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The confusion of taste and consumption: Evidence from a stated-choice experiment☆

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ABSTRACT

In this paper, we conduct a stated-choice experiment with German retail investors to examine how labeling sustainability information as financially material or immaterial influences investment decisions. Results reveal a strong non-pecuniary preference for sustainability. However, emotional affect leads some investors to erroneously project sustainability information onto firms' financial performance, regardless of financial materiality. When poor sustainability ratings are labeled as financially material, investors demand further an additional return premium, indicating a misinterpretation of these labels as financial indicators. This bias is particularly evident among investors who incorporate sustainability for pecuniary reasons in the experiment but do not use such information in real-life investing. Our findings suggest that while sustainability labels can guide investor behavior, they also risk distorting financial expectations. This underscores the need for careful design in sustainability disclosure practices and better investor education on the implications of sustainability information.

1. Introduction

Sustainable investments comprise estimated market shares of more than one third of assets under management in North America, Europe and Australasia (GSIA, 2021). One approach to explain this phenomenon enlarges the traditional view of purely consumption driven investors by assigning sustainability a value on its own. In this case, the utility function should be characterized by an independent non-pecuniary taste component that motivates investors to lower return expectations for doing good. Both studies using experimental designs (e.g., Riedl and Smeets, 2017; Gutsche and Ziegler, 2019) and actual market data (e.g., Hong and Kacperczyk, 2009; Bofinger et al., 2022) find evidence for this taste hypothesis.

Disclosure requirements reflect the growing popularity of sustainable investments. In this context, financially material and financially immaterial information have to be distinguished. In the US, the Securities and Exchange Commission (SEC) considers disclosure requirements for sustainability information, which is related to financial performance and, thus, financially material for shareholders. In contrast, the EU advocates the wider stakeholder-oriented principle of "double materiality", which requires companies to disclose information on their general impact on the environment as well. To classify financially material and financially immaterial information, the Sustainability Accounting Standards Board (SASB) has developed an industry-specific materiality framework, which gives guidance on how sustainability information affects enterprise values.[1] Khan et al. (2016) show empirically that the distinction between financially material and immaterial information may be economically important since expected financial performance and financially material sustainability information are related to each other.

According to the efficient market hypothesis (Fama, 1970), information that is publicly available and deemed financially material should already be reflected in stock prices, rendering it irrelevant to enhance financial performance, particularly for (less informed) non-professional investors. Thus, the binary classification of sustainability information into financially material and immaterial categories may not only fail to augment the decision-making process for retail investors but could even lead to biased financial expectations. Investigating the effects of introducing distinct labels for financially material

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[1] The assessment of whether an information is financially material may change over time. Therefore, the World Economic Forum (WEF) advances the concept of dynamic materiality which states that financial immaterial information can become material over time. An obvious example are carbon emissions (cf. Bolton and Kacperczyk, 2021).

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and immaterial sustainability, this paper examines the consistency of investors' intention to use sustainability information with regard to firms' financials and taste. Can investors distinguish information related to sustainability (taste component) and financial performance (pecuniary component) appropriately or are they becoming biased and project sustainability characteristics to financial fundamentals once a sustainability information is labeled as financially meaningful?

While the existence of non-pecuniary taste for sustainability has been confirmed by various studies (e.g., Hong and Kacperczyk, 2009; Riedl and Smeets, 2017 or Gutsche and Ziegler, 2019), Hartzmark and Sussman (2019) and Siemroth and Hornuf (2023) have uncovered behavioral biases emerging when sustainability and financial information are considered concurrently, resulting in a distortion of investors' performance expectations. With respect to enlarging disclosure requirements and classification systems, an open question persists: may the implementation of more specific labels for financially material and immaterial sustainability ratings mitigate such biases, or might it overwhelm cognitive capacities and exacerbate the situation? To address this question directly, we conduct a stated-choice experiment among 346 German non-professional retail investors. Choice experiments present participants with hypothetical scenarios where they must choose between alternative options, each described by specific attributes, to elicit preferences and decision-making behavior. In our experiment, participants are presented with various investment opportunities characterized by risk-return trade-offs (pecuniary component) and financially material and immaterial sustainability ratings (taste component). Importantly, participants are explicitly informed that risk-return trade-offs and sustainability information are independent and disentangled from each other. This experimental setup mirrors real-market conditions, where some sustainability information may indeed be financially material but already factored into stock prices due to market efficiency. Consequently, all sustainability information should theoretically be irrelevant for investment decisions made by purely pecuniary-driven investors. Conversely, for taste-driven investors, sustainability information should hold significance, with no justification for treating financially material and immaterial ratings differently. In the experiment, we test how investor react to these different kinds of sustainability labels.

The main findings are the following: First, the experiment confirms that investors have a non-pecuniary taste for sustainability. Good and bad sustainability ratings are treated differently. Independent of the label regarding financial materiality, investors try to avoid bad ratings while they favor good ones and green (marketing) labels. This behavior resembles the reaction towards risk. Investors demand a four times higher compensation for assets with high risk compared to what they are willing to forego for firms with low risk.

Second, there is evidence that only the perception of bad sustainability information depends on the label for financial materiality. Investors demand a return premium that is significantly higher for investments with a bad financially material sustainability rating compared to those with a bad financially immaterial ones. For the whole sample, the extra return required is 0.85 percentage points.

Third, to explore why the perception of bad sustainability information depends on the label for financial materiality, we divide investors into three groups. These are investors who (i) did not use sustainability information at all, (ii) used sustainability information exclusively for non-pecuniary reasons and, (iii) used sustainability information also for pecuniary reasons within the experiment. We find that the distinction between bad material and immaterial ratings is only significant for the latter group of pecuniary-driven investors who demand an extra return of 1.85 percentage points for investments with bad financially material compared to bad financially immaterial sustainability ratings. This suggests that this sustainability information is regarded as financially informative by these investors. However, in light of the experimental setup, this behavior cannot be explained with rationality. It seems that the distinct and salient labeling into financially material and financially immaterial ratings induced these investors to confuse taste information with firm fundamentals and assign a higher weight to the ratings as consciously intended.

Fourth, we also consider the impact of real-life investing behavior and individual-specific characteristics on results. We asked investors whether they use sustainability information in their real-life investing decisions and formed again three groups of investors (i) not using sustainability ratings at all, (ii) using sustainability ratings exclusively for non-pecuniary reasons and (iii) using sustainability ratings also for pecuniary reasons. It turns out that only investors who do not use sustainability information in real-life distinguish between bad financially material and immaterial sustainability ratings. This observation suggests that these investors confuse pecuniary and taste information as ratings on sustainability and financial materiality become available. It seems that these investors got erroneously activated by wealth concerns to use the provided ratings in the experiment. The other two subgroups seem to also project sustainability information on firms' financial performance but do not differentiate this information according to financial materiality. Moreover, they are characterized by a higher intrinsic motivation. There behavior is more likely to be explained by emotional affect, i.e. the believe that "doing good leads to something good" as proposed by Hartzmark and Sussman (2019).

Our paper contributes to the literature on sustainable investing. While other studies address the question of non-pecuniary taste (e.g. Riedl and Smeets, 2017; Gutsche and Ziegler, 2019; Barber et al., 2021 or Heeb et al., 2022), we ask whether taste-driven investors can consistently distinguish between information related to taste and financial performance. Most closely related to our research, Hartzmark and Sussman (2019) find evidence for emotional affect to explain sustainable investing. Our experimental dichotomy of labeling financially material and immaterial taste information separately extends the literature by showing that not only affect but also pecuniary wealth concerns motivate investors to deviate from optimal investment decisions. In line with Døskeland and Pedersen (2016) we find proof for the high effectiveness of addressing wealth concerns to induce a more sustainable investment behavior. These insights are important for policy makers and regulators who are currently trying to establish uniform classification frameworks for sustainable investments. As shown by Khan et al. (2016), there may be also rational motives to discriminate between financially material and immaterial sustainability information. However, the examination of performance differences and the implied hypothesis of errors-in-expectations (e.g. Derwall et al., 2011; Borgers et al., 2013) is not subject to this study.

The remainder of the paper is organized as follows. Section 2 discusses relevant literature and develops the research question. Section 3 describes the methodological approach and data. Section 4 reports the empirical results. Section 5 concludes and suggests future fields of research.

2. Theoretical framework and literature review

This section gives an overview over the literature on sustainability information and investing. Section 2.1 discusses the literature on investors' perception towards sustainability. Sections Section 2.2 reviews the concept of financial materiality in the context of sustainability reporting. Section 2.3 addresses the research question of this paper.

2.1. Sustainability information and investment decisions

The literature suggests that investors may use sustainability information for pecuniary and non-pecuniary reasons. From a traditional view, markets are efficient and investment decisions reflect optimal consumption plans. Investors consider sustainability issues only if they enhance market efficiency and enlarge information. In a inefficient market failing to price the informational value of sustainability correctly, sustainable investing may be used as a successful investment

strategy to achieve positive alphas (Derwall et al., 2011). The empirical evidence for a mispricing of sustainable assets is ambiguous, depending on the geographical focus (e.g. Auer and Schuhmacher, 2016), time-horizon (e.g. Borgers et al., 2013) as well as ways of measuring both sustainability (Halbritter and Dorfleitner, 2015) and financial performance (Belghitar et al., 2014). Other analysis indicate a reduced crash and downside risk protection of sustainable investments, reasoned in potentially higher levels of transparency and enhanced trust in times of financial turmoil.[2] Nofsinger et al. (2019) find support for an asymmetric sustainability preference. In contrast to strengths, weaknesses are valued by institutional investors as they may represent additional down-side risk.

Apart from future consumption plans, investors may derive non-financial utility from "doing good". Depending on the size of this taste component, investors may be willing to forego utility derived from consumption in exchange for non-financial taste. In this case, the differentiation between financially material and immaterial issues should not be meaningful for investors. If this group is large enough in size, taste may also influence equilibrium prices and firms' cost of capital (e.g. Heinkel et al., 2001; Friedman and Heinle, 2016). The findings of studies examining historical market data are mainly consistent with this hypothesis of shunned-stocks (Derwall et al., 2011) and support the existence of a taste component (e.g. Hong and Kacperczyk, 2009; Borgers et al., 2015; El Ghoul and Karoui, 2017; Barber et al., 2021). Analyzing green and conventional municipal securities in the U.S., Larcker and Watts (2020) observe no differences in the pricing of green and conventional securities, though.

Experimental research designs have tested different motives to explain non-financial taste. In its strongest form, investors may see investing as a form of environmentalism. According to value-belief-norm (VBN) theory (Stern et al., 1999), pro-environmental actions are the result of a feeling to be morally obligated to act, induced by personal norms. To activate these norms, individuals must not only (i) show high transcendental values but also (ii) fear that things they value are in threat and (iii) believe that their actions are an effective tool to counteract. Brodback et al. (2019) find evidence that VBN can be applied to explain sustainable investing. Also warm-glow (Andreoni, 1989, 1990), the good feeling from doing good, assumes an intrinsic motivation for pro-environmental behavior. Unlike VBN, this feeling is neither an obligation nor does it depend on the actual impact of personal actions and can be regarded as an impure form of altruism. Gutsche and Ziegler (2019) find warm-glow to be the main determinant for explaining sustainable investing. In line with the idea of warm-glow, Heeb et al. (2022) suggest that sustainable investors are not consequential in their taste and seek rather for positive emotions than actual impact. Social norms and perceived social pressure may be a third non-pecuniary motive for sustainable investing. In contrast to the two preceding approaches, social norms represent an extrinsic motivator. Hong and Kacperczyk (2009) explain their observed abnormal returns of sin stocks with social norms. Also (Brodback et al., 2019) support the impact of norms on investing behavior. Riedl and Smeets (2017) find a significant influence of social signaling that is related to social norms. The results of Gutsche and Ziegler (2019) do instead not indicate a direct relation between the consideration of sustainability information and social pressure.

2.2. Financial materiality

Sustainability information may or may not be related to a firm's financial performance. According to the Securities and Exchange Commission (SEC), "a matter is 'material' if there is a substantial likelihood that a reasonable shareholder would consider it important". The Sustainability Accounting Standards Board's (SASB) aims to establish industry-specific standards for the materiality of sustainability issues. Matching this recently published classification with existing sustainability ratings from *MSCI KLD,khan2016corporate* find performance-related differences between material and immaterial sustainability issues. While assets with good material ratings outperformed those with poor ones, there is no comparable effect for immaterial ones. As found by Amel-Zadeh and Serafeim (2018) and Eccles and Klimenko (2019), materiality represents the main driver why professional investors use sustainability information today. ESG integration, the systematic use of financially material information, is globally seen the most popular sustainability investing strategy (GSIA, 2021). Also the methodology of third-party sustainability rating providers as, for example, MSCI, Refinitiv or Sustainalytics is putting increased focus on delivering financially material information. However, once unambiguous information regarding the materiality of sustainability issues is available to the public, such information should be incorporated in stock prices, meaning that investors cannot longer use such information to beat the market.

Under the term "dynamic materiality", it is currently discussed whether a clear demarcation between financial materiality and immaterial sustainability is actual possible. Following Freiberg et al. (2019), changing societal expectations may induce so far financially immaterial issues to become material in the future. Bolton and Kacperczyk (2021) show that carbon emissions got systematically priced and thus materialized only recently. Several standard setters, including the Sustainability Accounting Standards Board (SASB), meanwhile adopted this way of thinking about sustainability reporting.

To cope with the challenges of the climate change, also regulators and policymakers are increasingly trying to set incentives for sustainable investments. The idea that sustainability represents an inherent value in itself is currently pursued by the efforts of the EU. For reaching the objectives of its 2030 Climate Target Plan and aligning investment activities to climate goals, it advocates the concept of "double materiality". Broadly speaking, this means that companies should not only report sustainability information if it is (i) financially material for shareholders but also if it is (ii) financially immaterial but material for the broader public of stakeholders, including the environment. The concept of "double-materiality" thereby extends the stockholder-oriented focus of financial materiality to the stakeholder-oriented view of impact materiality. This non-pecuniary information should be relevant for taste driven investors, though.

Notably, no uniform classification system has been established until today. Frameworks like the Global Reporting Initiative (GRI), the UN Principles for Responsible Investing (PRI) or the EU's Taxonomy are still under development and differ widely in their methodology. Also third-party rating providers show large divergence in their sustainability assessment (Chatterji et al., 2016; Berg et al., 2022). This does not only complicate the academic analysis of sustainable investing with historical market data but also gives stage to the possibility of greenwashing conventional investments with random sustainability labels to attract more customers (e.g., Ghoul and Karoui, 2021 or Kleffel and Muck, 2023).

2.3. Research question

In this paper, we investigate how labels related to financially material and immaterial information affect investment decisions of non-professional retail investors. The differentiation according to financial materiality reflects the interrelationship between sustainability information and financial performance. However, once uniform ratings regarding the materiality of sustainability issues are publicly available, these ratings may no longer represent superior information, as their financial value should already be incorporated into stock prices. This poses a challenge for less-informed retail investors who may be encouraged by the term "financially material" to attribute pecuniary

[2] See, e.g., Kim et al. (2014), Nofsinger and Varma (2014), Lins et al. (2017), Broadstock et al. (2020).

value to these ratings, despite their potential lack of utility for enhancing financial performance. We inquire whether retail investors can disentangle this relationship in the context of their investment decisions. Observing investment decisions when providing traditional risk-return trade-offs and distinct labels related to financially material and immaterial sustainability, we explore how they deal with this complexity. May the introduction of such labels induce an inherent, unintentional pecuniary preference for financial materiality?

It is expected that financial materiality does not matter for rational investors along the taste dimension of their decisions. However, very detailed information can also overstrain investors. Borgers and Pownall (2014) suggest that the simultaneous consideration of both pecuniary and non-pecuniary goals may represent an overwhelming task for at least some market participants. From psychological literature it is known that individuals base their decision on simplifying but not necessarily rational heuristics (mental shortcuts) in such situations of cognitive overload (e.g., Tversky and Kahneman, 1974). The way how salient or prominent sustainability information is presented to investors may have an impact on how investors use it. Bordalo et al. (2013) find that consumers focus their attention to salient attributes when making choice decisions between different goods. Examining investors' reaction to the introduction of the Morningstar globe rating, Hartzmark and Sussman (2019) highlight the importance of salience and affect, that is, the tendency to base decisions rather on emotions than rationality, to explain sustainable investing. Funds rated best (worst), experienced significant inflows (outflows) in the months succeeding the publication of the ratings. This observation can primarily be traced back to the discrete five-glow-rating system and less to the more detailed continuous sustainability scores. Similarly, Siemroth and Hornuf (2023) find indications that German crowdfunders do not compartmentalize information concerning sustainability and financial performance as they opt for sustainable investments due to the biased belief that such choices yield greater profitability. In this paper and in contrast to the existing literature, we differentiate between labels with regard to financially material and immaterial sustainability information and confront investors with these salient attributes. The set-up is particularly interesting as it delivers insights whether the reduced informational barriers accomplished by such distinct ratings may at the same time be regarded with concern from the perspective of non-professional investors by increasing behavioral biases in their financial decision making.

3. Data and methodology

To address the research question, we conduct a stated choice experiment. Choice experiments are implemented to estimate preferences for existing but also hypothetical products and product attributes. In the experiment, participants choose among different alternatives. Assuming that participants will select the alternative which provides them the highest utility, preferences can be estimated from observed choices. In comparison to more traditional methods of preference elicitation as, for example, standard surveys or conjoint analyses, the indirect nature of choice experiments enhances the external validity of estimation results. Depending on the particular application and context, the meta-analysis of Haghani et al. (2021) suggests that also stated choice experiments can be subject to hypothetical biases as a result of social desirability, salience, or a lack of real-life consequences of choices. However, such potential hypothetical biases concern primarily absolute and less marginal estimates. Since our focus is on the relative importance of financially material and financially immaterial sustainability information, these biases are of minor importance in the context of this paper. Moreover, there were no incentives for participants within the experiment. In this regard, we follow Gutsche and Ziegler (2019) who were the first to introduce stated choice experiments to financial research. This ensures comparability of our results to theirs.

The goal of our study is to estimate the preferences for sustainability information. In particular, we are interested in the utility that investors derive from labels for financially material and immaterial sustainability. Therefore, we observe investors' choices between various investment alternatives. Each alternative is characterized by a traditional risk/return trade-off, financially material and immaterial sustainability labels, and other information as detailed below. Empirically, sustainability and financial performance may interact. To disentangle these effects, participants were explicitly informed, that all financially material information (including such sustainability information) is already incorporated in expected returns and risk. This information is communicated before and during the experiment.[3] All empirical analysis of the choice experiment are done with BIOGEME (Bierlaire, 2020), a flexible open source Python package designed particularly for the analysis of choice models. We consider all random parameters to be continuously normal distributed and rely on 500 Halton draws with a base of 2 for simulations.[4]

This section gives details on the data and the methodology. Section 3.1 addresses the data and survey design. Section 3.2 discusses the methodology of the stated choice experiment. Section 3.3 details the characterization of participants and their attitude towards sustainability.

3.1. Data

The study relies on a sample of exclusively experienced retail investors, which was collected in an anonymous online survey in collaboration with three local German cooperative and savings banks in summer 2021. Participants were invited through their online banking and newsletter subscriptions to the questionnaire. As a reward for finishing the survey, participants had the chance to win a 10 Euro voucher for regional shopping. Table 1 shows the demographics of survey participants. To assure the external validity, only participants with investment experience are included in the analyzed sample. The sample is representative in terms of gender and education for German investors. Market participants over the age of 60 are underrepresented, though.[5] To control for possible differences related to generation, we additionally surveyed business students with investment experience from a German university as a comparison group. After the exclusion of inconsistent and incomplete responses, our final sample consists of 267 German bank clients and German 79 students, all experienced in stock market investing. Considering a total sample size of 346 participants and the applied experimental design, our data fulfills the various requirements regarding the sample size selection discussed in the choice modeling literature.[6] To further ensure the representativeness of this sample, participants were also confronted with a second choice experiment that is similar to Gutsche and Ziegler (2019) who surveyed a representative sample of German investors. Qualitatively, we replicate their results. This supports the external validity of our data.

The consistency and comprehensibility of the questionnaire were ensured by a pre-test of 63 participants and discussions with experts. Personal interviews and feedback of participants in the pre-test indicate that they understood the concept of financial materiality better by using the term "value-relevant". As a result, we employed the terms "value-relevant" and "not value-relevant" instead of financially material and immaterial in the survey. More precisely, sustainability information was classified as (not) value-relevant if it had (not) a significant positive or negative impact on firms' business success and firm value. To ensure

[3] See also Appendix A.6.

[4] The base number serves as the foundation for generating quasi-random sequences for Halton draws.

[5] See Deutsches Aktieninstitut (2020).

[6] See Assele et al. (2023) for a literature overview.

Table 1
Demographics of participants.

Measure	Value	Bank clients		Student investors	
		# of obs.	%	# of obs.	%
Gender	Female	90	33.71	23	29.11
	Male	176	65.92	56	70.89
	Non-Binary	1	0.37	–	–
Age	16–24	21	7.87	48	60.76
	25–34	49	18.35	31	39.24
	35–44	45	16.85	–	–
	45–54	67	25.09	–	–
	55–65	67	25.09	–	–
	More than 65	18	6.74	–	–
Income	Less than 1'700€	19	7.12	42	53.16
	1'700-2'599€	28	10.49	15	18.99
	2'600-3'599€	63	23.60	10	12.66
	3'600-4'999€	66	24.72	5	6.33
	5'000-7'000€	37	13.86	4	5.06
	More than 7'000€	26	9.74	–	–
	No answer	28	10.49	3	3.80
Education	Secondary school	73	27.34	–	–
	High school	48	17.98	28	35.44
	University	105	39.33	51	64.56
	Advanced vocational education	37	13.86	–	–
	Other	1	0.37	–	–
	No answer	3	1.12	–	–
Investment experience	Less than 1 year	17	6.37	19	24.05
	1-5 years	64	23.97	45	56.96
	More than 5 years	169	63.30	15	18.99
	Professional/ Institutional investor	5	1.87	–	–
	No answer	12	4.49	–	–
Total: 346		267	77.17	79	22.83

Note: The table shows the demographics of survey participants. # of obs. refers to the absolute number of participants in a category. % is the amount of participants in a category set in relation to each sample.

clarity on this binary concept, we took proactive measures by presenting two easy-to-understand graphs explaining vividly the difference between financially material and immaterial sustainability issues to participants before they joined the experiment (see Appendix A.5). Upon querying participants about their clarity regarding the difference between value-relevant and not value-relevant sustainability issues before the experiment started, we found that more than 95 percent of participants indicated that they understood the distinction. This results is in line with the feedback we received from personal interviews of the pre-test stage. In the remainder of this paper and for the sake of clarity, we will refer to financial materiality instead of value-relevance, though. To make the concept of sustainability more tangible for study participants, our experiment focused further exclusively on the environmental dimension. This is the most prevailing sustainability aspect in light of current accounting and policy efforts[7] and the most referred sustainability category among investors according to Hartzmark and Sussman (2019). All relevant survey questions can be found in Appendix.

3.2. Stated choice experiments

Within the experiment, each participant i faced $M = 5$ different choice sets. In each choice set m participants were asked to choose between two conventional and two green labeled mutual funds.[8] Additionally, participants were given the opportunity to invest in a savings account ("status quo option"). An exemplary choice set is provided Fig. 1. In choice modeling, it is assumed that the utility U_{ijm} can be divided into an observable value function V_{ijm} and an unobservable identically and independently (i.i.d.) distributed error term ϵ_{ijm}.

$$U_{ijm} = V_{ijm} + \epsilon_{ijm}$$

For each alternative j a separate value function is given.

$$V_{i1m} = \alpha_{\text{fund}} + \beta' x_{i1m} \quad (1)$$

$$V_{i2m} = \alpha_{\text{fund}} + \beta' x_{i2m} \quad (2)$$

$$V_{i3m} = \alpha_{\text{fund}} + \alpha_{\text{green}} + \beta' x_{i3m} \quad (3)$$

$$V_{i4m} = \alpha_{\text{fund}} + \alpha_{\text{green}} + \beta' x_{i4m} \quad (4)$$

$$V_{i5m} = 0 \quad (5)$$

The alternatives $j \in \{1,2\}$ are conventional funds while $j \in \{3,4\}$ are green funds. The alternative $j = 5$ is the status quo option (savings account), which was added to increase realism and enhance the external validity of the experiment. The value function of this option constitutes the overall reference level and is set to zero. The preference for green funds in comparison to conventional ones is measured by α_{green}. Mutual fund alternatives are further characterized by (i) expected return, (ii) risk and (iii) geographic investment focus. The latter was also added to increase realism by reducing the salience of the sustainability characteristics. Participants were further provided with distinct financially material and immaterial sustainability ratings. Both ratings are divided into the levels "good", "middle" and "bad".

Our study aims to investigate whether retail investors understand that a financial sustainability label does not necessarily correlate with enhanced financial returns when such information is publicly available. Therefore, our experimental design needed to clearly separate financial returns from sustainability characteristics. Unlike Gutsche and Ziegler (2019), who used historical returns, we opted to provide participants with expected returns. This approach disentangles sustainability and risk/return information by definition. Using historical returns instead of expected returns would not permit this analysis, as participants might base their financial expectations rationally justifiable on sustainability characteristics (see, e.g., Khan et al., 2016).

All attributes and their corresponding levels are captured by x_{ijm}. The variables are summarized in Table 2. In total, we created 60

[7] These accounting and policy efforts include, e.g., the EU Taxonomy, EU Emissions Trading Scheme, Carbon Disclosure Project, and the GHG protocol.

[8] Mutual funds were offered instead of single stocks to address potential diversification concerns.

Advertised as:	**Normal Fund**	**Normal Fund**	**Green Fund**	**Green Fund**	**Savings Account**
Expected Return	10%	2%	5%	2%	0%
Risk	High	Low	High	Middle	No Risk
Geographic Focus	International	Germany	Germany	International	
Value-relevant Sustainability Rating	Bad	Good	Bad	Middle	
Not Value-relevant Sustainability Rating	Middle	Good	Good	Bad	
Your Choice:	○	○	○	○	○

Fig. 1. Exemplary choice set for illustration. In total, 60 different choice sets were created using D-efficient experimental designs.

Table 2
Attributes and attribute levels of the stated choice experiment.

Attribute	
Expected annual return	1%, 2%, 3%, 5%, 6%, 7%, 8%, 10%
Risk	Low, **Middle**, High
Green label	Yes, No
Material sustainability rating	Low, **Middle**, High
Immaterial sustainability rating	Low, **Middle**, High
Geographic focus	**International**, Domestic

Note: The table shows the attributes and corresponding attribute levels used in the choice experiment. For categorical variables, the reference category is printed in bold type.

Table 3
Summary statistics of individual-specific characteristics.

Variable	Mean	Standard deviation	Min	Max
Warm glow	5.37	1.51	1.0	7.0
Social norms	4.10	1.36	1.0	7.0
Environmentalism	22.75	17.70	0.0	49.0
Transcendental values	5.57	0.91	1.5	7.0
Perceived environmental threat	5.66	1.43	1.0	7.0
Perceived effectiveness	0.68	0.47	0.0	1.0
Risk aversion	5.07	1.99	1.0	11.0
Patience	6.55	2.43	1.0	11.0
High literacy	0.83	0.38	0.0	1.0
High income	0.49	0.50	0.0	1.0

Note: The table shows summary statistics of the individual-specific characteristics used as explanatory variables. "arm glow" "ocial norms", "Transcendental values" and "erceived environmental threat" are measured on Likert scales ranging from 1 to 7. "Perceived effectiveness" is a binary variable coded to one if participants believe in the effectiveness of sustainable investing to do something good and zero otherwise. "Environmentalism" is the product of "Transcendental values", "Perceived environmental threat" and "Perceived effectiveness". "Risk aversion" and "Patience" assess individuals attitude towards risk and time on Likert scales ranging from 1 to 11. "High literacy" and "High income" are binary variables coded to one if respondents answered at least three out of four financial literacy questions correctly or stated to earn an above average monthly net income of 3'500€ or more. Summary statistics are based on the answers of 346 German retail investors. Apart from income, students did not show significant differences to bank customers regarding the assessed personality traits.

different choice sets which were blocked into 12 groups and randomly assigned to participants. The applied D-efficient experimental designs[9] are based on prior values from pre-test results and were generated with the software *ChoiceMetrics Ngene*.

The objective of the empirical analysis is to determine the impact of sustainability labels on investment decisions. For this purpose, the corresponding vector β is estimated from observed choices. Under the assumption of i.i.d. extreme-value I distributed unobservable error terms, each observed choice can be expressed by a multinomial logit model. The value function and thus the probability of an alternative is coded one if the alternative was chosen and zero otherwise. The quested vector β can then be estimated with the method of maximum-likelihood.[10]

To facilitate the interpretation of results, we also calculate the corresponding return premium or discount in terms of percentage points that investors demand for accepting a fund which includes a respective attribute. In the literature, this elasticity is known as the Willingness-to-Pay (WTP) and is determined by the negative ratio of the estimated mean of an attribute of interest and the estimated parameter for expected returns. The WTP is positive (negative) if investors demand a return premium (discount) for choosing a fund which includes the specific attribute.

The expected serial correlation resulting from the panel structure of data violates the assumption of i.i.d. distributed error terms. To overcome this restriction, we assume α_{fund} and α_{green} to be normally distributed within the population. Similarly, all attributes x_{ijm} are assumed to be normally distributed to account for potential heterogeneity in taste. In consequence, the standard deviation of the distributed parameters has to be estimated from data in addition to the mean. In line with literature, "Expected returns" is defined as a fixed parameter, as is represents the monetary attribute used to derive WTP estimates. The gained flexibility of such mixed logit models comes at a numerical cost. Closed form solutions for the probability equations are not available and the parameters can only be estimated by simulating probabilities with Monte Carlo methods.[11]

[9] See, e.g., Street et al. (2005).
[10] See, e.g., Train (2009).
[11] See, e.g., Train (2009) or Hensher and Greene (2003).

3.3. Individual characteristics

To characterize participants attitude towards sustainability, we collect data on a number of individual characteristics. Summary statistics are provided in Table 3. In line with Gutsche and Ziegler (2019), the variable "warm glow" was estimated by asking participants how far it makes them happy to do something good for the environment. The variable "social norms" is based on two questions about the role and expectations of one's surrounding concerning sustainability. These questions were answered on 7-point Likert scales. As proposed by VBN theory (Stern et al., 1999), "Environmentalism" is assessed by the product of transcendental values, perceived environmental threat, and the perceived effectiveness of sustainable investing to protect the environment. Items for biospheric and altruistic values are taken from the E-PVQ developed by Bouman et al. (2018) to measure "Transcendental values". "Perceived environmental threat" is controlled by two questions about environmental and climate protection on 7-point Likert scales. Finally, we created the dummy variable "Perceived effectiveness". It is zero if participants regard a lack of environmental effectiveness as an obstacle for sustainable investing and one otherwise. With Cronbach alphas higher than 0.7, all used constructs show acceptable levels in terms of internal consistency.

The ability to distinguish between taste and consumption information may depend on cognitive capabilities and financial expertise. Dohmen et al. (2010) find a positive effect of patience and risk-taking on individuals cognitive capabilities. Therefore, risk and

time preferences are assessed on 11-point-scales, using the respective finance-related survey questions for "Risk-aversion" and "Patience" validated by Dohmen et al. (2011) and Vischer et al. (2013). Financial literacy is estimated using the "Big Five" questions from Lusardi and Mitchell (2011) excluding the question on mortgages due to lack of relevance in the given context. To distinguish between investors with higher and lower financial literacy, we transform this ordinal concept into the binary dummy variable "High literacy", which equals to one, if respondents answered at least three out of four question correctly and zero otherwise.[12] Eventually, the taste-driven appreciation of sustainability may require a certain amount of wealth. The dummy variable "High income" is one if the respondent stated to have a monthly net household income above the German average of 3'600 Euros.[13] Apart from income, students did not show significant differences to bank customers regarding the assessed personality traits.

3.4. Actual use of sustainability information

In order to bridge the gap between participants' behavior in experimental settings and their real-life investment practices, participants were asked about their use of sustainability information in actual investment decisions. Interestingly, a slight majority of participants (51.4%) reported to already incorporate sustainability information into their real-life investment decisions. While non-financial motives are prevailing, 38.8% cited (also) pecuniary motives such as performance enhancement or risk mitigation as a reason for using sustainability information. Their main impediment relates instead with 58.4% to the ambiguity and availability surrounding sustainability information. Vice versa, only 15.7% of this investor group stated to not rely more on sustainability information due to financial concerns.

This holds even stronger for those not investing sustainably in real-life. More than 75% of these investors expressed uncertainty or faced challenges in determining the sustainability of investment options as a reason for restraining from sustainable investments. These findings suggest a prevailing skepticism among investors regarding the credibility and accessibility of sustainability information in the investment landscape and gives reason to anticipate that the provision of unambiguous sustainability ratings, as utilized in our experiment, could serve as a catalyst for encouraging greater reliance on sustainability information among participants. Concerns with regard to the financial performance of sustainable assets where expressed instead only by one third of these conventional investors".

4. Results

This section contains the experimental results. Section 4.1 addresses the impact of sustainability information on investors' behavior. Section 4.2 explores the motivation for doing so. In particular, we consider pecuniary and non-pecuniary motives. Section 4.3 looks at the link to the actual real-life investment behavior.

4.1. Impact of sustainability information on investors' behavior

Table 4 shows the results of the mixed logit model discussed in Section 3.2. The table includes the corresponding WTP estimates. Recall that a positive (negative) WTP indicates that investors request a return premium (discount) for choosing a fund with such an attribute. Except for expected returns, all parameters are assumed to be normally distributed, as indicated by the estimated standard deviations. To begin with risk/return trade-offs, it turns out that investors derive positive utility from expected returns and show an aversion towards risk. This is in line with expectations. Note that high and low risk are treated asymmetrically, though. While investors require an extra return of about 4 pp for high risk investments they are willing to sacrifice only 1 percentage point of return when risk is low.

Table 4
Basic mixed logit estimation results of the choice experiment. .

Explanatory variables	Mean	Standard deviation	Mean WTP
Expected Return	0.324***	–	–
	(0.0176)		
Mutual Funds	3.01***	3.09***	–
	(0.524)	(0.435)	
Risk high	−1.31***	1.01***	4.04 pp
	(0.124)	(0.181)	
Risk low	0.327**	0.788***	−1.01 pp
	(0.0933)	(0.132)	
Domestic focus	−0.0933	0.151	n.s.
	(0.061)	(0.0926)	
Green Label	0.384***	0.0124	−1.18 pp
	(0.0731)	(0.152)	
Material good	0.346***	0.0525	−1.07 pp
	(0.0837)	(0.121)	
Material bad	−1.30***	0.122	4.00 pp
	(0.104)	(0.165)	
Immaterial good	0.296***	0.388***	−0.91 pp
	(0.085)	(0.125)	
Immaterial bad	−1.02***	0.248	3.15 pp
	(0.101)	(0.152)	
δ Mat.-Immat. good	0.05	–	n.s.
δ Mat.-Immat. bad	−0.28**	–	0.85 pp
Students			
x Green Label	−0.116	0.226	n.s.
	(0.146)	(0.213)	
x Material good	0.116	0.155	n.s.
	(0.174)	(0.22)	
x Material bad	−0.153	0.234	n.s.
	(0.228)	(0.308)	
x Immaterial good	−0.404**	0.117	1.25 pp
	(0.171)	(0.238)	
x Immaterial bad	−0.277	0.263	n.s.
	(0.217)	(0.275)	
N (# of observations)	346 (1719)		
Log-likelihood	−1,959.688		

The table shows the results of a mixed logit model for the choice experiment. For fixed parameters only the 'Mean' is estimated, whereas for random parameters also the 'Standard deviation' is reported. 'Mean WTP' shows the average willingness to pay in terms of expected returns, measured in percentage points (pp). Differences in student behavior are controlled by respective interaction terms. 500 Halton draws were used for simulation of the random parameters. The corresponding *t*-statistics of the parameter estimates are in parentheses. * (**, ***) means that the estimated parameter is different from zero at the 10% (5%, 1%) significance level, respectively. All estimation results are calculated using Panda's Biogeme.

The variables "Material good/bad" and "Immaterial good/bad" measure the impact of financially material and immaterial sustainability information on expected returns. These are the variables of main concern. Investors distinguish between good and bad ratings. Similar to risk, the importance of avoiding bad ratings is about four times as high as the corresponding preference for good ones. Psychological literature suggests that humans focus more on avoiding bad things rather than on doing good ones (e.g. Baumeister et al., 2001; Rozin and Royzman, 2001). This negativity bias may induce investors to put a greater weight on negative characteristics compared to positive ones. In this case, also pure taste-motives may be responsible for this observation. Another potential explanation is that investors perceive investments with bad sustainability ratings as more risky. Nofsinger et al. (2019) find an empirical relationship between bad sustainability ratings and economic

[12] Note that recalculating our analyses while treating the variable as continuous yielded consistent results, though.
[13] See Statistisches Bundesamt (2022).

risk. However, in the experimental setup, risk-return trade/offs and sustainability information are disentangled from each other. Therefore, the implicit assumption underlying this interpretation is that investors confuse these two pieces of information with each other.

To explore whether financial materiality matters, we look at the differences of the WTP between the labels for good (bad) financially material and immaterial sustainability ratings. While this difference is not significant for good ratings, it is significant for bad ones. In total, investors require 0.85 percentage points more return for funds that have a bad financially material rating compared to those funds that have a bad financially immaterial rating. This result is difficult to rationalize with taste. Why should it matter whether bad sustainability information is labeled as financially material or immaterial? A possible explanation might be that the perceived riskiness of funds with a bad financially material is higher. This implies that financial materiality interacts with the risk/return trade-off. However and as discussed above, this is not coherent with the experimental set-up. This question will be discussed in greater detail in the subsequent Sections 4.2 and 4.3.

We also check for further potential factors that might have an impact on the WTP. First, the positive estimate for "Mutual funds" suggests a general preference for mutual funds compared to the savings account option. As the savings account option was added to the experimental design as a status-quo alternative to increase realism, the respective estimates should be regarded as study-specific. Second, the geographic investment horizon does not represent a significant decision criteria. As indicated by the variable "Domestic", investors are indifferent between domestic and international investments. Third, the variable "Green Label" measures the impact of a generic green marketing label. Investors are aware that these labels are not substantiated by any quality standards. The determined willingness to forego around one percentage point of returns for these labels indicates that they might pay for greenwashing.[14] Fourth, the impact of the sustainability variables on the WTP of students and bank customers is mostly not statistically significant. The only exception are good financially immaterial sustainability ratings for which they are willing to sacrifice less return than the other investors. Due to these only minor deviations in behavior, we will not distinguish between student investors and bank clients in the subsequent analysis.

4.2. The influence of pecuniary and non-pecuniary motives

An important feature of the experiment is that sustainability ratings are available and clearly communicated, which is, as shown in Section 3.4, not necessarily the case in practice. This provides an opportunity to study the impact of the provision of sustainability information. After the experiment, we asked participants whether and – if applicable – why they used the provided sustainability ratings. We divide investors into three groups. The first group is comprised of investors who stated to not have used the sustainability ratings at all ("no conscious use"). Investors who used sustainability information – among others – for pecuniary reasons ("pecuniary reasons") are in the second group. The third group consists of investors who used sustainability for non-pecuniary reasons only ("Non-pecuniary reasons"). Recall that in the experimental set-up, sustainability information and risk/return trade-offs are disentangled from each other. Therefore, it is difficult to rationalize a pecuniary motivation for the consideration of sustainability information within the experiment.

Table 5 gives an overview over the three groups of investors. In total, about 68% stated to have used the sustainability ratings. A majority of about two-thirds of these investors considered sustainability information at least partially for pecuniary reasons, while about one-third took it into account for non-pecuniary motives only. Regardless of the motivation to use the ratings, both groups of sustainable investors receive a higher satisfaction from warm-glow giving than individuals who did not use sustainability information in the experiment. Also social norms seem to have triggered participants to use the given ratings. In general, we register a 20% increase of investors using sustainability information compared to real-life investing. Hence, participants were activated to rely on sustainability criteria in the experiment. In particular, we register an increase in investors using sustainability for pecuniary reasons.

We repeat the estimation of the logit model for the three groups of investors, respectively. Results are reported in Table 6. The strongest impact of both financially material and immaterial sustainability information on the WTP is found for investors who stated to have used sustainability information also for pecuniary reasons, followed by investors who use it for non-pecuniary reasons only. The lowest impact is observed for investors who did not consciously use sustainability information. The effect is still statistically significant for good and bad financially material as well as for bad financially immaterial labels, though. Thus, these investors used the ratings at least subconsciously. All groups have in common that they treat good and bad sustainability differently. Hence, there is a negativity bias. The only group that discriminates bad financially material and immaterial information are investors who use sustainability information also for pecuniary reasons. This suggests that investors using sustainability information out of pecuniary considerations overestimate the importance of a label for financial materiality and its impact on financial performance, which is not only explicitly ruled out in the experiment but should also not represent a distinct success strategy in practice.

4.3. The impact of actual investment behavior

To further explore on the biases inducing investors to discriminate between the labels for financially material and immaterial sustainability within the experiment, we focus on the group of pecuniary-driven sustainability investors and compare their behavior in the experiment to their real-life trading behavior described in Section 3.4. We divide this investor segment again into three subgroups. The first subgroup comprises conventional investors who do not use sustainability information in practice but used the ratings within the experiment also for pecuniary reasons ("Conventional to pecuniary"). The second subgroup contains investors who use sustainability information also for pecuniary reasons both in practice and the experiment ("Pecuniary to pecuniary"). Investors in the third group use sustainability information for non-pecuniary reasons only in practice but used it also for pecuniary reasons within the experiment ("Non-pecuniary to pecuniary"). Table 7 shows the composition and individual-specific characteristics of investors who pursued pecuniary-intentions in the experiment. In particular, it demonstrates that investors who use sustainability information in real-life receive a significantly higher pleasure from warm-glow giving than those who do not.

We repeat the estimation of the logit model for the three groups of investors, respectively. Table 8 has the results. All subgroups distinguish between good and bad sustainability information. More importantly, the discrimination between bad financially material and immaterial labels can be traced back to the group of investors who do not use sustainability information in practice ("conventional to pecuniary"). Apparently, these investors got activated by wealth concerns to use sustainability information. Triggered by the term "financially", they erroneously projected sustainability characteristics on firm fundamentals. The lower intrinsic motivation of this group reduces the suitability of affect to explain this behavior, though. Instead, they might be overconfident and overestimate their personal skills to exploit sustainability information and/or are simply inexperienced in using sustainability information in the context of investments.

For the other two subgroups of investors, the differences between the WTP for financially material and immaterial sustainability labels

[14] See also Kleffel and Muck (2023) for further discussion.

Table 5
Self-Declared use of the material and immaterial sustainability ratings within the experiment. .

	No conscious use	Conscious for	
		Pecuniary reasons	Non-pecuniary reasons
Warm glow	–	0.306***	0.335***
		(0.108)	(0.124)
Social norms	–	0.227*	0.256*
		(0.117)	(0.134)
Environmentalism	–	0.005	−0.007
		(0.008)	(0.009)
Risk aversion	–	−0.016	0.025
		(0.070)	(0.082)
Patience	–	−0.052	−0.012
		(0.056)	(0.064)
High literacy	–	−0.035	−0.443
		(0.381)	(0.408)
High income	–	−0.233	−0.443
		(0.292)	(0.333)
Students	–	−0.409	−0.717
		(0.340)	(0.416)
Constant	–	−1.63**	−2.13**
		(0.799)	(0.917)
Share in sample	31.50%	44.22%	24.28%
	(n=109)	(n=153)	(n=84)
δ to real-life use	−19.95%	+18.79%	+1.16%

The table shows the results of logit regressions to characterize participants stating to not use and use the sustainability ratings consciously for pecuniary and nonpecuniary reasons within the experiment. Each group is regressed with potential explanatory variables using the Stata command mlogit. The corresponding standard errors of the parameter estimates are in parentheses. * (**, ***) means that the estimated parameter is different from zero at the 10% (5%, 1%) significance level, respectively. Investors not using the sustainability ratings represent the reference category.

Table 6
Mixed logit estimation results of the choice experiment, grouping investors according to their stated use of sustainability information within the experiment.

	No conscious use			Conscious use for pecuniary reasons			Conscious use for nonpecuniary reasons		
Explanatory variables	Mean	Standard deviation	Mean WTP	Mean	Standard deviation	Mean WTP	Mean	Standard deviation	Mean WTP
Expected Return	0.34***			0.34***			0.34***		–
	(0.0181)			(0.0181)			(0.0181)		
Mutual Funds	3.0***	3.0***		3.0***	3.0***		23.0***	3.0***	
	(0.523)	(0.43)		(0.523)	(0.43)		(0.523)	(0.43)	
Risk high	−1.42***	1.23***	4.18 pp	−1.42***	1.23***	4.18 pp	−1.42***	1.23***	4.18 pp
	(0.131)	(0.173)		(0.131)	(0.173)		(0.131)	(0.173)	
Risk low	0.293***	0.71	−0.86 pp	0.293***	0.71	−0.86 pp	0.293***	0.71	−0.86 pp
	(0.0922)	(0.132)		(0.0922)	(0.132)		(0.0922)	(0.132)	
Domestic focus	−0.115*	0.186*	0.34 pp	−0.115*	0.186*	0.34 pp	−0.115*	0.186*	0.34 pp
	(0.0622)	(0.0969)		(0.0622)	(0.0969)		(0.0622)	(0.0969)	
Green Label	−0.128	0.0631	n.s.	0.714***	0.074	−2.10 pp	0.382***	0.446	−1.12 pp
	(0.114)	(0.212)		(0.0996)	(0.187)		(0.136)	(0.176)	
Material good	0.266**	0.0655	−0.78 pp	0.533***	0.229	−1.57 pp	0.324**	0.31	−0.95 pp
	(0.129)	(0.129)		(0.117)	(0.168)		(0.152)	(0.195)	
Material bad	−0.718***	0.106	2.11 pp	−2.15***	0.142	6.32 pp	−1.14***	0.212	3.35 pp
	(0.143)	(0.203)		(0.167)	(0.25)		(0.183)	(0.248)	
Immaterial good	−0.0322	0.427**	n.s.	0.465***	0.221	−1.37 pp	0.241	0.263	n.s.
	(0.131)	(0.175)		(0.116)	(0.17)		(0.148)	(0.193)	
Immaterial bad	−0.459***	0.141	1.35 pp	−1.52***	0.431*	4.47 pp	−1.43***	−0.201	4.21 pp
	(0.137)	(0.115)		(0.151)	(0.255)		(0.181)	(0.23)	
δ Mat.-Immat. good	0.2982		n.s.	0.998		n.s.	0.083		n.s.
δ Mat.-Immat. bad	−0.259		n.s.	−0.63***		1.85 pp	0.29		n.s.
N(# observations)	346 (1719)								
Log-likelihood	−1,886.883								

The table shows the results for estimating the sustainability parameters separately according to the stated conscious use of the material and immaterial sustainability ratings within the experiment. For fixed parameters only the 'Mean' is estimated, whereas for random parameters also the 'Standard deviation' is reported. 'Mean WTP' shows the average willingness to pay in terms of expected returns, measured in percentage points (pp). 500 Halton draws were used for simulation of the random parameters. The corresponding standard errors of the parameter estimates are in parentheses. * (**, ***) means that the estimated parameter is different from zero at the 10% (5%, 1%) significance level, respectively.

Table 7
Individual-specific characteristics of investors following pecuniary-intentions in the experiment.

	Conventional to Pecuniary	Pecuniary to Pecuniary	Non-pecuniary to Pecuniary
Warm glow	–	0.579***	0.694***
		(0.191)	(0.215)
Social norms	–	0.183	0.201
		(0.191)	(0.196)
Environmentalism	–	0.004	0.014
		(0.012)	(0.013)
Risk aversion	–	−0.144	−0.040
		(0.124)	(0.126)
Patience	–	0.137	0.012
		(0.089)	(0.090)
High literacy	–	−1.383**	−0.847
		(0.664)	(0.692)
High income	–	0.373	−0.212
		(0.499)	(0.492)
Students	–	0.252	−1.028*
		(0.552)	(0.609)
Constant	–	−3.389**	−4.233**
		(1.428)	(1.545)
Share of pecuniary-motivated investors	36.60% (n=56)	32.03% (n=49)	31.37% (n=48)

The table shows the constitution and characteristics of participants stating to have used the sustainability ratings for pecuniary within the experiment according to the participants' use of sustainability information in real-life investing. Each group is regressed with potential explanatory variables using the Stata command mlogit. The corresponding *t*-statistics of the parameter estimates are in parentheses. * (**, ***) means that the estimated parameter is different from zero at the 10% (5%, 1%) significance level, respectively. Investors not using the sustainability ratings represent the reference category.

Table 8
Mixed logit estimation results of the choice experiment of investors who used the sustainability ratings for pecuniary reasons, grouped according to stated use of sustainability information in real-life.

	Conventional to Pecuniary			Pecuniary to Pecuniary			Taste to Pecuniary		
Explanatory variables	Mean	Standard deviation	Mean WTP	Mean	Standard deviation	Mean WTP	Mean	Standard deviation	Mean WTP
Expected Return	0.33***			0.33***			0.33***		–
	(0.0286)			(0.0286)			(0.0286)		
Mutual Funds	2.02***	2.29***		2.02***	2.29***		2.02***	2.29***	
	(0.639)	(0.584)		(0.639)	(0.584)		(0.639)	(0.584)	
Risk high	−1.28***	0.398	3.88 pp	−1.28***	0.398	3.88 pp	−1.28***	0.398	3.88 pp
	(0.175)	(0.245)		(0.175)	(0.245)		(0.175)	(0.245)	
Risk low	0.52***	0.633***	−1.58 pp	0.52***	0.633***	−1.58 pp	0.52***	0.633***	−1.58 pp
	(0.145)	(0.196)		(0.145)	(0.196)		(0.145)	(0.196)	
Domestic focus	−0.133	0.161	n.s.	−0.133	0.161	n.s.	−0.133	0.161	n.s.
	(0.101)	(0.17)		(0.101)	(0.17)		(0.101)	(0.17)	
Green Label	0.499***	0.00477	−1.51 pp	0.837***	0.34	−2.54 pp	1.03***	0.514*	−3.12 pp
	(0.156)	(0.232)		(0.197)	(0.224)		(0.202)	(0.286)	
Material good	0.367*	0.704	−1.11 pp	0.564**	0.195	−1.71 pp	0.64***	0.302	−1.94 pp
	(0.196)	(0.345)		(0.222)	(0.252)		(0.236)	(0.296)	
Material bad	−1.87***	0.19	5.67 pp	−2.49***	0.217	7.54 pp	−1.94***	0.378	5.88 pp
	(0.262)	(0.415)		(0.346)	(0.425)		(0.305)	(0.417)	
Immaterial good	0.463**	0.476	−1.40 pp	0.503**	0.209	−1.52 pp	0.473**	0.424	−1.43 pp
	(0.197)	(0.29)		(0.224)	(0.295)		(0.224)	(0.297)	
Immaterial bad	−1.05***	0.711**	3.18 pp	−1.94***	0.948**	5.88 pp	−2.58***	0.755	7.82 pp
	(0.255)	(0.36)		(0.388)	(0.399)		(0.39)	(0.507)	
δ Mat.-Immat. good	−0.096		n.s.	0.061		n.s.	0.167		n.s.
δ Mat.-Immat. bad	−0.82**		2.49 pp	−0.55		n.s.	0.64		n.s.
N(# observations)	153 (762)								
Log-likelihood	−760.3802								

The table shows the constitution and characteristics of participants stating to have used the sustainability ratings for pecuniary within the experiment according to the participants' use of sustainability information in real-life investing. For fixed parameters only the 'Mean' is estimated, whereas for random parameters also the 'Standard deviation' is reported. 'Mean WTP' shows the average willingness to pay in terms of expected returns, measured in percentage points (pp). 500 Halton draws were used for simulation of the random parameters. The corresponding standard errors of the parameter estimates are in parentheses. * (**, ***) means that the estimated parameter is different from zero at the 10% (5%, 1%) significance level, respectively.

is statistically not significant. Moreover, these investors have a significantly higher intrinsic motivation to do something good. These observations suggest that Hartzmark and Sussman (2019)'s explanation of emotional affect is applicable. Broadly speaking, affect occurs when decisions are made on emotions instead of rational considerations.[15] These investors associate positive emotions with sustainability and may believe or hope that "doing good" implies to also "do well" in a financial way. In particular, this believe is independent of financial materiality.

5. Conclusion

In this study, we examine investors' reaction to financially material and immaterial information sustainability labels that are detached from financial fundamentals. We ask if investors can distinguish between information related to taste and firm financials. Results indicate that investors are primarily concerned to avoid investments with bad sustainability ratings, independent of financially materiality. Although participants were explicitly made aware that financial performance and sustainability characteristics are disentangled from each other, almost half of investors pursue pecuniary motives when using the sustainability ratings in the experiment. For intrinsically-motivated investors, this behavior may be explained with affect. The distinction between financially material and immaterial labels is instead only significant for investors who do not use sustainability information in real-life investing. These individuals have a lower intrinsic motivation to "do good" and got erroneously activated by wealth concerns to rely on sustainability information.

These findings highlight the importance of behavioral issues to understand sustainable investing and are of importance for policy makers. As sustainability regulations evolve, transparency in sustainability reporting grows. While distinct sustainability information may reduce informational asymmetries, it can also confuse retail investors. Classification frameworks should be easily understandable and focus rather on the identification of firms with lagging sustainability records than on good ones. Our study delivers evidence that the concept of "double materiality" is best suited to meet the needs of taste-driven shareholders. While the provision of distinct labels for financially material and immaterial sustainability may indeed reduce informational gaps in general, it may be just as difficult to understand and confusing for retail investors, ultimately inducing them to invest sustainably against their own interest. Regulatory efforts should focus on improving communication and financial literacy to aid investors in understanding the complexities of sustainable investing. Its both the task of policy makers but also individuals to make it evident that sustainability does not guarantee financial gains. Clear guidance and education are key to navigating this landscape and fostering informed decision-making aligned with both values and financial goals.

It is important to acknowledge potential limitations of our study. While our sample size of 346 experienced investors and 1719 observations provides substantial data for analysis, the segmentation of participants into three main groups and further subgroups may have implications for statistical power. We note that similar choice experiments in the literature have utilized larger sample sizes, such as Gutsche and Ziegler (2019) with 599 participants and 4128 observations, and Lagerkvist et al. (2020)'s study with 559 participants. While our sample maintains an acceptable margin of error (5.27% at a 95% confidence level), the segmentation approach could potentially limit the reliability and significance of our results. However, our inclusion of interaction terms significantly improved the model's log-likelihood compared to the plain model, indicating enhanced statistical power.[16] Also in Section 4.3, where the sample size was reduced to 153 individuals and 762 observations, the margin of error remained within acceptable limits (7.9%) and most rules discussed in the literature regarding sample size requirements in choice modeling (Assele et al., 2023) were still met.

For future research, the verification of our results with large samples or historical market data may yet represent promising albeit challenging fields of research. The results of this paper are further based on a sample of private investors from Germany. As private investors constitute only a minority in regard of trading volumes (Börse Frankfurt, 2019), it should be verified whether the results of this research can also be transferred to the whole market and professional investors. Extending this analysis to a larger international sample and controlling for professional investors may represent interesting field for future research.

CRediT authorship contribution statement

Philipp Kleffel: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Matthias Muck:** Writing – review & editing, Writing – original draft, Supervision, Resources, Conceptualization.

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Appendix

A.1. Use of sustainability in real-life investing

Do you use sustainability information/criteria for your investment decision?

- Yes
- No
- I do not have any experience with investing.

Please tell us the reasons, why you use sustainability information and/or criteria for your investment decision. *Multiple selection possible.*

- I want to make a positive contribution to environment.
- I want to reduce my financial risk.
- I want to avoid investment with a bad influence on the environment.
- I have to fulfill regulatory requirements.
- I feel ethically obliged to do so.
- I want to better diversify my investment portfolio.
- I want to support companies, which are pioneers in sustainability issues.
- I want to obtain a higher financial return.

[15] See, e.g., Alhakami and Slovic (1994), Finucane et al. (2000), Slovic et al. (2007).

[16] Note, that only the variables with regard to sustainability were estimated as group-specific by using respective interaction terms. Other variables were instead generically modeled for the whole sample. Hence, the segmentation did not reduce the sample size.

A.2. Use of sustainability ratings within the experiment

Did you use the not value-relevant sustainability rating as a decision criteria?

- Yes
- No
- Do not known

Why did you use the not value-relevant sustainability rating as a decision criteria? *Multiple selection possible.*

- I feel ethically obliged to do so.
- My social surroundings expect me to include the environment in my investment decision.
- I want to avoid investments with a negative impact on the environment.
- I like to do something good for the environment.
- I want to avoid companies, which use their resources for not value relevant business activities.
- I want to improve my financial performance by doing so.
- I want to support companies, which are pioneers in sustainability issues.
- I think that also not value-relevant sustainability issues have an impact on firm-value.
- Do not know.
- Other:

Did you use the value-relevant sustainability rating as a decision criteria?

- Yes
- No
- Do not known

Why did you use the value-relevant sustainability rating as a decision criteria? *Multiple selection possible.*

- I like to do something good for the environment.
- My social surroundings expect me to include the environment in my investment decision.
- I want to avoid investments with a negative impact on the environment.
- I think that the influence of value-relevant sustainability issues on financial returns is undervalued.
- I feel ethically obliged to do so.
- I think that the influence of value-relevant sustainability issues on financial returns is overvalued.
- I want to support companies which are pioneers in sustainability issues.
- I want to improve my financial performance by doing so.
- Do not know.
- Other.

A.3. Description of the choice experiment

Assume that you would like to add stock mutual funds to your sufficiently diversified investment portfolio.

On the following page, you are offered different corresponding investment products.

'Green Funds' are explicitly advertised as environmentally sustainable by the issuing investment companies. This classification lacks a uniform regulatory framework.

The offered mutual funds differ regarding the following characteristics:

1. Expected Return
   Shows the market's expectations regarding the fund's annual performance in percentage terms after fees under consideration of all value-relevant information.
2. Risk
   Shows the risk of price fluctuations of the funds.
   - Low
   - Middle
   - High
3. Investment Focus Shows the geographic investment focus of the funds.
   Germany: The fund only invests in companies based in Germany. International: The fund invests in companies worldwide, particularly in non-European countries.
4. Value-relevant Sustainability Rating
   Measures today's average sustainability rating of the invested companies regarding value-relevant sustainability issues.
   - Good: Invests only in companies, which belong to best 25 percent regarding value-relevant sustainability issues.
   - Middle: Invests only in companies, which belong neither to the best nor the worst 25 percent regarding value-relevant sustainability issues.
   - Bad: Invests only in companies, which belong to worst 25 percent regarding value-relevant sustainability issues.
5. Not Value-relevant Sustainability Rating
   Measures today's average sustainability rating of the invested companies regarding not value-relevant sustainability issues.
   - Good: Invests only in companies, which belong to best 25 percent regarding not value-relevant sustainability issues.
   - Middle: Invests only in companies, which belong neither to the best nor the worst 25 percent regarding not value-relevant sustainability issues.
   - Bad: Invests only in companies, which belong to worst 25 percent regarding not value-relevant sustainability issues.

Please note that there is no automatic link between the value-relevant and not value-relevant sustainability rating.

Alternatively, you can further keep your savings on your savings account. This results in no risk but also in no return.

A.4. Describing difference between financially material and immaterial sustainability issues

A company's business model can have both (i) positive and (ii) negative effects on the environment, climate and people.

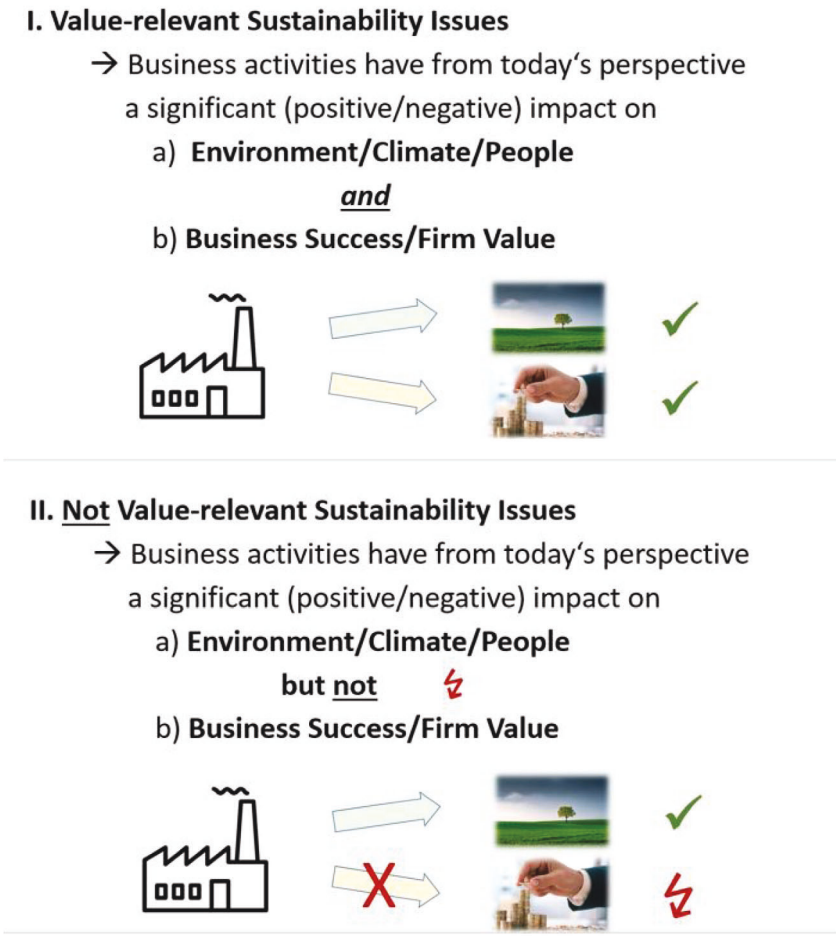
These effects are represented by different sustainability issues.

From today's perspective, some sustainability issues have also an impact on the business success and firm value of a company. Therefore, we distinguish between:

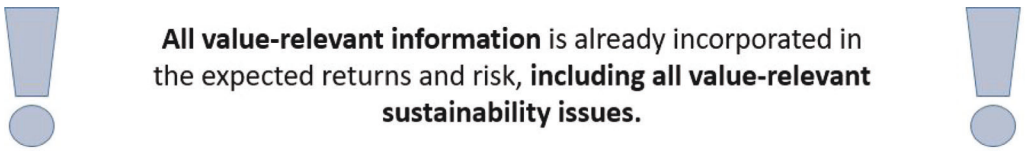
- Value-relevant Sustainability Issues: Business activities have from today's perspective a significant (positive/negative) impact on
  - Environment/Climate/People and
  - Business Success/Firm Value
- Not Value-relevant Sustainability Issues Business activities have from today's perspective a significant (positive/negative) impact on
  - Environment/Climate/People but not
  - Business Success/Firm Value

Not value-relevant sustainability issues may become value-relevant in the future due to social and regulatory changes.

A.5. Figure informing participants about the difference between value-relevant and not value-relevant sustainability issues



A.6. Figure informing participants about value-relevance of attributes



A.7. Survey questions for individual-specific explanatory variables

Variable: "Transcendental values"
It is important to him/her

- that every person is treated justly.
- to prevent environmental pollution.
- that every person has equal opportunities.
- that there is no war or conflict.
- to protect the environment.
- to respect nature.
- take care of those who are worse off.
- to be helpful to others.

Variable: "Perceived effectiveness (PCE)"

1. If participant uses sustainability information:
   Are there reasons which keep you from relying even more on sustainability information and/or criteria for your investments? *Multiple selection possible.*
   - No
   - It is difficult to obtain reliable sustainability information.
   - I am not sure, if I can thus effectively protect the environment.
   - Focusing more on sustainability may have a negative influence on my financial performance.
   - It lacks uniform standards to measure sustainability.
   - It is difficult to measure and compare sustainability.
   - This would restrict my diversification possibilities.
   - Other
2. If participant does not use sustainability information:
   Please tell us the reasons, why you do not use sustainability information or criteria for your investments. *Multiple selection possible.*
   - These are not relevant for my financial performance.
   - This would restrict my diversification possibilities.
   - It is difficult to obtain reliable sustainability information.
   - These have a negative influence only my financial performance.
   - It lacks uniform standards to measure sustainability.
   - I did not know about these so far.
   - Sustainable investment show higher fees.
   - I do not think, that his helps to protect the environment effectively.
   - My investment decision has no impact on the environment.
   - I am not interested.
   - It is difficult to measure and compare sustainability.
   - Other:

Variable: "Perceived environmental threat"
To what extent do you agree with the following statement? You can chose between 0 disagree completely and 6 agree completely.

- Society is doing to little to protect climate and environment.
- Aside of the COVID-19 pandemic, climate protection is the biggest challenge for humanity.

Variable: "High literacy"

1. Suppose you had 100 Euro in a savings account and the interest rate was 2% per year. After 3 years, how much do you think you would have in the account if you left the money to grow?
   - More than 106 Euro
   - Exactly 106 Euro
   - Less than 106 Euro
   - Do not know
2. Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account?
   - More than today
   - Exactly the same
   - Less than today
   - Do not know
3. If the interest rate falls, what should happen to bond prices?
   - They rise
   - They fall
   - They stay the same
   - None of the above
   - Do not know
4. Buying a company stock usually provides a safer return than a stock mutual fund.
   - True
   - False
   - Do not know

Variable: "Warm glow"
To what extent do you agree with the following statement? You can chose between 0 disagree completely and 6 agree completely.
It makes me happy to do something good for the environment.
Variable: "Social norms"
To what extent do you agree with the following statements? You can chose between 0 disagree completely and 6 agree completely

- Sustainability plays an important role in my social surroundings.
- My social surroundings expect me to buy environmentally sustainable products.

Variable: "Risk aversion"
Are you rather risk-averse or risk-loving, when it comes to investing?
Please select a value between 0 "very risk-averse", 5 "Neither risk-averse nor risk-loving" and 10 "very risk-loving".
Variable: "Patience"
Are you in general a rather patient or impatient person?
Please select a value between 0 "very patient", 5 "neither patient nor impatient" and 10 "very impatient".

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