RESEARCH



Exploring the financial consequences of biodiversity disclosure: how does biodiversity disclosure affect firms' financial performance?

Raghda Abdellatif Abdelkhalik Elsayed*

Abstract

This study aims to contribute to the existing business strategy and the environment literature by exploring how biodiversity disclosure affects the financial performance of firms. The study employs the content analysis of a sample of 100 Fortune Global companies for 3 years, after developing a comprehensive index to measure the quality of disclosure. Then normality, correlation, and multiple linear regression model and its estimation using ordinary least squares are performed to measure the impact of biodiversity disclosure on the financial performance of companies. In addition, the Hausman test is used to check the robustness of the study. The study results reveal a relationship between biodiversity disclosure and financial performance measured by return on assets and a stock's price-to-book ratio. Biodiversity disclosure has a positive relationship with return on assets at a significance level below 5%. While biodiversity disclosure has a positive relationship with stock price/ book value per share, they are not statistically significant at a significance level of 5%. The sample represents only a small proportion of a larger population. The study only investigated Global 100 firms with different sectors and countries for 3 years. This study provides an opportunity to learn about the effect of the disclosure of practices associated with managing biodiversity and extinction risks through preparing a quality index of biodiversity and extinction disclosure and examining the relationship between biodiversity disclosure and the financial performance of firms by the prepared index. This study can be considered a contribution to the flow of accounting research about biodiversity and extinction. A few studies examine the effect of biodiversity disclosure. The study is among the first to examine how biodiversity disclosure affects the financial performance of firms. The results of this study inform firms and the academic literature about the economic consequences of biodiversity disclosure where biodiversity disclosure has a positive effect on firms' financial performance. The study evidence appears to be robust there is no endogeneity problem.

Keywords Biodiversity and extinction disclosure, Biodiversity risks, Corporate social responsibility, Financial performance, Content analysis

Introduction

There is a trend to increase global environmental awareness and achieve sustainable economic development [1]. In 2010 at the Davos conference, in Switzerland, world

*Correspondence: Raghda Abdellatif Abdelkhalik Elsayed raghdaabdellatif@azher.edu.eg; d.raghda02@ymail.com Department of Accounting, Faculty of Commerce for Girls, Al-Azhar University, Cairo, Egypt leaders and elite firms begin to talk about the risks to the global economic system related to the loss of biodiversity and set a road map for sustainable recovery [1-3]. Worl-dEconomicForum [4] considers biodiversity loss as one of the top 5 global risks. It ranks third among these risks. It is a material risk to the global economy. The current rate of extinction and species is greatly accelerating [4]. Biodiversity-related business risks result from direct impacts or dependencies on biodiversity or ecosystem services, in addition to regulatory, financing, and reputation risks.



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There are many serious impacts of biodiversity loss on humanity, from the collapse of food and health systems to the disruption of entire supply chains [4].

The risks of biodiversity loss occupy international attention not only at the World Economic Conference but also from many international organizations and institutions that prepare reports on the risk of biodiversity and species loss such as the World Resources Institute Financial Program of the United Nations Environment Program and a wide variety of financial institutions, whereas these risks are not considered regularly by corporate management in the decision-making process related to operational and strategic objectives [1].

The United Nations require organizations to achieve the Sustainable Development Goals (SDGs) to ensure sustainable development, human activities, and businesses affect nature which caused the mass extinction of the planet Earth [5]. Therefore, sustainable investments help improve the quality of life for future generations through environmental, social, and institutional management standards that add long-term value from a financial perspective. Adler, Mansi and Pandey [6] indicate that a lack of disclosure of corporate impacts on ecosystems, wetlands, or biodiversity has resulted in extinction and increased risk of biodiversity loss. Although the abundance of scientific evidence on human behavior leads to global warming, habitat destruction, and unparalleled loss of species, the corporate reporting model remains highly concentrated on interpreting value creation from a financial perspective [2, 5]. Also, Atkins and Maroun [5] indicate that if firms are not interested in sustainable investment, biodiversity, and preventing extinction, we will face a miserable future where work, finance, and accounting end and man is unable to make a fundamental change. Consequently, the value creation process must take into consideration the interrelationship between different types of capital (including financial, factory, intellectual, environmental, human, social, and relationship relationships) and that firm management takes into account the risks of biodiversity and gender differences in the context of the entity's strategy when making various decisions and disclosing them in their reports. Many researchers call for the inclusion of a form of extinction accounting in integrated reports [5, 7]. According to the Global Reporting Initiative (GRI), "the sustainability report is the general disclosure by the organization of its economic, environmental and/or social impacts, and hence its positive or negative contributionstoward achieving the SDG" [8]. Therefore, firm success becomes largely based on the positive impact of their activities on their host communities and stakeholders. Positive responses by companies to environmental and societal issues through accountability and disclosure make stakeholders confident that the companies they interact with are transparent and socially responsible.

Considering the gap in the accounting literature related to biodiversity disclosure, first, a comprehensive index was developed to measure the quality of biodiversity disclosure. Subsequently, the study data were manually collected from the annual reports of a sample of 100 Fortune Global companies for a period of 3 years. Then conducting a content analysis of the biodiversity disclosure made by 100 firms listed on the Fortune Global 500. This study focuses on both stakeholder theory and legitimacy theory to understand global companies' motivation for biodiversity disclosure. Normality, correlation, and ordinary least squares regression are performed to measure the impact of biodiversity disclosure on the financial performance of firms.

The aim of this study is to investigate how disclosure of the practices associated with biodiversity and extinction risks affect the financial performance of firms. The importance of this study is that it provides an opportunity to learn about the reality of biodiversity disclosure and its impact on financial performance through a specially prepared index.

The study results reveal a relationship between biodiversity disclosure and financial performance measured by return on assets (ROA) and a price-to-book ratio (P/B ratio) of a stock.

The study makes several contributions to the extant literature on biodiversity/extinction accounting. First, in accordance with the study of Hassan, Roberts, and Atkins [9], biodiversity can be considered as a continuation of corporate social responsibility (CSR); our paper contributes to the dearth of work on this topic by borrowing some of the CSR-established factors to measure the relationship between biodiversity disclosure and the financial performance of firms. Second, based on the limited prior research, the index was developed to measure developing the quality of disclosure through 51item disclosure and classified into four various themes. Third, this paper is among the first to examine how biodiversity disclosure affects the financial performance of firms. The fourth contribution, 3 years were examined for 100 firms about 300 reports.

This study is organized as follows. In the next section, we provide a brief overview of the literature on biodiversity accounting and CSR. Then Sect. "Theoretical framework and hypotheses development shows the theoretical framework and hypotheses development". Section "Research methodology" shows the research methodology. Section 5 presents the results of the study. Section "Discussion" shows the discussion. Finally, Sect. "Conclusion" shows the conclusion with a discussion of the study's contributions and implications, its limitations, and chances for future research.

Literature review

Previous studies have discussed the role of accounting for a firm's CSR to support financial performance. For example, Torugsa, O'Donohue, and Hecker [10] contribute to CSR literature by demonstrating a case for small- and medium-sized firms to be able to increase financial returns by making progress toward corporate social responsibility. They cleared that adopting valuecreation strategies that make the most effectively use of a company's capabilities is essential to financial success. Rhou, Singal, and Koh [11] supported the idea that stakeholder awareness of CSR influences the way in which CSR initiatives can lead to financial gains, while Long, Li, Wu, and Song [12] have revealed that CSR positively impacts financial performance. State ownership weakens the relationship between CSR and financial performance. In addition, they demonstrated that although both the practical point of view and the political viewpoint of corporate social responsibility can be applied, the drive to create economic benefits for companies dominates, and market competition increases the strategic use of corporate social responsibility. In another study, Wu, Shao, Yang, Ding, and Zhang [13] explored the impact of CSR and financial distress on corporate financial performance. They found that CSR has a significant positive impact on firms' financial performance and that the relationship is more pronounced for more stable firms. Moreover, the win-win relationship between CSR and corporate financial performance is stronger in state-owned firms, while Awaysheh, Heron, Perry, and Wilson [14] re-examined the relationship between CSR and financial performance by comparing firms with their industry peers in a given year to identify best-in-class and worst-in-class companies. They have found that best-in-class firms perform better than their peers in the industry in terms of operating performance and have more realistic market assessments. However, a significant relationship between operating performance and categories of corporate social responsibility does not appear. Cho, Chung, and Young [15] analyzed whether there is a systematic relationship between CSR performance and corporate financial performance measured by profitability and firm value. They confirmed that corporate social responsibility performance has a positive partial relationship with profitability and company value. Previous studies have empirically found a relationship between environmental disclosure and financial performance (e.g., [2, 12, 16, 17]) where the results of these studies have revealed that there is a positive relationship between the disclosure of environmental performance and the financial performance of the firm.

In addition, prior studies have examined the role of accounting for a firm's social responsibility to support decision-making. For example, Nguyen and Tran [17] argue that accounting for a firm's social responsibility works to provide the information necessary to support internal decision-making in business operations for improving financial and environmental performance, as well as providing information for stakeholders such as financial institutions, environmental management agencies. Chinedu and Ogochukwu [18] indicated that CSR helps firms to improve their image in front of the community due to the green consumption of clean products. Thus, timely and accurate disclosure of environmental information plays an important role for stakeholders. On the other hand, previous research related to biodiversity/extinction accounting (e.g., [5, 6]) painted a negative perspective for the relationship between the state of the planet and the role of different types of reports to reverse trends in biodiversity loss. In addition, most of the development in sustainability reporting reflects companies' efforts to reformulate urgent environmental issues as financial considerations to relieve change claims. Although the abundance of evidence boosts the negative effects of human behavior that drives global warming, habitat destruction, and the loss biodiversity, reporting model of the firm remains heavily focus on a financial perspective to value creation. Therefore, critical theorists have argued that the pace at which firms deal with the risks contributes to a lack of a sustainable [1, 19, 20].

There are only a limited number of studies that have analyzed practices for disclosing biodiversity and extinction as it is recent [9]. Previous research (e.g., [3, 6, 9, 21, 22]) reveals that most firms practice impression management when doing biodiversity and extinction disclosure and that disclosure of biodiversity and extinction stems from the source of self-interest. Where firms do this disclosure if there are some benefits related to detecting these risks such as achieving advantages in terms of reputation and enhancing the impression you give to stakeholders. That is, previous studies (e.g., [3, 6, 21) 22], have explained that disclosing environmental performance is a way for companies to enhance their image and reputation in front of stakeholders. Also, the results of previous studies have shown that investors have become more interested in information related to corporate social responsibility, especially considering the world's trend toward achieving green development. As an extension of corporate social responsibility, this study attempts to examine the impact of biodiversity disclosure biodiversity on financial performance, which may be an incentive for companies to expand on this type of disclosure for achieving integrated green development.

Previous researchers have empirically found there is some level of recognition of biodiversity risks. Dempsey's survey (2013) showed that there is some level of recognition, the survey cleared that 27% of CEOs were 'extremely' or 'somewhat' concerned about biodiversity loss, and only two of the Financial Times Stock Exchange (FTSE) 100 companies recognized that biodiversity is to be strategic importance to their business. Only 6 of 50 banks have taken steps to account for both biodiversity risks and for financial opportunities at the organizational level or within their lending portfolios [1]. Tregidga, Milne, and Kearins [23] argue that companies' efforts to reformulate environmental issues and advance development in sustainability reporting aim to achieve financial considerations to mitigate calls for change. Poor environmental performer tends to use to manage stakeholders' perceptions by using more comprehensive disclosure or disclosing selective good news [24]. In addition, Boiral [21] explored the strategies that organizations use to demonstrate their responsibility for biodiversity and legitimize their influence by using neutralization techniques. King and Atkins [7] argue that integrated reporting is a way to report these issues focused on content analysis of biodiversity reporting, while focused on content analysis of biodiversity reporting for large mining companies. The findings of their study show that there is a few corporate biodiversity reporting which does not enable stakeholders to meaningfully evaluate a firm's biodiversity effects.

Atkins and Maroun [5] have provided an emancipatory accounting framework for extinction that can be included in integrated reporting. They introduce accounting and accountability mechanisms which help in preventing extinction. This may lead to changes in organizational behavior and guarantee consistent and transparent reporting on how the firm manages the risk of extinction rather than legalization. The framework is based on if firms can be encouraged to provide accounts of their own impacts on species extinction.

Weir (2018) noted that the efforts to prevent further extinctions depend on the goodwill of the parties concerned rather than the centrally funded and well-funded initiatives. Weir [25] shows there is a lack of financial investment for species protection where there is "not enough money" to prevent extinction and achieve sustainability. Gallhofer and Haslam [20] assessed major developments and changes in the meaning of emancipatory accounting in accounting literature during the last four decades. They cleared that emancipatory accounting reflecting a post-Marxist new pragmatist perspective can become more focal and applicable in general. Hassan, Roberts, and Atkins [9] concluded that there are positive relationships between disclosure of biodiversity and extinction and a set of determinants such as obtaining an environmental award, whether companies are from highrisk sectors for biodiversity, and the presence of biodiversity partners.

From the discussion of previous studies, it can be said that it did not address the effect of disclosure of biodiversity and extinction on the financial performance of the firm, and therefore the current study works to bridge this gap.

The present study contributes to the stream of prior studies, providing further empirical evidence about how biodiversity and extinction disclosure contribute to the financial performance of firms, which is one of the main aims that management seeks to achieve. In addition, conducting both qualitative analyses for financial statements and a content analysis of the biodiversity disclosure made by the top 100 Fortune Global firms covering various industries to well assess the effects of their disclosure on the firm's financial performance.

The present study can be considered a contribution to the flow of accounting research about biodiversity and extinction. It is a continuation of CSR research into firms' disclosure practices.

Theoretical framework and hypotheses development

Theoretical framework

Many international organizations and institutions that prepare reports on the risk of biodiversity and species loss such as the International Union for the Conservation of Nature (IUCN), the World Resources Institute (WRI), World Resources Institute Financial Program of the United Nations Environment Program, the World Economic Forum, and a wide variety of financial institutions attempt to produce biodiversity loss as a material (financial) risk, they face a critical challenge is that there is a relatively low interested in the financial and business community about the risks of biodiversity business, whereas these risks are not considered regularly by corporate management in the decision-making process [1]. Achieving profit maximization is closely related to the business risk to which the firm is exposed. It is expected that firms with better biodiversity and extinction disclosure should become the investment selection for investors, as there are many biodiversity risks that affect the financial performance of the firm, which are as follows [1-4]

- Reputation risks: These are the risks associated with market campaigns that affect the brand and social license of the firm, which leads to lower revenues.
- Operational risks: These are risks associated with low productivity, increased operating costs, and a scarcity

of resources. For example, the collapse of the bee colonies in 2007 cost US producers \$ 15 billion.

- Regulatory risk: These are the risks that the firm may face due to legal penalties for violating government policies such as taxes and the suspension of procedures for extracting natural resources.
- Market and product risks: Businesses may face risks when customers turn to other suppliers that offer products with fewer impacts on the ecosystem or implement new sustainable purchasing policies.
- Financial risks: These are the risks associated with the ability of the firm to obtain new financing, not only from banks and financial institutions but also through the stock market, which results from new lending guidelines or shareholder standards.

The loss of biodiversity impacts negatively the final results of the business—through the decline in fish stocks that disrupt commodity supply chains, economic losses from disasters such as floods, and supply chain risks arising from business relationships with biodiversity and ecosystems [4]. To explain how the disclosure of biodiversity and extinction affect financial performance, this study focuses on both stakeholder theory and legitimacy theory. Both the legitimacy theory and the stakeholder theory are among the most important theories that explain the orientation of firms toward preparing social responsibility reports.

According to the theory of legitimacy, a firm should sign a social contract that managers agree to implement [17]. Firms must abide by the social contract by implementing many socially desirable measures in exchange for agreeing to their goals [3, 18]. Many researchers (e.g., [26]) have used the theory of legitimacy to interpret corporate social responsibility as volunteering, based on the social contract between it and society. Legitimacy theory indicates that firms may try to legalize their activities by publishing reports of corporate social responsibility, in order to obtain approval and support from the community in support of its continued existence, and thus social responsibility is considered a "license to operate." Legitimacy theory considers that the preparation of corporate social responsibility reports is a social contract between the company and the society in which it operates, providing it with legal legitimacy to own and use natural resources and the possibility of hiring users. Consequently, firms must work in a balanced and rational manner to use community resources with high efficiency and distribute them to society fairly which would give the firm a more acceptable image to the various parties. A firm can exist in the social system when its value is consistent with the value of the larger social system in which it sits. Hence, firms disclose more information in order to

gain legitimacy, which ultimately guarantees their existence. Thus, disclosure of the environment is the motivation for firms to legalize their activities and thus enhance their image in front of the social system.

On the other hand, according to the theory of stakeholders, firms should take care of all stakeholders not only shareholders in conducting their business activities but also all stakeholders including the host community, government, suppliers, customers, environmental groups, etc. The stakeholder theory is taken from the perspective of economic interests in all actions. The stakeholder theory considers the effects of its activities on the environment and discloses these issues in its annual report for use by stakeholders [17]. Many researchers (e.g., [17, 27]) have used the theory of stakeholders to explain the social duty of firms toward stakeholders. It refers to the many groups with special interests who can influence the firm or be influenced by the acts or decisions of the firm such as investors, users, customers, government, lobby groups, and society.

Prior researches (e.g., [28, 29]) assign the social responsibility of firms to the stakeholder theory, which states that the primary goal of firms is to generate and maximize value for all stakeholders, including shareholders or partners, suppliers, distributors, customers, as well as employees and their families, the surrounding environment, the local community, and society as a whole. CSR is a major tool to reach this goal by achieving political, economic, social, and environmental stability for the business community. Several researchers (e.g., [27-29]) believe that CSR is the method used by firms to manage and organize their relationships with all of those dealing with them. The importance of this theory lies in the quest to consider the interests of the parties in order to achieve a balance in the responsibility entrusted to the institutions, so that we find that many concepts and positions of social responsibility are related to recent developments in society, such as preventing a polluted environment, which represents a new social position, awareness, and new social responsibility. Social consequences also pressure these firms to assume their responsibilities toward them, as they are considered negative influences on their inputs. So, it must be emphasized that concern for social and environmental responsibility by institutions does not mean that they abandon their economic responsibility in achieving their financial goals, but firms must strive to strike a balance between them.

Legitimacy theorists (e.g., [30]) are clear that firms facing social and political pressures may use disclosure to try to reduce these exposures. Much research [6, 9, 21, 22] showed that biodiversity disclosure stems from a source of self-interest, as firms practice disclosure if there are some benefits related to the disclosure of these risks. Also, many studies [9, 22] have supported the idea that most firms practice impression management when doing biodiversity and extinction disclosure. The firms are concerned with biodiversity and extinction disclosure only when it achieves advantages in terms of reputation and improving the impression they give to stakeholders [22]. Therefore, biodiversity is critical to business survival and therefore must be strengthened [6, 31]. Therefore, the value creation process should take consider the interconnection between multiple capitals concept which include financial, manufactured, environmental, human, social and relationship, intellectual, and natural capital in decision-making related to operating model, risks, and an entity's strategy. Natural capital presents life on the earth and provides the environment for the other five without which the other capitals would be meaningless [5].

Based on the foregoing, it can be said the relationship of firms with biodiversity is two-way, as firms influence biodiversity and biodiversity affects firms. Therefore, firms must be aware that nature and ecosystems have a fundamentally important value that is directly or indirectly related to the firm activity.

Hypotheses development

In line with what has been noted above, providing disclosure of biodiversity/extinction can be considered an extension of corporate social responsibility. The current study derives from existing social responsibility the impact of disclosure of biodiversity/extinction on the financial performance of the firm. Prior research (e.g., [3, 30, 32] has suggested that the firm's financial performance can be measured in either a measurement based on accounting for example ROA or a market-based such as P/B Ratio. Accounting metrics such as ROA are most used to measure the financial performance of a firm, as Page 6 of 18

it is less likely to be manipulated [18], while market metrics clear future factors and focus on market efficiency. Therefore, market metrics avoid some constraints related to accounting procedures. So, market metrics help the investor to predict the ability of a firm to generate future gains [17]. This study relies on both accounting and market metrics to examine how the disclosure of biodiversity affects the financial performance of the firm by using ROA and P/B ratios. The following figure shows the research framework (Fig. 1):

Previous researchers have empirically found a positive relationship between return on assets ROA and environmental disclosure (e.g., [18]). Recently, investors become more interested in sustainable investing [32]. Consequently, this study attempts to examine how biodiversity and extinction disclosure affect financial performance, which may be an incentive for companies to expand on this type of disclosure for achieving green development. Therefore, the following hypotheses are tested:

H1 The biodiversity/extinction disclosure has an effect on the return of assets.

H2 The biodiversity/extinction disclosure has an effect on the price-to-book ratio.

Research methodology Sample and data selection

The study is based on a sample of 100 firms listed on the Fortune Global 500 in three years 2019, 2016, 2013 for several reasons. First: obtaining a sample size that can be managed. Second: These companies are receiving more attention from the public, the media, capital markets, and non-government organizations (NGOs).



Fig. 1 A research framework. Source: the author

Third, these companies are globally active, as they have many operations in many countries around the world. Finally, disclosure of biodiversity and extinction is rarely made by the remaining companies in Fortune Global 500. The study sample covers three years, namely 2019, 2016, and 2013, in order to determine the impact of disclosure on biological diversity during a relatively long period of time during which it is possible to indicate whether the level of disclosure has increased and the impact on the financial performance of the firm. The sample was for 16 sectors and covered 15 countries around the world. Sustainability reports were obtained from the sustainability discloser database. We download annual reports from the firms' web pages and the macrotrends database.

Research variables

This study focuses on the quality of biodiversity and extinction disclosure. In addition, financial performance domain variables, the price-to-book ratio, and return on assets as well as control variables (e.g., financial leverage, industry sector, country, firm size, and Big4 accounting).

Quality index of biodiversity and extinction disclosure

The quality of disclosure was measured through a disclosure index consisting of (51) items grouped into 4 categories (which are adapted from previous studies, [2, 3, 6, 9]). The disclosure index is divided into four dimensions (see Appendix 1). The first dimension covers "disclosure of current/past actions" 23 items. The second dimension addresses "disclosure of future prevents actions" 7 items. The third dimension addresses "financial disclosure of preventative activities, legal fines and claims" 5 items. Finally, the fourth dimension addresses "the extent to which the extinction/biodiversity accounting framework is followed to mitigate extinction and biodiversity loss" 16 items. All items of the disclosure index have deals with equal importance. It was measured by building a quadrilateral scale based on the weighted approach. All 51 items have a score ranging from 0 to 3, where a score of (0) if the item does not disclosure at all in the annual report, a score of (1) if the item appears in minimum, fuzzy, and/or general, and a score of (2) if the item appears to include objective, present actual data, and verifiable disclosure form, and a score of (3) if the item appears including all the ingredients of a score of (2), in addition to providing specific information on the operating sites used and/or the species affected and/or the number of plants/animals affected; a description of the measures taken and the amount of money allocated to meet the biodiversity and extinction risks; and/or linking biodiversity-related data to corporate strategy, firm operational and strategic goals (Appendix 2).

Return on assets

ROA was employed which is one of the most accounting indicators used to measure the financial performance of the firm as it is less likely to be manipulated [18]. ROA helps investors and analysts to determine the efficiency of a firm's management in how to use assets to generate profitability [33]

Price-to-book

P/B ratio is one of the market metrics which clear future factors and focus on market efficiency. Therefore, market metrics avoid some constraints related to accounting procedures. It helps the investor to predict the ability of a firm to generate future gains [17]. Firms use P/B ratio to compare the market value of a firm with its book value. It is measured by dividing the firm's stock price by the share by its book value per share (BVPS). The P/B ratio measures a firm's market valuation relative to its book value. The investors use the P/B ratio to identify potential investments. If P/B ratios are less than 1, this can be a sign of a problem in a firm, which means that it trades for less than the value of its assets. Therefore, it should be used as part of a comprehensive stock analysis. In addition, P/B ratios can be useful if a firm has inconsistent or negative earnings since common metrics like priceto-earnings would not be meaningful in these situations. Therefore, the P/B ratio can help get a clearer picture of the value of these firms.

Control variables

By following the literature on environmental accounting and financing (e.g., [3, 9, 33]) the control variables for this study include the firm size (measured as the logarithm of total assets), industry sector (the firm has a value of "1" if it properly to be exposed to biodiversity and extinction risks, and it has a value of "0" if it does not potentially expose to biodiversity and extinction risks) [34], financial leverage (it is measured as the ratio of total debt to total assets), country, and big four accounting firms. To get more details on research variables, please see Table 1.

Data analysis and model specification

This study gives depth to the findings by using content analysis and a weighted index which convey a detailed provision of qualitative and quantitative ranges of data. Data were collected between January 2020 and Jun 2020. The statistical software Stata 15 was employed to analyze the data. First, descriptive statistics of all study variables are calculated, including mean, median, and standard deviation which help display data more clearly and easier to understand. Second, the quality index of biodiversity and extinction disclosure is classified by themes, and the

Variables	Acronym	Method of measurement	Data source
Return on Assets	ROA	Net Income/Total Assets	The firms' annual reports and the mac- rotrends database
Price-To Book Ratio	PtoB	Stock Price/ book value per share	
Total biodiversity and extinction disclosure score	BIODIS	All 51 items have a score ranging from 0 to 3, where a score of (0) if the item does not disclosure at all in the annual report, a score of (1) if the item appears in minimum, fuzzy and/or general, and a score of (2) if the item appears to include objective, present actual data and verifiable disclosure form, and A score of (3) if the item appears including all the ingredients of score of (2). In addition to providing specific information on the operating sites used and/or the species affected and/or the number of plants/animals affected; biodiversity-related data to corporate strategy, company operational and strategic goals	Sustainability Reports
Firm size	FirmsizeLog	the logarithm of total assets	Annual Report and Financial Statements
Financial leverage	LEV	Total debt/total assets	
Industry sector	IndsSector	The firm gets a value of "1" if it belongs to an industry sector that is classified under a high-risk area red/amber and the firm gets a value of "0" if it belongs to an industry sector classified under a low- risk green zone (F&C,2004)	F&C BIODIVERSITY Report A-W-G
Country	Country	takes 1 if the country is classified as developed, "0" if it is classified as developing	The United Nations Website
Big four Accounting Firms	Big4	The firm gets a value of "1" when a firm got assured by Big 4, and "0" otherwise	Annual reports of firms

Table 1 Overview of research variables and how to measure them. Source Author

year is offered. Third, the Pearson correlation was used to test the relationship between variables of the study to test its hypotheses. Finally, the multiple linear regression model by the least-squares method was used to test the relationship between the dependents and the independent variables. An additional test was carried out to check the robustness of the study results. The Durbin–Wu– Hausman test as an extra test was used to tell us whether we will use random-effects versus fixed-effect regression analysis and helps us to evaluate whether a statistical model matches the data. The statistical significance was specified by considering the respective p values, where a p value of below 0.05 indicates statistical significance at a 95% level. The regression models are specified as:

$$ROA = \alpha + \beta 1 \text{ BIODIS} + \beta 2 \text{ Firm size Log} + \beta 3 \text{ LEV} + \beta 3 \text{ Inds Sector}$$
(1)
+ \beta 3 Country + \beta 3 \text{ Big4} + e

PtoB =
$$\alpha$$
 + β 1 BIODIS
+ β 2 Firm size Log
+ β 3 LEV + β 3 Inds Sector
+ β 3 Country + β 3 Big4 + e (2)

where

ROA is return on assets, PtoB refers to *stock price/ book value per share*, BIODIS is total biodiversity and extinction disclosure score, FirmsizeLog refers to firm size measured by the logarithm of total assets, LEV is financial leverage, IndsSector refers to Industry sector, Country refers to country (developed or developing), and Big4 indicates to assured by four big accounting firms.

Results

Tests of normality

It is important to perform the necessary tests to ensure the extent to which the study data are followed for normal distribution. According to the central end theory, when the sample is greater than or equal to 30 items, it follows for normal distribution. Therefore, the study data can be considered is naturally distributed without the need to perform this test [35]. Consequently, it can be considered the study data follow the normal distribution, as the study sample is equal to (300), and the possibility of using the parametric tests for the study hypotheses.

Descriptive analysis

Table 2 shows a summary of descriptive statistics for dependent variables, independent variable, and control variables.

From Table 2, it is clear that the mean of RoA is 3.866% and the standard deviation is 4.7. The mean of the Price-To Book Ratio is 2.778, and its standard deviation is 19.81, while the mean of total biodiversity and extinction disclosure score is 35.19 and its standard deviation is 33.161. Most of the reports included in the sample are for companies operating in developed countries, and only 89 reports were made in developing countries, and

	N	Minimum	Maximum	Sum	Mean	Std. Deviation
ROA	300	- 34.50%	22.23%	1159.75%	3.866%	4.73496%
PtoB	300	- 236.31	103.95	1148.63	2.778	19.81
BiodDi	300	2	153	10,557	35.19	33.161
LEV	300	.09949	13.522	.7322	.04474	.7749
FirmsizeLog	300	2.792	9.311	5.1944	.0475	.822
Country	300	0	1	89	.30	.458
IndsSector	300	0	1	196	.65	.477
Big4	300	0	1	297	.99	.100

Table 2 Descriptive statistics. Source Author's calculations using Stata

Table 3 Collinearity test. Source Author's calculations using Stata

Model	ROA		PtoB		
	Tolerance	VIF	Tolerance	VIF	
BiodDi	.931	1.074	.874	1.144	
IndsSector	.923	1.084	.899	1.112	
Country	.934	1.071	.755	1.324	
LEV	.932	1.073	.861	1.161	
FirmsizeLog	.914	1.094	.828	1.208	
Big4	.928	1.078	.859	1.165	

all companies except one company review their reports by the big four. Also, Table 2 presents the minimum and maximum of other research variables.

Testing the study hypotheses

In order to test the hypotheses of this study, the Pearson correlation test and standard multiple regression analysis were employed.

Correlation tests

The multicollinearity test was used to test the study data validity for the statistical tests based on two indicators: Variance Inflation Factor (VIF) and Tolerance as Table 3 multicollinearity test. The multicollinearity shows to be a problem if the VIF for any variable of the research is more than 10 or the tolerance of any variable is less than 0.1 [35]. Pearson correlation test was performed to test for significant relationships between variables of the study. Correlation tests clear that there is a relationship between biodiversity disclosure and financial performance measured by return on assets and a price-to-book ratio of a stock. Biodiversity disclosure has a positive relationship with return on assets at a significance level below 5%. While biodiversity disclosure has a positive relationship with stock price/ book value per share, they are not statistically significant at a significance level of 5%. Table 4 includes the correlation matrix for all variables included in this study. Line with the assumptions of the previous two indicators, it is clear that according to the results shown in Table 3, there are no multicollinearity problems in study variables.

The standard multiple regression analysis

The multiple linear regression model and its estimation using ordinary least squares (OLS) were used to examine how biodiversity disclosure affects financial performance. Two models were built to measure the effect of biodiversity and extinction disclosure on the firm's financial performance by measuring the effect of biodiversity/extinction disclosure on the return on assets (the first hypothesis) and measuring the effect of biodiversity/extinction disclosure on a price-to-book ratio of a stock (the second hypothesis). Table 5 shows the results of this test. The results of regression analysis related to the first model of the first hypothesis clarify the significance of this model, as the value of F is (8.653) and R Square = 0.151 which indicates an explanatory capacity of 15%. which defines the return on assets through changes that occur in biodiversity and extinction disclosure, which means about 15% of the fluctuations that occur in the return on assets can be interpreted with changes that occur in biodiversity and extinction disclosure. Regarding the effect of biodiversity and extinction disclosure on financial performance (return on assets), it is clear P Value is less than the level of significance which means the existence of a significant effect. That is, biodiversity disclosure has a positive effect on return on assets at a significance level below 5%. Where that R Square is less than 30%, therefore it is not possible to build a model equation to predict the value of the return on assets (Table 6).

The results of regression analysis related to the second model of the second hypothesis clarify the significance of this model, as the value of F is (0.17) and R Square = 0.006 which indicates an explanatory capacity

		ROA	PtoB	BiodDi	LEV	FirmsizeLo	g Country	IndsSector	Big4
ROA	Pearson Correlation	1							
	Sig. (2-tailed)	0.000							
PtoB	Pearson Correlation	0.364	1						
	Sig. (2-tailed)	.000							
BiodDi	Pearson Correlation	0.084	0.051	1					
	Sig. (2-tailed)	0.05	0.485						
LEV	Pearson Correlation	- 0.536	- 0.091	- 0.0036	1				
	Sig. (2-tailed)	0.000	0.2126	0.9500					
FirmsizeLog	Pearson Correlation	- 0.298	- 0.0893	0.0364	0.3122	1			
	Sig. (2-tailed)	0.000	0.2203	0.5298	0.0000				
Country	Pearson Correlation	0.036	- 0.0543	- 0.1058	- 0.1355	0.0021	1		
	Sig. (2-tailed)	0.535	0.4565	0.0673	0.0189	0.9716			
IndsSector	Pearson Correlation	- 0.180	- 0.2192	0.2154	0.1454	- 0.0641	0.1664	1	
	Sig. (2-tailed)	0.0017	0.0024	0.0002	0.0117	0.2687	0.0038		
Big4	Pearson Correlation	0.143	- 0.0658	- 0.1031	0.0787	0.1530	- 0.1547	- 0.0732	1
	Sig. (2-tailed)	0.0130	0.3669	0.0744	0.1739	0.0079	0.0072	0.2061	

Table 4 Pearson correlations coefficients matrix. Source Author's calculations using Stata

Table 5 Multiple regression analysis test results. Source Author's calculations using Stata

Dependent Va	ariable	ROA					PtoB				
Model		В	Std. Error	Beta	т	Sig	В	Std. Error	Beta	Т	Sig
1	(Constant)	7.643	2.946		2.594	.010	446	16.614		027	.979
BiodDi		.001	.008	.005	.094	.925	017	.050	027	341	.733
IndsSector		- 1.486	.557	150	- 2.668	.008	957	3.225	023	297	.767
Country		.541	.577	.052	.937	.349	.739	4.423	.014	.167	.868
LEV		964	.341	158	- 2.829	.005	- 2.871	7.663	030	375	.708
FirmsizeLog		- 1.598	.324	278	- 4.927	.000	1.737	2.207	.064	.787	.432
Big4		6.075	2.656	.128	2.288	.023	- 2.598	12.607	016	206	.837
R = 0.388							R = 0.074				
R Square = 0.15	51						R Square =	= 0.006			
Adjusted R Squ	uare = 0.133						Adjusted /	R Square = -0 .	027		
F = 8.653							F = 0.170				
Sig. = 0.000							Sig. = 0.984				

 Table 6
 Results of Hausman test. Source Author's calculations using Stata

Model	ROA	PtoB
Durbin (score) chi2(1)	= 1.29366 (p $=$ 0.2554)	=.111018 (p=0.7390)
Wu-Hausman F(1,292)	=1.26461 (p=0.2617)	=.106406 (<i>p</i> =0.7446)

of 0.6% which defines the price-to-book ratio of a stock through changes that occur in biodiversity and extinction disclosure, which means about 0.6% of the

fluctuations that occur in the price-to-book ratio of a stock can be interpreted with changes that occur in biodiversity and extinction disclosure. It is clear P value is greater than the level of significance which means the absence of a significant effect. That is, biodiversity disclosure has a positive effect on stock price/ book value per share, but they are not statistically significant at a significance level of 5%. Where that R2 is less than 30%, therefore it is not possible to build a model equation to predict the value of the price-to-book ratio of stock regarding the effect of biodiversity and extinction disclosure on a price-to-book ratio of a stock.

Test of endogeneity

An additional test was carried out to check the robustness of the study results. If there is no endogeneity problem in the model, then ordinary least squares can be used. However, when the model suffers from an endogeneity problem, the estimators of OLS regression are biased. In the presence of an endogeneity problem, the two-stage least squares will give efficient and consistent estimators. However, if endogeneity equations are applied to a model that does not include the endogeneity problem, this will lead to estimators that are consistent but not effective (minimum variance). Therefore, the Durbin-Wu-Hausman test as an extra test was used to tell us whether we will use random-effects versus fixed-effect regression analysis and helps us to evaluate whether a statistical model matches the data (Beckert, 2020). It is clear that according to the results shown in Table 4, there is no endogeneity problem because of P value > 0.05.

Discussion

The current study can be considered a contribution to the flow of accounting research about biodiversity and extinction. A few studies examine the effect of biodiversity disclosure. The study is among the first to examine how biodiversity disclosure affects the financial performance of firms. This study focuses on stakeholder and legitimacy theories to understand global companies' motivation for biodiversity disclosure. Normality, correlation, and ordinary least squares regression are performed to measure the impact of biodiversity disclosure on the financial performance of firms.

The study results are in line with Hassan, Roberts, and Atkins [9] that disclosure by the top 100 Fortune Global companies is very limited, with very few firms providing substantial reporting. Also, the present results support the results from Hassan, Roberts, and Atkins [9] and Adler, Mansi, and Pandey [6] that firms with activities with environmental risks have higher levels of disclosure of biodiversity to maintain their legitimacy, whereas the content analysis of corporate sustainability reports indicated that firms that engage in environmentally hazardous activities have more disclosures of biodiversity and extinction. This is due to that there are many biodiversity risks that affect the financial performance of the firm such as reputation risks, operational risks, and regulatory risks. Hence, firms may try to legalize their activities by publishing reports of corporate social responsibility, in order to obtain approval and support from the community in support of its continued existence. This supports the results from [3, 27, 29] that CSR is the method used by firms to manage and organize their relationships with all of those dealing with them. The results of this study

are in line with the results Rounaghi, Jarrar, Dana [36] which emphasizes the importance of measuring the sustainability of production. The results of this study contribute to achieving corporate sustainability by working to achieve sustainable production that does not harm the environment. The results of this study show that most of the reports included in the sample are for companies operating in developed countries and that only 89 reports were made in developing countries. The multicollinearity test clears that there are no multicollinearity problems in the study Variables. Correlation tests are clear that there is no significant correlation between biodiversity disclosure and financial performance measured by return on assets and stock price/ book value per share. The results of the regression analysis show related to the models of the hypotheses clarify the significance of these models with the absence of a significant effect. The Hausman test shows the robustness of the study results, and there is no endogeneity problem in the model of ordinary least squares. The study results are valuable and have some implications for academics, policymakers, and regulators where eliminate concerns about disclosure of biodiversity and extinction where the results inform firms and the academic literature about the economic consequences of biodiversity disclosure. Social consequences pressure these firms to assume their responsibilities toward stakeholders, as they are considered negative influences on their inputs. So, this study emphasizes that concern for social and environmental responsibility by institutions does not mean that they abandon their economic responsibility in achieving their financial goals, but firms must strive to strike a balance between them. Therefore, the value creation process should take consider the interconnection between multiple capitals concept which include financial, manufactured, environmental, human, social and relationship, intellectual, and natural capital decision-making related to operating model, risks, and a firm's strategy [3, 5].

The study results show the correlation between biodiversity disclosure and the financial performance of firms measured by return on assets and a stock's priceto-book ratio. Biodiversity disclosure has a positive relationship at a significance level below 5%. While biodiversity disclosure has a positive relationship with stock price/ book value per share, they are not statistically significant at a significance level of 5%., which might increase interest in biodiversity and conserve species from extinction and motivate firms to biodiversity disclosure. In addition, there is a positive relationship between biodiversity disclosure and the industry sector with a high risk. Also, there is a positive relationship between biodiversity disclosure in developed countries.

Conclusion

The aim of this study is to investigate how disclosure of the practices associated with biodiversity and extinction risks affects the financial performance of firms. This study contributes to the disclosure literature by providing further empirical evidence about how biodiversity and extinction disclosures contribute to the financial performance of firms, which is one of the main aims that management seeks to achieve. The focus of firms on financial performance has led to the insufficiency of disclosure of firms' impacts on ecosystems and biodiversity which has resulted in extinction and increased risk of biodiversity. This paper focuses on both stakeholder theory and legitimacy theory to understand global companies' motivation for biodiversity disclosure. The study employs the content analysis of a sample of 100 Fortune Global companies for 3 years, after developing a comprehensive index to measure the quality of disclosure. The study is based on a sample of 100 firms listed on the Fortune Global 500 in three years 2019, 2016, and 2013. The sample was for 16 sectors and covered 15 countries around the world. The quality of disclosure was measured through a disclosure index consisting of (51) items grouped into 4 categories (which are adapted from previous studies, [2, 3, 6, 9]). The first dimension covers "disclosure of current/past actions." The second dimension addresses "disclosure of future prevents actions." The third dimension addresses "financial disclosure of preventative activities, legal fines, and claims." Finally, the fourth dimension addresses "the extent to which the extinction/biodiversity accounting framework is followed to mitigate extinction and biodiversity loss." The normality, correlation, and multiple linear regression model and its estimation using ordinary least squares were performed to measure the impact of biodiversity disclosure on the financial performance of firms. In addition, the Hausman test was used to check the robustness of the study by telling us whether we will use random-effects versus fixed-effect regression analysis. The statistical software Stata 15 was employed to analyze the data.

Despite the study's contribution, it has a number of limitations that provide promising opportunities for future research. Firstly, the sample represents only a small proportion of a larger population to which it could reasonably apply. Future research may target a bigger sample. Secondly, this study investigated 3 years only which may affect the results. Therefore, future research that might target a longer period might affect the results. Finally, Global 100 firms with different sectors and different countries were investigated. So, future studies may focus on analyzing a single industry/country. These issues need further examination in future research.

Appendix 1 Quality SCORE index of biodiversity and extinction disclosures

No	Disclosure item				
		0	1	2	3
First: Disclosure of current/past actions					
1	Expressions in reports of moral and/or emotional motives for the conservation of species and the ecosystem, as well as considering the impact on the environmental system, including the firm's impact on endangered species				
2	There is an engagement with both local and international organizations that aim to conserve of biodiversity, wildlife, and nature				
3	Firm report on partnerships and decisions made regarding necessary policy changes and reflecting on the results and impact of future participation				
4	Setting a successful attempt to conserve the spe- cies and biodiversity within the top management plan				
5	Reporting on establishing procedures for training employees in extinction accounting				
б	Statement of support provided at the administra- tive level and decision-makers to understand extinction accounting				
7	Statement on participation in sustainable forestry practices and afforestation activities				

No	Disclosure item	Score				
		0	1	2	3	
8	Statement on participation in preservation activities of ecological/wildlife corridors around mines, trans- port infrastructure and places related to a firm					
9	Statement on an assessment of the impact of the firm's activities on the biodiversity of species in and around the factory, mines, and/or other sites related					
10	The firm implements biodiversity offset to mitigate their effects biodiversity					
11	Statement on setting biodiversity projects to refine its impacts in/ around related sites					
12	Statement of participation in land management/ land rehabilitation actions					
13	Statement on floral wealth in and around its operat- ing sites					
14	Statement on faunal wealth in and around its operating sites					
15	The firm discloses its charitable activities under- taken to the protection and conservation of biodiversity					
16	The firm discloses its activities taken for creating biodiversity attention in the community					
17	The firm discloses participation in world biodiversity association (WBA) to enhance biodiversity practices in society					
18	The firm discloses the expenditures related to R&D activities, technologies, and innovations to biodiver- sity preservation and ban extinction					
19	Statement environment policies and strategies biodiversity					
20	The firm discloses biodiversity award or apprecia- tion of the biodiversity received for species preser- vation and restoration					
21	Disclosure of international agreements to conserve and restore biodiversity					
22	Disclosure of regular assessments of biodiversity in regions affected by firm operations					
23	Integrating extinction accounting into the business model, internal control system, and operational processes					
Second: Disclosure of future prevent actions1						
24	Disclosure of potential biodiversity risks resulting from the firm's operations					
25	Disclosure of future initiatives/actions which help in conserve and restore biodiversity					
26	Disclosure of strategy to improve actions and initia- tives for coming years					
27	Discussions on ways in which future biodiversity liabilities can be prevented					
28	Suggest future action plans on accounting for biodiversity and extinction for coming years					
29	Work to achieve future cooperation with ecologists, humanities scholars, and advisors					
30	Support the provision of educational curricula in schools biodiversity conservation initiatives in future					

No	Disclosure item	Score				
		0	1	2	3	
Third: Financial Disclosure of preventative activities, le	gal fines, and claims					
31	Disclosure of potential liabilities regarding future likely legal fines/claims relating to endangered species loss					
32	Perfect disclosure through narrative and financial numbers related to any continuous fines or claims related to the legislation of endangered species including species names and a summary of the losses incurred with specified reasons					
33	The expenses associated with financing activities to prevent and maintain species loss					
34	Disclosure of operating and capital environmental costs					
35	Allocations to address environmental risks and biodiversity loss					
Fourth: The extent to which the extinction/biodiversit	y accounting framework is followed to mitigate extin	ction and	biodiversit	ty loss		
36	Ensuring that extinction accounting is fully integrated into the company's strategy, integrated reports, and sustainability reports					
37	Taking urgent and critical actions to prevent biodi- versity loss and species extinction, compliance line with the Sustainable Development Goal (No. 15) of the United Nations					
38	Report using framework of the International Inte- grated Reporting Council (IIRC)					
39	Disclosure of the rate of emissions and leaks into the environment					
40	Disclosure of threatened plants and animals' species exposed to extinction according to the IUCN Red List, whose habitats are influenced by the firm's activities					
41	Disclosure of places where the firm's activities pose a geographical threat to plant and animal species exposed to extinction, according to the IUCN Red List					
42	Assessment and disclosure of habitat status regions affected, restored, and preserved					
43	Disclosure of potential extinction/biodiversity loss risks resulting from the firm's operations					
44	Disclosure of operations in protected areas cat- egory I–IV according to the IUCN					
45	Identification of affected/preserved/protected/ restored/indigenous/endemic species					
46	Statement ecosystems affected/preserved/ restored					
47	Identification of affected/protected/preserved/ restored wetlands					
48	Disclosures of marine biodiversity impacted/pre- served/protected/recovered					
49	Disclosures of rivers, lakes, reservoirs, or affected/ protected/restored					
50	Disclosure by a depicted representation of biodi- versity loss which includes pictures or photographs of threatened species that are affected by the firm's operations and need to protect					
51	Disclosure of the noise and gases rate					

Appendix 2 list of firms

	Firm name	Industry sector	Country
1	Walmart	Retail/e-tail	USA
2	Sinopec	Energy & chemical	China
3	Shell	Energy & chemical	Netherlands
4	CNPC	Energy & chemical	China
5	State Grid	Energy & chemical	China
6	Cinga	Pharmaceuticals & life sciences	USA
7	BP	Energy & chemical	USA
8	ExxonMobil	Energy & chemical	USA
9	VW (Volkswagen)	Automotive	Germany
10	Toyota	Automotive	Japan
11	Apple	Telecom and IT	USA
12	Berkshire Hathaway	Financial services & insurance companies	USA
13	Amazon	Retail/e-tail	USA
14	UnitedHealth Group	Pharmaceuticals & life sciences	USA
15	Samsung	Consortia & organizations	Korea
16	Glencore	Industrial products & services	Switzerland
17	McKesson	Pharmaceuticals & life sciences	USA
18	Daimler	Automotive	Germany
19	CVS Health	Retail/e-tail	USA
20	Total	Energy & chemical	France
21	China State Construction Engineer- ing	Construction & construction materials	China
22	Trafigura	Energy & chemical	Netherlands
23	Hon Hai Precision Industry Foxconn	Industrial products & services	Taiwan
24	EXOR	Consortia & organizations	Italy
25	AT&T	Telecom and IT	USA
26	Industrial and Commercial Bank of China	Financial services & insurance companies	China
27	Amerisourcebergen	Pharmaceuticals & life sciences	USA
28	Chevron	Energy & chemical	USA
29	Ping An	Financial services & insurance companies	China
30	Ford	Automotive	USA
31	China Construction Bank	Financial services & insurance companies	China
32	General Motors	Automotive	USA
33	Mitsubishi	Automotive	Japan
34	Honda	Automotive	Japan
35	Costco	Retail/e-tail	USA
36	Agricultural Bank of China	Financial services & insurance companies	China
37	Alphabet	Consortia & organizations	USA
38	Cardinal Health	Pharmaceuticals & life sciences	USA
39	SAIC Motor	Automotive	China
40	Walgreens Boots Alliance	Consortia & organizations	USA
41	JPMorgan Chase & Co	Financial services & insurance companies	USA

	Firm name	Industry sector	Country
42	Gazprom	Energy & chemical	Russian federation
43	Verizon	Telecom and IT	USA
44	Bank of China	Financial services & insurance companies	China
45	Allianz	Telecom and IT	Germany
46	XAX	Financial services & insurance companies	France
47	Kroger	Retail/e-tail	USA
48	General Electric	Consortia & organizations	USA
49	Freddie Mac	Financial services & insurance companies	USA
50	Lukoil	Energy & chemical	Russian federation
51	China Life	Financial services & insurance companies	China
52	Japan Post Holdings	Logistics & Mail	Japan
53	BMW Group	Automotive	Germany
54	Phillips 66	Energy & chemical	USA
55	China Railway Group	Sports, Leisure & travel	China
56	China Mobile Limited	Telecom and IT	China
57	Valero	Energy & chemical	USA
58	Bank of America	Financial services & insurance companies	USA
59	China Railway Construction	Construction & construction materials	China
60	Microsoft	Telecom and IT	USA
61	Huawei	Telecom and IT	China
62	The Home Depot	Retail/e-tail	USA
63	CNOOC	Energy & chemical	China
64	NTT Group	Telecom and IT	Japan
65	Itochu Corp	Consortia & organizations	Japan
66	Nissan Motor Company	Automotive	Japan
67	China Development Bank	Financial services & insurance companies	China
68	Boeing	Industrial products & services	USA
69	Wells Fargo	Financial services & insurance companies	USA
70	Siemens	Personal and household appli- ances	Germany
71	Citigroup	Financial services & insurance companies	USA
72	Marathon Petroleum	Energy & chemical	USA
73	SK Holdings	Energy & chemical	Korea
74	Petrobras	Energy & chemical	Brazil
75	ComCast	Telecom and IT	USA
76	Nestlé	Food & Beverage	Switzerland
77	Hewlett Packard (HP)	Technology, Computers, Office Equipment	USA
78	Uniper	Energy & chemical	Germany
79	Anthem	Professional services	USA
80	China Resources	Consortia & organizations	China
81	Carrefour	Retail/e-tail	France
82	PepsiCo	Food & Beverage	USA
83	ENI	Industrial products & services	USA
84	Dell Technologies	Telecom and IT	USA

	Firm name	Industry sector	Country
85	Santander	Financial services & insurance companies	Spain
86	Rosneft Oil	Energy & chemical	Russian federation
87	FedEx	Logistics & Mail	USA
88	Sinochem	Chemicals	China
89	Enel	Energy & chemical	Italy
90	T-Deutsche Telekom	Telecom and IT	Germany
91	Crédit Agricole	Financial services & insurance companies	France
92	Target	Retail/e-tail	USA
93	China Communications Construc- tion Company	Construction & construction materials	China
94	Hyundai	Automotive	Korea
95	PEMEX I	Energy & chemical	Mexico
96	Peugeot	Automotive	France
97	Pacific Construction Group	Construction & construction materials	USA
98	SoftBank	Telecom and IT	Japan
99	HSBC	Financial services & insurance companies	UK
100	DuPont	Industrial products & services	USA

Abbreviations

SDGs	Sustainable development goals
CSR	Corporate social responsibility
ROA	Return on assets
PtoB	Price-to book ratio
BIODIS	Total biodiversity and extinction disclosure score
LEV	Financial leverage
VIF	Variance inflation factor
OLS	Ordinary least squares

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Author contributions

I am the only author of this manuscript.

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Availability of data and materials

The datasets for the present study are available electronically and publicly.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

I am hereby giving acceptance for publication of my manuscript.

Competing interests

There are no competing interests.

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