was the year when the European standard setter published the NFRD. Our included firms cover approximately 90% of the free-float market capitalization of the European stock market. The primary data were obtained from the Thomson Reuters Eikon database. In line with prior research on that topic, we dropped all financial services companies because of their specific capital structure and regulatory requirements. Missing (non)-financial information meant fewer firm-year observations. Table 1 provides an overview of the final sample of 2319 firm-year observations.

3.2 | Dependent variables

Corporate disclosure on biodiversity activities (*BD*) from the Thomson Reuters Eikon database was chosen as the *dependent variable*. The BD score is based on the sum of eight dummy variables representing a firm's disclosure of biodiversity initiatives as disclosed by the sampled firms and compiled by Thomson Reuters. These are biodiversity policies and processes, restoration or protection of biodiversity, reduction of impact, reduction of toxic chemicals, recycling of hazardous waste, or wastewater, biodiversity impact on land use, and management monitoring of biodiversity initiatives. As robustness checks, we modified our dependent variable by using the corporate reporting on biodiversity impact assessments (*BDA*). This dummy variable represents, whether or not the company monitors its impact on biodiversity through the balanced scorecard or key performance indicators.

3.3 | Independent and moderator variables

In line with Dyck et al. (2019), Gloßner (2019), and Kordsachia et al. (2022), *SIIs* as our *independent variable* can be classified as institutional investors with signatures in the UN PRI and thus actively monitor the sustainability efforts of the invested firms.

Our *moderator variable* is a score of three dominant sustainable board governance attributes in prior research (*SBG*). All three proxies are classified as dummy variables and were collected or modified from the Asset4 database. Our first proxy is the critical mass of female directors (*BG*); it equals 1 if the board of directors comprises more than one third female directors. The second proxy is the implementation of a sustainability board committee (*CSRC*) which equals 1 if such a board committee exists in the firm. Moreover, the existence of a sustainability-related executive compensation (*SEC*) equals 1 if the

TABLE 1 Final sample.

	2014	2015	2016	2017	2018	2019	2020
Listed European companies in the STOXX Europe 600	600	600	600	600	600	600	600
Less							
Financial services firms	131	131	131	131	131	130	131
Observations with missing firm-level data on Eikon database	140	132	143	124	142	142	142
Final sample (base regression) $n = 2319$	329	337	326	345	327	328	327

compensation of the senior executives is linked to sustainability targets. In line with prior research, we assumed a complementary relationship between the three variables and an equal contribution to BD (Velte, 2023). Sustainable board composition (GB and CSRC) and sustainable board compensation (SEC) can be classified as the three most important variables used in recent sustainable corporate governance research (Velte, 2023). Given that corporate governance is a system of various interrelated factors, our aim is to include the combinatory effects of the three sustainable board variables. The selection of a corporate governance score was also often used in prior studies (e.g., Velte, 2023). Based on stakeholder agency theory, we assumed a positive moderating effect of the link between *SIIs* and BD. SIIs and sustainable boards may be a major catalyst for top managers to increase the degree of biodiversity initiatives. Consequently, we defined sustainable board governance score (*SBG*) as the sum of the three attributes. For the robustness tests, we also analyzed the single contribution of each proxy.

3.4 | Control variables

We included several *control variables* commonly used in this research area (e.g., Hassan et al., 2020; Kim et al., 2019; Kordsachia et al., 2022). When relying on fundamental firm characteristics, it is common in prior research to include firm size, financial performance, leverage, R&D expenses, and firm age as control variables (Haque & Jones, 2020; Hassan et al., 2020). In line with the business case argument for sustainability, the financial conditions of the firm may significantly impact the degree of BD. Firm size (*SIZE*) is included as the natural logarithm of total assets, because it is related to economics of scale or scope, which may be relevant for competitive aspects (Hassan et al., 2020). We assumed a positive impact on BD. Financial performance must also be included as it may positively influence BD. We included return on assets (*ROA*) (Haque & Jones, 2020) and leverage (*LEV*) to control for financial stability of the firm (Hassan et al., 2020). We likewise included R&D expenses (*R&D*) as a major proxy of corporate innovation and assumed a positive impact on BD. Moreover, we also included firm age (*FIRMA*) as the logarithm of the years the respective company exists. We assumed that firm age and BD are negatively related due to decreased innovativeness.

In line with our theoretical framework, we stress that corporate governance as a monitoring instrument will increase the quality of BD. An increased level of board effectiveness will stimulate executives to promote biodiversity activities. As corporate governance variables should have a positive impact on BD, we first recognized board independence (*BOARDIN*) (Haque & Jones, 2020). Board independence was measured as the ratio of independent directors on the board as reported. Second, board size (*BOARDS*) refers to the logarithm of amount of board directors. We also included external corporate governance mechanisms in the context of BD and assumed a positive impact: the extent of analyst following (*ANALYST*), the percentage of shares held by public investors (*FREE_FLOAT*) (Haque & Jones, 2020) and dummy variables for the Dow Jones Sustainability Index listing in the European sub-section (*DJSI_EU*). CEO power is reflected in the CEO duality model because we also included many companies with one-tier systems. *CEOD* indicates whether the CEO is also the board chair (1 = yes) or not (0 = no). As CEO duality is qualified as decreased board effectiveness, we assumed a negative impact on BD. We give an overview of included variables in Table 2.

3.5 | Regression model

We included regression analyses as we are interested in the impact of SII on BD and the moderation effect of sustainable board governance. Our main regression model recognizes whether (lagged) *SII* has a positive impact on *BD* and whether his link is moderated by *SBG*. We applied this specification (Equation 1) to test H1 and H2:

$$BD_{it+1} = alpha + beta_1\, SII_{it} + beta_2\, SBG_{it} + beta_3\, SIZE_{it} + beta_4\, ROA_{it} + beta_5\, LEV_{it} + beta_6\, R\&D_{it} + beta_7\, BOARDIN_{it} + beta_8\, BOARDS_{it} + beta_9\, ANALYST_{it} + beta_{10}\, FREE\_FLOAT_{it} + beta_{11}\, DJSI\_EU_{it} + beta_{12}\, FIRMA_{it} + beta_{13}\, CEOD_{it} + e_{it}. \quad (1)$$

$$BD_{it+1} = alpha + beta_1\, SII_{it} + beta_2\, SBG_{it} + beta_3\, SII^{*}\, SBG_{it} + beta_4\, SIZE_{it} + beta_5\, ROA_{it} + beta_6\, LEV_{it} + beta_7\, R\&D_{it} + beta_8\, BOARDIN_{it} + beta_9\, BOARDS_{it} + beta_{10}\, ANALYST_{it} + beta_{11}\, FREE\_FLOAT_{it} + beta_{12}\, DJSI\_EU_{it} + beta_{13}\, FIRMA_{it} + beta_{14}\, CEOD_{it} + e_{it}. \quad (2)$$

We used panel data regression based on significant Lagrange multiplier tests, *F*-tests for overall significance, and Hausman tests. Panel data regressions are superior in comparison to classical OLS regressions due to endogeneity concerns. In detail, we included country fixed effects, industry fixed effects based on two-digit SIC codes, and

TABLE 2 Variables of the study.

Panel A: Dependent variables	
BD	Sum of eight dummy variables representing a firm's disclosure of biodiversity initiatives as disclosed by the sampled firms and compiled by Thomson Reuters. These are biodiversity policies and processes, restoration or protection of biodiversity, reduction of impact, reduction of toxic chemicals, recycling of hazardous waste, or wastewater, biodiversity impact on land use, and management monitoring of biodiversity initiatives
BDA (as robustness check)	Dummy variable = 1, if the company monitors its impact on biodiversity through the balanced scorecard or key performance indicators (KP) or 0, if not
Panel B: Independent variable	
SII	Total equity owned by the firm's largest 100 investors that are signatories to the UN PRI (hand-collected)
Panel C: Control variables	
SBG (also moderator variable)	Sustainable board governance score, based on three sustainable board composition and incentive variables: (1) critical mass of female directors (1 = more than 1/3; dummy), (2) existence of a sustainability board committee (1 = yes; dummy), and (3) existence of a sustainability-related executive compensation package (1 = yes; dummy), obtained from Refinitiv
SIZE	Firm size = natural logarithm of total assets obtained from Refinitiv
ROA	Return on assets = (Net income before preferred dividends + ((Interest expense on debt-interest capitalized) * (1 − Tax rate)))/Average of last year's and current year's total asset obtained from Refinitiv
LEV	Leverage = Long-term debt scaled by total assets obtained from Refinitiv
R&D	(Research and Development Expense)/(Net Sales or Revenues) obtained from Refinitiv
BOARDIN	Board independence = (Independent board members)/(Total number of board members) obtained from Refinitiv
BOARDS	Board size = natural logarithm of the amount of directors on the board obtained from Refinitiv
ANALYST	Natural logarithm of the number of analysts following the firm obtained from Refinitiv
FREE_FLOAT	Free float as a percentage of shares outstanding obtained from Refinitiv
DJSI_EU	Indicator variable taking the value 1 if the firm is listed in the Dow Jones Sustainability Index (Europe) in the corresponding year, and 0 otherwise obtained from RobecoSam
FIRMA	Logarithm of the number of years the company exists obtained from Refinitiv
CEOD	Dummy variable = 1, if the CEO is also the board chair, 0 = not obtained from Refinitiv

TABLE 3 Descriptive statistics.

Variable	Mean	Median	SD	Min	Max
Panel A: dependent variables					
BD	2.780	0.000	1.82	0.000	8.000
BDA (as robustness check)	0.131	0.000	0.04	0.000	1.000
Panel B: independent variable					
SII	0.192	0.145	0.182	0.000	0.942
Panel C: control variables					
SBG (also moderator)	2.000	2.000	0.198	0.000	3.000
SIZE	18.953	20.151	1.814	11.225	28.252
ROA	3.284	3.201	5.844	1.019	29.352
LEV	0.142	0.134	0.404	0.242	0.602
R&D	0.204	0.382	0.201	0.000	0.524
BOARDIN	0.544	0.615	20.312	0.000	1.000
BOARDS	9.642	9.761	3.676	3.000	27.000
ANALYST	2.542	2.624	0.631	0.000	3.980
FREE_FLOAT	0.692	0.803	0.252	0.000	1.000
DJSI_EU	0.121	0.000	0.242	0.000	1.000
FIRMA	2.532	2.341	1.584	1.423	4.647
CEOD	1	1	0.4	0	1

TABLE 4 Pearson correlation matrix.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) BD	1.000														
(2) BDA	0.742***	1.000													
(3) SII	0.354**	0.387**	1.000												
(4) SBG	0.253**	0.243**	0.289**	1.000											
(5) SIZE	0.287**	0.252**	0.241**	0.189	1.000										
(6) ROA	0.242**	0.225**	0.265**	0.253*	0.242*	1.000									
(7) LEV	−0.154**	−0.114*	−0.142	−0.255*	−0.321*	−0.231*	1.000								
(8) R&D	0.189**	0.123**	0.015	0.224*	0.224*	0.154	0.178	1.000							
(9) BOARDIN	0.221**	0.265**	0.212**	0.211*	0.311*	0.216	0.205*	0.221	1.000						
(10) BOARDS	0.221*	0.113*	0.221*	0.152*	0.114	0.251	0.315*	0.144	0.151	1.000					
(11) ANALYST	0.299**	0.217**	0.255*	0.214*	0.151	0.014	0.063	0.074	0.023	0.114	1.000				
(12) FREE_FLOAT	0.182*	0.153*	0.121**	0.114*	0.253*	0.321*	0.051	0.131*	0.155	0.212	0.245	1.000			
(13) DJSI_EU	0.013	0.065	0.213	0.112*	0.054	0.143	0.221	0.153	0.021	0.215	0.115	0.150	1.000		
(14) FIRMA	−0.154	−0.164	0.043	0.142	0.222*	0.253*	0.076	−0.165	0.054	0.015	0.118	0.098	0.143	1.000	
(15) CEOD	−0.124	−0.078	0.225*	0.324*	0.013	0.089	0.131	0.112*	0.021	0.121	0.213	0.153	0.012	0.121	1.000

Note: This table represents the correlation coefficients between independent, dependent, and control variables for the whole sample. The variables are defined in Table 2. Significance levels: *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

year fixed effects. This procedure is common in related archival research (Haque & Jones, 2020). BD was forwarded by 1 year to model a possible causal relationship and mitigate potential endogeneity concerns due to reverse causality. We are in line with other researchers who have also assumed time lagged effects (Haque & Jones, 2020). As a consequence, we provided robust regression results. We estimated Equation (1) using fixed effects panel regressions with robust standard errors adjusted for heteroscedasticity.

4 | RESEARCH RESULTS

4.1 | Descriptive statistics

Table 3 provides an overview of the descriptive statistics for the dependent variable (panel A), independent variable (panel B), and control variables (panel C). On average, UN PRI signatories own 19.21% of equity outstanding with a median value of 14.55%. The BD score ranges from 0 to 8. The mean (median) score in our sample is 2.78 (0.00). *SBG* is linked with a mean (median) of 2.000 (2.000).

4.2 | Correlation results

Table 4 presents the Pearson correlation matrix for the dependent, independent, and control variables. As supposed, *SII* is positively significantly correlated with *BD*. This result is in line with prior research on related topics, as SII increases environmental performance and reporting (e.g., Kordsachia et al., 2022). In line with our prior assumptions, we also find that *SBG* is positively related with *BD* as well. This outcome is in line with prior research (Haque & Jones, 2020) that found a significant positive impact of board gender diversity on BD. We calculated variance inflation factors (VIFs) to test for multicollinearity. Multicollinearity might occur if the VIF is higher than 10 (Hair et al., 2009). In our data, no VIF is higher than 3.6, and thus multicollinearity should not be realistic. Most of our included variables show the assumed positive versus negative impact on BD. However, many relationships did not show any significant correlation.

4.3 | Regression results

The results of the multivariate regression analysis are explained in Table 5. *Model 1* includes the link between *SII* and *BD* and *Model 2* includes the moderator variable (*SII* * *SBG*). We note that *SII* is positively significantly linked with *BD*. Thus, H1 is supported. Regarding Model 2, we find that the significant positive link between *SII* and *BD* is more pronounced by *SBG* ($p < 0.01$). Thus, H2 is also supported. In comparison to related research on that topic (e.g., Haque & Jones, 2020), the degree of R^2 is satisfactory. Interestingly, few control variables do not significantly contribute to the model (e.g., LEV and FREE_FLOAT). However, as they represent "best practice" control variables in related research, we decided not to delete them. Our results are in line with both prior empirical research and our theoretical framework. Stakeholder agency theory assumes that sustainable corporate governance (both *SIIs* and *SBG*) will increase BD activities due to the monitoring and incentive function. The increased level of BD is linked with reduced information asymmetries and conflicts of interests as agency conflicts. Sustainable board governance by the voluntary implementation of a critical mass of female directors, sustainability board committees, and sustainability-related executive

TABLE 5 Regression analysis.

Variables	Model 1 (BD)	Model 2 (BD; interaction)
SII	0.082** (0.049)	0.167*** (0.022)
SBG	0.135** (0.045)	0.156** (0.043)
SII * SBG	-	0.189*** (0.012)
SIZE	3.567** (0.031)	3.463** (0.030)
ROA	0.665** (0.034)	0.641** (0.031)
LEV	−0.145 (0.176)	−0.151 (0.186)
R&D	0.191** (0.041)	0.188** (0.042)
BOARDIN	1.513** (0.032)	1.761** (0.029)
BOARDS	2.141 (0.221)	2.443 (0.231)
ANALYST	6.342*** (0.421)	6.453*** (0.412)
FREE_FLOAT	0.042 (0.054)	0.040 (0.053)
DJSI_EU	9.432* (0.065)	9.142* (0.061)
FIRMA	0.065 (0.242)	0.076 (0.212)
CEOD	0.098 (0.212)	0.089 (0.223)
CONSTANT	−2.754** (2.140)	−2.945** (2.217)
Observations	2319	2319
R^2 (adj.)	0.302	0.315
Industry FE	YES	YES
Country FE	YES	YES
Year FE	YES	YES

Note: This table presents results from panel regressions of sustainable institutional investors (SII) on corporate biodiversity disclosure (BD) (model 1), interaction of sustainable board governance (SBG) (model 2), and controls over the period 2014–2020 for the whole sample. Total variables are explained in Table 2. Robust and clustered (by firm) standard errors are reported in parentheses. The *p* values are two-tailed. The symbols ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

TABLE 6 Robustness checks.

Variables	Model 3 BDA	Model 4 BDA (interaction)	Model 5 Board gender diversity (interaction)	Model 6 Sustainability board committee (interaction)	Model 7 Sustainability-related executive compensation (interaction)
SII	0.092** (0.041)	0.132*** (0.014)	0.145*** (0.019)	0.157*** (0.018)	0.174*** (0.017)
SBG	0.131** (0.041)	0.165** (0.035)	-	-	-
SII * SBG	-	0.164*** (0.0.14)	-	-	-
Board gender diversity	-	-	0.131** (0.040)	-	-
Sustainability board committee	-	-	-	0.138** (0.039)	-
Sustainability-related executive compensation	-	-	-	-	0.140** (0.038)
SII * board gender diversity	-	-	0.176*** (0.015)	-	-
SII * sustainability board committee	-	-	-	0.193*** (0.014)	-
SII * sustainability-related executive compensation	-	-	-	-	0.195*** (0.014)
Controls are not tabulated					
Pseudo R^2	0.318	0.367	-	-	-
R^2 (adj.)	-	-	0.315	0.291	0.325

Note: This table presents results from logit and panel regressions of sustainable institutional investors (SII) on BDA (model 3), interaction of SII and sustainable board governance (SBG) (model 4), and disaggregated moderator variables (models 5–7) over the period 2014–2020 for the whole sample. Controls are not tabulated. Total variables are explained in Table 2. Robust and clustered (by firm) standard errors are reported in parentheses. The *p* values are two-tailed. The symbols ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

compensation represents a major channel to promote the monitoring function of SIIs. Our results are also in line with prior studies, which assume a positive impact of SIIs on environmental performance (e.g., Alda, 2019; Kordsachia et al., 2022) and of board gender diversity on BD (Carvajal et al., 2021; Haque & Jones, 2020).

5 | ROBUSTNESS CHECKS

We conducted several robustness checks to test the sensitivity of our regressions. Table 6 gives a summary of the results of our robustness checks. First, we ran regressions with regard to the impact of *SII* on *BDA* (model 3) due to logit regressions and found positive significant results in line with model 1. Second, we included the interaction term (*SII * SBG*), analyzed the impact of *BDA* (model 4), and stated supportive results in comparison to model 2. Thus, the combination of our three sustainable board governance variables strengthens both *BD* and *BDA*. We also measured the disaggregated moderating influence of board gender diversity, sustainability committees and sustainability-related executive compensation (models 5–7, respectively). We also found significant positive results in line with our theoretical framework.

Throughout this study, we employed various panel data methods to mitigate endogeneity concerns. To further mitigate potential endogeneity problems, we applied a two-stage least squares instrumental variable design. To do this, we construct industry-year averages for *SII* in line with prior research (e.g., Kordsachia et al., 2022). These averages exclude the focal firm of analysis and are therefore regarded as exogenous to *BD*. We also deleted any industry-year combinations with fewer than 10 observations. The untabulated results are in line with our previous analysis. The second stage coefficient for SII (0.562) is positively and statistically significant (p-value = 0.000). Post-estimation analysis confirms the strength and relevance of our instrument.

6 | SUMMARY

6.1 | Conclusions

This study analyzed the impact of sustainable institutional investors (*SII*) on corporate biodiversity disclosure (*BD*). Moreover, we recognized the inclusion of sustainable board governance (*SBG*), based on the critical mass of female directors, sustainability board committees,

and sustainability-related executive compensation, as a moderator of this link. Sustainable board governance may represent a major channel of the monitoring function of *SIIs*. As empirical-quantitative research on *BD* just started, we present the first study on this topic. Stakeholder agency theory suggests that sustainable corporate governance as a monitoring and incentive tool leads to an increased awareness of stakeholder demands and therefore, increased BD. Voluntary corporate disclosure on biodiversity strategies reduces information asymmetries and conflicts of interests (agency conflicts). *SIIs* will not only push for environmental performance in general but also for active biodiversity strategies in particular. Sustainable boards are a major driver of this relationship.

In view of the huge impact of *SIIs* on corporate environmental reporting, we documented a major contribution to prior research on the European capital market owing to sustainable finance and reporting regulations. We referred to listed European corporations (2319 firm-year observations; EUROSTOXX 600) covering the business years 2014–2020. By conducting panel regressions, we found that *SII* has a positive and significant impact on *BD*. The positive link between *SII* and *BD* is also more pronounced by sustainable board governance (*SBG*). Thus, the dual existence of sustainable internal and external corporate governance will lead to stronger *BD* because it reduces the risk of greenwashing. The results are robust after conducting several robustness checks, (alternative BD measure, disaggregated moderator variables, and instrumental variable design). Our main results are in line with our theoretical framework and recent studies, which found a positive link between SIIs and environmental outputs (e.g., Alda, 2019) and between sustainable boards and BD (Carvajal et al., 2021; Haque & Jones, 2020).

Now, we stress major implications for researchers, regulators, and business practice to support the connection between sustainable corporate governance and BD.

6.2 | Managerial implications

Firms should be aware of the massive stakeholder awareness on environmental protection and the moral duty of firms to promote environmental strategies. While current discussions mainly concentrate on climate change policies, biodiversity strategies should be included in environmental management systems as well. Many researchers have stressed the interrelations between corporate climate activities and biodiversity efforts (Haque & Jones, 2020). Given that global reporting frameworks on biodiversity strategies are less precise in comparison to climate aspects, there are still great possibilities for managerial discretion and greenwashing. A solid environmental management system requires an explicit reliance on biodiversity goals and interrelations to other environmental topics. Our analysis stresses the increased power of SIIs and the awareness of sustainable boards to increase the extent of BD.

6.3 | Regulatory implications

From a *regulatory perspective*, recent regulatory strategies to increase the quality of corporate sustainability reporting and sustainable finance activities may not be enough. Instead, listed firms should be requested to include specific sustainable board attributes, such as a critical mass of female directors, sustainability-related management compensation schemes, or sustainability board committees. While the EC recently finalized a new Directive on mandatory gender quotas on boards of directors in 2022, the current reform initiatives on sustainable corporate governance (proposed CSDD) do not address sustainability board committees. A current proposal for an EU CSDD Directive only refers to climate-related incentives in management compensation and neglects other environmental goals (e.g., biodiversity strategies). The voluntary recognition of sustainable board factors may be linked with the risks of greenwashing and self-impression management (Kanashiro & Rivera, 2019). As a consequence, regulators should consider explicit mandatory expertise on biodiversity in the boards of directors and the compensation contracts.

Moreover, we stress the need for increased regulations on BD. The new CSRD of the EU standard setter of 2022 requires the recognition of biodiversity strategies, processes, and impact measures in the new European sustainability report. However, recent standards do not include objective and quantitative key performance indicators of those activities. This also relates to the standard No. 304 of the Global Reporting Initiative, which is currently under revision. Regulators should decrease the risks of greenwashing in sustainability reports. Comparable performance measures of corporate biodiversity initiatives represent a major challenge for a decision useful report and a successful sustainable transformation.

6.4 | Research implications

From a *research perspective*, future researchers should address in more detail other demographic and behavioral attributes of top management team members (e.g., age, gender, and power) according to stakeholder agency theory and their impact on BD. The link between *SIIs*, sustainable board governance, and pressure of non-shareholding stakeholders should be also analyzed in future designs. Finally, the interrelations between BD and other kinds of environmental reporting, based on the six environmental goals of the EU Taxonomy Regulation 2020 should be recognized.

6.5 | Limitations

In this context, we refer to the major *limitations* of our analysis. First, regulatory effects after the financial crisis 2008–2009 include the learning effects of the firms. As our time period (2014–2020) does not include recent regulatory initiatives of the EU Green Deal project, future research should explicitly include those regulatory aspects. Second, we collected our BD proxies from the Asset4 database, leading to some subjective influences ("black box character"). Third, we only focused on SIIs and neglected other forms of equity ownership, such as family ownership, state ownership, or managerial ownership. As our moderator variable *SBG* is a dummy variable, the range and heterogeneity of sustainable board governance within the firms cannot

be addressed properly. Text analyses of sustainability and corporate governance reports may be useful to overcome these limitations. As we only referred to sustainable board governance, other "traditional" governance measures (e.g., board independence, board interlocks, or financial expertise) may also be relevant. These interdependencies should be included in future studies.

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