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Nipper, Marvin; Ostermaier, Andreas; Theis, Jochen

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RESEARCH ARTICLE



Mandatory disclosure of standardized sustainability metrics: The case of the EU Taxonomy Regulation

Marvin Nipper¹ | Andreas Ostermaier²

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| Jochen Theis³

¹School of Business, Economics and Society, Friedrich-Alexander-Universität Frlangen-Nürnberg, Nuremberg, Germany

²Zeppelin Chair of Sustainability and Management Accounting, Zeppelin University, Friedrichshafen, Germany

³Department of Business & Management, University of Southern Denmark, Kolding, Denmark

Correspondence

Marvin Nipper, School of Business, Economics and Society, Friedrich-Alexander-Universität Erlangen-Nürnberg, Lange Gasse 20, 90403 Nuremberg, Germany. Email: marvin.nipper@fau.de

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Abstract

The European Union's Taxonomy Regulation establishes standardized sustainability metrics and makes disclosure mandatory for many companies, aiming to channel investment into sustainable business. These metrics compete with voluntary thirdparty sustainability ratings in influencing investors. Using an online vignette study, we examine how green revenue, as an exemplary standardized metric, interacts with a traditional third-party rating to influence investors. We find that green revenue influences investors, but sustainability ratings have an incremental effect, both if green revenue is low and if it is high. Hence, sustainability ratings remain relevant for companies and investors. Our findings contribute to the literature on real effects of reporting regulation and have important implications for mangers and regulators.

KEYWORDS

ESG reporting, EU Taxonomy, green revenue, investor decision-making, sustainability reporting

JEL CLASSIFICATION M41, M42, M48, G41, C91

INTRODUCTION 1

Sustainability metrics help investors evaluate and compare companies' sustainability and make informed investment decisions (Ilhan et al., 2023). However, these metrics are heterogeneous, which inhibits comparison (Amel-Zadeh & Serafeim, 2018). Third-party ratings, in turn, are often incongruent and intransparent (Christensen et al., 2022; Li et al., 2021). The European Union's Taxonomy Regulation (Regulation, 2020/852) introduces standardized metrics, long called for by investors (Amel-Zadeh & Serafeim, 2018), and makes disclosure mandatory for many companies. It requires them to report how much of their revenue and expenditures are associated with sustainable business. A purpose of the regulation is to channel private funds to this business and support the transition towards a European net-zero economy (European Commission, 2018; Moneva

et al., 2023). However, it is yet unclear how government-backed standardized metrics, such as "green revenue," influence investors' decisions. The objective of our study is to show how such metrics combine with third-party ratings to influence investors' decisions. Our findings suggest that they channel investment, but that they complement rather than replace third-party ratings.

Sustainable companies attract investors because they promise higher financial performance for reasons such as product and labor market benefits as well as reduced litigation and compliance cost (Aibar-Guzmán et al., 2024; Gull et al., 2022). In addition, some investors are willing to pay a premium for stocks of sustainable businesses (Dhaliwal et al., 2011; Matsumura et al., 2014; Plumlee et al., 2015; Richardson & Welker, 2001). However, investors, and particularly private investors, largely use third-party ratings to identify sustainable businesses, although these ratings are susceptible to greenwashing

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(Scalet & Kelly, 2010; Windolph, 2011). This is why the Taxonomy Regulation introduces government-backed, mandatory, and standardized metrics, which present a unique measure of a company's sustainability (Hummel & Bauernhofer, 2024; Moneva et al., 2023). As a result, investors now have two types of metrics available that aggregate a company's environmental sustainability into a single number: green revenue and third-party ratings. It is an empirical question of utmost interest how investors incorporate these standardized metrics, along with sustainability ratings, into their decisions.

Building on agency theory and prior evidence (Chrzan & Pott, 2024; Johnson et al., 2020; Theis et al., 2024; Xie et al., 2023), we predict that the disclosure of high green revenue increases investors' willingness to invest. Moving beyond this individual effect, we examine how it interacts with a sustainability rating to influence investors' decisions. Depending on whether green revenue is high or low, a favorable rating provides contradictory or redundant information. As a contradiction is unsettling for investors, we expect that a favorable rating mitigates but does not compensate low green revenue, with cognitive dissonance inhibiting investment. Conversely, a high rating confirms the sustainability of a company with high green revenue. Drawing on theory and evidence for a counting heuristic in investors (Koonce & Lipe, 2017), we predict that investors, nonetheless, do not discount the rating as redundant information but prefer to invest in a company that reports a favorable rating in addition. Adding voluntary disclosure of green revenue, we predict that the disclosure of high green revenue increases investment probability relative to non-disclosure, but the disclosure of low green revenue decreases it.

To test our predictions, we conducted an online vignette study on CloudResearch, where participants took the role of private investors and indicated their likelihood to invest in a company. We manipulated, within subjects, the information about the company's green revenue and sustainability rating, each at three levels. Thus, the company reported either high or low green revenue, or it did not disclose its green revenue. Likewise, the company reported either a high or a low sustainability rating, or it did not report any rating. In addition, we varied whether the company reported high or low financial performance to assess whether our results hold for different financial performance levels.

The results of our experiment support our predictions. First, we find that investors are more likely to invest in a company that discloses high rather than low green revenue. Likewise, investment probability is higher if a company reports a high rather than no sustainability rating. Second, a high rating mitigates the adverse effect of low green revenue partially. Moreover, the incremental effect of a favorable rating on the investment probability is the same whether green revenue is high or low. Third, the disclosure of high green revenue raises the investment probability relative to non-disclosure, and the disclosure of low green revenue reduces it. Additional analyses reveal interactions with participants' attitudes to environment and government (i.e., how much they support environmental protection and how they feel about government intervention). A strong proenvironment attitude reinforces the effect of the disclosure of high green revenue or a high rating. A strong pro-government attitude

reinforces the former but not the latter, and it also increases investors' reliance on green revenue relative to the rating.

Governments and public authorities exert increasing regulatory pressure on businesses to mitigate climate change (García-Sánchez et al., 2023). This study contributes in at least two ways to our understanding of the effects of regulation. First, while there is much literature on voluntary disclosure (Garcia-Torea et al., 2020; Minutiello & Tettamanzi, 2022), evidence on reporting mandates is still limited. Recent research, however, documents real effects of reporting mandates in the European Union and the United Kingdom (Downar et al.. 2021; Fiechter et al., 2022). In line with this research, ours suggests that a government-backed standardized sustainability metric like green revenue influences investors' judgment. Thus, we add to the literature on the influence of investors on corporate social responsibility (Aluchna et al., 2022; Dimson et al., 2015; Pucheta-Martínez & López-Zamora, 2018). Investors "vote" with their dollars by allocating funds to sustainable business activities. Standardized metrics, in turn, reduce the information asymmetry between companies and investors and provide decision-relevant information.

Second, adding to recent evidence on the effects of the Taxonomy Regulation on investor judgment (Chrzan & Pott, 2024; Hummel & Bauernhofer, 2024), our study is the first to examine how such standardized metrics combine with traditional sustainability ratings to influence investors' judgment. Specifically, if the standardized metric reveals poor performance, a company can sugarcoat this bad news with a cherrypicked rating and thus mitigate the negative effect on investment probability; however, the rating does not fully compensate the effect of low green revenue because the contradictory information unsettles investors. If the standardized metric reveals good performance, in turn, a favorable rating still increases investment probability, which suggests that investors tend to ignore that congruent information might be redundant.

Our findings hold lessons for regulators and managers. Regulators may, first, feel assured that government-backed mandatory sustainability metrics channel investment effectively into sustainable business, confirming previous findings (Downar et al., 2021; Fiechter et al., 2022). Second, while these metrics cannot rule out greenwashing (with cherrypicked ratings, in this case), they can reduce the potential for it. Third, companies continue to have use for sustainability ratings, in addition to mandatory metrics. Hence, mandatory metrics do not make sustainability ratings obsolete.¹ Managers, in turn, particularly those whose companies fall under the Taxonomy Regulation, will be interested to see that mandatory metrics influence investors and increase pressure for operational change. Favorable sustainability ratings cannot heal the damage of disclosing low green revenue. Thus, companies will need to focus on sustainable business activities to meet heightened investor scrutiny and maintain investor interest.

Overall, our paper provides novel insights into the effect of disclosure regulations in general and the Taxonomy Regulation in particular on investors' judgment, extending extant evidence (Aluchna

¹Indeed, the European Commission (2023) has proposed a regulation of ESG rating agencies.

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et al., 2022; Chrzan & Pott, 2024; Dimson et al., 2015; Hummel & Bauernhofer, 2024; Pucheta-Martínez & López-Zamora, 2018). The remainder of this paper unfolds in five steps. We first provide more information about the Taxonomy Regulation and develop our hypotheses (Section 2). We then explain our experimental design (Section 3), present our results (Section 4), and discuss them (Section 5). Finally, we conclude with a summary and discussion of our findings (Section 6).

2 | BACKGROUND AND HYPOTHESES

2.1 | Background

In response to climate change, the European Union initiated a comprehensive set of policies to make the European economy climateneutral (European Commission, 2018; García-Sánchez et al., 2023). Sustainability reporting is a centerpiece of this so-called European Green Deal. The Taxonomy Regulation, along with its delegated regulations and technical annexes, establishes criteria for economic activities to qualify as environmentally sustainable (Hummel & Bauernhofer, 2024; Lámfalusi et al., 2024). Companies match their activities with those listed in the Taxonomy. If there is a match, and the activity fulfills the technical criteria, they disclose the revenue. capital expenditures, and operating expenditures related to it as Taxonomy-aligned or "green." In particular, the Climate Delegated Act (Delegated Regulation, 2021/2139) requires companies to disclose revenue and expenditures associated with economic activities that help us mitigate climate change or adapt to it. This includes, for example, activities that reduce greenhouse gas emissions or shield people against the adverse impact of climate change.

Disclosure of green revenue and expenditures is mandatory for companies that are required to submit sustainability reports. The European Union's Corporate Sustainability Reporting Directive (Directive 2022/2464, CSRD), in turn, which introduces European Sustainability Reporting Standards, specifies which companies are required to report. Practically, the CSRD extends the scope of mandatory disclosure substantially, compared to the prior Non-Financial Reporting Directive (Directive 2014/95/EU). It makes disclosure of green revenue and expenditures mandatory for an estimated 50,000 companies. While the Taxonomy Regulation is a European act, it is also a potential model for other jurisdictions. For example, there is an ongoing debate in the U.S. about how to enhance and standardize climate-related disclosures for investors.² Certain features of the Taxonomy Regulation, namely that it establishes a small set of mandatory and highly standardized government-backed metrics, promise lessons that are of interest beyond the European Union.

Sustainability ratings by independent rating agencies have long been a way for companies to voluntarily document their sustainability. However, there are multiple rating agencies, some of them alone offering multiple different ratings, which diverge remarkably (Christensen et al., 2022). The plethora of incongruent ratings allows companies to choose which ratings to solicit and disclose. Incidentally, companies can always not solicit or disclose any rating. Unsurprisingly, it is uncommon to see a company report an unfavorable third-party rating. According to the Taxonomy Regulation, in turn, revenue and expenditures are "brown" by default, and green revenue and expenditures are mandatory to report. If a company fails to establish that some portion of its revenue is green, it will have to report zero green revenue. Thus, the Taxonomy Regulation gives companies incentives to identify green revenue. In summary, the mandatory disclosure of green revenue and expenditures is markedly different from the voluntary disclosure of sustainability ratings, but both sustainability measures coexist henceforth.

2.2 | Individual effects of green revenue and sustainability rating disclosure

Sustainability reports, like financial reports, contain decision-relevant information for investors (Bose et al., 2024; Chrzan & Pott, 2024; Hummel & Bauernhofer, 2024; Johnson et al., 2020; Theis et al., 2024; Xie et al., 2023). Regulators, therefore, justify sustainability reporting mandates with improved disclosure quantity and quality. Disclosure reduces information asymmetry in capital markets, improves corporate sustainability, and benefits society in the best case (Downar et al., 2021; Fiechter et al., 2022). Thus, our analysis of the impact of standardized sustainability metrics is rooted in agency theory. In line with previous research (Ali et al., 2024; Chrzan & Pott. 2024), we expect that the disclosure reduces information asymmetry. Of course, investors have alternative sources of information. The Taxonomy, however, requires a detailed assessment of a company's activities, and Taxonomy-alignment is measured by specific product-oriented or production-process-oriented emissions thresholds (Hummel & Bauernhofer, 2024; Lámfalusi et al., 2024). Hence, an outside-in assessment of Taxonomy-alignment is difficult.

The literature proposes several reasons why the disclosure of sustainability information influences investors, which fall into two broad categories. First, the disclosure of sustainability performance leads investors to expect cashflow effects (Aibar-Guzmán et al., 2024; Gull et al., 2022; Richardson et al., 1999). Responsible behavior reduces the risk of litigation,³ helps prevent government regulation and related cost of compliance, and appeals to certain consumers and thus carries product and factor market benefits—or, conversely, it helps avoid negative publicity and boycotts (Dhaliwal et al., 2011; Matsumura et al., 2014; Richardson et al., 1999; Xie et al., 2023). These arguments imply that responsible corporate behavior, through lower costs or higher revenues, promises higher financial performance and makes the investment more worthwhile (Al-Tuwaijri et al., 2004;

²The SEC's (2024) Rules 14–02(c) and (d) require companies to disclose capital and operating expenditures as a result of natural conditions (Section K.3.c), which resemble green expenditures according to the Taxonomy Regulation.

³Litigation in the context of sustainability, specifically environmental sustainability, can include claims for false or misleading sustainability disclosures that cause financial harm to investors, customers, or other stakeholders, as well as claims for environmental impacts, such as pollution or emissions. For an overview, see Cummins et al. (2021).

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Richardson & Welker, 2001). If a company does not disclose such information, investors make inferences about its sustainability, too. They may get suspicious, take non-disclosure as a bad signal, and penalize it (Matsumura et al., 2014).

Second, some investors are willing to pay a premium for stocks from socially responsible corporations, regardless of whether social responsibility "pays off." Indeed, many investors have prosocial and especially pro-environmental attitudes, and the emergence of ethical, green, and other socially responsible investment shows that they "vote" with their dollars (Pucheta-Martínez & López-Zamora, 2018; Richardson & Welker, 2001). By this argument, socially responsible companies have a larger pool of investors (Dhaliwal et al., 2011; El Ghoul et al., 2011; Velte, 2023). Incidentally, the effect of investors' preferences is arguably reinforced by biases. Investors respond affectively to both good and bad performance and consequently tend to over-evaluate or under-evaluate the fundamental value of companies (Elliott et al., 2014; Guiral et al., 2020). Investors who do not have any such preference still need to account for sustainability because of others' preferences. In summary, the two categories of arguments suggest that corporations that disclose good sustainability performance are more appealing to investors and have a lower cost of equity (El Ghoul et al., 2011; Plumlee et al., 2015; Richardson et al., 1999).

The evidence on whether voluntary sustainability disclosure reduces the cost of equity is nonetheless mixed. Richardson and Welker (2001) find a positive association between social disclosure and cost of equity; Clarkson et al. (2013) do not find any; Dhaliwal et al. (2011) find the predicted negative association. Recent studies argue for a negative association, though (Cheng et al., 2014; Egginton & McBraver, 2019; Horn, 2023; Plumlee et al., 2015). Measurement issues are a potential reason for the mixed evidence. Indeed, Plumlee et al. (2015) show that the association between disclosure and cost of equity depends on the valence of the information disclosed. Positive disclosure is negatively associated with cost of equity, negative disclosure, positively. Matsumura et al. (2014) find a negative association between the volume of carbon emissions disclosed and firm value, although disclosure is voluntary and the companies with the highest emission volumes might not even disclose these. The residual variation is enough to establish the association. Likewise, Holm and Rikhardsson (2008) find, in an experiment, that investors allocate more funding to a company that discloses positive environmental information than a company that does not disclose such information.

A sustainability rating provides third-party assured summary information about a company's sustainability and therefore conveys relevant sustainability-related information to investors. Based on this argument, along with the available empirical evidence, we predict that a high sustainability rating increases the probability of investment. Since it is voluntary for companies to report a sustainability rating, the base level to measure the effect of a high rating is no rating. The Taxonomy-aligned green revenue also summarizes a company's sustainability. Its measurement follows strict rules, and companies can be held liable for mismeasurement (Hummel & Bauernhofer, 2024;

Lámfalusi et al., 2024). Hence, we predict that high green revenue, just like a high sustainability rating, increases the probability of investment. However, since the disclosure of green revenue is mandatory for many firms, we benchmark the effect of disclosing high green revenue against the disclosure of low green revenue.

> H1. Investors are more likely to invest in a company if it reports high green revenue than if it reports low green revenue.

> H2. Investors are more likely to invest in a company if it reports a high sustainability rating than if it does not report a sustainability rating.

2.3 Combined effect of green revenue and sustainability rating disclosure

Since the disclosure of Taxonomy-aligned activities is mandatory, companies that fall under the regulation have no choice but to report their green revenue, no matter how low it is. According to H1, however, the disclosure of low green revenue has a negative effect on investment probability. Thus, the Taxonomy Regulation builds up pressure for companies to change their operations and increase the green share of their revenue. Operational change is not always technically feasible for a company, though, or the cost is prohibitive. Indeed, there are multiple reasons why companies have low green revenue.⁴ They can then still supplement the disclosure of low green revenue with a high sustainability rating, as the plethora of ratings affords them a chance to find a rating to attest their sustainability (Christensen et al., 2022).⁵ In line with H2, we expect that a good sustainability rating increases the investment probability and thus mitigates the adverse effect of the simultaneous disclosure of low green revenue.

Having said that, we do not expect that the positive effect of a high sustainability rating neutralizes the negative effect of low green revenue. The combination of a high rating and low green revenue, regardless of why it occurs, sends mixed signals to investors, which unsettle them and discourage them from investing. Related evidence from consumer research shows that mixed reviews create cognitive dissonance, which has a negative effect on consumers' purchase intentions. In particular, mixed reviews reduce purchase intentions relative to neutral reviews and, thus, do not average out (Xu & Jin, 2022). Accordingly, we predict that investment probability is lower if a company reports a low green revenue and a high rating than if it reports a high green revenue but no rating. In the latter case, investors may perceive that information is missing, but missing information bothers them less than contradictory information.

⁴As a whitelist, the Taxonomy may lag behind technological change or be incomplete for other reasons. Hence, it may miss sustainable activities, resulting in low green revenue. ⁵Ratings may consider social aspects or allow carbon offsetting. As an example, the German chemical manufacturer BASF reports several A ratings from CDP and MSCI, although its green revenue is below 10 percent.

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H3. The positive effect of a company reporting a high sustainability rating on investment probability does not make up for the negative effect of reporting low green revenue.

For a company with high green revenue, the question is whether to report a high sustainability rating in addition, which should be easy for it to obtain in this case. On the one hand, the high rating is redundant, as it confirms that the company is sustainable, which is what high green revenue tells investors. On the other hand, there is research showing that the provision of sustainability information in addition to sustainability ratings, such as information about a firm's emissions mitigation strategy, has an incremental effect on investors' judgment (Chrzan & Pott, 2024; Ghosh & Wu, 2012; Johnson et al., 2020). By the same token, a high sustainability rating arguably has an incremental effect on investors' judgments if combined with high green revenue. The incremental effect might be smaller if the rating comes with high rather than low green revenue, conveying the same rather than different information. However, the case can be made that the incremental effect of a high rating is the same in both cases.

Specifically, previous research suggests that investors might treat green revenue and sustainability ratings as independent pieces of information. Koonce and Lipe (2017) propose a counting heuristic to explain the effect of earnings surprises on investors' valuation of firms. The count of positive versus negative surprises strongly influences valuation and often dominates the magnitudes of the surprises. The same heuristic explains the effect of guidance frequency on investor judgments (Tang & Venkataraman, 2018). Likewise, investors apprehend correlations heuristically by counting co-movements between stock returns. Again, the count dominates the proper correlation, and there is more evidence in the finance literature that investors struggle to understand the concept of correlation (Ungeheuer & Weber, 2021). Hence, the counting heuristic implies that investors neglect the correlation between green revenue and the sustainability rating and argues for the same incremental effect of a high rating irrespective of the disclosure of high or low green revenue. Taken together, we expect an incremental effect of a high rating if green revenue is high, which is the same or less compared to if it is low.

H4. If a company reports a high sustainability rating along with high green revenue, investment probability increases as much as or less than if the company reports it along with low green revenue.

2.4 | Effect of voluntary versus mandatory disclosure of green revenue

While the CSRD makes disclosure mandatory for many companies, it remains voluntary for others. Thus, the case of non-disclosure is important to consider from two perspectives. First, if disclosure of high green revenue increases investment probability compared to non-disclosure, there is an incentive for voluntarily disclosure. Managers will want to know whether voluntary disclosure is worthwhile, which calls for a comparison of investment probability between the disclosure of high green revenue and non-disclosure. Second, the European Union wants disclosure to incentivize operational change. The prospect of being obliged to disclose low green revenue and being penalized for this reinforces this incentive. If managers expect to be penalized for the disclosure of low green revenue and can choose not to disclose it, however, they will rather not disclose it. From a regulatory perspective, it is therefore important to know how investors respond to the disclosure of low green revenue compared to non-disclosure.

For H2, we argued that the voluntary disclosure of a high sustainability rating increases the probability of investment relative to nondisclosure. The same argument applies to the voluntary disclosure of green revenue, which leads us to hypothesize that the disclosure of high green revenue, too, increases the investment probability relative to non-disclosure. Turning to the second comparison, there are arguments to suggest that unfavorable disclosure might actually be better than non-disclosure. On the one hand, disclosure can be seen as a positive signal by investors, indicating that a company seeks to reduce information asymmetry. Matsumura et al. (2014), for example, find that the median value of firms that do not disclose their carbon emissions is lower than the one of firms that do. Although the volume of carbon emissions is negatively associated with firm value, it seems that non-disclosure can be worse than disclosure (Matsumura et al., 2014).

On the other hand, the arguments presented for H1 and H2 suggest that the disclosure of unfavorable information is worse than nondisclosure. For example, if it is true that companies want to showcase their responsible behavior to appease regulators and argue for their reduced risk of litigation, the disclosure of irresponsible behavior calls for regulation, invites litigation, supports competitors' green marketing, and facilitates activist campaigns (Matsumura et al., 2014). Likewise, if favorable disclosure allows companies to capitalize on investors' prosocial attitudes and decrease their cost of equity, then unfavorable disclosure makes the pool of investors shrink and increases the cost of equity. In Matsumura et al. (2014), the volume of carbon emissions is still negatively associated with firm value among disclosers, and we cannot tell whether non-disclosers' low firm value would be even lower if they disclosed their arguably high emission volumes. Similarly, Plumlee et al. (2015) find a differential effect of good versus bad news on the cost of equity, and "sin" industries, such as the tobacco and nuclear industries, have a higher cost of equity (El Ghoul et al., 2011). Hence, we expect and hypothesize that the disclosure of low green revenue decreases the investment probability compared to non-disclosure.

H5. Investors are more likely to invest in a company if it reports high green revenue than if it does not report green revenue.

H6. Investors are less likely to invest in a company if it reports low green revenue than if it does not report green revenue.

3 **EXPERIMENT**

3.1 **Participants**

We recruited 180 participants from Amazon.com's CloudResearch platform (formerly known as Amazon Mechanical Turk) to proxy for non-professional private investors.⁶ Non-professional private investors are an important force in the stock market. For example, about 162 million, or 62% of American adults, invest directly in stocks (Gallup, 2024). Prior research shows that these investors are supportive of and responsive to CSR activities and disclosures (Cohen et al., 2011; Elliott et al., 2014; Martin & Moser, 2016).

We required that participants resided in the United states, had completed at least 100 other assignments, and had an approval rate of at least 90% from prior assignments. Furthermore, we confined the pool to participants approved by CloudResearch to ensure a high response quality for our sample. 99 participants passed our attention check (see below). 59 of these were male; 39, female. One participant did not state her or his gender. Participants' age averaged 40.5 years. About 63% had a bachelor's degree or a higher level of education. Approximately 74% had invested in stocks in the past, 81% planned to invest in the future. Participants earned \$3.50 and took on average less than 12 min to complete our survey. This corresponds to an hourly wage of about \$17.50, which is well above the minimum wage in the United States.

While our research is inspired by the European Union's Taxonomy Regulation, we are interested in the effect of design choices that it instantiates (i.e., the mandatory disclosure of a sustainability metric that results from rule-based standards). These design choices are generally relevant and not exclusive to the Taxonomy. Therefore, we phrased the instructions neutrally and never referred to the European Union. We administered our experiment to U.S. residents because CloudResearch is more prevalent in the United States. Participants from CloudResearch were found to be representative of the population (Berinsky et al., 2012; Buhrmester et al., 2011; Paolacci et al., 2010). They perform similarly to in-laboratory participants in intelligence tests (Buchheit et al., 2017) and problem-solving and learning tasks (Crump et al., 2013). Consequently, experiments ran on CloudResearch produce similar results as laboratory experiments (Casler et al., 2013; Horton et al., 2011).

3.2 Task and procedure

We employ a within-subjects design, where participants take the role of a private investor in search of new investment opportunities. At the beginning, participants are told that they will make a series of investment decisions, each for a specific company. They are provided with background information on the three metrics that vary between these companies: green revenue, a sustainability rating, and financial performance. They also see an exemplary vignette of a company. After that, participants are presented with 18 hypothetical companies from the aluminum industry,⁷ which differ in the three metrics. The companies are shown one by one and appear in random order.⁸ Before moving to the next company, participants indicate their probability to invest on a scale from 0% to 100% by grabbing and dragging a slider.⁹ Participants can neither skip companies nor navigate back and forth. At the end, they are asked to answer post-experimental questions. The instructions are reprinted in Appendix B.

3.3 Dependent and independent variables

The dependent variable is the probability for the investor to invest in a company (Reimsbach et al., 2018; Theis et al., 2024). Participants in their role as investor indicate this probability for each of the 18 companies on a scale ranging from 0 to 100.

We manipulate the information about the company to invest in, resulting in 18 cases. First, we are mainly interested in the individual and combined effects of green revenue and sustainability ratings on investment decisions. Green revenue and the sustainability rating can each be either high or low (above or below industry average). Moreover, both can also be "not reported," because it may not be mandatory for a company to report green revenue and it is voluntary to report a sustainability rating. Hence, we manipulate both attributes at three levels. Second, we vary financial performance at two levels, high or low, for validation. (Intuitively, financial performance matters more for investment probability than sustainability performance, regardless of how the latter is measured.) Third, to control for the effect of a pro-environment attitude, we measure this attitude with a set of nine questions, which we adapt from the literature (Ebenbach et al., 1998; Kortenkamp & Moore, 2001). Likewise, we adapt a set of questions to measure pro-government attitude (Goff & Noblet, 2018). We consider these variables in additional analyses.

Since the disclosure of green revenue is mandatory for firms that fall under the Taxonomy Regulation, the case where the company reports green revenue is of primary interest. Hence, we first focus on

⁶Data collection with human subjects was performed in compliance with relevant laws and institutional guidelines and approved by the appropriate institutional committee at the principal investigator's university. Informed consent was obtained from all subjects prior to participation.

⁷The aluminum industry is energy-intensive and produces significant levels of CO₂ emissions, making the relevance of sustainable practices salient (Johnson et al., 2022). ^BWhile we follow a similar procedure as in a conjoint experiment (de Villiers et al., 2021), the

limited number of companies permits a full factorial design.

⁹There is no default probability. The slider is set to zero, but the investor needs to move it to proceed. Thus, if the investor wants to indicate that the probability for her or him to invest in the company is zero, she or he needs to move the slider forth and back to zero. If an investor tried to proceed without moving the slider, she or he was reminded to move the slider, even if she or he wanted to set it to zero.

cases where high or low green revenue must be disclosed. Subsequently, we examine the case where it is not reported. From a practical viewpoint, this case is interesting because there are companies that are not subject to the regulation. In particular, the regulation applies to European companies only, but investors can naturally invest their money in a European or a comparable non-European company. From an academic viewpoint, the case of unreported green revenue allows us to recover the effect of mandatory disclosure in the instance where it hurts—that is, where the company is required to disclose that little of its revenue is green. The disclosure of a sustainability rating is normally voluntary, and it is therefore unlikely that a company reports a low rating. We include this case for completeness. The three attributes (financial performance, green revenue, and the sustainability rating) are presented to the investor in random order to preclude order effects (Warnick et al., 2018).

3.4 | Attention check

The difference between government-backed standardized green revenue and a third-party sustainability rating is subtle. To ensure that our participants understood this difference, we required them to correctly answer two multiple-choice questions. The first question asks which organization determines the sustainability rating (an independent rating agency). The second question asks how green revenue is determined (by the company based on a list of sustainable business activities established by the government). The available answers include incorrect but plausible alternatives (see Appendix B). 99 of our 180 participants (55%) answered both questions correctly. The other 81 participants continued the survey, but we disregard their answers for our analyses.¹⁰ The demographics of the participants who failed the test do not differ significantly from those who passed it. However, the investors who failed the test took only slightly more than 8 min (with a standard deviation of 8 min) to finish the survey. This is significantly less than the time that those who passed the test took (t = 3.03, p = 0.003).

4 | RESULTS

4.1 | Individual effects of green revenue and sustainability rating disclosure

We first examine how any combination of high versus low green revenue and a high sustainability rating versus non-disclosure influences investment probability. Panel A of Table 1 lists the mean investment probability for each of the resulting four conditions along with the means across conditions. For example, the probability for our 99 investors to invest in a company that reports high green revenue but no sustainability rating averages 50%, across high and low levels of financial performance. Figure 1 depicts the means for illustration. H1 holds that the disclosure of high versus low green revenue increases the investment probability. H2 predicts the same effect for the disclosure of a high sustainability rating versus non-disclosure. To test H1 and H2, we regress investment probability on green revenue, sustainability rating, and the interaction terms between them.¹¹ We cluster the errors by investor to account for the dependence of the investment decisions that arise from our within-subjects design. In line with our theory, we choose the disclosure of low green revenue and the non-disclosure of a sustainability rating as base levels. Panel B of Table 1 reports the regression estimates.

The effects predicted by H1 and H2 are obtained by contrast tests, whose results are listed in Panel C of Table 1. According to the summary statistics in Panel A of Table 1, the disclosure of high (vs. low) green revenue increases the investment probability from about 38% to 57%. By the results of the contrast tests, this increase is significant and strong ($\beta = 18.65$, t = 14.96, p < 0.001, d = 0.57).¹² Likewise, the disclosure of a high-sustainability rating, as opposed to non-disclosure, increases the probability significantly and strongly ($\beta = 14.13$, t = 12.63, p < 0.001, d = 0.46). Summing up, the results of our tests support H1 and H2.

4.2 | Combined effect of green revenue and sustainability rating disclosure

H3 predicts that the disclosure of a high sustainability rating does not repair the damage to the investment probability from reporting low green revenue. Indeed, the probability is 46% if the company reports low green revenue and a high sustainability rating, but 50%, if it reports high green revenue and no sustainability rating. This difference is small but significant (β = 4.52, *t* = 3.69, *p* < 0.001, *d* = 0.14), which confirms H3.

H4 makes a weak directional prediction against a positive interaction effect between green revenue and the sustainability rating. A high sustainability rating increases investment probability by about 14 percentage points in fact, whether the company reports it along with high or low green revenue (from 31% to 46% and from 50% to 64%). The coefficient on the interaction term is close to zero and insignificant ($\beta = -0.77$, t = -0.44, p = 0.664). Hence, we do not find any interaction, particularly no positive interaction, which is in line with H4.

4.3 | Effect of voluntary versus mandatory disclosure of green revenue

The previous hypotheses assume that green revenue is mandatory to disclose. In the motivating case of the Taxonomy Regulation, however, small and non-European companies are exempt from mandatory disclosure. H5 predicts that investment probability is higher if a company reports high green revenue than if it does not report green

¹⁰The results of our hypothesis tests remain qualitatively the same if the answers of these 81 participants are included.

¹¹We report results of ordinary least squares regressions for ease of exposition (Angrist & Pischke, 2009). Our inferences remain unchanged if we use beta regressions instead. This is also true if we winsorize our data, which argues against outliers driving our findings.
¹²We use the cutoffs 0.10, 0.30, and 0.50 for Cohen's *d* to discern small, medium, and large effect sizes or weak, medium, and strong effects (Gignac & Szodorai, 2016).

Panel A: Summary statistics

	Green revenue							
Sustainability rating	Low		High		Total			
Unreported	31.15 (29.19)		50.18 (32.70)		40.67 (32.39)			
High	45.67 (32.00)		63.93 (35.23)		54.80 (34.83)			
Total	38.41 (31.44)		57.06 (34.64)		47.73 (34.35)			
Panel B: Regression to test Hypotheses 1–6								
	Coefficient		Standard error		p-Value			
Green revenue								
Unreported	0.52		1.01		0.612			
High	19.03		1.57		< 0.001			
Sustainability rating								
Low	-3.74		1.04		0.001			
High	14.52		1.55		< 0.001			
Green revenue \times sustainability rating								
Unreported \times Low	2.83		1.45		0.054			
Unreported \times High	3.12		1.37		0.025			
$High \times Low$	-0.86		1.52		0.572			
$High \times High$	-0.77		1.76		0.664			
Constant	31.15		1.45		< 0.001			
Panel C: Tests of Hypotheses 1–6								
		Coefficient	Standard error	p-Value	Cohen's d			
High vs. low green revenue (H1)		18.65	1.25	<0.001	0.57			
High vs. no sustainability rating (H2)		14.13	1.12	< 0.001	0.46			
High green revenue vs. high sustainability rating	4.52	1.22	< 0.001	0.14				
High green revenue and high sustainability rating (H4)		-0.77	1.76	0.664	n.a.			
High vs. no green revenue (H5)		16.57	1.07	< 0.001	0.49			
No vs. low green revenue (H6)		-2.07	0.86	0.017	0.08			

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Note: Panel A: Mean and, in parentheses, standard deviation of investment probability (in percent) by condition. The number of observations is 99. Panel B: Results of an ordinary least squares regression with errors clustered by investor (1,782 observations = 99 clusters \times 18 observations per cluster, $R^2 = 0.12$). The dependent variable is the investor's probability of investment. Green revenue has three levels: High, low, and unreported, where low is the base level. The sustainability rating has three levels: high, low, and unreported, where unreported is the base level. Panel C: Tests of the hypothesized effects. The coefficient of the interaction term for testing H4 is included in the regression results. The other results are from planned contrast tests.



FIGURE 1 Summary statistics. Investment probability depending on green revenue (square vs. disk markers) and the sustainability rating. The graph plots the summary statistics from Panel A of Table 1.

revenue. Investment probability averages 40% if green revenue is not disclosed (untabulated), compared to 57% if it is high. The difference of 17 percentage points is significant and strong (β = 16.57, t = 15.49, p < 0.001, d = 0.49).

H6 posits, in turn, that reporting low green revenue is worse for a company than non-disclosure. Indeed, the disclosure of low green revenue decreases investment probability by about two percentage points, from 40% to 38%. This difference is significant, albeit small ($\beta = -2.07$, t = -2.41, p = 0.017, d = 0.08). In summary, we find support for both H5 and H6.

4.4 | Pro-environment attitude

One of the arguments for H1 and H2 is that some investors are willing to pay a premium for stock from sustainable companies.

TABLE 2 Pro-environment attitude.

Panel A: Summary statistics

	Weak pro-env	vironment attitude		Strong pro-environment attitude				
	Green revenue	Green revenue			Green revenue			
Sustainability rating	Low	High	Total	Low	High	Total		
Unreported	36.28 (31.29)	49.31 (32.82)	42.79 (32.64)	26.13 (26.18)	51.04 (32.72)	38.58 (32.09)		
High	47.56 (34.18)	62.54 (36.15)	55.05 (35.89)	43.81 (29.76)	65.29 (34.43)	54.55 (33.86)		
Total	41.92 (33.17)	55.92 (35.07)	48.92 (34.80)	34.97 (29.33)	58.17 (34.26)	46.57 (33.90)		
Panel B: Interaction betwe	een green revenue, s	ustainability rating, a	nd attitude					
			Coefficient	Standa	rd error	p-Value		
Green revenue \times Pro-envi	ronment attitude		9.19	2.32		< 0.001		
Sustainability rating \times Pro-	-environment attitude	e	3.70	2.22		0.098		
Panel C: Interaction betwe	een green revenue ve	s. sustainability rating	and attitude					
				Coefficient	Standard error	<i>p</i> -Value		
(High green revenue – Hig	h sustainability rating	y) × Pro-environment	tattitude	5.49	2.39	0.024		

Note: Panel A: Mean and, in parentheses, standard deviation of investment probability (in percent) by pro-environment attitude and condition. The sample is split at the median into 49 investors with a weak pro-environment attitude; 50, with a strong attitude. Pro-environment attitude averages the answers, on 7-point Likert scales, to nine questions (Cronbach's $\alpha = 0.87$). The questions are reprinted as part of the instructions in Appendix B. Panels B and C: Planned contrasts, based on ordinary least squares regressions, with clustered errors, of investment probability on green revenue, sustainability rating, and pro-environment attitude (Table A2 in Appendix A). Panel B: Interaction of pro-environment attitude with the effect of green revenue (H1) and sustainability rating (H2). Panel C: interaction with the difference between the effects of green revenue and sustainability rating (see H3).

These investors should care more than others about both a company's green revenue and sustainability rating and respond more sensitively to these. We asked our investors a series of questions about their attitude to the ecological environment and its protection, which are reprinted with the instructions in Appendix B. We average the answer scores (Cronbach's α of 0.87) to obtain a single measure and split our sample at the median to discern 49 investors with a weak and 50 with a strong pro-environment attitude. Panel A of Table 2 breaks investment probability down by attitude and condition. Figure 2 depicts the resulting means for illustration.

Revisiting H1, the increase of investment probability if high rather than low green revenue is disclosed should be larger among proenvironment investors. Indeed, it increases by about 23 percentage points (from 35% to 58%) among these, as opposed to 14 (from 42% to 56%) among others (Panel A of Table 2). To test the difference (9 = 23 - 14) for significance, we regress investment probability on green revenue, sustainability rating, and pro-environment attitude. Panel B of Table 2 reports the results of contrast tests based on the regression estimates, which show that the difference is significant ($\beta = 9.19$, t = 3.86, p < 0.001).

Returning to H2, if the company discloses a high rather than no sustainability rating, the investment probability increases by 16 percentage points (from 39% to 55%) among pro-environment investors and by 12 (from 43% to 55%) among others. The difference



FIGURE 2 Pro-environment attitude. Investment probability depending on green revenue (square versus disk markers), sustainability rating, and pro-environment attitude (solid versus dashed lines). The graph plots the summary statistics from Panel A of Table 2.

(4 = 16 - 12) between those increases is marginally significant ($\beta = 3.70$, t = 1.67, p = 0.098). Summing up, pro-environment investors care about both green revenue and sustainability ratings more than other investors. That said, do they also care more about green revenue than sustainability ratings (i.e., 9 > 4)? Panel C

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TABLE 3 Pro-government attitude.

Panel A: Summary statistics

	Weak pro-gove	rnment attitude		Strong pro-government attitude Green revenue			
	Green revenue						
Sustainability rating	Low	High	Total	Low	High	Total	
Unreported	34.24 (30.62)	50.11 (33.33)	42.18 (32.90)	28.25 (27.62)	50.25 (32.25)	39.25 (31.92)	
High	48.57 (33.92)	63.23 (35.92)	55.90 (35.61)	43.93 (29.99)	64.59 (34.74)	53.76 (34.14)	
Total	41.41 (33.02)	56.67 (35.18)	49.04 (34.92)	35.59 (29.69)	57.42 (34.20)	46.50 (33.80)	
Panel B: Interaction betwe	een green revenue, sus	tainability rating, ar	nd attitude				
			Coefficient	Standa	rd error	p-Value	
Green revenue \times Pro-gove	ernment attitude		6.56	2.40		0.007	
Sustainability rating \times Pro-	-government attitude		0.79	2.24		0.725	
Panel C: Interaction betwe	een green revenue vs.	the sustainability ra	ting and attitude				
				Coefficient	Standard error	p-Value	
(High green revenue – Hig	h sustainability rating)	× Pro-government	attitude	5 77	2 37	0.017	

Note: Panel A: Mean and, in parentheses, standard deviation of investment probability (in percent) by pro-government attitude and conditions. The sample is split at the median into 48 investors with a weak pro-government attitude; 51, with a strong attitude. Pro-government attitude averages the answers to six questions on 7-point Likert scales (Cronbach's $\alpha = 0.84$). The questions are reprinted as part of the instructions in Appendix B. Panels B and C: Contrasts, based on an ordinary least squares regression, with clustered errors, of investment probability on green revenue, sustainability rating, and pro-government attitude (Table A3 in Appendix A). Panel B: Interaction of pro-government attitude with the effects of green revenue (see H1) and sustainability rating (H2). Panel C: Interaction with the difference between the effects of green revenue and sustainability rating (see H3).

of Table 2 shows that they actually do ($\beta = 5.49$, t = 2.30, p = 0.024).

4.5 | Pro-government attitude

Green revenue was described to our investors as governmentregulated metric. Investors' perception of green revenue may therefore depend on their attitude to government intervention. We conjecture that investors who approve of government intervention care more for green revenue than investors who rather trust in the market. Our investors answered six questions about trust in government and market. We average the answer scores (Cronbach's $\alpha = 0.84$) and median-split our sample into 51 investors with a strong and 48 with a weak pro-government attitude. Panel A of Table 3 breaks investment probability down by attitude and condition. Figure 3 plots the means.

Investment probability rises by 21 percentage points (from 36% to 57%) among pro-government investors if the company reports high rather than low green revenue. For the other investors, the increase is 16 percentage points (from 41% to 57%). The contrast test in Panel B of Table 3 shows that the difference is significant ($\beta = 6.56$, t = 2.74, p = 0.007). Investors' response to the sustainability rating, in turn, does not depend on their pro-government attitude, with an



FIGURE 3 Pro-government attitude. Investment probability depending on green revenue (square versus disk markers), sustainability rating, and pro-government attitude (solid versus dashed lines). The graph illustrates the summary statistics from Panel A of Table 3.

incremental increase of investment probability of less than 1 (= 50 – 49) percentage point (β = 0.79, *t* = 0.35, *p* = 0.725). Consequently, pro-government investors rely more on green revenue than on the sustainability rating for their investment decision, as Panel C of Table 3 shows (β = 5.77, *t* = 2.44, *p* = 0.017).

TABLE 4 Financial performance.

	Low financial	performance		High financial	High financial performance		
	Green revenu	e		Green revenu			
Sustainability rating	Low	High	Total	Low	High	Total	
Unreported	9.45 (14.33)	24.34 (21.40)	16.90 (19.64)	52.85 (23.60)	76.02 (18.50)	64.43 (24.13)	
High	22.10 (21.70)	35.97 (26.63)	29.04 (25.21)	69.23 (21.57)	91.89 (14.38)	80.56 (21.53)	
Total	15.78 (19.40)	30.16 (24.79)	22.97 (23.37)	61.04 (24.00)	83.95 (18.34)	72.50 (24.22)	
Panel B: Interaction betwe	en green revenue, su	stainability rating, and	financial performar	ice			
		Co	pefficient	Standard	error	p-Value	
Green revenue \times Financial	performance	8.	54	1.71		< 0.001	
Sustainability rating \times Fina	ncial performance	3.	99	1.49		0.009	
Panel C: Interaction betwe	en green revenue vs.	sustainability rating a	nd financial perform	ance			
			Co	efficient	Standard error	p-Value	
(High green revenue – Hig	h sustainability rating)	× Financial performa	nce 4.5	55	1.92	0.020	

Note: Panel A: Mean and, in parentheses, standard deviation of investment probability (in percent) by financial performance and condition. Panels B and C: Contrasts, based on an ordinary least squares regression, with clustered errors, of investment probability on green revenue, sustainability rating, and financial performance (Table A4 in Appendix A). Panel B: Interaction of financial performance with the effect of green revenue (see H1) and sustainability rating (H2). Panel C: Interaction with the difference between the effects of green revenue and sustainability rating (see H3).

4.6 | Financial performance

Although sustainability information matters for investment decisions, financial performance metrics should matter more. Therefore, we vary financial performance at two levels in our experiment (high and low). We conjecture that high financial performance raises investors' interest. Once they are interested, they consider a company's green revenue and sustainability rating. Hence, we expect that investors respond more sensitively to differences in a company's green revenue or sustainability rating if its financial performance is high. Panel A of Table 4 breaks investment probability down by financial performance and condition. Figure 4 illustrates the summary statistics.

The investment probability is higher if financial performance is high, averaging 73% as opposed to 23%. In response to the disclosure of high rather than low green revenue, the average investment probability rises by 23 percentage points if financial performance is high, from 61% to 84%, and by 14 if it is low, from 16% to 30%. To test the difference of 9 (=23 - 14) percentage points for significance, we regress investment probability on green revenue, sustainability rating, financial performance, and their interactions. Panel B of Table 4 shows that the difference is significant (β = 8.54, *t* = 4.99, *p* < 0.001). Turning to the rating, investment probability increases by about 16 percentage points (from 64% to 81%) if financial performance is high, and by 12 if it is low (from 17% to 29%). Again, the resulting difference of 4 percentage points is significant (β = 3.99, *t* = 2.68, *p* = 0.009).



FIGURE 4 Financial performance. Investment probability depending on financial performance (filled versus unfilled makers, high versus low performance) and green revenue (square versus disk makers). The graph illustrates the summary statistics from Panel A of Table 4.

Finally, we examine whether the difference between the effects of the disclosure of high green revenue versus a high sustainability rating, which H3 is about, hinges on financial performance, too. If investors are more sensitive to sustainability information once a company's high financial performance has drawn their interest, they are likely more sensitive to the different combinations of such

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information. Looking at Panel A of Table 4, the disclosure of green revenue combined with no sustainability rating entails an investment probability higher by 7 percentage points (from 69% to 76%) compared to low green revenue and high sustainability rating if the company's financial performance is high. The difference is 2 if financial performance is low (from 22% to 24%). The result of the contrast test in Panel C of Table 4 confirms that the difference of 5 (= 7 - 2) percentage points is significant ($\beta = 4.55, t = 2.36, p = 0.020$).

5 DISCUSSION

Our results extend prior research in multiple ways and have important managerial and regulatory implications. First, we argued that sustainability information is relevant for investors, who care about the financial implications of sustainability or have a preference for sustainable investment (Aibar-Guzmán et al., 2023; Bose et al., 2024; Ilhan et al., 2023). Hence, sustainability reporting provides investors with decision-relevant information and, consequently, influences their decisions. The Taxonomy Regulation, which inspires our experiment, differs from prior reporting standards and from sustainability ratings. Thus, it is not trivial that green revenue is decision-relevant. Still, our results show that it influences investment probability and that investors place more importance on green revenue when green revenue and ratings disagree. Therefore, our results extend previous research on the decision-usefulness of the Taxonomy metrics (e.g., Bassen et al., 2022; Chrzan & Pott, 2024; Hummel & Bauernhofer, 2024) by examining their effect in combination with sustainability ratings. From a practical perspective, managers should expect that the disclosure of green revenue influences investment decisions, and regulators may feel assured that such standards channel investment.

Second, we propose that a high sustainability rating cannot make up for low green revenue, as the contradictory information unsettles investors. Our results for H3 confirm this argument, which is novel to the sustainability literature. There are various possible reasons for a company to have low green revenue but a high sustainability rating. These include greenwashing (i.e., cherrypicked ratings) but also deficiencies of green revenue, which may fail to account for sustainable business activities. Our finding tells managers that inconsistent information can hurt a company's valuation and is better avoided. Regulators, in turn, may be interested to see that a sustainability metric that is mandatory to report and hard to manipulate effectively creates incentives for companies to increase their sustainability, as it reduces, although does not eliminate, the potential for greenwashing.

Third, our results for H4 show that users count rather than discount likely redundant information (i.e., high green revenue and a high sustainability rating). Although it is reasonable to assume that green revenue and sustainability ratings overlap or correlate, their effects on investment decisions are independent. While the counting heuristic can explain this finding, it is not trivial, as participants could suspect there is a correlation due to overlapping objectives of the green revenue metric and the sustainability rating. For managers, our finding implies that reporting a high sustainability rating in addition to green

revenue is more worthwhile than one might expect in case of high green revenue. Taken together, our results for H3 and H4 imply that it is always a good idea to report a high rating, provided that it is not too costly to obtain. This means for regulators that the introduction of a standardized metric does not make sustainability ratings, and regulation of these, obsolete. Indeed, the European Commission (2023) initiated such regulation.

H5 and H6 complement H1 in examining non-disclosure of green revenue. Our results for H5 show that high green revenue increases investment probability not only against the baseline of low green revenue, but also of non-disclosure of green revenue. Our results for H6, in turn, imply that it is worse for a company to disclose low green revenue than not to disclose green revenue, if it has a choice. From a regulatory viewpoint, this finding underlines the importance of mandatory disclosure. The incentive for companies to avoid having low green revenue is significantly higher if low green revenue must be disclosed

Our additional analyses offer further exiting insights. A proenvironment attitude increases the effect of both green revenue and sustainability ratings on investment probability. Pro-environment investors also care about green revenue more than about sustainability ratings. A pro-government attitude, in turn, increases the effect of green revenue but not that of sustainability ratings. The moderating role of a pro-government attitude is an intuitive but novel finding. which adds to the literature. The moderating effect of a proenvironment attitude, in turn, is both novel and nontrivial. Specifically, why would pro-environment investors respond to green revenue more than to sustainability ratings? This question remains to be explored in future research. One possible reason is that investors who genuinely care about sustainability are suspicious of ratings, which have the reputation of being susceptible to greenwashing.

Finally, the effects of financial performance validate the design of our study. The effect of a company's financial performance on investment probability is much larger than that of sustainability (reporting), which is what any manager would expect. Likewise, the effects of green revenue and sustainability ratings are intuitively more pronounced if financial performance is high and, therefore, investors are interested in investing in the company in the first place, than if it is low, and they are disinterested.

CONCLUSION 6

Sustainability reporting helps investors make informed decisions and is hoped to facilitate the transition to a green economy. However, the lack of standardized metrics makes it difficult for investors to evaluate and compare companies' performance, who resort to third-party sustainability ratings instead. The European Union's Taxonomy Regulation introduces standardized metrics and makes their disclosure mandatory for a great many of companies. In an online experiment, we pit green revenue against a third-party sustainability rating to examine how such a standardized metric interacts with the rating to influence investment decisions. We find, first, that the disclosure of

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high green revenue, like that of a favorable rating, increases investors' willingness to invest. Second, if a company has low green revenue, it can mitigate but not level out investor's discount by adding a favorable rating. Conversely, if it complements the disclosure of high green revenue with a favorable rating, investors consider both signals to be independent. Third, voluntary disclosure is worthwhile for companies who do not fall under the regulation if they have high but not if they have low green revenue to disclose.

Our findings hold important lessons for management and regulators. Our results show that investor "vote" with their dollars. Hence, the disclosure of low green revenue reduces the probability for a company to raise funding, even if it is combined with a favorable sustainability rating. Conversely, a favorable sustainability rating normally comes without an extra cost if a company has a high share of green revenue because its operations are environmentally sustainable. In this case, investors reward the sustainability rating disproportionately. Summing up, it is always a good idea for a company to report a favorable third-party sustainability rating, whether it has high or low green revenue. That said, it pays off surprisingly much to report a favorable rating in the case where one would think that investors care less for it, which is when a company already discloses a high level of green revenue.

Our experiment contrasts a government regulation with the sustainability rating as a market-based solution. While ratings are popular, they lack standardization and reliability (Christensen et al., 2022). Although we describe the rating as assured by an independent third party in our experiment, the mandate gives green revenue more pull. Our additional analyses show that investors' reliance on green revenue is influenced by their attitude to government intervention. That said, our findings are not contingent on the investors' attitude to government regulation and environmental protection but hold in the whole sample. Overall, our findings imply that a government-backed mandatory and standardized metric effectively channels investments into sustainable business. However, they also suggest that taxonomyaligned reporting will not crowd out sustainability ratings. Instead, companies that have low green revenue to disclose will experience heightened pressure to resort to sustainability ratings as alternative proof of their sustainability to avert damage, and to explain why ratings are better metrics to measure their sustainability. Companies that have high green revenue, in turn, will likely rely on sustainability ratings to further stress the sustainability of their business.

Our study is not without limitations. First, we consider private investors in our experiment. However, there is much evidence that institutional investors also demand corporate sustainability (Ding et al., 2022; Federo et al., 2020; García-Sánchez et al., 2022; Pucheta-Martínez & Chiva-Ortells, 2018; Velte, 2023). Hence, future research could focus on how institutional rather than private investors use reporting standards, such as the European Union's Taxonomy, to assess investment options to complement our research.

Second, we provide aggregate descriptions for a sustainability rating and green revenue. Therefore, our results hinge on our explanations of the taxonomy and the sustainability score and the context provided (e.g., the aluminum industry). That said, green revenue and extant ratings are not perfectly transparent for investors; these rely on their understanding of the numbers, which is arguably similar to our explanations. Future research could, however, manipulate those explanations to probe the effect of the level of investors' understanding of the metrics on their investment decisions. Moreover, green revenue and sustainability ratings differ in various characteristics, such as whether standards are set by government or a private agency, or whether the sustainability metric is integrated into a financial metric (namely green revenue) or separate. Our simultaneous manipulation closely reflects extant metrics. It would be interesting, although, to manipulate these characteristics separately to isolate their effects.

To conclude, our study is an experiment, conducted in the early stages of the adoption of the Taxonomy Regulation. As reporting becomes mandatory for more and more firms, we hope to see archival research. For example, we are excited to see whether sustainability reports combine green revenue with sustainability ratings. This would confirm our conclusion that sustainability ratings remain worth reporting in the presence of green revenue, for which our experiment offers a causal intuition.

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Table A1 shows detailed breakdowns of the investment probability.

TABLE A1 Detailed summary statistics.

Panel A: Green revenue and sustainability rating

	Green revenue				
Sustainability rating	Little	Unreported	High		
Low	27.41	30.75	45.58		
	(28.19)	(28.93)	(31.19)		
Unreported	31.15	31.67	50.18		
	(29.19)	(29.54)	(32.70)		
High	45.67	49.30	63.93		
	(32.00)	(32.61)	(35.23)		

Panel B: Green revenue, sustainability rating, and financial performance

	Low financial perf	ormance		High financial performance			
	Green revenue			Green revenue			
Sustainability rating	Low	Unreported	High	Low	Unreported	High	
Low	5.71	11.04	22.41	49.11	50.46	68.74	
	(10.58)	(17.93)	(19.81)	(23.10)	(24.00)	(21.90)	
Unreported	9.45	9.44	24.34	52.85	53.89	76.02	
	(14.33)	(14.95)	(21.40)	(23.60)	(23.08)	(18.50)	
High	22.10	24.37	35.97	69.23	74.22	91.89	
	(21.70)	(21.58)	(26.63)	(21.57)	(20.41)	(14.38)	

Note: Mean and, in parentheses, standard deviation, of the investment probability (in percent) by condition (Panel A) and by financial performance and condition (Panel B) for all conditions.

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Tables A2–A4 complement the results reported in Tables 2–4. They report the results of the regressions underlying the contrasts in Tables 2–4.

TABLE A2Pro-environmentattitude.

	Coefficient	Standard error	p-Value
Green revenue			
Unreported	-1.46	1.36	0.287
High	13.03	1.92	< 0.001
Sustainability rating			
Low	-4.68	1.81	0.011
High	11.29	2.16	< 0.001
Pro-environment attitude	-10.15	2.71	< 0.001
Green revenue \times Sustainability rating			
Unreported $ imes$ Low	5.74	2.25	0.012
Unreported \times High	1.19	2.00	0.551
$High \times Low$	2.00	2.08	0.343
High imes High	1.95	2.52	0.441
Green revenue \times Pro-environment attit	ude		
Unreported $ imes$ Strong	3.91	1.99	0.052
$High \times Strong$	11.88	2.90	< 0.001
Sustainability rating \times Pro-environment	attitude		
$Low\timesStrong$	1.86	2.09	0.374
$High \times Strong$	6.39	3.04	0.038
Green revenue \times Sustainability rating \times	Pro-env. attitude		
$\textbf{Unreported} \times \textbf{Low} \times \textbf{Strong}$	-5.77	2.85	0.046
$Unreported \times High \times Strong$	3.81	2.72	0.165
$\text{High} \times \text{Low} \times \text{Strong}$	-5.63	2.99	0.063
$High \times High \times Strong$	-5.38	3.49	0.126
Constant	36.28	2.07	< 0.001

Note: Results of an ordinary least squares regression, with errors clustered by investor, of investment probability on green revenue, sustainability rating, and pro-environment attitude (observations as in Table 2, $R^2 = 0.13$). By median split, pro-environment attitude has two levels: strong and weak.

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	Coefficient	Standard error	p-Value
Green revenue			
Unreported	-1.44	1.67	0.393
High	15.88	2.15	< 0.001
Sustainability rating			
Low	-3.48	1.64	0.037
High	14.33	2.11	< 0.001
Pro-government attitude	-5.99	2.82	0.036
Green revenue \times Sustainability rating			
Unreported \times Low	3.50	2.22	0.118
Unreported \times High	0.50	2.05	0.808
$High \times Low$	-0.21	1.98	0.916
$High \times High$	-1.22	2.66	0.648
Green revenue \times Pro-government attitude	e		
Unreported \times Strong	3.79	2.02	0.063
$High \times Strong$	+6.13	3.08	0.049
Sustainability rating \times Pro-government at	titude		
$Low\timesStrong$	-0.51	2.10	0.808
$High \times Strong$	0.35	3.10	0.910
Green revenue \times Sustainability rating \times P	Pro-gov. attitude		
Unreported \times Low \times Strong	-1.30	2.92	0.656
Unreported \times High \times Strong	5.08	2.71	0.063
$High \times Low \times Strong$	-1.27	3.03	0.676
$High \times High \times Strong$	0.88	3.54	0.805
Constant	34.24	1.88	< 0.001

Note: Results of an ordinary least squares regression, with errors clustered by investor, of investment probability on green revenue, sustainability rating, and pro-government attitude (observations as in Table 2, $R^2 = 0.12$). By median split, pro-government attitude has two levels: strong and weak.

	Coefficient	Standard error	p-Value
Green revenue			
Unreported	-0.01	1.03	0.992
High	14.89	1.70	< 0.001
Sustainability rating			
Low	-3.75	0.95	< 0.001
High	12.65	1.55	< 0.001
Financial performance	43.39	2.67	< 0.001
Green revenue \times Sustainability rating			
Unreported \times Low	05.34	1.26	< 0.001
Unreported $ imes$ High	2.28	1.75	0.196
$High \times Low$	1.82	1.62	0.264
$High \times High$	-1.02	2.14	0.634
Green revenue \times Financial performance			
Unreported $ imes$ Strong	1.05	1.94	0.590
$High \times Strong$	8.28	2.44	< 0.001
Sustainability rating \times Financial performa	nce		
$Low \times Strong$	0.01	2.01	0.996
$High \times Strong$	3.74	2.48	0.135
Green revenue \times Sustainability rating \times F	in. performance		
$\textbf{Unreported} \times \textbf{Low} \times \textbf{Strong}$	-5.03	2.62	0.058
Unreported \times High \times Strong	1.67	2.88	0.564
$High \times Low \times Strong$	-5.36	3.02	0.079
$High \times High \times Strong$	0.51	3.43	0.883
Constant	9.45	1.45	< 0.001

Note: Results of an ordinary least squares regression, with errors clustered by investor, of investment probability on green revenue, sustainability rating, and financial performance (observations as in Table 1, $R^2 = 0.63$). Financial performance has two levels: high and low.

Financial performance. **TABLE A4**

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APPENDIX B

B.1 | Instructions

Thank you for agreeing to participate! In this study, we ask you to assume that you are a **private investor in search of an investment opportunity**. You will be asked to make a series of **investment decisions**. For each decision, you will be given **information about a company**.

- The study consists of three parts:
- I. Introduction to the types of information about the companies;
- 2. Eighteen investment decisions;
- 3. Further questions.

B.2 | Description of company data

Your company data will include one to three pieces of information: financial performance, the Sustainability Agency score, and green revenue.

B.2.1. | Financial performance

Financial performance refers to your potential gains from holding shares of the company, both from dividend payments and capital appreciation (increase in company value).

B.2.2. | Sustainability Agency score

Sustainability Agency is an independent non-profit organization that scores companies for sustainability. Companies that want to be scored report to the Sustainability Agency, which publishes the scores online. Those companies can include their score in their annual report. The Sustainability Agency provides those scores to help investors make better investment decisions with respect to climate change and other environmental impacts. The Sustainability Agency's scores are based on information from questionnaires, which are updated regularly. Scoring criteria include the quantity and quality of environmental information disclosed as well as the management's actions to manage the company's environmental impact.

B.2.3. | Green revenue

The government has adopted a list of environmentally sustainable business activities, the "taxonomy." Companies who fall under the taxonomy law must match their business activities against that list. These companies label revenue from listed activities as "green" in their annual reports. The purpose of the law is to help investors make better investment decisions with respect to climate change and other environmental impacts. For a business activity to be green, it must meet technical criteria such as low CO₂ emissions, which are updated regularly. Moreover, the business activity must comply with social minimum safeguards (e.g., workplace safety).

Please find below an example for a company you are going to evaluate hereafter.

Company data:

Financial performance	Low
Sustainability Agency score	High
Percentage of green revenue	High

Low denotes below industry average. High denotes above industry average.

Companies can voluntarily choose not to report their Sustainability Agency score and might not be obligated to report the percentage of green revenue, or both. In these cases, the table will say "not reported."

B.3 | Attention checks

Please answer the following questions.¹³

Which organization determines the company's sustainability score?

- A governmental agency.
- An independent rating agency.
- A group of private businesses.
- An international consortium of banks.

How is green revenue determined?

- By a rating agency based on publicly available information.
- By an auditor based on a list of sustainable business activities.
- By the company based on a list of sustainable business activities established by the government.
- By a rating agency based on questionnaires to be filled in by the company.

B.4 | Task

You will assess **18 companies from the aluminum industry**. Some of these companies report their Sustainability Agency score, some report their green revenue, some both, some neither.

If a company does not report a Sustainability Agency score or its green revenue, you **cannot infer that this company is hiding information**. Sustainability Agency scoring is voluntary, and the company may just not fall under the taxonomy law.

The aluminum industry is considered an energy-intensive industry with high CO_2 emission levels.

¹³The order of the answer options is randomized. Correct answers: "An independent rating agency." "By the company based on a list of sustainable business activities ..."

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Please indicate the probability that you would invest in each of the companies.

B.5 | Company

Company data¹⁴:

Financial performance	High
Sustainability Agency score	Low
Percentage of green revenue	Low

	What is the probability that you would invest in this firm? ¹⁵										
	Investment			probability			(from		0%	to	100%)
0	10	20	30	40	50	60	70	80	90	100	
•-		· — —								•	

B.6 | Questions

Please indicate your agreement with each of the following statements. $^{\rm 16}$

1. I try hard to carry my pro-environmental beliefs over into all the other parts of my life.

2. Because of my personal values, I believe that ignoring environmental matters is OK.

3. When it comes to questions about the environment, I feel driven to know the truth.

4. According to my personal values, ignoring human impacts on the larger ecosystem is OK.

5. I am motivated by my personal beliefs to try to protect the environment.

6. The interrelatedness of all living things in the ecosystem is something I have never felt personally compelled to consider.

7. What happens to the larger ecosystem, beyond what happens to humans, doesn't make much difference to me.

8. I have not found it essential to try to protect the larger ecosystem, beyond what happens to humans.

9. It is personally important to me to try to protect the larger ecosystem, beyond what happens to humans.

B.7 | Questions (continued)

Please indicate your agreement with each of the following statements.¹⁷

1. In my opinion, it is never acceptable for the government to intervene in markets.

2. In my opinion, the market rules and regulations the government sets are necessary to protect citizens and the environment.

3. In my opinion, government regulation of business usually does more harm than good.

 In my opinion, markets dominated by only one or a few businesses should be regulated by the government.

5. In my opinion, market systems require a lot of government control to be efficient.

6. In my opinion, there are some goods and services which should not be exchanged through a free market system.

7. Whom do you trust more to cope with the challenges of climate change: government or non-governmental organizations (e.g., business firms, non-profit organizations, and the like)?

¹⁴The order of both the cases and the attributes within in each case are randomized. ¹⁵A slider is adjusted to indicate the percentage. The slider is set to 0% by default but must

be moved, even if the investor's answer is "0%." ¹⁶The statements are rated on a 7-point Likert scale ranging from "Fully disagree" (1) to

[&]quot;Fully agree" (7). The items 2, 4, and 6–8 are reversely coded.

¹⁷The statements (1–6) are rated on a 7-point Likert scale ranging from "Fully disagree" (1) to "Fully agree" (7). The question (7) is answered on a 7-point scale, too, with the anchors "Government" (1) to "Non-governmental organizations" (7). The items 2 and 4–7 are reversely coded.