

Sustainable Products and Audit Fees: Empirical Evidence from Western European Countries

Abstract

Purpose –The present study examines whether firms that appear to exhibit high sustainable outputs are more likely to pay higher audit fees than firms without such outputs.

Design/methodology/approach–The sustainability outputs are measured using a sustainable product portfolio consisting of four products: clean energy products (CEP), eco-design products (EDP), environmental products (EP) and sustainable building projects (SBP). The audit fee variable is measured by the natural logarithm of the total amount of audit fees. The study tests two models of the association between these outputs and audit fees; Model 1 tests this association in the absence of the moderating variable (sustainability committee) and Model 2 tests the association in the presence of the moderating variable.

Findings– An analysis of data on 261 European firms from the Refinitiv Eikon database from 2010 to 2019, shows that high sustainability outputs are significantly and positively associated with audit fees. More importantly, this association is moderated by the presence of a board-level sustainability committee, suggesting that this type of committee reflects a factor considered by auditors in their audit risk assessment practices. The findings indicate that in Model 1, one (EP) out of four variables has a significant and positive association with audit fees, while in Model 2 and in the presence of sustainability committee, two variables (EP and EDP) have a significant and negative association with audit fees. However, the robust analysis shows that three variables (EP, EDP and SBP) have significant and negative associations with audit fees.

Practical implications –The study findings have important implications for policy makers, auditors and firms’ managers. For policy makers, the findings provide support for the argument that sustainable attitudes incentive firms to manage sustainable product profiles more effectively. As such, policy makers should incentivise firms to establish a sustainability committee and regulate its role and responsibilities. Auditors should coordinate with the sustainability committee to facilitate audit efforts and reduce audit fees.

Social implications Understanding the relationship between sustainable products and audit fees will allow firms to improve their portfolio of sustainable products. In addition, other social implications of this study relate to improving relationships with society by establishing a sustainability committee that is responsible to communicate with that society.

Originality/value–The results support the argument that firms should manage sustainable product portfolios more effectively. In addition, the results of the study highlight the importance of a new variable as a moderator, the sustainability committee, which has not been examined before.

Keywords sustainable products, audit fees, sustainability committee, Western European countries

Paper type Research paper

1. Introduction

The present study investigated the association between sustainable products and audit fees and explored the debate about the implications for sustainable business strategies for creating long-term value for firms. The importance and urgency of sustainability-related matters have put pressure on firms to respond accordingly. Furthermore, recent studies have discussed the impact of sustainable practices on audit fees. For example, Rabarison et al. (2020) and Kim and Jung (2021) show that sustainability issues, such as environmental policy stringency and corporate social performance, have a significant impact on audit fees. Meanwhile, the accounting and auditing literature includes investigations of audit fees and their association with earnings management (Gandia and Huguet, 2021), audit quality (Moraes and Martinez, 2015), R&D (Liu and Ouyang, 2014), environmental policy (Rabarison et al., 2020), environmental administrative penalties (Xin et al., 2022), foreign institutional investors (Li et al., 2022) and corporate social responsibility (CSR) (Kim et al., 2020).

Xin et al. (2022) pointed out that current studies have discussed the impact of environmental matters on auditors' behaviours from the perspectives of corporate environmental information disclosure, environmental responsibility and environmental regulation. According to Haleem et al. (2022), the broader social concerns of sustainability, stakeholder pressures and the demand for reliable information have changed significantly in recent years, and firms are must to respond to these changes. Researchers have also examined the relationship between sustainable performance and audit pricing. For example, Rabarison et al. (2020) explored the effect of environmental policy stringency on audit pricing. Kim and Jung (2021) studied the relationship between corporate social performance and audit hours. Aprianti et al. (2021) examined the effect of audit committee characteristics on the quality of sustainability reports. Xin et al. (2022) investigated the association between environmental administrative penalties and audit fees.

To respond to the transition towards a sustainable society, most companies have started to produce sustainable products because of the widespread consumer acceptance of purchasing these products. Despite the importance of these products to companies and consumers, their various impacts have not been carefully studied in the area of sustainability accounting. However, to the best of our knowledge, the relationship between sustainable products and audit fees has yet to be explored. The present study aims to fill this gap by examining the relationship between sustainable product portfolios and audit fees in selected Western European countries.

This study contributes to the literature in several ways. First, it addresses a gap in the literature by examining the effects of sustainable products on audit fees. Furthermore, although sustainable products can have positive effects, such as improving the reputation of firms in society, and negative effects, such as increasing firms' costs in the form of audit fees, most studies have focused on the former and paid little attention to the latter. Second, this study contributes to prior studies on the association between sustainability issues and audit fees by investigating the moderating role of a sustainability committee in this relationship. Many Western European countries firms have established this type of committee to coordinate between the board of directors and society. The results of the study highlight the importance of a new variable as a moderator, the sustainability committee, which has not been examined before. Third, the sample used in the present study covers a more recent time period (2010–2019) than other studies. For example, Zhao (2017), Rabarison et al. (2020) and Kim and Jung (2021) examined data from 2000–2008, 2000–2012 and 2011–2016, respectively. The time period of the present study is especially relevant because Western European countries firms have adopted sustainable practices in recent years that should be further researched.

Sustainable outputs are important tools for communicating sustainability efforts and effective governance to stakeholders. For example, governance and politics are central to understanding, analysing and shaping transformations towards sustainability (Hojnik et al., 2019). Sustainable products are the outputs of sustainability policies that respond to the environmental, social, sustainability and economic vision. Silvius and Schipper (2015) pointed out that firms have shown an interest in including environmental, social and economic perspectives in their product portfolios. Villamil and Hallstedt (2018) asserted that the product portfolio of a firm that has a sustainability plan should include sustainable products, such as green, organic, renewable, clean energy and eco-design products. Companies are motivated to add sustainable products to their portfolios for several reasons. First, such products reflect the strategic sustainability perspective adopted by firms (Hallstedt and Isaksson, 2017). Second, studies (e.g. Lassala et al., 2017; Hongming et al., 2020; Zhou et al., 2022) have identified a positive relationship between the sustainability perspective of a firm, such as social and environmental performance, environmental, social and governance and sustainable financial reporting and performance, indicating that improved financial performance is likely to motivate companies to include sustainable products in their portfolios. Third, Hanss and Böhm (2012) found that customers reward firms that have sustainable products by focusing on packaging recyclability, fair payments to producers, low energy use and low carbon dioxide emissions during production and shipping. Fourth and more importantly, Schulte et al. (2020) argued that the transition to sustainable business practices is inevitable, but it brings new risks to the firms. Also, Schulte and Knuts (2022) pointed out that sustainable products as part of the transition to a sustainable society require drastic changes in all areas of the firms; it involves extensive uncertainties and risks. Therefore, managing the sustainable risks is an important aspect that needs to be considered. Villamil and Hallstedt (2020) and Majumdar et al., (2021) asserted that the firms are seriously considering the sustainability risk by adopting some strategies to moderate and manage the risk. One of these strategies is to produce sustainable and environmentally friendly products within the product portfolio. Villamil and Hallstedt, (2018) argued that the portfolio of sustainable products could bring additional benefits to the firms through a systematic approach to implement sustainability in their product portfolio. Jugend et al. (2017) argued that the sustainable products portfolio reduces business risk by improving sustainability performance and firm performance in general and Landi et al. (2022) argued that firms with high commitment to their society need to increase social value by creating value-added products and services that meet social needs, such as sustainable products, in order to reduce the risk and improve the firm's reputation in that society.

Western European countries have shown increasing interest in and commitment to sustainability and sustainable development. Czupich et al. (2022) indicated that EU countries have committed to reducing greenhouse gas emissions and fossil fuel consumption. In addition, they have more interest in quality of life and higher environmental rankings than cities on other continents. Matschoss et al. (2019) asserted that EU countries have made great efforts towards sustainable development and that their citizens appreciate issues related to sustainability. In fact, EU citizens have recently become more interested in sustainable products. Bergmann and Posch (2018) found that large German firms are interested in mandatory sustainability reporting. In addition, most Western European countries, including Germany, France, Austria and the Netherlands, had the highest scores in the Eco-innovation index in 2021, indicating that they had transitioned more towards sustainability than other countries. Chiripuci et al. (2022) found that European customers showed more interest in consuming organic products as a model of sustainable food consumption, which gives incentives for huge investments in organic food.

Malatinec (2019) found that European customers had a positive attitude towards green products made by Western European countries firms. Statistics related to sustainable products support this direction toward sustainability aspects. For example, European Commission statistics revealed a 319% increase in the growth rate of these products from 2010 to 2022 as well as a 27.6% increase in food innovation in EU countries in 2019, indicating increased investments in such products.

The present study aimed to investigate the association between sustainable product portfolios and audit fees in Austria, Germany, France, the Netherlands, Switzerland and Belgium from 2010 to 2019. It also aimed to examine whether firms that appear to exhibit high sustainability outputs are more likely to pay high audit fees. The findings revealed a significant positive association between sustainable products and audit fees, In addition, the presence of a sustainability committee was found to moderate the relationship between sustainable products and audit fees. Furthermore, the findings indicated that the impact of sustainable products on audit fees was driven by greater audit efforts rather than higher audit risk. A sustainable product portfolio increases audit effort and thus audit fees; however, this portfolio may reduce business and audit risks associated with the company's sustainability orientation. Therefore, auditors should coordinate with sustainability committees to reduce audit effort and audit fees.

The rest of this paper is organised as follows. Section 2 describes the literature review and the development of the research hypotheses. Section 3 discusses the data, the measurement of the variables and the empirical models used in the study. Section 4 presents the results, and Section 5 provides conclusions, recommendations and suggestions for future research.

2. Literature review and hypothesis development

2.1. Audit fees

Audit fees refer to remunerations obtained by audit firms for providing professional assurance services (Ye, 2020). According to Pul and Fallah (2021), audit fees include any amount paid to external auditors for the provision of audit services in accordance with the agreement or contract between the auditor and the client. The main issue for the auditor is the establishment of reasonable audit fees that cover the cost of the audit, ensure effective and acceptable work performance and increase the demand for this service.

According to Shakhatareh et al. (2020), clients pay more attention to audit fees than other costs due to the invisible benefits they receive from auditors. Meanwhile, Musah (2017) stated that clients pay more attention to audit fees because the service is hardly visible, and they do not recognise the benefits, unlike those of tangible products. It is evident that the audit service adds value to financial statements, and clients expect their audited financial statements to have a high level of quality. Since the work of Abdel-Khalik (1993), Vanstraelen and Schelleman (2017) pointed out that studies on the demand and supply for auditing have concluded that the value of auditing is greater than its cost.

Studies have also provided justification for the value of audit fees. For example, Shahzad et al. (2019) found that Big 4 audit firms provide a higher quality of audited financial reporting that enhances investment efficiency. Meanwhile, Hsiao et al. (2012) found no relationship between audit fees and the independence impairment of the auditor, and it will not lead to fraudulent financial reporting. Jerry and Saidu (2018) found that auditing enhanced financial reporting quality and was more related to auditor size.

2.2. Sustainable product portfolios and audit fees

Given the growing interest in the relationship between companies and society, a stream of research has discussed the impact of sustainability and social and environmental performance on audit fees. Zhao (2017) found that the voluntary assurance of sustainability reporting has an impact on audit fees. Carey et al. (2017) examined the relationship between CSR reporting and audit fees. Al-Shaer (2020) investigated the association between sustainability reporting quality and financial reporting quality and the moderating effect of audit effort, as measured by audit fees. Rabarison et al. (2020) observed that strengthening environmental policy can reduce audit fees. Xin et al. (2022) found that environmental administrative penalties can increase audit fees. The aforementioned studies all concluded that audit fees are influenced by audit firm and client characteristics. Although recent studies have also explored the influence of sustainability and environmental characteristics, these factors have not been fully explored in the literature.

In the present study, we expected that firms with more sustainable products would have higher audit fees than those with relatively non-sustainable products due to several strong factors associated with business risk and audit efforts. While previous studies have primarily examined the impact of sustainability and environmental issues such as green policy implementation (Wu et al., 2023), environmental regulatory violations (Yao et al., 2023), and climate-related risks (Yang et al., 2023) on audit implementation, this study expands on that by analyzing how the sustainable product portfolio affects audit fees. Sustainable products provide new opportunities for companies to pursue sustainable development, as many companies seek to achieve sustainability goals by producing sustainable products, which significantly affect their operations and financial position. The financial changes of producing such products have a direct impact on the scope of audit services and the fees paid to audit firms. In this regard, auditors are confronted with new responsibilities that include assessing the risk of investing in these products, the policies the company has used to develop these products, and the economic results of selling such products. The new responsibilities have two related aspects: increasing the audit effort and increasing the business risk. The auditors face such situations when the firms adopt an innovation and sustainability policy leading to greater complexity in the work of auditors. Kim et al. (2019) and Datta et al. (2019) asserted that the innovation process requires greater audit efforts. Xiao et al. (2020) pointed out that audit efforts increase because the auditor performs audit adjustments due to the detection of material misstatements. Al-Shaer (2020) finds that the sustainability reporting quality reduces the information asymmetry and improves the decision-making process. However, the sustainability information disclosed in these reports will increase the audit effort and then audit fees. Lee and Ha (2021) found that, after a client discloses fraudulent activities, audit fees significantly increase due to an increase in audit hours. Thus, increases in audit adjustments, material misstatements, innovation processes and fraudulent activities lead to increases in business risks, and the auditor increases audit efforts to moderate or respond to business risks. Wu et al., (2023) pointed out that when auditors face complex tasks, they will increase audit efforts to compensate the cost of audit by charging higher audit fees.

Business risk is one of the most important factors affecting audit efforts. In general, the higher the business risk, the higher the audit risk and the higher the auditor's response to the business risk through an increase in audit efforts. Qian et al., (2022) find that the implementation of the green credit policy increases audit fees because the auditors can perceive the risks imposed by this policy on heavily polluting firms. Yang et al., (2023) find that climate-related risks can significantly raise audit fees. This is because the auditors consider a client's climate risk exposure when evaluating inherent and control risks and determine the extent of audit effort required to reduce detection risk, and thus overall audit risk. Yao et al., (2023) find that auditors tend to increase audit fees after

client firms have violated environmental regulations or have been punished for such violations. This is because the auditor focuses on auditing the financial restatement and earnings management as the potential areas for such violations.

The present study contributes to this discussion by showing that sustainable products contribute to business risk for two reasons. First, sustainability in terms of the green innovation process leads to four types of business risk: R&D, manufacturing, marketing and services risks (Sun et al., 2020); auditors should respond to these risks by increasing audit efforts. Second, most sustainable products, including green, organic, renewable, clean energy and eco-design products, are outputs of innovation processes that lead to increased innovation risk. Innovation is a complex process that involves many uncertainties and creates a high level of risk, which makes the work of auditors difficult and requires more audit efforts (Lobo et al., 2018). According to Brones et al. (2013), firms that include sustainable products in their portfolios might experience a high level of complexity.

Meanwhile, auditors respond to business risk by employing more staff, using experts and technologies and collecting and evaluating more audit evidence. *As firms strive to integrate sustainability issues into their regular operations by offering sustainable products, auditors are faced with new responsibilities, including assessing sustainable performance, providing assurance on disclosures, and addressing challenges related to earnings management. When faced with such responsibilities, the auditor will increase audit effort by performing more specialized audit procedures and will seek to offset audit costs by charging higher audit fees. In particular, the increasing diversity of sustainable products could lead to greater complexity in the work of auditors. More and more sustainable products lead to greater investment by auditors in research and development, innovation and green innovation efforts, which in turn lead to higher audit fees. Auditors may face challenges due to a lack of experience when they audit firms which have more investments in environmental and sustainable products. Therefore, to compensate for potential losses, auditors will charge higher audit fees for firms with such investments as the auditors need to put more effort into addressing the increased business complexity, auditor insufficient experience, audit costs and audit litigation risk.* In addition, auditors may experience an opportunity cost if spending more time on one client leads them to lose another. Given the link between sustainable products and both business risk and audit effort, auditors may charge high fees to audit these products because the auditor's opinion is an important tool for stakeholders who need this opinion to increase the reliability of financial reporting. Auditors send a clear signal to stakeholders that the quality of sustainability reporting is high and that there is no earnings management risk associated with such reporting. In order to do this, auditors need to gain knowledge of sustainability products, either through an existing specialist team or by communicating with sustainability experts, which may increase audit fees. When companies tend to produce sustainable and environmental products, the impact on shareholder wealth should be considered, as investing in such products may be inconsistent with the shareholder's goal of maximizing wealth. As a result, managers tend to overlook such costly investment strategies at the expense of the welfare of non-shareholder stakeholders and the long-term benefits of the firms. Therefore, both shareholders and managers may require the services of an auditor to ensure that the costs of investing in sustainable products are justified, that the products are profitable, and that

sustainability goals are achieved. Accordingly, high audit fees may be required to compensate for the audit effort and business risk. Therefore, Hypothesis 1 (H1) was developed as follows:

H1: Introducing various sustainable products within a product portfolio leads to increased audit efforts in terms of audit fees.

2.3. The moderating role of the sustainability committee

Firms interested in sustainable and environmental issues adopt different regulatory policies, such as strict environmental regulations (Rabarison et al., 2020), environmental administrative penalties (Xin et al., 2022) and the formation of a sustainability committee (del Valle et al., 2019). The relationship between strict environmental regulations, environmental administrative penalties and audit fees has been examined in the literature. However, the moderating role of a sustainability committee on the association between sustainable products and audit fees has not yet been studied.

Many large, leading European firms have established sustainability committees consisting of a small group of directors who aim to orientate decisions based on sustainability indexes, lead socially responsible policies and ensure that the firm is included in sustainability indexes (Mackenzie, 2007). Such committees play an important role in decision making regarding sustainability issues; the fulfilment of responsibilities to shareholders with regard to sustainable growth-related policies and practices; and management's formulation and implementation of policies, principles and practices to achieve sustainable development (del Valle et al., 2019).

Sustainability committees help manage environmental and sustainable risks, which leads to long-term success, a good firm reputation, better environmental performance and financial stability. Yan et al. (2022) found that CSR, a dimension of sustainability, had a positive effect on a firm's reputation and posited that an increase in customer loyalty likely leads to a decrease in business. Jarboui et al. (2022) found a positive association between firms' social performance and the presence of a sustainability committee operating through a corporate board. They asserted that a sustainability committee represents a useful corporate governance mechanism that adds value to a firm and plays an important role in improving the transparency of financial reporting and reducing business risk when sustainability information is presented in financial reports. Rabarison et al. (2020) found that better sustainability management (through a sustainability committee) significantly reduced systematic risk and improved reporting quality and profoundly influence auditors' assessments of clients' business risks. It is expected that a sustainability committee will improve communication between the management of the firm and the auditor, which may lead to the detection and correction of more misstatements and reduced audit risk. Therefore, Hypothesis 2 (H2) was developed as follows:

H2: Better sustainability management through a sustainability committee moderates the relationship between sustainable products and audit fees.

3. Research method

3.1. Sample selection

To achieve the objectives of the present study, we conducted quantitative cross-country research on leading companies operating in Austria, Belgium, France, Germany, the Netherlands and Switzerland, Liechtenstein, Luxembourg and Monaco. Based on the M49 coding classification, the United Nations Statistics Division (UNSD) devised a geoscheme to divide the 249 countries and territories in the world into six regional and 17 sub-regional countries for statistical analysis purposes. In this study, we excluded Liechtenstein, Luxembourg and Monaco due to missing data,

especially regarding audit fees and sustainable products. We focused on this region because of its rather high innovation levels in terms of new technology and investments, as evident in Eco-innovation index, Organisation for Economic Co-operation and Development (OECD) and Sustainable Development Goal (SDG) performance indicators.

We constructed an initial sample consisting of firm-year observations of 483 industrial and energy firms from the Refinitiv Eikon database for the fiscal years from 2010 to 2019. After excluding 222 firms due to missing data, the final sample contained 261 firms (54% of the initial sample) and 2,610 firm-year observations. However, the percentage of missing data is high (46%). The reason for this is due to the unavailability of these data for most of the research variables. The percentage of completed data for the research variables is different, and we took the minimum amount of completed data to ensure the accuracy of the statistical analysis of the research and to obtain reasonable results. For example, the percentage of completed data for the independent variable EP was 60% of the total data, while the percentage of completed data for the independent variable CEP was 54%. On the other hand, the percentage of completed data of the control variables was high, reaching about 80% of the total available data. Therefore, the study dropped all firms that don't have completed data. Table 1 summarises the sample used in the study.

Table 1. Sample by firms and country

Country	Industrial and Energy Firms	
	No.	%
Austria	13	5%
Belgium	8	3%
France	82	31%
Germany	75	29%
Netherlands	28	11%
Switzerland	55	21%
Total	261	100%

The sampled firms have long experience in the sector as their product profile includes normal product as well as sustainable products. There are many examples of the normal products that they produce such as construction materials, electrical circuits and wires, automobiles, production systems and other machinery. However, these companies show more interest in sustainable and environmental products as they support their global customers to improve efficiency and sustainability.

3.2. Variable measurement

The dependent variable, audit fees (LOGAF), was measured by the natural logarithm of the total amount of audit fees paid by the firms. The independent variables were four types of sustainable products: clean energy products (CEP), eco-design products (EDP), environmental products (EP) and sustainable building projects (SBP). These four variables were measured using binary variables, where a dummy score of 1 was assigned if a product existed, and a score of 0 was used otherwise.

We controlled for variables in accordance with prior studies (e.g. Xin et al., 2022; Rabarison et al., 2020; Al-Shaer, 2020; Silva et al., 2020). Since the literature indicates that auditor size may affect the level of audit fees (Balsam et al., 2003; Cabal-Garc_1a et al., 2019; Cano, 2007), we included a variable, BIG 4, to account for the size of the auditor. A score of 1 was assigned for companies that used a Big 4 auditor, and 0 was used otherwise. Firm size (TA) was measured by

the natural logarithm of total assets (Huguet and Gandia, 2016; Kim et al., 2003; Van Tendeloo and Vanstraelen, 2008). We also controlled for profitability, as measured by return on assets (ROA). To account for the financial soundness of a company, we included two control variables: leverage (LEV), as measured by the ratio of total liabilities to total equity (Becker et al., 1998; Reynolds and Francis, 2000), and firm age, as measured by the natural logarithm of the year since the establishment of the firm. **To control for business complexity, we use number of subsidiaries owned by the firm (Musa et al., 2021; Silva et al., 2020). Finally, we control for assets that require specific audit procedures as measured by the natural logarithm of the inventory and receivables divided by natural logarithm of total assets (Krishnagopal et al., 2001; Ye, 2020; Liu, 2017) and current liquidity as measured by cash and cash equivalents divided by total assets (Krishnan et al., 2015).** We included a moderator variable, sustainability committee, in the empirical model; the dummy variable had a value of 1 if there was a sustainability committee on the board and 0 otherwise. Table 2 contains the definitions of the variables.

Table 2. Definition of variables

Variable	Independent Variables	
Clean Energy Product	CEP	Dummy score of “1” if a product is there and “0” if otherwise
Eco-Design Product	EDP	Dummy score of “1” if a product is there and “0” if otherwise
Environmental Product	EP	Dummy score of “1” if a product is there and “0” if otherwise
Sustainable Building Project	SBP	Dummy score of “1” if a product is there and “0” if otherwise
		Dependent Variable
Audit Fees	LOGAF	Natural logarithm of the total amount of audit fees
		Moderator Variable
Sustainability Committee	SUCOM	Dummy score of “1” if a committee is there and “0” if otherwise
		Control Variables
Age of the firm	AGE	Natural logarithm of number of years
Leverage	LEV	Total liabilities/ equity
Firm Size	TA	Natural logarithm of total assets
Profitability	ROA	Return on Assets
Auditor Size	BIG4	Dummy score of “1” if auditor is BIG-4 and “0” if otherwise
Complexity	COMP	Natural logarithm of number of subsidiaries.
Assets need specific audit procedures	ASST	Natural logarithm of inventory and receivables /total assets
Liquidity Assets	LASST	Natural logarithm of liquidity assets /total assets

3.3. Model specification

Cross-sectional and time series panel data were used simultaneously to address multicollinearity issues, increase the parameters and handle the degree of freedom (Hsiao, 2007; De Hoyos and Sarafidis, 2006). The heterogeneity of a large set of observations is managed by panel data (Baltagi, 2005). Panel data were created for the two study models to diagnose audit fees. Panel least squares (PLS) was used as the basic estimator by ignoring the possible group structure of the data as well as time and individual trends; therefore, all data trends were the same in the various periods of study. Since the panel data model is known to suffer from heterogeneity problems (Wooldridge, 2010), fixed effect (FE) and random effect (RE) estimators, which can adapt to and accommodate the differences between individuals in different intercepts, were employed. The FE estimator was selected for both study models based on the Hausman estimator results (Johnston and Dinardo, 1997). In addition, since Model 1 of LOGAF showed cross-sectional dependence (Hoechle, 2007), FE regression with Driscoll-Kraay standard errors (FERDKSE) was used.

Diagnostic tests, including the Wooldridge test for autocorrelation, the modified Wald test for group wise heteroskedasticity, Pesaran's test of cross-sectional independence and the Breusch-Pagan LM test of independence, were also used.

To increase robustness and confirm that there was no serial correlation or heteroskedasticity in either model, the feasible general least squares (FGLS) regression estimator was used to eliminate cross-sectional and serial correlation bias. This was managed by proposing a high-dimensional error covariance matrix estimator (Romano and Wolf, 2017) to measure the coefficients and the covariance matrix under multiple linear regressions. Meanwhile, since low-dimensional settings usually reflect the inverse covariance matrix, this matrix was sufficient for the first-order asymptotic theory (Newey and McFadden 1994). Accordingly, the panel dynamic estimation of the one step difference Generalized Method of Moments (D-GMM) estimator was used to solve the problem of endogeneity issue of panel data. Blundell and Bond (1999) indicated that the one-step difference GMM is an appropriate estimator when the levels are not stationary; the differences are used as instruments in such cases. These instruments depend on the correlation between the variables, and we used first differences as instruments to avoid weak instrument problems. The one step D- GMM estimates the first differences of the error term by using moment conditions. The use of the one step D-GMM estimator is beneficial here as it takes the second-order difference as an instrumental variable to estimate lagged variables and eliminate serial correlation and heteroscedasticity in the model of the study by differencing the moment conditions, which help to mitigate the effects of model misspecification (Baltagi, 2005).

The study uses the model below to estimate the impact of sustainable products portfolio consisting of 4 products, CEP, EDP, EP, and SBP on audit fees (LOGAF).

$$\begin{aligned} LOGAF_{it} = & \alpha + \beta_1 CEP_{it} + \beta_2 EDP_{it} + \beta_3 EP_{it} + \beta_4 SBP_{it} + \beta_5 AGE_{it} + \beta_6 LEV_{it} + \beta_7 TA_{it} \\ & + \beta_8 ROA_{it} + \beta_9 BIG4_{it} + \beta_{10} COMP_{it} + \beta_{11} ASST_{it} + \beta_{12} LASST_{it} \\ & + \epsilon_{it} \end{aligned} \quad (1)$$

$$\begin{aligned} LOGAF_{it} = & \alpha + \beta_1 CEP_{it} + \beta_2 EDP_{it} + \beta_3 EP_{it} + \beta_4 SBP_{it} + \beta_5 CEP_{it} * SUCOM_{it} + \beta_6 EDP_{it} \\ & * SUCOM_{it} + \beta_7 EP_{it} * SUCOM_{it} + \beta_8 SBP_{it} * SUCOM_{it} + \beta_9 AGE_{it} \\ & + \beta_{10} LEV_{it} + \beta_{11} TA_{it} + \beta_{12} ROA_{it} + \beta_{13} BIG4_{it} + \beta_{10} COMP_{it} + \beta_{11} ASST_{it} \\ & + \beta_{12} LASST_{it} + \epsilon_{it} \end{aligned} \quad (2)$$

The interaction terms $CEP_{it} * SUCOM_{it}$, $EDP_{it} * SUCOM_{it}$, $EP_{it} * SUCOM_{it}$ and $SBP_{it} * SUCOM_{it}$ capture the role of sustainability committee in the association between audit fees and sustainable products portfolio.

Note:

β = coefficient

α = constant

i = firm

t = year

ϵ = residual error

3.4. Descriptive statistics

Table 3 presents the descriptive statistics of the variables used in the study. Regarding the dependent variable, the mean AF (Log) value was 5.69, which is equal to 489,779 euros,

suggesting that, on average, firms paid high audit fees, and auditor efforts were high. Regarding the independent variables, the mean CEP, EDP, EP and SBP values were 0.28, 0.28, 0.59 and 0.08, respectively, indicating that companies operating in Western European countries had various sustainable products and considered sustainability in their strategies and when developing products. The mean SUCOM value was 0.5, indicating that half of the studied firms had a sustainability committee operating on the board to coordinate sustainability matters. Regarding the control variables, the mean firm age value of 1.79, which is equivalent to 63 years, indicated that the firms had good experience. The mean BIG4 value was 0.50, indicating that 50% of the firms hired Big 4 auditors to enhance the quality of financial reporting. The high mean leverage value (0.98) indicated that a large proportion of the firms' assets were financed by debt, as this ratio implies that the firms depended heavily on debt and had little equity. The mean firm size value was 8.64, which is equivalent to 436,515,832 euros. The low mean ROA value of around 4% suggested that firm profitability was low during the studied period. The mean value of complexity was 1.15 which indicates that all firms in the sample have at least one subsidiary. The mean of inventory and receivable is 0.89 suggested that such assets need specific audit procedures. **The mean of liquidity assets is 0.85 which is near of the mean of inventory and receivable.**

Table 3. Descriptive statistics

Variables	N	Min	Max	Mean	SD	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
LOGAF	261	3.70	7.59	5.69	0.68	0.12	0.17	0.32	0.33
CEP	261	0.00	1.00	0.28	0.45	1.00	0.15	-1.002	0.30
EDP	261	0.00	1.00	0.28	0.45	0.98	0.15	-1.05	0.30
EP	261	0.00	1.00	0.59	0.49	-0.36	0.15	-1.88	0.30
SBP	261	0.00	1.00	0.08	0.28	3.06	0.17	7.42	0.34
AGE	261	1.52	1.93	1.79	0.06	-0.90	0.19	1.82	0.37
BIG4	261	0.00	1.00	0.50	0.51	0.008	0.15	-2.02	0.30
LEV	261	0.00	15.06	0.98	1.71	5.33	0.15	35.72	0.31
ROA	261	-0.72	0.56	0.04	0.10	-1.86	0.17	21.40	0.35
TA	261	5.87	11.32	8.64	1.07	-0.19	0.16	-0.21	0.31
COMP	261	0.00	2.64	1.15	0.65	0.016	0.16	-0.61	0.33
ASST	261	0.00	1.02	0.87	0.21	-0.346	0.16	2.55	0.33
LASST	261	0.43	1.30	0.85	0.16	-0.039	0.16	0.06	0.33
SUCOM	261	0.00	1.00	0.50	0.50	0.00	0.16	-2.02	0.33

3.5. Correlation matrix

As shown in Table 4, the correlation matrix between the study variables revealed a significant positive relationship between LOGAF and EP, indicating that this type of sustainable product required more audit efforts; there was no significant relationship between the other sustainable products (CEP, EDP and SBP). Regarding the control variables, there was no significant relationship between AGE and LOGAF or ROA and LOGAF. However, BIG4, firm size, complexity, ASST and leverage each had a significant positive association with LOGAF, indicating that large and risky firms and firms audited by Big 4 auditors which have high level of complexity had high audit fees. **LASST has a significant negative association with LOGAF indicating that increase cash and cash equivalents will reduce audit fees as they did not require high audit effort.** Finally, there was an insignificant association between SUCOM and LOGAF.

Table 4. Correlation matrix between the variables

	LOGAF	CEP	EDP	EP	SBP	AGE	BIG4	LEV	ROA	TA	COMP	ASST	LASST	SUCOM
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LOGAF	1													
CEP	-0.023	1												
EDP	0.018	0.034	1											
EP	0.632**	0.028	-0.034	1										
SBP	-0.051	-0.021	0.080	0.052	1									
AGE	-0.056	-0.076	0.004	-0.060	0.016	1								
BIG4	0.490**	-0.138*	-0.015	0.092	0.107	-0.155*	1							
LEV	0.169*	0.001	0.032	-0.070	0.082	0.079	0.035	1						
ROA	-0.102	0.029	-0.014	0.114	-0.036	-0.103	0.004	-0.128	1					
TA	0.162**	-0.111	-0.047	0.099	0.025	0.093	0.072	0.092	-0.007	1				
COMP	0.198**	-0.017	0.043	0.164**	0.098	-0.050	0.124***	0.052	-0.122	0.083	1			
ASST	0.238**	0.063	-0.042	0.045	0.037	-0.098	-0.035	-0.214**	-	0.573**	0.726**	-0.012	1	
LASST	-0.286**	0.102	0.059	0.003	0.007	0.043	-0.036	-0.043	0.005	-0.513**	0.064	0.309**	1	
SUCOM	-0.082	-0.021	0.121	0.121	0.047	-0.061	-0.033	0.002	0.007	0.072	0.022	-0.008	0.029	1

4. Results and related discussions

4.1. Baseline analysis

Table 5 shows the PLS, FE and FGLS estimator results for the two models. In Model 1, the PLS regression results indicated that EP (0.164) had a significant positive effect on audit fees (LOGAF) at the 10% level. In Model 2, EP shows a significant positive effect on audit fees (LOGAF) as the coefficient is (0.175) at the 10% level. In addition, EP*SUCOM (0.187) and EDP*SUCOM (-0.244) had a significant negative effect on LOGAF at the 10% level. These results indicated that SUCOM had a moderating effect on the association between audit fees and sustainable products (EP and EDP) by reducing LOGAF. However, both CEP and SBP did not show any significant effect on LOGAF.

Hausman test was conducted to choose between FE and RE. The result of this test indicates that FE should be used as Hausman test Prob>chi2 is 0.000 which is less than 0.05. The FE results for Model 1 indicated that EP (0.164) had a significant positive effect on LOGAF at the 5% level. In Model 2, EP (0.175) had a significant positive effect on LOGAF at the 10% level but in the presence of SUCOM, EP and EDP moderated by SUCOM had a significant negative effect on LOGAF, indicating that SUCOM played a moderated role in the relationship between EP, EDP and LOGAF at 10% as the presence of a sustainability committee led to decrease in LOGAF. In both models, CEP and SBP did not show any significant effect on LOGAF.

In addition, the FGLS test was used to overcome the problems of heteroskedasticity and serial correlation in the two models. The results for Model 1 confirmed all of the PLS and FE results, indicating that EP (0.181) had a significant positive effect on LOGAF. However, FGLS improved the level of significance, as the first hypothesis was accepted at the 5% level but not at the 1% level. In Model 2, the results indicated that SUCOM played a moderating role by reducing LOGAF as both EDP and EP moderated by SUCOM had a significant negative effect on LOGAF at 10% and 5% respectively.

The control variable results were consistent for all study estimators. TA and ASST had a significant and positive effect on LOGAF for Models 1 and 2. The results indicated that the larger the size of the firm in terms of assets and assets need specific audit procedures, the higher the

audit fees, as auditors may spend more time and effort on audits for larger firms and thus charge higher fees. Complexity (COMP) had a significant and negative effect on LOGAF for Models 1 and 2. The results indicate that low audit fees are required when the firm has task complexity, as the firms that have more subsidiaries are less complex to audit than the firms that have fewer subsidiaries. In addition, the level of risk of such firms is lower and auditors may spend less time and effort in auditing such firms and thus charge lower fees. In Models 1 and 2, ROA had a significant negative effect on LOGAF for all estimators at the 10% and 5% level respectively, indicating that less financially healthy firms have lower audit fees because auditors expect more earnings management. In Model 2, AGE had a significant negative effect on LOGAF for all estimators at the 1% level, indicating that the SUCOM played a moderating role by reducing LOGAF for newer aged firms. Liquidity assets (LASST) had a significant and negative effect on LOGAF for Models 1 and 2 at 1% level and for all estimators. The results indicate that low audit fees are required when the liquidity assets are increased as they do not require more audit effort and thus charge lower fees. The other control variables (LEV and BIG4) had insignificant effects on LOGAF at the 1%, 5% and 10% levels.

Table 5: Panel least squares, fixed effect, and feasible generalised least squares regression results

VARIABLES	Panel Least Squares		Fixed Effect		Feasible Generalized Least Squares	
	Model 1 LOGAF	Model 2 LOGAF	Model 1 LOGAF	Model 2 LOGAF	Model 1 LOGAF	Model 2 LOGAF
CEP	0.110 (0.300)	0.088 (0.558)	0.115 (0.207)	0.069 (0.638)	0.048 (0.607)	0.119 (0.673)
EDP	-0.016 (0.150)	-0.123 (0.439)	-0.055 (0.870)	-0.115 (0.396)	-0.055 (0.533)	-0.096 (0.523)
EP	0.164*** (0.061)	0.175*** (0.093)	0.164* (0.038)	0.175*** (0.089)	0.181* (0.026)	0.189* (0.036)
SBP	-0.020 (0.524)	-0.087 (0.720)	-0.025 (0.878)	-0.088 (0.720)	-0.061 (0.697)	-0.015 (0.536)
CEP*SUCOM	-	-0.070 (0.748)	-	-0.071 (0.784)	-	-0.071 (0.724)
EDP*SUCOM	-	-0.244*** (0.062)	-	-0.236*** (0.058)	-	-0.193*** (0.061)
EP*SUCOM	-	-0.187*** (0.078)	-	-0.187*** (0.079)	-	-0.211* (0.021)
SBP*SUCOM	-	-0.101 (0.693)	-	-0.086 (0.820)	-	-0.086 (0.802)
AGE	-0.691 (0.290)	-1.741** (0.003)	-0.855 (0.151)	-0.729** (0.003)	-0.798 (0.195)	-0.727** (0.003)
BIG4	-0.013 (0.880)	-0.026 (0.762)	-0.017 (0.982)	-0.026 (0.761)	-0.013 (0.871)	-0.081 (0.838)
TA	0.543** (0.000)	0.551** (0.000)	0.554** (0.000)	0.431** (0.000)	0.573** (0.000)	0.574** (0.000)
LEV	0.024 (0.553)	0.021 (0.603)	0.017 (0.641)	0.025 (0.542)	0.024 (0.524)	0.021 (0.583)
ROA	-0.576*** (0.071)	-0.730* (0.037)	-0.576*** (0.098)	-0.730* (0.035)	-0.576*** (0.076)	-0.590*** (0.071)
COMP	-0.188** 0.000	-0.185** 0.010	-0.182** (0.007)	-0.157* (0.004)	-0.182** (0.005)	-0.191** (0.003)
ASST	0.586**	0.485**	0.489**	0.487**	0.536**	0.576**

	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LASST	-0.115**	-0.116**	-0.109**	-0.107**	-0.115**	-0.116**
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Constant	2.48*	2.79*	2.45*	2.18*	2.38**	2.69*
	(0.035)	(0.014)	(0.013)	(0.015)	(0.012)	(0.011)
Observations	261	261	261	261	261	261
R-squared	0.6245	0.691	0.6290	0.637		
F- Value	10.87	15.58	11.87	15.56		
Prob. F	0.000	0.000	0.000	0.000		
Wald chi2(10)					149.52	151.30
Prob > chi2					0.000	0.000
Panels:					homoskedastic	homoskedastic
Correlation					no autocorrelation	no autocorrelation
Hausman test Prob>chi2			0.000	0.000		
Breusch-Pagan LM test of independence: chi2(3)-Prob.						
Panel cross section heteroskedastici ty LR test.	5.82	5.63				
Prob.	0.428	0.425				
Wooldridge test for autocorrelation – Prob			0.239	0.183		
Note: The significance levels refer to $p < 0.01$ (**), $p < 0.05$ (*) and $p < 0.1$ (***)						

4.2. Dynamic One-Step Difference Generalized Method of Moments (D-GMM)

The one-step (D-GMM) estimator was used to solve the problem of the endogeneity issue of panel data. The endogeneity problem arises when explanatory variables in a statistical model are correlated with the error term against the standard assumption of exogeneity this situation leads to disturbances in the model. In other words, if there is a causal two-way relationship between the dependent variable and one or more of the independent variables.

As shown in Table 6, the D-GMM results indicated that the EDP, SBP, TA, EP and BIG4 coefficients were positive and significant at the 1% and 5% levels for Model 1 respectively. Meanwhile, the D-GMM results indicated that the ROA, AGE and LASST coefficients were negative and significant at the 1% level for Model 1. According to the one-step D-GMM results for Model 1, three sustainable products (EP, EDP, and SBP) had significant positive effects on LOGAF, indicating that these products increased audit efforts and, in turn, increased audit fees. In Model 2, the D-GMM results indicated that the coefficients of EDP*SUCOM, EP*SUCOM, SBP*SUCOM, AGE, ASST, LASST and ROA were negative and significant at the 1% and 5% level respectively. The results indicated that the TA and BIG 4 coefficients were positive and significant at the 1% level. Finally, the results indicated that CEP*SUCOM, LEV and COMP coefficients are insignificant at 1%, 5% and 10%.

The one-step D-GMM results improved the results of the PLS, FE and FGLS tests for Models 1 and 2. According to the one-step D-GMM results for Model 1, three sustainable products (EDP,

EP and SBP) had significant positive effects on LOGAF, indicating that these products increase audit effort and, in turn, increase audit fees. In Model 2, sustainability committee variable moderated the effects of EDP, EP, and SBP on LOGAF but was unable to moderate the relationship between CEP and LOGAF. Furthermore, one step D-GMM estimator showed Hansen test and used an Arellano-Bond test for second-order AR (2) that to address potential issues of model misspecification and endogeneity. The Hansen test checks the validity of the instrumental variables (IV) in the model as the model should be correctly specified. As shown in Table 6, the value of the probability of the Hansen test is insignificant this interpreted the instrumental variables as valid in the estimation. Finally, the AR (1) and AR (2) were used to capture the presence of autocorrelation in the error term of the model, as shown in Table 6; the values were insignificant suggesting no autocorrelation in the model. This produced more efficient estimates as well as precision and reliability of the results.

Table 6- Dynamic panel data estimation one-step difference GMM

Dynamic panel-data estimation, one -step difference GMM		
VARIABLES	Model 1-LOGAF	Model 2-LOGAF
CEP	-0.002 (0.359)	0.095 (0.109)
EDP	0.287** (0.005)	0.314** (0.008)
EP	0.339* (0.021)	0.387* (0.024)
SBP	0.388** (0.000)	0.173** (0.005)
CEP*SUCOM	- -	-0.097 (0.628)
EDP*SUCOM	- -	-0.286** (0.000)
EP*SUCOM	- -	-0.110** (0.000)
SBP*SUCOM	- -	-0.504** (0.000)
AGE	-0.982** (0.000)	-0.736* (0.001)
BIG4	0.073* (0.038)	0.158** (0.000)
TA	0.590** (0.000)	0.565** (0.000)
LEV	0.013 (0.296)	0.035 (0.132)
ROA	-1.03** (0.000)	-1.23** (0.035)
COMP	0.081 (0.259)	0.097 (0.369)
ASST	0.016 (0.828)	-0.215** (0.000)
LASST	-0.362** (0.000)	-0.674** (0.000)
Observations	2610	2610
Number of ID	261	261
Robust	Yes	Yes
ARI	0.203	0.208

AR 2	0.726	0.577
Hansen test	1.00	1.00
Note: The significance levels refer to $p < 0.01$ (**), $p < 0.05$ (*) and $p < 0.1$ (***) .		

4.3. Discussion

Even though sustainable products can have a positive impact on firm reputation, the study findings indicate that these products can negatively affect auditor efforts by increasing the audit fees. In fact, the purpose of introducing sustainable products is to encourage firms to adopt and invest in environmentally friendly corporate policies. Table 5 shows the results of Model 1 which indicates that the coefficients of sustainable products differed. PLS and FE indicate that the coefficient of EP is positive and marginally significant at the 10% level, indicating that EP had a significant positive effect on audit fees. The coefficients for the other sustainable products (CEP, EDP and SBP) and audit fees were insignificant. The results showed that sustainable products increased audit fees, supporting H1.

Sustainable products can have adverse effects on the sustainable operation of firms, leading to greater reputational pressure and a higher risk premium charged by auditors. Meanwhile, auditors may spend more effort on and expect higher cost compensation from firms that produce sustainable products; however, the specific mechanism needs to be studied further. Similarly, Sun et al. (2020) found that auditors responded to sustainable risks by increasing audit efforts. Likewise, Lobo et al. (2018) and Brones et al. (2013) found that sustainable products, such as green, organic, renewable, clean energy and eco-design products, are outputs of the innovation process, which is a complex process that involves many uncertainties and creates a high level of risk, making the work of auditors difficult and requiring more audit efforts.

Firms need to continuously adjust environmental plans to absorb increases in audit fees, as the auditing process is costly and risky. However, firms can use mechanisms such as reputation and operational risks (Xin et al., 2022) and sustainability reporting (Al Natour et al., 2022) to reduce the effects of increasing audit fees. The present study used the sustainable committee as a novel mechanism for reducing audit fees. The Model 2 results showed that the presence of sustainability committee moderated the relationship between sustainable products and audit fees by reducing the latter. Furthermore, the coefficients of EP*SUCOM, EDP*SUCOM and SBP*SUCOM were significant and negative, indicating that SUCOM had a moderating role on the relationship between sustainable products and audit fees; thus, H2 was verified.

The D-GMM results improved the regression results in Models 1 and 2. Model 1's one step D-GMM results indicated that three sustainable products (EDP, EP, and SBP) dramatically increased audit fees. In Model 2, the one-step D-GMM regression results indicated that firms required a sustainability committee operating on the board to reduce audit fees. The role of the sustainability committee is important in coordinating between the firm, the auditor, and society, as the presence of this committee reduced audit effort and, in turn, reduced audit fees. If a firm encourages the introduction of more sustainable products—which is considered a positive behavior—it should not be punished by increased audit fees. Likewise, Xin et al. (2022) asserted that a firm should not pay more audit fees when it behaves positively toward society.

SUCOM plays an important, positive role in protecting stakeholders' interests by enhancing the monitoring process to reduce business risks and avoid increases in audit fees. Although SUCOM coordinates the relationship between the firm and society, this coordination should not increase the firm's costs through increases in audit fees. A sustainable product profile conveys a positive message to society about a firm. The audit report conveys the same positive message, namely, that the firm incorporates society into its operations. Although the sustainable product

profile and the audit report increase the firm's costs, the existence of a sustainability committee has positive economic consequences, such as reducing and mitigating costs.

5. Conclusion

In the present study, we examined how a sustainable product profile affects audit fees. We argued that firms with this profile would have increased audit fees because more audit efforts would be required. We found a significant positive association between sustainable product profiles and audit fees. In addition, we showed that the presence of a sustainability committee plays an important role in moderating the relationship between sustainable product profiles and audit fees.

The study findings have important implications for policy makers, auditors and firm managers. For policy makers, while prior evidence suggests that there are advantages and disadvantages associated with the sustainable attitudes of a firm, the findings provide support for the argument that this attitude incentivises firms to manage sustainable product portfolios more effectively. In addition, the study findings highlight the importance of a sustainability committee. As such, policy makers should incentivise the establishment of this type of committee and regulate its role and responsibilities.

Meanwhile, auditors need to take the positive side of a sustainable product profile when making decisions about audit fees. A sustainable product profile increases audit efforts and, in turn, increases audit fees; however, this profile might reduce business risks related to the innovation process and the sustainability direction of the firm. Understanding the relationship between sustainable products and audit fees will allow firms to improve their portfolio of sustainable products. This might be done through developing a reasonable profile of sustainable products which will reduce business risks related to the innovation process. In developing such a profile, the firm converts the resources into output efficiently (sustainable products) as firms engaging in sustainable products are more likely to receive positive feedback from stakeholders in the community, and that develops auditors' skills in addressing sustainability issues and reduces auditors' concerns about the opportunistic use of sustainable products, thereby reducing business risk and audit fees in the long term. In addition, when auditors coordinate with sustainability committees, the information about sustainable products will transfer to them which helps in facilitating audit efforts and reducing audit fees. Sustainability committees play an important role in communicating between auditors and society, the firm and the auditor and between the firm and society **as the presence of sustainability committee within the governance of the firms improves the relationship between these firms and society and reflects a positive attitude of the society toward the firms.** Sustainability committees can reduce audit efforts by providing audit-related information to auditors. Managers should establish a sustainability committee to coordinate communication between the firm and the auditor. Managers should be aware that sustainability committees can moderate the business risks associated with a sustainable product profile, which is likely to affect audit fees. This awareness will enable managers to give sustainability committees some authority to organise the relationship between auditors and society. Although the present study considered various conditions, it had a few limitations that provide opportunities for future research. First, the study examined the relationship between sustainable product profiles and audit fees in selected Western European countries. Although these countries represent the largest developed countries, they are different from other countries, such as the United States and China, in terms of economic systems and market characteristics. Second, the studied firms did not produce sustainable products equally. For example, one country had more environmental products and

fewer sustainable building projects, while another country had a different situation. Third, the sustainable product profile data were derived from the Refinitiv Eikon database, and only firms that had made investments in sustainability were included in this study. When data acquisition is more convenient, the sample can be extended to all listed firms in the database.

Disclosure statement

No potential conflict of interest was reported by the authors.

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