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The impact of biodiversity score on the European firm's performance

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ABSTRACT

This study aims to contribute to the corporate-environment nexus by investigating the impact of biodiversity scores on firms' financial performance. Employing a panel model applied to 36 European firms, we find a positive and statistically significant relationship between the Biodiversity Impact Reduction Score and financial performance and firm value. These findings highlight the financial advantages of effective biodiversity management, improving operational efficiency and strengthening investor confidence. Our results offer useful insights for both corporate decision-makers and the academic community, shedding light on the economic implications of biodiversity-related risks.

1. Introduction

Biodiversity risk has become an important consideration in modern corporate finance, influencing firm valuation and risk exposure (Cosma et al., 2023). As firms increasingly face audits from stakeholders, regulators, and investors, the ability to manage biodiversity-related risks has become critical to long-term sustainability. The empirical literature suggests that biodiversity risk impacts firm performance, with recent studies highlighting its influence on stock market reactions (Bassen et al., 2024; Giglio et al., 2023; Kalhoro & Kyaw, 2024; Liang et al., 2024; Ma et al., 2024), firm performance (Bach et al., 2025; Cosma et al., 2024; Elsayed, 2023), and corporate efficiency (Li et al., 2025). Further, the Corporate Biodiversity Footprint (CBF) introduced by Iceberg Data Lab has been used to quantify firms' biodiversity impact. Empirical evidence from large international samples shows that firms with higher CBF scores experience significant declines in firm value (Cosma et al., 2024; Garel et al., 2024).

The effect, however, is far from uniform across industries. In resource-intensive sectors such as agriculture and energy, biodiversity scores are becoming critical sustainability performance measures. For these companies, biodiversity-related risks are material to their business models, making integrating biodiversity considerations into their operations essential. In contrast, service-based sectors may experience more indirect pressure but still face scrutiny from investors regarding biodiversity impacts across their supply chains. Although many companies are introducing specific policies, a large share of enterprise value remains exposed to unmanaged biodiversity risks (Carvalho et al., 2023). The literature shows that the performance of financial portfolios is closely correlated with biodiversity risk (e.g., Schrapffer et al., 2022; Van Toor et al., 2020). Highly exposed portfolios earn extra returns when the overall biodiversity risk increases (Coqueret et al., 2025). However, because analysts often overlook the effects of ecosystem degradation on future cash flows, these risks are still partly underpriced (Kalhoro & Kyaw, 2024; Thompson, 2023). To bridge the gap, several guidelines have been published to help companies set targets and monitor progress on biodiversity (Salmi et al., 2023; Stephenson & Carbone, 2021). Overall, the empirical evidence and new frameworks underscore the urgency of integrating biodiversity into financial decision-making and supply chain management to reduce risk and preserve value creation over the long term.

In the European context, consumers are becoming more aware of the environment. Hence, their behavior influences corporate reputations based on biodiversity performance (Crenna et al., 2019; Garel et al., 2024). On the one hand, firms with high biodiversity scores can leverage this as a competitive advantage, i.e., marketing their products as environmentally friendly. Environmental involvement and innovation in green products are antecedents of corporate reputation, positively affecting risk-adjusted profitability and reducing the risk of financial distress (Gangi et al., 2020; Haddock-Fraser & Tourelle, 2010). On

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the other hand, companies with poor biodiversity scores may suffer reputational damage, reducing customer loyalty and lowering sales, i.e., decreased profit and value.

The focus on European firms is significant due to the increasing regulatory pressure they face to disclose biodiversity-related risks and adopt sustainable practices. The European Union (EU) has introduced key initiatives, such as the EU Biodiversity Strategy for 2030[1] and the Corporate Sustainability Reporting Directive (CSRD),[2] which mandates firms to report on their environmental impact, including biodiversity. Firms with low biodiversity scores may experience heightened regulatory scrutiny and potential fines. Conversely, companies with strong biodiversity management practices are better positioned to comply with these regulations, improving overall compliance. This regulatory framework emphasizes the growing importance of biodiversity in corporate governance and risk management for European firms.

The main objective of this study is to investigate how the adoption of biodiversity practices – measured through the *Biodiversity Impact Reduction Score* (BIRS) – affects the financial performance of European companies, paying particular attention to the amplifying role played by the regulatory environment. In light of this purpose, our main research question is as follows: *"To what extent do biodiversity protection efforts combined with regulatory pressures impact the value and profitability of European firms?"*

By empirically analyzing the corporate-environment nexus and testing its interaction with the regulatory environment, we aim to understand whether and how biodiversity is a strategic factor in financial performance.

Our research is part of the growing debate on integrating biodiversity into corporate strategies and governance models. Compared to the existing literature, which mainly focuses on global dynamics (Cosma et al., 2024; Garel et al., 2024) or US contexts (Bach et al., 2025), our contribution offers a specific perspective on the European market, where regulatory action and consumer awareness are accelerating the adoption of sustainability practices (Crenna et al., 2019). This approach allows us to highlight how regulatory pressure results in greater transparency and an increasing focus on ecosystem protection. Our work shows how adopting environmental policies (e.g., EU Biodiversity Strategy 2030 and CSRD) acts as a catalyst, amplifying the positive effects of commitment to biodiversity on firm performance (profitability, market value). Existing literature documents the impact of institutional pressures on sustainability (see Gangi et al., 2020; Haddock-Fraser & Tourelle, 2010; Posadas et al., 2023), but rarely explores the synergy between biodiversity-specific regulations and financial performance. In this paper, we present new evidence showing how the European regulatory framework can shift from constraint to competitive advantage. The analysis highlights that this orientation is not merely a compliance obligation but a factor that can generate competitive advantages (see Posadas et al., 2023).

A further differentiator from the literature is using the *Biodiversity Impact Reduction Score* as a leading indicator of biodiversity performance. Many previous studies use indirect proxies (textual analysis) for environmental sustainability (e.g., Giglio et al., 2023; He et al., 2024; Ma et al., 2024; Tian & Chen, 2024). The BIRS, on the other hand, allows for a more timely capture of the efforts undertaken by companies to reduce their impact on ecosystems. Compared to, for example, the Corporate Biodiversity Footprint (see Garel et al., 2024), which aims to capture a company's overall impact (footprint) on ecosystems, the BIRS focuses more specifically on the actions and efforts put in place to reduce that impact. Hence, this index helps investigate whether and how biodiversity protection efforts can translate into improved corporate financial performance.

[1] Introduced by the European Commission in May 2020. Available at: https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_entimeline.

[2] Introduced in December 2022 by the European Parliament. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022L2464.

Our results show that increased BIRS is associated with a significant improvement in key performance indicators. We show that the commitment to ecosystem protection is not just a response to sensitive stakeholders' demands or mere regulatory compliance. On the contrary, it emerges as a strategic lever that can translate into greater operational efficiency, reduced reputational risks, and a stronger reputation. The findings confirm the growing relevance of biodiversity in modeling sustainability-oriented business models, showing that companies that adopt "nature-positive" strategies and align with community regulations achieve profitability and market value benefits. Furthermore, we analyze the heterogeneous effects of firms' exposure to climate change risk. Splitting the sample according to Sautner et al. (2023)' Climate-Change (CC) exposure measure, we show how the economic impact of biodiversity protection is not homogeneous but depends on firm exposure to climate risks. The results indicate that, in sectors most exposed to environmental shocks, investors interpret alignment with EU policies and mandatory transparency as signals of risk management capabilities, recognizing a "biodiversity premium". Our work contributes to the academic debate on the dynamics between the environment, governance, and financial performance, suggesting that a holistic approach to natural capital management is not just an ethical investment but a real driver of competitiveness.

Our study complements previous literature, highlighting how biodiversity is becoming a crucial aspect of the ESG paradigm and corporate strategy, especially in contexts such as Europe, where the environmental dimension is increasingly seen as a fundamental requirement for successful companies.

The paper proceeds as follows. Section 2 outlines the theoretical framework. Section 3 explains the methodological approach, while Section 4 describes the data and the sample. Section 5 presents the empirical analysis and discusses the findings. Finally, Section 6 concludes by summarizing the key insights and exploring policy implications.

2. Theoretical framework and hypothesis

In the climate change crisis context, the relationship between environmental sustainability and corporate performance has drawn increasing attention. Studies explore the impact of biodiversity on firm value (Bach et al., 2025; Cosma et al., 2024; Smith et al., 2020), reputation (Bassen et al., 2024), regulatory compliance, and risk management (Tian & Chen, 2024).

This theoretical framework is based on several theoretical and conceptual contributions highlighting the strategic role of biodiversity for firms and the mechanisms through which it influences financial performance and market value. As suggested by Perdichizzi et al. (2024) and Tian and Chen (2024), the first theoretical perspective of reference is the Resource-Based View (RBV), in which firms can achieve and maintain a competitive advantage by using rare, valuable, difficult-to-imitate, and non-substitutable resources (Barney, 2000; Dierickx & Cool, 1989; Hillman & Dalziel, 2003; Pfeffer & Salancik, 2015). According to Barney (1991), rare, valuable, difficult to imitate, and non-substitutable resources provide a lasting competitive advantage. From this perspective, Hart and Ahuja (1996) examine the relationship between pollution prevention and potential competitive advantage. According to the authors, a "narrow" interpretation of the empirical results might suggest that pollution reduction "pays off" only for the slowest and most inefficient firms, which make immediate gains by optimizing previously unvirtuous processes. However, there is a second interpretation: firms that are first to reduce emissions (and thus are less polluting than their competitors) may develop more advanced strategies centered on waste and waste reduction that become a source of sustainable competitive advantage. In particular, companies with very low emission levels can gain a first-mover advantage in emerging markets for "green" products (Russo & Fouts, 1993).

In this context, biodiversity is a crucial resource, as it ensures high-quality inputs, stability in the supply of natural resources, and capacity

for innovation (Cosma et al., 2023). Agribusinesses, for example, can benefit from crop genetic diversity to improve resistance to climate change. In contrast, pharmaceutical companies benefit from the diversity of natural species to discover new active ingredients (Bishop et al., 2010). The capacity for differentiation and resilience generated by biodiversity can thus reflect positively on financial performance and market value (Garel et al., 2024; Smith et al., 2020).

The second theoretical perspective is stakeholder theory, in which the company interacts with various stakeholders whose interests and values must be considered in a strategy setting (Freeman, 2010). The increasing focus on environmental sustainability creates pressure for companies to adopt policies for the conservation and responsible management of natural capital. These actions improve corporate reputation (Suchman, 1995) and social and institutional legitimacy, resulting in benefits in terms of investor confidence and increased business value (Deegan, 2002; Eccles et al., 2011).

Another central element is risk reduction. Environmental risk management is crucial in Enterprise Risk Management (ERM) and sustainability studies, as biodiversity degradation can cause disruptions in production chains, volatility in commodity prices, and uncertainties in the availability of natural resources. Companies that adopt policies to protect and restore ecosystems reduce operational and reputational risks, improving robustness in the face of external shocks. For example, Sharfman and Fernando (2008) found that improved environmental risk management is associated with a lower cost of equity capital and increased debt financing. These practices contribute to positive perceptions of management quality and business model robustness, with beneficial effects on the cost of capital and market value (Hudson, 2024).

The integration of natural capital into decision-making processes is another key element. The natural capital perspective views nature as a strategic asset that should be included in managerial and accounting decisions (Costanza & Daly, 1992). Companies that measure and value natural capital, including biodiversity, are able to anticipate regulatory changes, identify opportunities in emerging "green" markets, and attract investors (Carvalho et al., 2023; He et al., 2024). This ability to internalize environmental costs and generate positive externalities can translate into long-term value growth.

We recognize that biodiversity is a new and distinct risk category. Although climate risk is widely studied and priced by financial markets (Bolton & Kacperczyk, 2021; Di Tommaso et al., 2024; Flammer et al., 2025; Liang et al., 2024; Ma et al., 2023), biodiversity risk remains largely unexplored (Cosma et al., 2023; Thompson, 2023). This risk can affect firm performance through two main channels. As well evidenced by Bach et al. (2025), the first is sectoral exposure, as firms operating in natural resource-dependent sectors, such as agriculture, fishing, and mining, are more vulnerable to environmental changes and regulatory pressures (Cevik & Miryugin, 2023). The second channel is product innovation. Firms that develop eco-innovative products and sustainable processes reduce negative impacts on biodiversity, increasing reputation and customer loyalty (Carvalho et al., 2023).

As a result, firms that manage biodiversity effectively can benefit from reduced regulatory risks, improved operational efficiency, and improved reputations with investors and consumers (Garel et al., 2024; Hoepner et al., 2023). In contrast, firms with poor biodiversity practices could face penalties, stricter regulations, and potential reputational damage (Carvalho et al., 2023; Elsayed, 2023).

Based on this context, we develop our first hypothesis as follows:

H1: Biodiversity management is positively associated with financial performance and firm value.

Institutional theory provides an additional theoretical foundation for understanding the influence of biodiversity on firm value (DiMaggio et al., 1983; Hoffman & Jennings, 2015). According to this perspective, social rules, norms, and values guide business behavior (Blay et al., 2018; Posadas et al., 2023). In Europe, the introduction of the EU Biodiversity Strategy 2030 and the Corporate Sustainability Reporting Directive (CSRD) have intensified institutional and regulatory pressures on biodiversity. The adoption of reporting standards, such as those proposed by the Taskforce on Nature-related Financial Disclosures,[3] pushes companies to integrate biodiversity into reports and governance systems. Biodiversity management is now a key component of corporate governance due to the growing importance of environmental sustainability, especially in Europe, where stricter regulatory frameworks are being developed. The importance of biodiversity for the long-term viability of businesses is increasingly acknowledged (Ali et al., 2024; Ma et al., 2024), since firms are expected to mitigate their impact on ecosystems while ensuring compliance with environmental regulations. Adapting to these regulatory requirements signals to investors a long-term view and a lower risk of litigation and reputational issues, with positive effects on market value (Garel et al., 2024; Hoepner et al., 2023; Orlitzky et al., 2003).

Given the introduction of critical regulatory frameworks, such as the EU Biodiversity Strategy for 2030 and the CSRD, firms with strong biodiversity management practices will benefit more from compliance and enhanced market confidence. These regulations create challenges and opportunities for companies. While firms with poor biodiversity scores may face increased regulatory scrutiny and financial penalties (Pastor & Veronesi, 2012), companies that proactively manage biodiversity are better positioned to manage this regulatory environment (Kalhoro & Kyaw, 2024). They stand to gain from reduced risk exposure, improved investor relations, and a stronger market presence (Bolton & Kacperczyk, 2021; Garel et al., 2024; Hoepner et al., 2023; Kalhoro & Kyaw, 2024; Sautner et al., 2023). In light of these developments, we hypothesize that the introduction of these regulations will benefit firms that excel in biodiversity management. Specifically, companies with higher biodiversity scores should experience more significant financial advantages, as their proactive compliance with biodiversity requirements makes them more attractive to investors and stakeholders.

In this context, we propose the following hypothesis:

H_2: Firms with strong biodiversity management practices benefit more after introducing regulatory frameworks.

3. Methodology

We use a panel regression model with fixed-effect[4] to quantify the relationship between *Biodiversity Impact Reduction Score* (hereafter BIRS) and firm performance. The model uses BIRS as the independent variable and EBITDA and market value (MV) as the dependent variables. This approach allows us to assess whether improvements in biodiversity scores are associated with higher profitability and greater firm value.

The general form of the regression model is as follows:

$$Y_{i,t} = \alpha + \beta_1 \times BIRS_{i,t-1} + \beta_2 \times X_{i,t-1} + \epsilon_{i,t} \quad (1)$$

where $Y_{i,t}$ represents the dependent variables (EBITDA and market-to-book value) for the company i at time t, $BIRS_{i,t-1}$ is the biodiversity impact reduction score, $X_{i,t-1}$ is a vector of control variables (such as firm size, leverage, EPS, ESG score, industry, and year-fixed effects), and $\epsilon_{i,t}$ is the error term.[5]

[3] https://tnfd.global/.

[4] We performed a Hausman test to compare the fixed-effects and random-effects specifications. The test yielded a p-value of 0.000, indicating a strong rejection of the null hypothesis that the random-effects estimator is consistent. Consequently, we adopt the fixed-effects model to account for unobserved heterogeneity correlated with the explanatory variables.

[5] We included the lagged dependent variable Y_{t-1} to model the adjustment dynamics of firm performance explicitly. Partial-adjustment theory (Bond, 2002) suggests that indicators such as EBITDA margin react gradually to structural changes (e.g., biodiversity policies), and the literature on optimal short lags (Dormann & Griffin, 2015) shows that in short annual panels such

Our primary focus is on the coefficient β_1, which represents the relationship between BIRS and financial performance and firm value. A positive and statistically significant β_1 would suggest that improved biodiversity management is related to improved financial performance and greater firm value. This would imply that firms investing in biodiversity reduction efforts are likely to see tangible financial benefits, such as higher profitability or market valuation. Conversely, a negative or statistically insignificant β_1 would indicate either a weak or non-existent relationship between biodiversity management and financial outcomes, suggesting that biodiversity efforts may not directly influence financial metrics in a meaningful way.

4. Data and sample

We analyze yearly data from the EURO STOXX 50 to assess the impact of biodiversity on firm value. To do this, we first download data on the BIRS for the companies in the EURO STOXX 50 from the LSEG database. Out of the 50 firms, 36 reported their BIRS between 2018 and 2023. We use EBITDA margin as an economic performance indicator and market value to book value (MV) to evaluate a firm's financial performance.[6]

The financial sector is excluded from our analysis due to a lack of available data on biodiversity impact and reporting. Unlike other sectors, financial institutions often do not interact directly with biodiversity in the same way as industries such as manufacturing, agriculture, or energy do. As a result, complete biodiversity-related metrics for financial firms are less frequently reported, making it challenging to assess their biodiversity impact. This exclusion ensures a more accurate and focused analysis of biodiversity's influence on firm value across sectors with more direct environmental interactions. Moreover, this decision is consistent with existing literature (Bach et al., 2025; Huang et al., 2024). The rationale behind this choice is multifaceted. First, financial institutions operate under distinct business models and accounting frameworks compared to other industries (Whited & Wu, 2006). Second, the financial sector primarily faces transitional risks rather than physical risks, complicating the construction of biodiversity impact indicators. Challenges include information asymmetry, incomplete reporting, and methodological biases in econometric models (Hudson, 2024).

We applied winsorization to all firm-level variables at the 1% cutoff and other key variables at the 2.5% cutoff to mitigate the potential influence of extreme outliers on our results (Bach et al., 2025; Bassen et al., 2024; Perdichizzi et al., 2024). Table 1 presents the definition of the variables, while Table 2 reports the summary statistics.

Fig. 1 displays the trend in BIRS over the years. The BIRS shows a positive overall trend from 2018 to 2023, indicating that firms have progressively improved their efforts to reduce their impact on biodiversity. In 2022, the score reached its highest point at 74.46, suggesting significant improvements in corporate biodiversity management. However, in 2023, there was a slight decrease to 72.36, although the score remained substantially higher than in earlier years. This indicates that firms have largely sustained their biodiversity management efforts. This trend aligns with Europe's increasing regulatory and market pressures to improve biodiversity-related disclosures and practices, driven by policies such as the EU Biodiversity Strategy for 2030.

Table 1
Variable definitions.

Variable	Description
Panel A: Dependent variables	
EBITDA	Earnings Before Interest, Taxes, Depreciation, and Amortization
Market to Book (MV/BV)	Market capitalization divided by the book value of equity at the beginning of the year
Panel B: Variables of interest	
BIRS	Biodiversity Impact Reduction Score
Biodiversity strategy	Dummy variable taking the value of 1 after the introduction of EU Biodiversity strategy for 2030 and 0 otherwise
CRSD	Dummy variable taking the value of 1 after the introduction of the Corporate Sustainability Reporting Directive (CSRD) and 0 otherwise
Panel C: Control variables	
Size	Natural logarithm of total assets
Leverage	Total liabilities divided by total assets
ESG score	Environmental, Social and Governance score
EPS	Earnings per Share: Net income divided by the number of ordinary shares
ROA	Return of Asset: Net income before extraordinary items and preferred dividends, scaled by total assets

Table 2
Descriptive statistics.

Variable	Mean	Std. Dev.	Min	Max
Panel A: Dependent variables				
EBITDA	22.625	0.980	18.891	24.461
MV/BV	5.361	6.740	0.578	47.302
Panel B: Variables of interest				
Commitment	0.270	0.445	0	1
Biodiversity strategy	0.511	0.501	0	1
Commitment × Biodiversity strategy	0.169	0.375	0	1
CSRD	0.191	0.394	0	1
Commitment × CSRD	0.073	0.261	0	1
Panel C: Control variables				
Size	24.866	1.082	22.158	26.938
Leverage	37.167	33.086	1.02	90.406
ESG score	78.648	10.543	43.116	93.485
EPS	6.363	6.495	−0.174	31.819
ROA	5.929	5.07	−12.809	22.25

Notes: The table presents the descriptive statistics. Panel A presents the dependent variables, Panel B the variables of interest, and Panel C the control variables.

5. Empirical results

5.1. BIRS and financial performances

Table 3 provides the summary of regression results exploring the relationship between the Biodiversity Impact Reduction Score (BIRS)

as ours, a single year of lag captures much of this persistence. Including LDV in a fixed effects model then transforms the specification into a dynamic panel consistent with Arellano and Bond (1991), which reduces residual autocorrelation and omitted variables bias related to unobserved but persistent shocks. We are aware of the Nickell (1981) of order $\frac{1}{T}$; with $T = 6$ it remains small (<10%). We do not use the lag as a "cure" for endogeneity (criticism of Bellemare et al., 2017), but rather as part of the economic structure. The long-run effect of our policy variables is in fact obtained as $\frac{\beta}{(1-\phi)}$ and is economically significant. Recent studies (Wilkins, 2018) also demonstrate that LDV and extensive controls improve precision in the presence of autocorrelation. In short, LDV makes our estimates consistent and methodologically robust within a short but heterogeneous dataset.

[6] To determine the reliability of the results from the benchmark regression model, we conduct a series of robustness checks. Please refer to the Appendix for full details. Specifically, we use Return on Assets (ROA) as an alternative measure of firm performance in place of EBITDA (Table A.3). Additionally, to further control for heterogeneity across sectors with varying levels of exposure to climate change (Sautner et al., 2023), we divide our sample into high and low groups based on the median values of climate change exposure (Table 5).

Table 3
Effect of biodiversity impact reduction score on financial performance.

	EBITDA						MV/BV					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
BIRS	0.002***	0.001***	0.001***	0.001***	0.001***	0.002***	0.009***	0.018***	0.011***	0.018***	0.034***	0.005**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.007)	(0.000)
Biodiversity Strategy			0.032***	0.016***	0.359***	0.337***			0.119***	0.208***	0.595	0.373***
			(0.003)	(0.006)	(0.101)	(0.099)			(0.009)	(0.000)	(0.094)	(0.006)
BIRS × Biodiversity Strategy					0.001***	0.001***					0.024***	0.024***
					(0.000)	(0.000)					(0.000)	(0.000)
CSRD			0.120***	0.190***	0.298**	0.267***			0.328***	0.293***	0.308***	0.307***
			(0.009)	(0.005)	(0.115)	(0.004)			(0.002)	(0.000)	(0.000)	(0.000)
BIRS × CSRD					0.002***	0.001***					0.050***	0.043***
					(0.000)	(0.000)					(0.007)	(0.000)
Intercept	1.036**	0.814**	1.748**	1.963***	1.399***	2.695**	1.423***	1.660***	1.702**	1.660***	1.304***	1.384***
	(0.042)	(0.036)	(0.038)	(0.127)	(0.479)	(0.113)	(0.001)	(0.005)	(0.031)	(0.005)	(0.008)	(0.006)
Controls	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	NO	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES
Observation	111	111	111	111	111	111	111	111	111	111	111	111
Adj. R2	0.249	0.266	0.230	0.275	0.257	0.275	0.241	0.274	0.251	0.274	0.280	0.282
Mean VIF	3.97	4.98	3.78	4.48	5.10	5.55	3.29	3.82	3.77	3.51	5.14	4.62

Notes: The table presents the regression estimates examining the relationship between the Biodiversity Impact Reduction Score (BIRS), firm performance metrics (EBITDA and Market-to-Book Value (MV/BV)), and other explanatory variables. Models (1)–(6) focus on EBITDA, while Models (7)–(12) examine MV/BV. Firm size, leverage, ESG scores, and other control variables are included to account for financial and operational differences. Firm, year, and industry fixed effects are applied to ensure robust estimation.
Symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

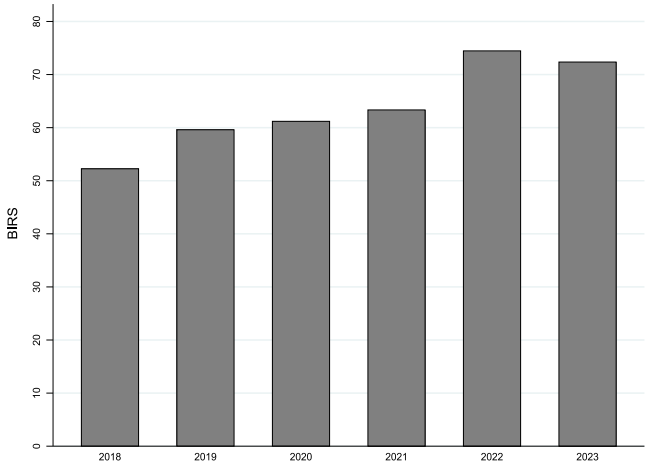

Fig. 1. Biodiversity Impact Reduction Score (BIRS) distribution by year.

and firm performance, measured by EBITDA and Market-to-Book Value (MV/BV), under varying model specifications.[7]

The BIRS shows a significant positive relationship with EBITDA and MV/BV in all models. This result strongly supports our first hypothesis, underscoring the financial benefits of biodiversity management. Firms with higher BIRS scores are associated with better profitability and higher market valuations. The significance across profitability and valuation metrics suggests that biodiversity management contributes to operational efficiency and investor confidence. The coefficient of 0.001 on BIRS in the regression with EBITDA means that each unit variation of BIRS increases EBITDA. An increase of 10 points – equivalent to a realistic variation over a few years – therefore increases log EBITDA by 0.01, equal to a percentage increase of approximately 1%. Concerning the sample average value of EBITDA (= 6.7 billion euros), the increase is approximately 67 million euros per financial year. The effect on the MV/BV (=0.018) is more significant. The same 10 points of BIRS increase MV/BV by 0.18. Compared to a sample average of 5.361, the relative improvement is 3.36%.

In models (4) and (8), the interaction terms between BIRS and the EU Biodiversity Strategy for 2030 and BIRS and the Corporate Sustainability Reporting Directive are positive and significant. This indicates that firms benefit more from strong biodiversity management practices in the presence of regulatory frameworks. The European regulatory framework significantly amplifies these effects. The interaction between BIRS and the EU Biodiversity Strategy 2030 adds a further coefficient of 0.001 on EBITDA and 0.024 on MV/BV, doubling the operational impact and bringing the market premium to almost 7% of the average. The effect of CSRD is even more marked: the interaction term $BIRS \times CSRD$ drives the overall variation to +2% on EBITDA and to +11.4% on MV/BV.

These results highlight how regulations act as a stimulus, amplifying the positive effects of biodiversity efforts on firm performance. Firms aligned with these policies enjoy increased operational resilience and reduced regulatory risks, translating into financial benefits. Similarly, the variables Biodiversity Strategy and CSRD are positive and significant, suggesting that these frameworks independently improve firm performance by creating an enabling environment for sustainability. These findings strongly support the hypothesis that firms with robust biodiversity practices, especially under favorable regulatory conditions, experience improved financial and market performance. Our results fully fit into the strand of studies analyzing the growing role of biodiversity risk in the financial world. Indeed, several papers (Cosma et al., 2024; Garel et al., 2024; Kalhoro & Kyaw, 2024; Ma et al., 2024) have shown how markets are beginning to recognize the relevance of biodiversity. Studies such as those by Bassen et al. (2024) and Bach et al. (2025) emphasize how good biodiversity management practices can reduce the risk of sudden stock collapses and positively affect profitability. Similarly, the literature on disclosure (Carvalho et al., 2023; Elsayed, 2023; Hassan et al., 2020) confirms that biodiversity disclosure transparency helps reduce information asymmetry and increase investor confidence.

The control variables suggest that larger, less leveraged firms and firms with high ESG scores perform better. The positive and significant sign on the *Size* coefficient highlights economies of scale and resource

[7] We present here the main summary of the regression model for a clearer and more immediate interpretation of the results. The complete regression model estimates are in the Appendix. Please see Table A.1.

Table 4
Effect of biodiversity commitment on financial performance.

	EBITDA						MV/BV					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Commitment	0.238**	0.080***	0.067***	0.096***	0.028***	0.099***	1.822***	1.433***	0.265***	1.433***	1.009***	0.396***
	(0.005)	(0.001)	(0.003)	(0.003)	(0.001)	(0.007)	(0.002)	(0.001)	(0.011)	(0.001)	(0.009)	(0.037)
Biodiversity Strategy			0.033***	0.040**	0.249***	0.223***			1.237**	2.262***	3.495**	1.956***
			(0.003)	(0.020)	(0.066)	(0.064)			(0.091)	(0.003)	(1.528)	(0.004)
Commitment × Biodiversity Strategy					0.060	0.072					1.422	0.290***
					(0.092)	(0.092)					(1.352)	(0.040)
CSRD			0.099***	0.133***	0.230***	0.184***			0.872**	2.510***	2.708*	0.629***
			(0.008)	(0.009)	(0.070)	(0.071)			(0.030)	(0.000)	(1.435)	(0.004)
Commitment × CSRD					0.085	0.064					0.394	0.308***
					(0.089)	(0.091)					(1.366)	(0.000)
Intercept	1.206**	0.218***	1.046**	1.067***	1.468***	1.627***	1.627***	1.483***	1.635***	1.567***	1.654***	1.764***
	(0.043)	(0.045)	(0.027)	(0.068)	(0.001)	(0.000)	(0.000)	(0.005)	(0.004)	(0.002)	(0.003)	(0.001)
Controls	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	NO	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES
Observations	111	111	111	111	111	111	111	111	111	111	111	111
Adj. R2	0.252	0.266	0.270	0.287	0.257	0.267	0.244	0.275	0.279	0.285	0.269	0.278
Mean VIF	3.30	3.38	3.93	4.27	4.61	4.85	2.60	3.99	3.94	4.31	3.71	4.17

Notes: The table presents the regression estimates examining the relationship between the Biodiversity Commitment, firm performance metrics (EBITDA and Market-to-Book Value (MV/BV)), and other explanatory variables. Models (1)–(6) focus on EBITDA, while Models (7)–(12) examine MV/BV. Firm size, leverage, ESG scores, and other control variables are included to account for financial and operational differences. Firm, year, and industry fixed effects are applied to ensure robust estimation.
Symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

advantages that support better financial performance. The negative and significant relationship between leverage and performance suggests that higher debt levels may impede financial outcomes, likely due to increased financial risk. The positive and significant coefficient on ESG scores reinforces that sustainability practices contribute to corporate success (Chen & Xie, 2022; Han & Wu, 2024; Lee et al., 2022).

5.2. 'Nature-positive' strategies and firm value

In this subsection, we examine the relationship between corporate commitment to biodiversity and financial performance in more detail. As an indicator of the level of commitment, we use a dummy variable that takes a value of 1 in the year following the company's disclosure of biodiversity information, and 0 in other cases. Indeed, attention to biodiversity disclosure is crucial in reducing information asymmetries between the company and its stakeholders (Healy & Palepu, 2001). Firms that report biodiversity-related risks and opportunities offer greater transparency, reducing investors' perceived uncertainty and, consequently, their risk premium (Anthony & Morrison-Saunders, 2023; Haque & Jones, 2020).

Given these considerations, we expect an explicit and communicated corporate commitment to biodiversity to result in better financial performance. Accordingly, we propose the following hypothesis:

H_3: Commitment to biodiversity positively affects corporate financial performance.

For this purpose, we employ the following regression model, i.e.,

$$Y_{i,t} = \alpha + \beta_1 \times Commitment_{i,t-1} + \beta_2 \times X_{i,t-1} + \epsilon_{i,t} \quad (2)$$

where $Y_{i,t}$ represents the dependent variables (EBITDA and market-to-book value) for the company i at time t, $Commitment_{i,t-1}$ is a dummy variable that takes a value of 1 in the year following the company's disclosure of biodiversity information, and 0 in other cases, $X_{i,t-1}$ is a vector of control variables, and $\epsilon_{i,t}$ is the error term.

Table 4 reports the primary summary estimations of the regression model.[8] The results confirm the positive effect of the commitment to biodiversity on the company's financial performance, as reflected in both firm performance metrics (measured by EBITDA and the market-to-book value ratio). The coefficient for biodiversity commitment is positive and statistically significant across all models. The *Commitment* coefficient (=0.099) implies that the transition from the absence to the presence of disclosure determines an increase of +10.4% on EBITDA. The effect on the market is even more evident: a coefficient of 1.433 on the MV/BV increases the valuation by 26.7%.

This suggests that firms prioritizing biodiversity commitment are more likely to achieve good financial outcomes. These findings underscore the importance of integrating biodiversity management into corporate strategies. Indeed, the positive effect of commitment on MV/BV shows a clear sign of increased investor confidence. These empirical results provide strong evidence to support our hypothesis: a clear and communicated commitment to biodiversity translates into economic-financial benefits for firms.

The variable Biodiversity Strategy also shows a positive and significant coefficient, suggesting that EU policies can generate measurable financial benefits for European firms. The interaction between biodiversity commitment and the EU Biodiversity Strategy significantly boosts market valuation. This indicates that biodiversity commitment and alignment with the EU Biodiversity Strategy can act as amplifiers, creating additional value for firms. The inclusion of the CSRD variable further highlights the importance of regulatory compliance in driving financial performance. Across both EBITDA and market valuation, CSRD has a positive and highly significant effect. This indicates that the Corporate Sustainability Reporting Directive encourages firms to integrate biodiversity considerations into their operations, yielding measurable financial rewards. Finally, the significant and positive effect on the market valuation of the interaction between commitment and CSRD reinforces the role of regulatory frameworks in amplifying the financial benefits of biodiversity management.

Overall, the empirical findings underscore the importance of the regulatory environment in which companies operate. The fact that companies that adhere to sustainability reporting guidelines reap benefits from their engagement in biodiversity highlights how these regulations encourage the integration of environmental dimensions into corporate operations. This translates into financial benefits, as investors appear sensitive to responsible natural capital management information. The

[8] In this case, we also present the main summary of the regression model to help readers interpret the results more clearly and immediately. The complete regression model estimates are in the Appendix. Please see Table A.2.

Table 5
Biodiversity impact reduction score and firms' climate change exposure.

	EBITDA		MV/BV	
	(1) Low CC exposure	(2) High CC exposure	(3) Low CC exposure	(4) High CC exposure
BIRS	0.002	0.002***	−0.036	0.005***
	(0.002)	(0.000)	(0.031)	(0.001)
Biodiversity strategy	0.367***	0.149***	0.128***	0.658***
	(0.119)	(0.017)	(0.039)	(0.085)
BIRS × Biodiversity strategy	0.002**	0.001***	0.125***	0.013***
	(0.001)	(0.000)	(0.048)	(0.001)
CSRD	−0.195	0.334***	0.510	0.512***
	(0.137)	(0.094)	(0.478)	(0.068)
BIRS × CSRD	0.002	0.004***	−0.024	0.005**
	(0.002)	(0.001)	(0.057)	(0.002)
Intercept	1.058	0.829	0.465*	0.912
	(0.953)	(0.195)	(0.253)	(1.325)
Controls	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Observations	50	61	50	61
Adj. R2	0.277	0.264	0.283	0.286
Mean VIF	6.57	5.35	5.10	4.73

Notes: The table presents the regression estimates of subsample tests conditional on climate change exposure. We divide our sample into low and high subsamples of climate change (CC) exposure (Sautner et al., 2023). Models (1)–(2) focus on EBITDA, while Models (3)–(4) examine MV/BV. Firm size, leverage, ESG scores, and other control variables are included to account for financial and operational differences. Firm, year, and industry fixed effects are applied to ensure robust estimation.
Symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

results align with the existing literature, which argues that environmental engagement is a mechanism by which firms manage and organize relationships with their stakeholders (Hassan et al., 2020; Henriques & Sadorsky, 1999; Teng et al., 2014). In particular, companies exposed to environmental risks, such as those operating in sectors with high biodiversity impacts, are in a position of greater reputational vulnerability and potential conflict with society. Such companies tend to increase information transparency by disclosing biodiversity data to maintain their legitimacy.

5.3. Biodiversity and firms' climate change exposure: a heterogeneity effect

In this section, we investigate how the relationship between biodiversity management and firm performance can vary as firms' exposure to climate change risks. Indeed, climate change is accelerating habitat loss and biological diversity reduction globally (Weiskopf et al., 2020). These processes do not affect all businesses equally. The sectors most dependent on ecosystem services, such as agriculture, fisheries, and natural resource extraction, suffer much more impacts than activities with low spatial impacts (Cosma et al., 2024; Li et al., 2025). The result is marked heterogeneity. Firms with high exposure to climate risk are more urgently forced to integrate ecosystem protection measures into their operational and reporting strategies. In contrast, less vulnerable firms may view such practices more as an element of institutional legitimacy (Eccles et al., 2011). To capture these differences, we divided the sample into two groups: low and high climate change risk, based on Sautner et al. (2023)'s climate change exposure (CC) measures.

Table 5 reports the estimation results.[9] As we can see, the economic relevance of biodiversity practices is strongly influenced by the firm's environmental vulnerability context. For firms with high exposure to climate risk, the direct effect of BIRS on EBITDA and Market-to-Book is significant.

It is interesting to note that a trade-off in the effectiveness of EU biodiversity policies emerges depending on the type of performance considered. For less-exposed firms, the coefficient of the Biodiversity Strategy variable on EBITDA (0.367***) is higher than for high-exposure firms (0.149***). This may reflect the fact that, in the absence of severe climate pressures, adoption of the EU strategy translates primarily into operational improvements. These firms have greater margins for action on production processes and the supply chain, and initiating conservation initiatives can translate into efficiency, i.e., performance gains. In contrast, the direct impact on EBITDA is smaller in companies that are more vulnerable to climate risks (0.149***). At the same time, the Biodiversity Strategy generates a much more significant effect on the MV/BV (0.658*** vs. 0.128***). This indicates that, for companies exposed to climate shocks, investors perceive the merit of adopting ecosystem protection policies as a signal of credibility and risk management ability. In other words, markets reward the decision to align with European standards with a "green premium" (Garel et al., 2024). This result is also confirmed by the effect of CSRD, suggesting that mandatory reporting improves the credibility.

Overall, the distinction between low and high CC exposure confirms a dual channel through which biodiversity generates value. For less vulnerable firms, alignment with EU policies serves as a legitimizing lever (Carvalho et al., 2023; Hassan et al., 2020; Posadas et al., 2023; Suchman, 1995), while for more exposed firms, the combination of strategy, formal commitment, and mandatory reporting emerges as a strong competitive drive, as explained by the Resource-Based View (Barney, 1991; Hart, 1995) and studies on the emerging "biodiversity risk premium" (Coqueret et al., 2025; Garel et al., 2024; Ma et al., 2024). This evidence suggests that an integrated approach, such as concrete actions, regulatory transparency, and timely communication, is effective for companies operating at the most critical boundaries of environmental sustainability.

5.4. Discussion of results

The empirical results strengthen the interpretation of biodiversity as a strategic lever for value creation in European companies. The positive and significant coefficients associated with the BIRS, both in

[9] For the sake of brevity, we do not report the estimation results between corporate commitment to biodiversity and financial performance. The results are qualitatively the same and they are available upon request.

terms of operating performance (as measured by EBITDA) and market valuation (as measured by the Market-to-Book Value ratio), provide evidence to support the thesis that careful biodiversity management reduces environmental risks and contributes to the firm's long-term competitiveness.

The finding is particularly relevant because, unlike climate risk, already widely investigated and, to some extent, incorporated into investors' assessments (Di Tommaso et al., 2024; Giglio et al., 2021; Pankratz et al., 2023; Perdichizzi et al., 2024), biodiversity risk represents an emerging and less explored dimension in corporate finance (Bach et al., 2025; Giglio et al., 2023; Hutchinson & Lucey, 2024). The fact that firms with high BIRS show better economic and market performance indicates that investors are beginning to view biodiversity protection as a sign of good management ability, risk reduction, and potential future growth. This approach rewards companies capable of differentiating themselves from competitors by anticipating regulatory and socio-cultural trends geared toward sustainability. This evidence aligns with stakeholder theory (Freeman, 2010) and legitimation perspectives (Eccles et al., 2011; Suchman, 1995). A high BIRS signals to stakeholders commitment to nature conservation, compliance with social expectations, and the ability to reduce reputational risks (Sterling et al., 2017). Hence, attention to biodiversity indicates responsibility, generating social legitimacy and trust, which translates into better financial and economic performance (Boiral & Heras-Saizarbitoria, 2017; Elsayed, 2023). This finding is further illustrated in Table 3, highlighting how a clear commitment to biodiversity translates into financial benefits for firms.

The significant interactions between BIRS and regulations suggest that adopting sound environmental policies becomes even more beneficial for companies when the institutional framework favors (or mandates) transparency, reporting, and measurement of environmental impacts. This result aligns with institutional theory (Hoffman & Jennings, 2015), according to which regulatory and mimetic pressures drive firms to align their behavior with emerging standards (Posadas et al., 2023). Firms that internalize biodiversity aspects reduce regulatory risk and signal greater reliability and strategic vision in the eyes of investors (Garel et al., 2024).

Moreover, the results indicate that European environmental policies do not operate in a unidirectional way. They do not simply impose compliance costs but create a favorable environment where firms with advanced sustainable practices can gain a competitive advantage. In fact, the positive and significant effect of ESG scores on performance strengthens the vision of biodiversity included within an integrated sustainability strategy (Raghunandan & Rajgopal, 2022). Consistent natural capital management, alongside environmentally sound product innovation practices (Carvalho et al., 2023; Srivastava et al., 2013), can improve brand reputation, customer loyalty, and ultimately, company profitability valuation.

6. Conclusion and policy implications

Our findings underscore the growing importance of biodiversity management as a strategic driver of corporate performance. In a global context marked by an increasing focus on environmental sustainability, companies that take a proactive approach to biodiversity risk mitigation achieve measurable financial performance benefits.

Empirical evidence confirms that biodiversity management has emerged as a critical component of sustainable business strategies. The strong positive relationship between biodiversity commitment and financial performance demonstrates the need for firms to embed biodiversity considerations into their strategic decision-making. By aligning their operations with sustainability principles, firms can improve profitability and market valuation while gaining greater investor confidence. Our empirical evidence suggests that aligning with regulatory frameworks, such as the EU Biodiversity Strategy and the Corporate Sustainability Reporting Directive (CSRD), amplifies these financial benefits. Firms that proactively adopt biodiversity management practices while complying with such policies stand to gain a competitive advantage. Furthermore, this proactive approach positions companies to mitigate risks, improve their reputation, and create long-term value. The positive link between biodiversity efforts and financial performance highlights the dual benefits of environmental stewardship and value creation. The results also show that firms with strong ESG performance and regulatory alignment are better positioned to manage market pressures.

In this scenario, an additional crucial lever to improve corporate commitment to biodiversity and other ESG factors could be a more accurate assessment of these aspects by banks in their creditworthiness processes. Specifically, introducing lower capital absorption (and thus reduced cost of credit) for companies with higher BIRS and ESG ratings would foster a virtuous circle between companies, banks, and sustainability. However, for this mechanism to be effective, achieving a more robust definition of ESG scoring systems and further developing banking regulations on assessing ESG factors in lending is essential. This would make it possible to reward the most sustainable companies, with apparent benefits in risk reduction and medium- to long-term competitiveness. However, it should be pointed out that this consideration refers to the bank-firm relationship from a wider perspective than our sample of 36 large firms. In fact, these firms mainly access capital markets and have privileged relationships with lending institutions.

From a public policy perspective, regulators are key in promoting biodiversity's centrality. The findings underscore the effectiveness of biodiversity-related policies in encouraging sustainable business practices. The positive financial outcomes associated with regulatory compliance suggest that well-designed policies can incentivize firms to integrate biodiversity into their operations. Introducing incentives linked to environmental performance, such as tax breaks and subsidies, can encourage companies to adopt forward-looking strategies, thereby accelerating progress toward biodiversity conservation goals. Equally important is implementing monitoring, which is essential to ensure fair competition, transparency, and system credibility by mitigating the prevalence of well-documented greenwashing practices.

Overall, the nexus between biodiversity management, regulatory frameworks, and integration into ESG parameters redefines corporate sustainability models. As the literature also evidences, recognizing biodiversity as a strategic resource and incorporating it into key governance and risk management decisions enables companies to strengthen their stability, meet stakeholder expectations, and create long-term value (Kopnina et al., 2024). In parallel, proactive action by regulators to incentivize and monitor the proper integration of biodiversity into business processes promotes the convergence of environmental sustainability.

Our study has some limitations that should be highlighted. First, the analysis focused on a sample of listed European companies. This limits the possibility of generalizing the results to unlisted companies or those active in other geographic, economic, and regulatory contexts. In the future, we aim to expand the panel of analyzed companies by including both unlisted firms operating in various sectors and organizations active in geographic and economic contexts beyond Europe. This would allow for a more precise assessment of the applicability and generalizability of the results obtained. Second, the annual frequency of data used delimits the ability to capture short-term variations. Adopting high-frequency (not available yet) time series could provide a deeper insight into the corporate-environment nexus. A further limitation concerns the measurement of biodiversity risk, which is still an emerging area of research. The available indicators only partially capture the multidimensional nature of biodiversity impacts. The lack of harmonized and standardized metrics at the firm level may introduce measurement errors. Additionally, in line with existing literature, we excluded the financial sector from the analysis, both for conceptual reasons and due to practical difficulties in directly quantifying biodiversity exposure. While this exclusion ensures greater

internal consistency in the analysis, it also restricts the applicability of the results to financial institutions whose exposure to biodiversity is typically indirect (mediated) through investment portfolios. Despite these limitations, we believe that our paper offers a good contribution to the emerging literature on biodiversity risk in finance and provides a solid basis for future research on this increasingly important topic.

CRediT authorship contribution statement

Caterina Di Tommaso: Conceptualization, Methodology, Data curation, Software, Formal analysis, Writing – original draft, Writing – review & editing. **Matteo Foglia:** Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing, Funding acquisition. **Vincenzo Pacelli:** Conceptualization, Writing – original draft, Writing – review & editing, Supervision, Project administration.

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

See Tables A.1–A.3.

Table A.1
Biodiversity management, regulatory frameworks and firm performance: Main results.

	EBITDA						MARKET TO BOOK VALUE					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
EBITDA$_{-1}$	0.540**	0.085**	0.916***	0.056**	0.941 **	0.057**						
	(0.019)	(0.033)	(0.001)	(0.025)	(0.022)	(0.025)						
MV/BV$_{-1}$							0.280***	0.206***	0.209***	0.206***	0.200***	0.199***
							(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
BIRS	0.002***	0.001***	0.001***	0.001***	0.001***	0.002***	0.009***	0.018***	0.011***	0.018***	0.034***	0.005***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.007)	(0.000)
Biodiversity Strategy			0.032***	0.016***	0.359***	0.337***			0.119***	0.208***	0.595***	0.373***
			(0.003)	(0.006)	(0.101)	(0.099)			(0.009)	(0.000)	(0.094)	(0.006)
BIRS × Biodiversity Strategy					0.001***	0.001***					0.024***	0.024***
					(0.000)	(0.000)					(0.000)	(0.000)
CSRD			0.120***	0.190***	0.298***	0.267**				0.293***		0.307***
			(0.003)	(0.005)	(0.115)	(0.004)				(0.000)		(0.000)
BIRS × CSRD					0.002***	0.001***						0.043***
					(0.000)	(0.000)						(0.000)
Size$_{-1}$		0.974***		0.847***		0.839***		0.591***		0.591***		0.478***
		(0.009)		(0.026)		(0.026)		(0.000)		(0.002)		(0.002)
Leverage$_{-1}$		−0.001***		−0.001***		−0.001***		−0.009***		−0.009***		−0.010***
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
ESG Score$_{-1}$		0.007***		0.025***		0.017***		0.245***		0.244***		0.214***
		(0.000)		(0.005)		(0.004)		(0.000)		(0.001)		(0.002)
EPS$_{-1}$		0.005		−0.001		−0.002		−0.533		−0.533		−0.470
		(0.004)		(0.001)		(0.002)		(0.650)		(0.649)		(0.401)
ROA$_{-1}$								0.164***		0.164***		0.181***
								(0.000)		(0.000)		(0.001)
Intecept	1.036***	3.714***	1.748***	1.963***	1.399***	2.695***	1.423***	1.660***	1.702**	1.661***	1.304***	1.384***
	(0.042)	(0.480)	(0.038)	(0.127)	(0.479)	(0.113)	(0.001)	(0.0005)	(0.031)	(0.000)	(0.008)	(0.006)
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	NO	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES
Observations	111	111	111	111	111	111	111	111	111	111	111	111
Adj. R2	0.249	0.266	0.230	0.275	0.257	0.275	0.241	0.274	0.251	0.274	0.280	0.282
Mean VIF	3.97	4.98	3.78	4.48	5.10	5.55	3.29	3.82	3.77	3.51	5.14	4.62

Notes: The table presents the regression estimates examining the relationship between the Biodiversity Impact Reduction Score (BIRS), firm performance metrics (EBITDA and Market-to-Book Value (MV/BV)), and other explanatory variables. Models (1)–(6) focus on EBITDA, while Models (7)–(12) examine MV/BV. Firm size, leverage, ESG scores, and other control variables are included to account for financial and operational differences. Firm, year, and industry fixed effects are applied to ensure robust estimation.
Symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A.2
Biodiversity commitment, regulatory frameworks and firm performance: Main results.

	EBITDA						Market to Book Value					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
EBITDA$_{-1}$	0.464**	0.040**	0.720***	0.722***	0.805***	0.808***						
	(0.020)	(0.018)	(0.005)	(0.007)	(0.052)	(0.053)						
MV/BV$_{-1}$							0.270***	0.205***	0.203***	0.205***	0.161***	0.155***
							(0.000)	(0.000)	(0.001)	(0.000)	(0.002)	(0.000)
Commitment	0.238***	0.080***	0.067***	0.096***	0.028***	0.099***	1.822***	1.433***	0.265***	1.433***	1.009***	0.396***
	(0.005)	(0.001)	(0.003)	(0.003)	(0.001)	(0.007)	(0.002)	(0.001)	(0.011)	(0.001)	(0.009)	(0.037)
Biodiversity Strategy			0.033***	0.040**	0.249***	0.223***			1.237**	2.262***	3.495**	1.956***
			(0.003)	(0.020)	(0.066)	(0.064)			(0.091)	(0.003)	(1.528)	(0.004)
Commitment × Biodiversity Strategy					0.060	0.072***					1.422	0.290***
					(0.092)	(0.022)					(1.352)	(0.040)
CSRD			0.099***	0.133***	0.230***	0.184***			0.872**	2.510***	2.708*	0.629***
			(0.008)	(0.009)	(0.070)	(0.071)			(0.030)	(0.000)	(1.435)	(0.004)
Commitment × CSRD						0.052					0.394	0.308***
						(0.087)					(1.366)	(0.000)
Size$_{-1}$		1.203***		0.190***		0.116**		0.588***		0.588***		0.514***
		(0.033)		(0.005)		(0.048)		(0.001)		(0.000)		(0.002)
Leverage$_{-1}$		−0.002***		−0.001***		−0.001***		−0.012***		−0.012***		−0.016***
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
ESG_Score$_{-1}$		0.065***		0.002***		0.005**		0.198***		0.198***		0.247***
		(0.005)		(0.000)		(0.002)		(0.000)		(0.000)		(0.001)
EPS$_{-1}$		0.005		−0.004		−0.001		−0.532		−0.532		−0.532
		(0.004)		(0.004)		(0.003)		(0.600)		(0.605)		(0.632)
								0.168***		0.168***		0.173***
								(0.000)		(0.000)		(0.001)
Intercept	1.206**	0.218***	1.046***	1.046***	1.468***	1.067***	1.627***	1.483***	1.635***	1.567***	1.654***	1.764***
	(0.043)	(0.045)	(0027)	(0.027)	(0.001)	(0.068)	(0.000)	(0.005)	(0.004)	(0.002)	(0.003)	(0.001)
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	NO	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES
Observations	111	111	111	111	111	111	111	111	111	111	111	111
Adj. R2	0.252	0.266	0.270	0.287	0.257	0.267	0.244	0.275	0.279	0.275	0.269	0.278
Mean VIF	3.30	3.38	3.93	4.27	4.61	4.85	2.60	3.99	3.94	4.31	3.71	4.17

Notes: The table presents the regression estimates examining the relationship between the Biodiversity Commitment, firm performance metrics (EBITDA and Market-to-Book Value (MV/BV)), and other explanatory variables. Models (1)–(6) focus on EBITDA, while Models (7)–(12) examine MV/BV. Firm size, leverage, ESG scores, and other control variables are included to account for financial and operational differences. Firm, year, and industry fixed effects are applied to ensure robust estimation.
Symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A.3
Robustness check. Replacing the dependent variable.

	ROA					
	(1)	(2)	(3)	(4)	(5)	(6)
Commitment	0.213***	0.172***	0.104***	0.609***	0.222***	0.464***
	(0.001)	(0.000)	(0.009)	(0.001)	(0.098)	(0.137)
Biodiversity Strategy			0.351***	0.391***	0.152**	0.342***
			(0.008)	(0.004)	(0.075)	(0.096)
Commitment × Biodiversity Strategy					0.247	0.495
					(1.263)	(1.515)
CSRD			1.024***	0.923***	0.792***	1.012***
			(0.025)	(0.013)	(0.108)	(0.112)
Commitment × CSRD					0.932	0.977
					(1.355)	(1.454)
Intercept	1.919***	1.499***	0.608***	2.494***	1.407**	2.677**
	(0.082)	(0.003)	(0.023)	(0.009)	(0.666)	(1.053)
Controls	NO	YES	NO	YES	NO	YES
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	YES	YES	YES	YES	YES
Observations	111	111	111	111	111	111
Adj. R2	0.280	0.284	0.268	0.271	0.269	0.271
Mean VIF	2.64	4.02	3.20	3.69	3.75	4.06

Notes: The table presents the regression estimates examining the relationship between the Biodiversity Impact Reduction Score (BIRS), firm performance metrics (ROA), and other explanatory variables. Firm size, leverage, ESG scores, and other control variables are included to account for financial and operational differences. Firm, year, and industry fixed effects are applied to ensure robust estimation.
Symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

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