Sustainable Finance Literacy and the Determinants of Sustainable Investing*

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Abstract

This paper introduces the concept of sustainable finance literacy. We survey a large sample of Swiss households and measure financial, sustainability, and sustainable finance literacy using two complementary approaches. First, we use traditional multiple-choice questions, and second, a novel approach based on open-ended questions asking respondents to write a text response. We find that Swiss households, which are generally highly financially literate, exhibit low levels of sustainable financial literacy. Interestingly, multiple-choice questions generate a gender gap that disappears under open-ended questions. Our results show an urgent need to create transparent regulatory standards and strengthen information campaigns about sustainable financial products.

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1 Introduction

Sustainable financial products already account for more than half of the inflow into European investment products (Morningstar 2021), which reflects a global and ongoing trend. However, despite numerous initiatives, no clear definition has yet emerged in the financial markets that identifies an investment product as sustainable. As a result, investors, especially retail investors, face a complex and confusing set of criteria when evaluating the level of sustainability of a financial product. To make informed investment decisions, this lack of transparency requires financial knowledge on sustainable investments that exceeds basic financial literacy. In this paper, we use a household survey in Switzerland to measure retail investors' knowledge about sustainable financial products and show its influence on sustainable investments. This concept can be understood as a type of literacy that we call "sustainable finance literacy."

Our results suggest that the general level of sustainable finance literacy is low. Nevertheless, it is an essential determinant for investments in sustainable products, which is especially relevant in the current non-transparent market for sustainable investments. Emerging guidelines, such as the EU taxonomy, are not rigid and do not assure a binding standard that defines a product as sustainable, and existing sustainability ratings are not homogeneous (Berg et al. 2020). Therefore, it is up to asset managers to evaluate if the products they are selling can be considered sustainable or not. This lack of information transparency regarding sustainability certainly is not in favor of consumers. Hence, with the observed level of sustainable finance illiteracy, private investors become easy prey for greenwashing.

According to European Commission,[1] sustainable finance refers to the process of taking environmental, social, and governance (ESG) considerations into account when making investment decisions. In the financial sector, the ESG criteria lead to more long-term investments in sustainable economic activities and projects. However, there is no empirical evidence on how informed consumers are about these products and how relevant this knowledge might be. The lack of uniform standards of sustainable finance products requires an additional layer of knowledge, which goes beyond the classical definition of financial literacy. Therefore, we define the concept of sustainable finance literacy

[1] https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance.

as *the knowledge of regulations, norms, and standards about financial products that have sustainable characteristics*. For our study, we define these sustainable characteristics in a broad sense, covering the entire range of ESG criteria on which companies are measured.[2]

With respect to the classical financial literacy, we interpret sustainable finance literacy as an extension of this basic concept. Financial literacy describes the skills and knowledge necessary for financial decision making. In order to make informed investment decisions in sustainable financial products, additional knowledge is necessary. While "literacy" in a non-finance related sense is traditionally defined as a set of skills covering reading, writing, and counting, our focus of literacy is mainly based on knowledge. We thereby follow a more recent understanding of literacy: as recently proposed by UNESCO,[3] the general concept of literacy can be understood as a means of identification, understanding, interpretation, creation, and communication in an increasingly digital, text-mediated, information-rich, and fast-changing world. Hence, we believe that our choice to use the term sustainable finance literacy, as opposed to the term sustainable finance knowledge, is a valid description of the concept.[4]

We measure sustainable finance literacy by surveying a large sample of households in Switzerland. Switzerland has a high level of financial literacy by international standards (Ackermann and Eberle 2016) and the Swiss government is strongly committed to making the Swiss financial center a pioneer of sustainable finance and a premier global hub in this field.[5] Moreover, in our sample, all respondents had invested in a voluntary pension plan, where they were required to make an active financial decision. Therefore, these households serve as an ideal sample to measure sustainable finance literacy as they are characterized by considerable financial engagement.

For the measurement of sustainable finance literacy, we rely on two complementary approaches. First, we apply a traditional multiple-choice-based questionnaire. Second, we introduce a novel

[2]We are aware that the finance industry often differentiates between ESG and sustainable investing. For example, according to S&P Global, ESG-oriented investors can invest sustainably while maintaining the same level of financial returns as they would with a standard investment approach. Sustainable investing puts a premium on positive social change by considering both financial returns and moral values. We think that for our study, we can use ESG and sustainability interchangeably, without loss of generality.

[3]See https://en.unesco.org/themes/literacy

[4]We also remark that Huston (2010) analyzes studies on financial literacy and finds 47% of them use the terms financial literacy and financial knowledge interchangeably.

[5]See the Federal Council's press release on June 26, 2020, https://www.admin.ch/gov/de/start/dokumentation/medienmitteilungen.msg-id-79606.html.

approach based on open-ended text answers that we analyze using recent advances in artificial intelligence. Both measures show similar results and a similar impact on investment decisions. Interestingly, the two measures are not strongly correlated with each other, which makes them complementary and allows for a more comprehensive description of investors' knowledge. In addition, the open-ended literacy measure does not show the gender gap observed in the closed measure, where men score higher than women. This gender gap is also observed for financial literacy (Lusardi and Mitchell 2014) and a well-known phenomenon that sometimes can occur in multiple-choice questions but disappears when the same concept is evaluated using open-ended text questions (Klein et al. 1997).

Although we find a generally low level of sustainable finance literacy for Swiss households, our results show that it is a highly significant and important determinant for owning sustainable finance products. At the same time, both financial literacy and the respondents' general knowledge about sustainability, for which we introduce the term sustainability literacy,[6] do not have a significant impact. In addition to the multiple-choice questions, the text answers to the open-ended question allowed us to differentiate further which topic respondents most strongly associate with sustainable investment products. This additional information allows us to study whether there are differences in the importance of the E, S, or G in the ESG or sustainable finance product. Indeed, it turns out that the G seems to be less critical to retail investors.

One important innovation of this paper is the analysis of open-ended survey questions to measure knowledge with "sustainable finance literacy" as a case in point. The introduction of open-ended questions hereby gives three novel insights about financial decision-making that are not accessible with traditional closed-ended questions.

First, the open-ended question on SFL allows uncovering the elements that respondents associate with sustainable investments at the top of their minds. Such a spontaneous expression of knowledge is closely related to real-life situations. On the other hand, capturing this general knowledge with closed-ended questions is challenging because they tend to prime respondents with pre-defined answers. In this context, the text-answers reveal that respondents mainly associate environmental

[6]Sustainability literacy includes the respondents' knowledge about the following sustainability aspects: the definition of sustainability, environmental sustainability, social sustainability, and economic sustainability.

topics with sustainable finance, to a lesser extent with social topics, and only in rare instances with governance.

As our second insight, we find that the knowledge measure with open questions has a low correlation with the traditional closed measure, making the two measures complementary. Strikingly, the more general type of knowledge with the text answers does not suffer from the gender and income bias that multiple-choice questions show. This finding suggests that the knowledge from the text answers may be more accessible to the general population.

The third insight relates to our finding that both types of knowledge are equally associated with owning sustainable financial products. Consequently, using only multiple-choice questions does not show the entire picture. Many respondents score low on the MC questions but show a high general knowledge when we analyze their text answers, which allows them to make similar financial decisions. However, respondents with the highest engagement in sustainable finance score high in both question types and are hence only revealed when using both measures.

From a more general perspective, our paper contributes to three different streams of the literature. Our first contribution is related to the research that analyzes the determinants of the level of financial literacy. Conceptually, sustainable finance literacy is related to financial literacy, first introduced by Noctor et al. (1992). In the general financial context, limited financial literacy influences the choice of financial investments and, therefore, individual financial outcomes.[7] However, sustainable finance literacy is not just about financial outcomes for individual investors but also about reorienting capital flows towards a more sustainable economy. Therefore, it is essential to understand how knowledgeable people are on sustainable finance and, second, how this knowledge influences their financial decision-making. Given the paramount importance to the financial sector, we complement financial literacy by accounting for literacy-related to sustainable finance.

[7]To measure financial literacy in our study, we closely follow Lusardi and Mitchell (2008). We remark that the definition of financial literacy by Lusardi and Mitchell (2014) goes beyond the financial knowledge considered by previous definitions (Noctor et al. 1992, Bernheim 1998, Hilgert et al. 2003, Van Rooij et al. 2011). They define financial literacy as the ability of economic information analysis and informed financial decision-making. See also Angrisani et al. (2016). For instance, individuals with relatively higher cognitive abilities and financial literacy are more likely to optimize their investment decisions and make optimal decisions related to credit card use and in applications for home loans (Agarwal and Mazumder 2013). Moreover, Titman et al. (2021) find that investors with low financial sophistication are more prone to invest in "suspicious" firms that use stock splits to inflate their share prices artificially.

Our second contribution to the literature relates to the analysis of sustainable finance literacy. Equipped with our definition and estimation of an indicator for sustainable finance literacy, we can add a new dimension to the determinants of demand for sustainable investment products. The literature on the demand for sustainable finance products is well documented, both observing real-life investments (Døskeland and Pedersen 2016, Gutsche et al. 2021, Riedl and Smeets 2017, Bauer et al. 2021, Anderson and Robinson 2022) and hypothetical choice experiments (Barreda-Tarrazona et al. 2011, Gutsche et al. 2020, Heeb et al. 2021, Rossi et al. 2019). However, these studies do not include an indicator of the knowledge of retail investors about sustainable finance products as an explanatory variable. Yet, as our results show, knowledge about sustainable financial products has a highly significant association with financial decisions.

Our third contribution is the assessment of the level of literacy with open-ended survey questions, using advances in artificial intelligence and natural language processing (NLP). Open-ended survey questions have been used in social sciences for a long time, but until recently, only on a small scale because the coding could not be automatized (Krosnick 1999, Roberts et al. 2014). Compared to closed-ended questions, the open-ended format does not prime respondents and allows them to express whatever is on the top of their minds. With new developments in artificial intelligence, this type of question sees its first emergence in the literature (Egami et al. 2018, Stantcheva 2020, Houde and Wekhof 2021, Ferrario and Stantcheva 2022, Stantcheva 2022). In the psychology literature, open-ended questions are commonly used for knowledge assessment (Lindner et al. 2015). Compared to multiple-choice questions, knowledge assessed with an open question is usually correlated with multiple-choice results (DeMars 1998). However, there are also differences, most notably the observation that men sometimes perform better than women if a concept is assessed with closed questions, while this gender gap disappears with open-ended questions (Klein et al. 1997). We build on this literature and use an open-ended question to assess knowledge in a finance setting. Hence, we add to the literature on survey methods in financial economics, especially those concerned with behavioral biases (Liu et al. 2022). The text-analysis method used in this paper allows us to use a large sample of respondents and transform the text answers into a quantifiable metric for statistical analysis.

Related to our work is Anderson and Robinson (2022). They measured financial literacy and environmental knowledge ("environmental literacy") for Swedish retail investors. We differ from this study in several aspects. First, as discussed above, we propose a broader concept of literacy directed to the required knowledge for sustainable investments, i.e., sustainable finance literacy. In contrast, Anderson and Robinson (2022) focus on environmental literacy and green preferences, but they let investors choose among ESG products that cover the whole range of environmental, social, and governance aspects.[8] Second, we control for several covariates, including wealth and various psychographics. Hence, our set of covariates is more extensive, especially by including individual wealth, which, as shown by previous studies, is highly associated with financial engagement and financial literacy (Van Rooij et al. 2011, Calvet et al. 2007, 2009). Finally, we use a novel and complementary method to estimate literacy based on open-ended questions and text analysis, giving important insights into a possibly illusive gender gap.

The remainder of this paper is structured as follows. In the next section, we will provide an overview of the data. Section 3 describes the different literacy concepts underlying our study. We also present in this section the open-ended question to assess sustainable finance literacy and our NLP-based method to analyze the text responses. In Section 4, we present our empirical strategy and the estimation results, followed by a concluding section.

2 Data

This section presents the survey and data used in the empirical analysis. Organized between October and November 2021, this survey provides data from 3,059 participants in the German-speaking part of Switzerland. The participants were recruited among a large panel of households by a professional marketing company. This panel has been incentivized to participate in the survey with a payment. Moreover, the company provided us with many background variables on the respondents, including socioeconomics, insurance, leisure time activities, and media consumption.

[8] While Anderson and Robinson (2022) find that households with a strong environmental attitude tend to be financially disengaged, a recent paper by Bethlendi et al. (2022) comes to the opposite conclusion when controlling for other factors in the demand for green financial products. They find a positive relationship between green and financial knowledge, and between financial and personal green attitudes.

Further, the survey company screened participants, such that only experienced investors participated.[9] In October, the survey company invited approximately 360 households to participate in a pretest. After this phase, we adjusted some questions and simplified the questionnaire. Afterward, the company invited 22,391 household members of the panel to participate in our study; 6,115 started the survey, which implies a response rate of 27.3%. The survey company stratified the invitations for age and gender. Out of the 6,115 potential survey respondents, 1,156 did not pass the screening because they did not have a pension plan (or did not have one in the past). 283 respondents could not participate because the quota based on age and gender was already fulfilled for these particular respondents. Finally, 1,617 respondents started to answer the survey but did not complete the questionnaire, which resulted in 3,059 complete responses. The questionnaire has been structured in three parts. We included questions to measure the various literacy concepts in the first part. In the second part, we organized a simple choice experiment that we intend to analyze for a future research project, and in the third part, we measured several psychographic variables.

Table 1 presents the summary statistics for all respondents for socioeconomic variables, environmental behavior, and psychographics. Our sample is representative for adult Swiss residents who hold a private pension plan. The mean age of the respondents is 49, and about 50% hold a university degree. The sample consists of slightly more men than women, with 54.7% male. Half of the sample is married, 16% are pensioners. The mean household consists of 2.4 persons. The monthly household income is at 9,193 CHF, and the mean household wealth is CHF 341,250, which, at the time, corresponds to approximately USD 314,000.

In addition, we asked respondents about three "sustainable" behaviors: if they donated to a social organization within the last 12 months (which applies to 70% of the sample) and if they made a donation to an environmental organization (44%). Most importantly, we asked if the respondents hold any sustainable financial investments, of which 26.7% answered with "yes"[10]. We also included psychographic variables on risk preferences, time preferences, altruism, and trust, where we follow

[9]Participants could take part in the survey if they had invested in the Swiss voluntary pension plan. Similar to the 401k, Switzerland's so-called "3rd pension pillar" allows investing in financial markets for a later pension plan. As of 2019, about 62% of the adult Swiss residents participate in this voluntary pension plan. See https://www.bfs.admin.ch/bfs/de/home.html.

[10]A sustainable financial investment could be a part of the investment decision related to the non-mandatory pension plan (the so called "third pillar") where the saver is required to choose if he or she would like to invest in a financial product or a general financial investment such as in mutual fund or direct stock.

Table 1: Summary statistics

Variable	Mean value
Demographics	
% Female	45.31
Age	49.34
% University Degree	52.91
% Pensioner	16.09
% Married	49.61
Household size	2.43
Income [CHF]	9,193
Wealth [CHF]	341,250
Pro environmental behavior	
% Social donation (within 12M)	71.20
% Environmental donation (within 12M)	44.36
% Own sustainable financial products	26.74
Psychographics (/10)	
Risk preferences	4.70
Time preferences	6.30
Altruism	6.21
Trust	5.95
Climate awareness	8.14

Note: This table presents the summary statistics for the entire survey sample that consist of 3,059 observations. Additional information on the variables can be found in Appendix F.

Falk et al. (2016). In addition, we asked about the importance of mitigating climate change. More detailed information on the exact questions for each variable can be found in Appendix F, Tables F.1 and F.2.

3 Literacy measures

While general financial literacy is a crucial prerequisite for investing, sustainable investments may require an additional form of knowledge, which mainly relates to the concept of sustainability. Anderson and Robinson (2022) measure the level of environmental literacy and analyze its association with owning sustainable finance products. They find that knowledge about the environment is not associated with owning sustainable finance products. Hence, *sustainability literacy* does not seem to have an impact on financial decision-making. Due to the complex nature of the market for sustainable

finance products, with no clear definition of what constitutes a sustainable investment, sustainable finance products can be challenging even for financially engaged individuals.

For this reason, in this paper, we propose to add a third form of knowledge that covers how sustainability is integrated into financial products. Therefore, we introduce the concept of *sustainable finance literacy*, henceforth SFL, as the knowledge of regulations, norms, and standards about financial products that have sustainable characteristics. We believe that this specific knowledge is a prerequisite to making informed decisions about ESG products and, therefore, complements financial literacy.

We measure three types of knowledge to explain the ownership of sustainable finance products: classical financial literacy, knowledge about general sustainability (sustainability literacy), and knowledge about sustainable finance products (sustainable finance literacy). As discussed in more detail in the following sub-section, sustainability literacy is a different type of understanding than the knowledge about sustainable finance products. Sustainability literacy measures the knowledge related to the three classical dimensions of sustainable development, i.e., environmental, economic, and social dimensions. SFL measures the knowledge of financial products that should promote sustainable development. We expect a positive correlation between these two literacy concepts. However, this correlation should not be high because these two literacy concepts cover different aspects of the broader concept of sustainable development. Next, we present the measurement of these literacy concepts using closed-ended questions. For the measurement of SFL, we additionally use open-ended questions.

3.1 Measuring literacy with closed-ended questions

We start our analysis of the three literacy concepts using closed-ended, multiple-choice questions, which is the prevailing approach in the finance literature. Closed-ended questions are defined as question types that ask respondents to choose from a distinct set of predefined responses.

3.1.1 Financial literacy

To assess general knowledge about investments, we build on the literature of financial literacy by Lusardi and Mitchell (2008) and use their three core questions to determine financial literacy. The first question assesses the knowledge of interest rates, the second the effect of inflation, and the third question addresses the importance of portfolio diversification. Each question can be answered correctly or incorrectly. Following the literature by Lusardi and Mitchell (2008), we construct a financial literacy indicator by summing the scores based on the answers given by the participants to each of the three questions. Therefore, this indicator varies from 0 to 3 (the list of questions can be found in Appendix E). This procedure to create a literacy indicator is also used to compute the other two literacy indicators.

3.1.2 Sustainability literacy

The literature on measuring knowledge about sustainability is scarce. One of the few attempts to measure sustainability literacy is Zwickle et al. (2014), who designed a set of multiple-choice questions to assess the level of knowledge about sustainability. Notably, Zwickle et al. (2014) follow the sustainability definition of the United Nations, which includes, in addition to environmental aspects, also the social and economic sphere. In the finance literature, Anderson and Robinson (2022) measure environmental literacy with a set of multiple-choice questions. However, the questionnaire used by these authors does not include questions about the social and economic dimensions of sustainable development. We start from the questionnaire by Zwickle et al. (2014) and we shorten and modify it for Swiss respondents to six questions that cover the three dimensions of sustainable development. After a pre-test with 360 respondents, we refined the six questions for better understanding for the respondents. Each question has several answers, out of which only one is right. We take the sum of correct answers for each respondent; hence, respondents can obtain a score between 0 and 6. A detailed list of all questions can be found in Appendix E.

For sustainability literacy, we investigate respondents' knowledge about the following sustainability aspects: the definition of sustainability, environmental sustainability, social sustainability, and economic sustainability. We start from the United Nation's goals for sustainable development, which

comprise economic growth, social participation, and environmental protection. Our first question targeted the UN's definition for sustainability; we inquired if respondents knew that sustainability exceeds environmental protection and includes economic and social aspects. Our second question asked about different definitions of sustainable development, where we aimed to find out how much a respondent's knowledge was aligned with the UN's definition. The UN defines sustainable development as *development that meets the needs of the present without compromising the ability of future generations to meet their own needs*. We proposed two alternatives that either emphasized environmental protection or did not include the future orientation of sustainable development. The following two questions covered the ecological aspect of sustainability where we asked for the primary source of pollution of rivers, and in a second question about the main reason why fish stocks are declining in the Atlantic Ocean. The social part was covered by a question on the share of individuals in Switzerland living below the poverty threshold. To finish, we asked to estimate Switzerland's average annual GDP rate for the economic part of sustainability.

3.1.3 Sustainable finance literacy (SFL)

SFL assesses the knowledge of private investors about sustainable finance products. For the design of this indicator, we consulted several industry experts in the field of sustainable finance, as well as experts from NGOs and academia. Moreover, we considered numerous publications from NGOs related to green finance. We hereby identified three main areas of knowledge related to sustainable investments that are likely to be important for retail investors to make informed investment decisions: questions on the general concept, rules, labels, questions on requirements to get an ESG label, and questions on impact on real economy. The SFL indicator consists of 8 multiple choice questions that cover these three major areas (a summary of the answers can be seen in Table 2 and the complete list of questions is in Appendix E).[11] The score for SFL is the sum of correct answers to the eight individual questions.

As with sustainability literacy, the first question asked about the definition of a major concept, namely the ESG acronym that is ubiquitous in sustainable investing. Respondents had to identify the correct meaning of ESG out of several options. As shown in Table 2, 26.4% of the respondents knew

[11] We refined the wording of the questions following a pre-test with 360 respondents.

Table 2: Sustainable finance literacy, individual questions

Questions on concept, rules, labels:	% correct
- ESG definition	26.41
- ESG rules	41.03
- Awareness of label	12.68
Questions on requirements to get an ESG label:	**% correct**
- ESG example	32.30
- ESG elements	4.48
Questions on impact on real economy:	**% correct**
- ESG impact	52.24
- ESG engagement	47.92
- Impact definition	20.14

Note: *p<0.1; **p<0.05; ***p<0.01

This table contains the 8 individual questions for the SFL score. For each question, the percentage of correct responses is displayed. The score for SFL consists of the sum of correct answers to the individual questions.

the correct meaning of ESG. The next two questions covered possible certifications of sustainable finance products. First, we asked if a product must meet a uniform set of criteria, set by the state regulatory authorities, to be advertised as a "sustainable finance product" in Switzerland. For this question, 41% knew the correct answer, which was "no." In the second question, we asked the respondents if they were aware of a label that certifies a sustainable finance product, which was the case for 12.7% of the respondents.

Next, we asked two questions if respondents were aware that a sustainable finance product is not required to meet sustainability in each of the three areas but only in one of them. The first question on this subject gave an example about a company with a low environmental footprint but poor social practices. We asked if it was possible to call the shares of this company on the financial markets as a "sustainable finance product," which 32% answered correctly with "yes." Then, we asked directly how many of the three ESG-components a company must be sustainable in, to being considered as a "sustainable company" by the financial market. The correct answer to this question was that only one of the three elements must be satisfied. Strikingly, only 4.5% of the respondents gave that answer, which may indicate that the definition of sustainability in financial markets is not always aligned with the general public understanding.

The last three questions covered the impact of sustainable finance products on the real economy. Many retail investors are unaware that a sustainable finance product is mainly traded on secondary

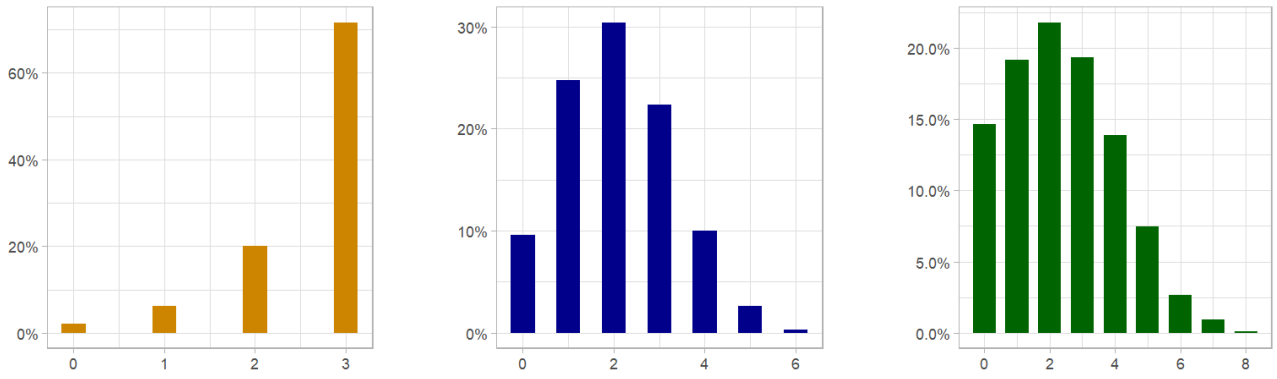
financial markets, which means that an investment in such a product has no direct and immediate impact on the real world. Therefore, the first question asked if an investment in a sustainable fund that includes companies with a low CO2 footprint directly reduces global CO2 emissions (52.2% correct). In the following question, we asked if financial institutions that offer sustainable products always pro-actively influence the behavior of the companies in which they are invested. 48% of the respondents correctly answered that this is not always the case. Our last question asked if there was a difference between "sustainable investing" and "impact investing." Only 20% of the respondents knew that there is a difference between the meaning of these two terms. The results of the individual questions on sustainable finance products clearly show that the level of knowledge about these products is generally low. This lack of knowledge on the investor side constitutes an apparent barrier to a well-functioning market for sustainable finance products.

We compare the results from measuring the three different literacy concepts using closed-ended questions in Figure 1, which shows the distribution of the scores for each of the literacy questions. For financial literacy, most respondents obtained a full score of 3 points, which is not surprising, given that all respondents are financially engaged. The sustainability literacy score shows more variance with a mean score of 2, a standard deviation of 1.2, and seems to follow a Poisson distribution. SFL follows a similar distribution with a mean value of 2.4 points and a standard deviation of 1.7. Hence, our sample of respondents is characterized by a high financial literacy standard, but with less knowledge of sustainability and only limited knowledge about sustainable finance. In this context, it is important to note that the three different literacy scores are distinct from each other and are not strongly correlated. The correlation between financial literacy and SFL is at 0.23, between sustainability literacy and SFL at 0.25 and between sustainability literacy and financial literacy at 0.24. This indicates that the three indicators are measuring different dimensions of knowledge.

3.2 Measuring literacy with open-ended answers

The literature of psychology and cognitive sciences differentiates between two major types of questions to assess knowledge: multiple-choice questions (MC), where respondents identify the correct answer among several options and constructed response questions (CR), which consist of open-ended questions that require a written text answer. Answering MC-questions is based on a cognitive process

Figure 1: Distribution of literacy scores



Financial literacy | Sustainability literacy | Sustainable finance literacy

	mean	median	90th percentile	sd
Financial literacy (/3)	2.61	3.00	3.00	0.70
Sustainability literacy (/6)	2.08	2.00	4.00	1.24
Sustainable finance literacy (/8)	2.37	2.00	5.00	1.66

Note: This figure presents the distributions and summary statistics of the three literacy scores: financial literacy, sustainability literacy and sustainable finance literacy.

called "recognition," where the correct answer must be recognized among possible choices on display. In contrast, CR questions require writing an original response using information from memory, a mental process referred to as "free recall." The cognitive processes needed to answer recognition-type questions are different, and they may be less complex compared to the more individual task in answering recall-questions (Lane 2004, Anderson and Bower 1972, Lindner et al. 2015).

While both question-types are valid measures of knowledge, there is no consensus which type of question performs better in its assessment (Lindner et al. 2015). Generally, if the same concept is evaluated with both MC and CR formats, the results are not identical but correlated (DeMars 1998). Hence, MC and CR questions measure overlapping concepts and abilities, but differences may originate from the distinct underlying cognitive processes. One of these differences that is documented in the literature consists in the observation that men tend to score higher on MC-tests compared to women; this gender gap, however, disappears with the open-ended CR-format on the same topic (Bolger and Kellaghan 1990, DeMars 2000, Klein et al. 1997). With these findings in mind, it will be interesting to analyze gender differences in the context of SFL.

To assess SFL in a CR format, we asked respondents to answer an open-ended question with a written text answer. Specifically, we asked the following question: *Describe which characteristics you think distinguish sustainable financial products from conventional investments. Please write a short text of about three sentences.* The responses were generally well written, with an average number of words of 13.8. Concerning the content of the answers, respondents wrote coherent sentences that suggest that they consciously reflected on their answers. An example for an answer would be the following: *"Sustainable financial products invest in companies or technologies that minimize environmental damage and unsocial conditions without being inefficient."*

Figure 2: Word cloud knowledge

Note: This word cloud contains the 50 most frequent keywords that respondents used to describe the difference between a traditional financial product and a sustainable product. Words with a larger font were used more often by respondents. All words were initially in German language and translated into English, using Google-translator.

Figure 4 shows a word cloud with the most commonly used words in all of the answers (words in a larger font were used more frequently). The most frequent words are "sustainable" and "companies," which is expected because the question was to explain sustainable financial products. However, more informative keywords about the characteristics of sustainable finance products consist of many, less frequent keywords, such as "eco-friendly" or "working-conditions." Since we need to map topics to

the answers, it is necessary to identify keywords for each topic. We describe this procedure in the next section.

3.3 Extracting open-ended question topics

To analyze the open-ended text answers and extract topics, we follow the method developed by Houde and Wekhof (2021).[12] Their method consists in creating an extensive dictionary, where keywords from the text-answers define topics. The final selection of keywords that define a topic, and the initial choice of topics, must be performed manually. To facilitate this manual step, Houde and Wekhof (2021) propose a method to cluster keywords into preliminary groups. Hence, we proceed as follows. First, we tag all words in the answers as either noun, verb, adjective, or adverb using the "spacy" library for Python (Honnibal et al. 2020) (this procedure is known as "part of speech tagging"). Next, we compile a list of unique words and only retain words with a length of at least four characters. In a third step, we match the unique words to a pretrained word-embedding matrix whenever possible.[13] A word embedding matrix assigns a vector to each word that measures the semantic distance to all other words in the embedding matrix. For example, the distance between the words "pen" and "paper" is smaller than between "pen" and "sky." In a fourth step, we cluster the words into groups using k-means clustering and the cosine similarity from the embedding matrix as a distance measure. Here, it is useful to perform the clustering separately for each part of speech. The underlying reason is that with all words, the distances from the word embedding are generally smaller between words of the same part of speech. As a result, the clustering algorithm will mostly cluster based on the part of speech and less based on semantics. The number of clusters should be such that each group has 20 to 40 words. In a final step, we manually went through each cluster of words and selected words into different topics.

Table 3 shows the summary statistics for the open-ended answers and the classification. The mean number of words was 13.8, with a standard deviation of 11.5 and the 90th percentile at 28

[12] In the literature, it is possible to find various algorithms that can be used to automatically extract topics from text, such as the Latent Dirichlet Allocation (LDA) (Blei et al. 2003) or the Structural Topic Model (Roberts et al. 2014). In a preliminary analysis, we tried these algorithms and found they tend to deliver topics difficult to interpret. Moreover, these methods are not able to clearly identify multiple topics per answer, while our proposed model specifically aims to allocate multiple topics per response.

[13] We use the pretrained German fasttext word-embeddings (Grave et al. 2018).

Table 3: Summary Statistics: Open-Text Answers

Metric	Score
# answers	3,059
mean # words	13.8
median # words	11
90 percentile # words	28
sd # words	11.5
total # unique words	5,630
total # words used for topics	2,211

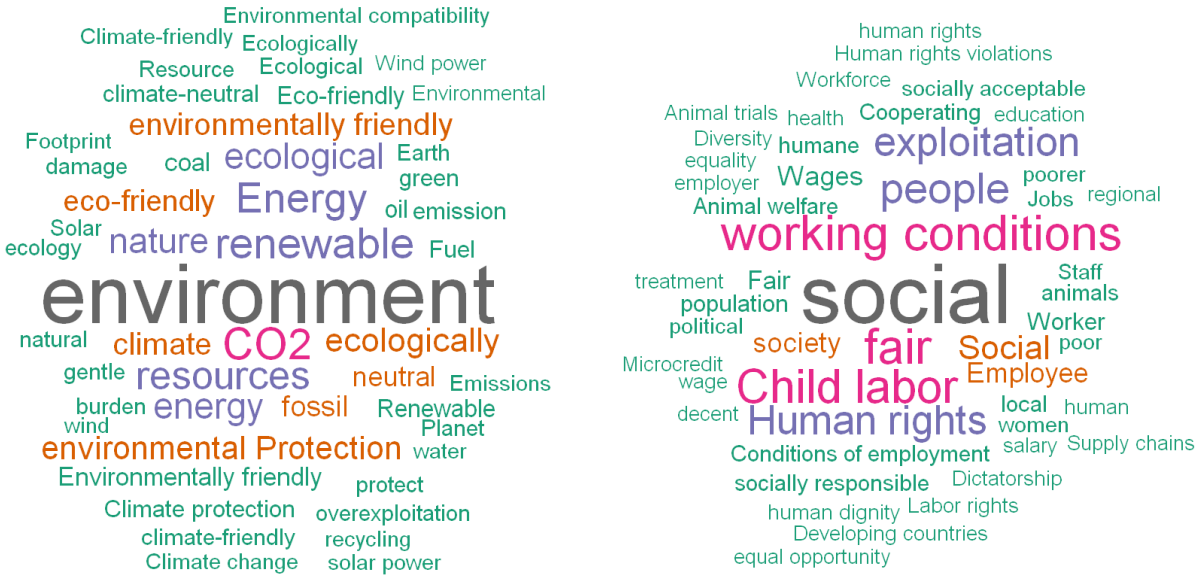
Note: This table contains the summary statistics from the open-ended text answers where respondents were asked to explain the difference between sustainable and traditional financial products. Out of 5,630 unique words with at least four characters, 2,211 words were used as keywords to identify 15 topics.

words. The text corpus with all answers consisted of 5,630 unique words, out of which 2,211 words could be clustered into one of the 15 topics.[14] In addition, 633 words could not be linked to the word embedding, either because they were very uncommon or because of spelling mistakes. These words usually occurred only once or twice per word and had to be classified manually, whenever possible. Following the keyword classification, 405 respondents out of 3,059 could not be classified with any topic. These answers were classified manually. Many of those answers consisted of "no answer," where the text-field contained only one character (such as a dash or a full stop). A second category could not be classified because the answer was not meaningful, in the sense that these respondents gave an answer but revealed that they did not know the difference between traditional and sustainable finance products. An example for such an answer would be: "a sustainable finance product invests in sustainable firms." We classified these answers as "revealed do not know," as opposed to respondents who honestly answered that they do not know the difference (and could be successfully identified with the keyword approach).

To illustrate our approach, we take, as an example, the sentence from the previous section: *"Sustainable financial products invest in companies or technologies that minimize environmental damage and unsocial conditions without being inefficient."* This sentence contains the keyword "environmen-

[14] All words had at least four characters, except for following abbreviations that were added manually "ESG," "ETF," "SDG" (sustainable development goals), "CO2," "CH" (for Switzerland), and "VR" (for German: Board of Directors).

Figure 3: Word clouds for the topics "Environment" and "Social"



"Environment" "Social"

Note: The word clouds contain the 50 most frequent keywords used to classify the topics "Environment" and "Social" from the open-ended answers. Words with a larger font were used more often by respondents. All words were initially in German language and translated into English using Google-translator.

tal," which classifies the answer into the topic "Environmental." In addition, the answer contains the words "unsocial," which adds the "Social" topic, and "technologies," which adds the topic "Innovation." The answer is therefore classified into three different topics: "Environment," "Social," and "Innovation." Figure 3 illustrates the most important keywords for the topics "Environment" and "Social" with two word clouds.

Table 4 reports the share of each topic that was extracted from the open-ended text answer. More than half of the respondents associate sustainable financial products with the environment, 26% with social characteristics, and only 5.8% with governance. Exclusion of weapons and other dangerous products, such as tobacco, was mentioned by 6.9%. Of all respondents, 10.2% associated sustainable investments with general ethical practices. Some respondents highlighted financial aspects of sustainability, i.e., they related sustainable finance products to low risk "financial sustainability" (8.5% of respondents), "long-term" investment horizons (7.8% of respondents), and "less return" (2.7% of respondents). A fraction of about 8.7% answered that sustainable products are only a marketing

strategy and, in reality, constitute greenwashing. At the same time, 9.8% stated that sustainable products should have a form of certification or control about their sustainability characteristics. Only 2.1% explicitly mentioned the "ESG" criteria or the United Nation's Sustainable Development Goals.

Table 4: Summary statistics open ended question knowledge

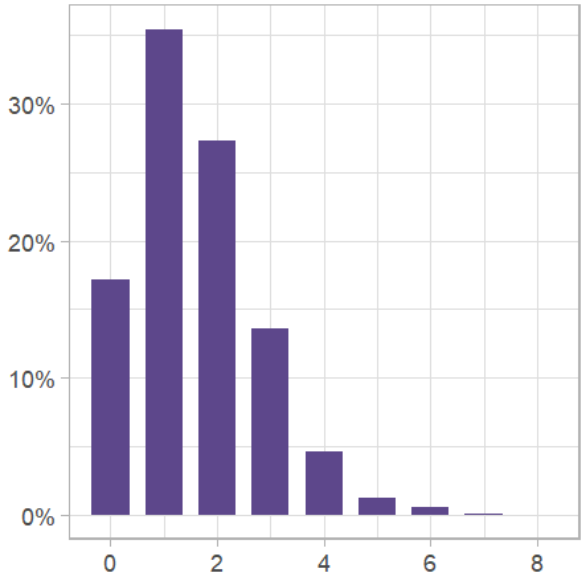
Topic	Topic share [%]
Environment	57.70
Social	26.22
Governance	5.85
ESG	2.16
Ethical	10.20
Innovation	5.95
Exclude dangerous products	6.86
Impact	7.13
Long-term	7.81
Financially sustainable	8.47
Less return	2.68
Green-washing	8.73
Certified	9.84
Do not know	10.95
Do not know (revealed)	4.18
No answer	3.37

Note: This table presents the topic shares obtained from the open-ended text answers, where respondents were asked to explain the difference between sustainable and traditional financial products. Individual answers can contain multiple topics.

As many as 11% of the respondents wrote that they do not know the difference between sustainable and non-sustainable products. In contrast, 4.1% gave a meaningless answer that revealed to the reader that they also do not know the difference between sustainable and traditional products. Therefore, we labeled this group as "revealed do not know." Finally, 3.3% of the respondents did not give any answer. Except for respondents who had no answer or were in one of the "do not know" categories, respondents often mentioned multiple topics in their responses.

Figure 4 shows a plot with the distribution of the number of topics per respondent. On average, respondents mentioned 1.6 topics per response, with the 90th percentile of three topics and a standard deviation of 1.19. To measure SFL, the topics from the open-ended questions provide two

Figure 4: Open questions: number of topics per respondent



	mean	median	90th percentile	max	sd
Number of topics	1.59	1	3.00	8	1.19

Note: This plot presents the distribution of the number of answers per respondent to the open-ended question on the difference between sustainable and traditional financial products.

different measures: first, we can analyze the effect of each individual topic-dummy variable on owning sustainable finance products. A second measure that allows for a more comprehensive analysis, comparable to the closed SFL-score, consists in the number of topics mentioned by each respondent in the text-answer.[15] In our main analysis, we consider this second measure, the number of topics per respondent, as the open-ended measure for SFL.[16]

While both the open and closed measurements of SFL describe the same concept, they are rather complements than substitutes. Both question types rely on different elicitation procedures and underlying cognitive processes. In this context, the closed SFL measure describes a more specific

[15] While the initial definition of the topics was performed manually, the number of topics per respondents is robust to combining topics. This is because the topics are defined by unique keywords and respondents usually only mention one or two keywords per topic. Hence, combining topics only affects the total number of topics per respondent in few cases.

[16] As with the closed measure of SFL, the correlation with the other two literacy measures is low: the correlation between the open SFL and sustainability literacy is at 0.19 and with financial literacy at 0.20.

type of knowledge than the more general understanding measured with the open-ended question. The correlation coefficient between both measures is at only 0.22, which indicates that many investors score higher on one question type than the other one. However, these differences go in both directions, meaning that some investors score higher on the open-ended question, some on the closed-ended question, and others have an equally high or low score in both SFL measures. It is possible to group the investors into one of four groups, depending on the combination of high/low SFL-scores in the open or closed measure. To do so, we first converted the literacy scores into percentiles, which makes the measures comparable. Next, we used a k-means clustering algorithm to group both variables into four groups. We use a k-means clustering because the cutoff-values for the literacy scores that define the groups are data-driven such that the groups are as distinct as possible. These distinct clusters capture the four different combinations of high and low scores in both measures. Table 5 shows the combinations of the open and closed measure of SFL, where the four groups are clearly visible: low level of SFL in both scores, a high score in both SFL-measures and respondents with a mixed score between open- and closed measures, where only one score is high.

Table 5: Clusters for combinations of closed and open SFL-percentiles

Observations per cluster			
SFL (C): low SFL (O): low 660	SFL (C): high SFL (O): low 949	SFL (C): low SFL (O): high 701	SFL (C): high SFL (O): high 749

Note: This table presents the four groups, defined by the combination of of the closed and open SFL-scores. The groups were obtained by first transforming both scores into percentiles and then applying a k-means clustering algorithm.

4 Empirical specification and results

In this section, we first present the model specification used to analyze the determinants of the level of literacy and the model specification employed to identify the factors that explain the choice of a sustainable financial product. Afterward, we illustrate and discuss the results obtained from the econometric analysis.

4.1 Model specifications

Our empirical strategy proceeds in two steps to show the effect of SFL on investment choice. First, we analyze the determinants of SFL alongside financial and sustainability literacy determinants. Then, in a second step, we show the influence of the different literacy scores on owning sustainable finance products. In both cases, our extensive set of covariates controls for the major confounders that could influence the analysis.

To specify an econometric model for the respondents' determinants of the literacy level, we should consider that these literacy concepts have been measured using the number of correct answers to the respective questions, a typical count variable. For this reason, we opt to estimate the following econometric specification using a Poisson regression:[17]

$$\text{Model 1}: \qquad literacy_i = \alpha_i + \beta X_i + \varepsilon_i,$$

where the dependent variable consists of the respective literacy score (financial literacy, sustainable literacy, or SFL) of the ith respondent, and the independent variables are the socioeconomic and psychographic characteristics.

As discussed in Section 2, our survey-data included the information if a respondent owns a sustainable financial product. Therefore, our dependent variable for the second model specification used in this paper is dichotomous. To analyze the determinants of the choice to invest in a sustainable financial product, we use a probit model of the form:

$$\text{Model 2}: \qquad SFP_i = \alpha_i + \beta Li_i + \delta X_i + \varepsilon_i,$$

where the dependent variable is an indicator that takes the value of 1 if the respondent i owns a sustainable financial product (SFP) and 0 otherwise. Li_i includes a set of variables representing the level of financial literacy, sustainable literacy, as well as SFL, and X_i denotes the set of respondent-specific socioeconomic controls, and ε_i denotes the residual term. As previously discussed, we measured the level of SFL using both closed-ended and open-ended questions, where the open-ended SFL consists of the number of topics mentioned in the text-answer. Having done so gives us now the possibility to

[17] The distributions in Figures 1 and 4 suggest that the literacy scores follow a Poisson distribution. We also estimated all model specifications using OLS. The results are similar to the results obtained using Poisson regression.

specify two specifications: the first specification includes as explanatory variables the two indicators of SFL, whereas the second specification includes only the individual topics from the open-ended question on SFL.

4.2 Determinants of literacy

We now present and discuss the results on the determinants of the different literacy scores obtained by Model 1, using a Poisson count data model. Table 6 shows the average marginal effects for four different regressions, one for each literacy score as a dependent variable (financial literacy, sustainable literacy, SFL measured with closed-ended questions, and SFL measured with the open-ended question).

Generally, the models that explain sustainability literacy or SFL show a higher number of significant coefficients than the model that explains financial literacy. Further, we find several statistically significant variables with a similar effect across models. For instance, all literacy scores positively correlate with university education. The literacy scores measured with multiple choice questions in the first three columns also all show a positive association with monthly income. Sustainability literacy and SFL (closed and open measures) share a higher time preference, meaning that respondents with a higher literacy score are more willing to forgo an immediate profit for future compensation.

In addition, the score on SFL, based on the closed questions, shows a strong negative correlation with age and trust in other people and a positive correlation with both wealth and a preference for taking risks. Importantly, all three multiple-choice based literacy scores show a strong negative correlation with female respondents, a well-known problem in the literature of financial literacy (Lusardi and Mitchell 2014, Blasch et al. 2021). In contrast, the number of topics from the open-ended question does not have any significant correlation with gender.[18] The open-ended score is similar to the other measures with a positive correlation for education and time preference. Like the multiple-choice score on SFL, the open version also positively correlates with risk-loving behavior,

[18] Anderson and Robinson (2018) and Bucher-Koenen et al. (2021) suggest that one reason that contributes to the gender gap in financial literacy consists in women's lack of confidence in financial matters. Both papers argue that women disproportionately choose the option "I do not know" if it is available, but in the absence of this option tend to choose the correct answer. Our survey data only partly confirms this hypothesis: in our sample, women choose more often the "I do not know" option. However, when women choose among the other answer options, the answer tends do be more frequently incorrect compared to men. Hence, with a different evaluation of the answers that penalizes guessing, we find that the gender gap increases (with correct: 1, do not know: 0, wrong: (-1)).

Table 6: Determinants of literacy scores - marginal effects Poisson regression

	Financial lit. (1)	Sustainability lit. (2)	SFL - closed (3)	SFL - open (4)
Age	0.001	−0.001	−0.022***	0.004
	(0.003)	(0.003)	(0.003)	(0.003)
Female	−0.171**	−0.465***	−0.416***	0.043
	(0.078)	(0.071)	(0.077)	(0.061)
University educ	0.139*	0.277***	0.422***	0.319***
	(0.076)	(0.069)	(0.074)	(0.061)
Pensioner	−0.023	−0.065	0.174	−0.121
	(0.128)	(0.115)	(0.128)	(0.099)
Married	−0.006	−0.018	0.016	−0.011
	(0.086)	(0.077)	(0.083)	(0.068)
HH-size	0.016	0.020	−0.008	−0.014
	(0.034)	(0.030)	(0.032)	(0.027)
Log income	0.230**	0.221**	0.338***	0.118
	(0.101)	(0.091)	(0.098)	(0.081)
Log wealth	0.025	0.034	0.091***	0.021
	(0.036)	(0.032)	(0.035)	(0.028)
Donation: environment	−0.061	0.096	0.182**	0.183***
	(0.077)	(0.068)	(0.073)	(0.060)
Donation: social	0.079	0.110	0.124	0.264***
	(0.088)	(0.079)	(0.084)	(0.073)
Risk preference	0.009	0.025*	0.137***	0.036***
	(0.017)	(0.015)	(0.016)	(0.013)
Time preference	0.033	0.043**	0.043**	0.056***
	(0.020)	(0.018)	(0.020)	(0.017)
Altruism	−0.006	0.001	0.018	0.018
	(0.019)	(0.017)	(0.018)	(0.015)
Trust	−0.001	0.000	−0.031**	0.005
	(0.014)	(0.013)	(0.014)	(0.011)
Importance climate	0.014	0.007	−0.006	0.061***
	(0.017)	(0.015)	(0.016)	(0.015)
Num.Obs.	2159	2159	2159	2159
Log.Lik.	−3259.946	−3441.674	−3890.236	−3225.683
Pseudo R2	0.024	0.006	0.052	0.035
Over-dispersion (p-val)	1.000	1.000	0.512	1.000

Note: *p<0.1; **p<0.05; ***p<0.01

Each column presents a separate regression model where the outcome is the respective literacy score. We estimated a Poisson regression model, the coefficients are the average marginal effects. The Over-dispersion test is performed according to Cameron and Trivedi (1990), where the null-hypothesis is under equidispersion.

but less strongly. However, unlike the other scores, the open measure positively correlates with making social donations but does not correlate with income or wealth. Overall, the above results confirm the conclusions obtained in other studies about the determinants of financial literacy as well as environmental literacy (Anderson and Robinson 2022, Lusardi and Mitchell 2014, Blasch et al. 2021).

To obtain a more granular view on the open-ended topics, we analyzed the determinants of mentioning each topic in the open answer.[19] For each topic, we estimated the average marginal effects from a probit regression with a dummy variable as a dependent variable that takes the value of 1 if a respondent mentioned the topic in the answer and 0 otherwise. The statistically significant determinants differ for each topic. The environmental topic is frequently mentioned by older respondents, with a high income, higher preference for risk, who donate to both social and environmental causes and place a high value on mitigating climate change. With a frequency of 25% the social topic is the second important one. It is highly dependent on university education but also depends on both types of donations and placing importance on climate change, and is slightly more common among women. Governance is only correlated with holding a university degree. This topic, however, was mentioned only rarely by 5.8% of the respondents.

Explicitly writing about ESG is also associated with higher education but also with higher wealth and a risk-loving attitude. In contrast, the "Ethical" topic is negatively correlated with wealth and positively with placing importance on climate change and education. Innovation does not show any statistically significant determinant. The exclusion of dangerous products is mainly associated with a university education, risk-loving, and placing importance on mitigating climate change. Respondents who mentioned that a sustainable financial product should have a real-world impact are younger, live in smaller households, and emphasize the importance of climate change.

Not surprisingly, respondents who wrote that sustainable products should have a long-term time horizon also have a strong time preference for the future (but show no other determinants). Financial sustainability is associated with larger household size and, interestingly, with lower income. Respondents, who believe sustainable investments generate less returns, do not show any difference from other respondents, apart from a slightly higher propensity to make environmental donations. Respondents, who emphasize the necessity for certifications, tend to have higher education and income, and place high importance on mitigating climate change. In contrast, respondents, who wrote that the difference between sustainable and traditional financial products consists in green-washing, show less trust toward other people. They also tend to be male, with a university degree, and risk-loving.

[19] These results are presented in Tables C.1, C.2, C.3, and C.4 of Appendix C.

Moreover, these respondents place less importance on mitigating climate change but are slightly more likely to make a social donation.

Lastly, the three topics that designate either no knowledge or no answer show a lot of heterogeneity from each other. Respondents who honestly stated that they did not know the difference between sustainable and traditional financial products tend to be female. They also tend to have a lower educational level, make fewer donations for environmental and social causes, they show a higher risk-aversion and place a lower importance of climate change. Surprisingly, there is no difference in income, and wealth is only weakly but negatively correlated. The "revealed do not know" topic, which indicates an answer such as "sustainable funds invest in sustainable firms", are only associated with younger age and less importance for climate change. No answer at all is also associated with lower age and high risk-aversion.

In conclusion, we can say that SFL is mainly influenced by the level of income, education, and time and risk preferences. Furthermore, the negative association between gender and the level of SFL is confirmed in the model specification that uses closed-ended questions but not in the model specification with the open-ended question. This finding suggests that the way we measure literacy concepts in general, exceeding SFL, crucially influences the results.

4.3 Determinants of sustainable investments

Next, we explore the determinants of sustainable investments. We estimate five versions of Model 2 using a probit-regression, with an indicator as dependent variable that takes the value of 1 if the respondent holds a sustainable financial product and 0 otherwise. Table 7 presents the results, and reports the average marginal effects. The five models differ in the included measures for SFL: column (1) reports the values of the marginal effects obtained by estimating a model that includes both indicators on SFL, i.e., the indicator obtained from the closed-ended questions and the indicator obtained from the open-ended question. The second and fourth columns show the results of the model specification that includes only the indicator of SFL, measured with the closed-ended questions. Columns (3) and (5), indicate the results of the model specification that considers only the indicator obtained using the open-ended question. Further, columns (1), (2), and (3) present the results

obtained by using a classical probit model, whereas columns (4) and (5) illustrate the results obtained with an instrumental variable probit model based on the two-stage residual inclusion (2SRI) approach for non-linear regression proposed by Terza et al. (2008).[20]

In all model specifications, the coefficients of the SFL indicator are positive and significant. At the same time, for these specifications, the coefficients of the two other literacy measures, i.e., financial and sustainability literacy, are not statistically significant.[21] The magnitude of the sustainable finance coefficients is similar across model specifications. Compared to other significant explanatory variables for sustainable investing, SFL shows, however, not the largest effect. The most important influencing factor is wealth, followed by previous donations to environmental organizations and university education. Interestingly, monthly income does not correlate with owning sustainable investment products. For psychographics, risk-loving and placing high importance on mitigating climate change positively influence sustainable investment decisions. The effect size of these psychographic variables is comparable to both the open and closed-ended SFL scores. We remark that the two variables "donation to environmental organization" and "importance to mitigate climate change" can be interpreted as variables representing the level of pro-environmental views of the private investors in our sample. We do not find a significant association between financial literacy and the choice to own a sustainable finance product.

Lusardi and Mitchell (2014) suggest that the potential presence of reverse causality and measurement error in estimating financial literacy may bias the estimates downwards. For this reason, we addressed this potential bias of our main variable of interest (SFL) by using the instrumental variable approach for nonlinear econometric models, suggested by Terza et al. (2008) and Terza (2017), i.e., the two-stage residual inclusion estimation approach (2SRI).

As an instrument, we propose to use the exposure to newspaper articles about "ESG" in the 12 month preceding the survey. For each major newspaper in Switzerland, the survey-company provided us with the information how often a respondent reads the respective newspaper. Using this

[20]The 2SRI method for non-linear regression models is based on two steps: first, residuals from the first-stage are obtained; second, the residuals are included as an additional covariate, together with the original endogenous variable, in the second stage regression model.

[21]We discuss in more detail in section A (Appendix) that neither financial literacy, nor sustainability literacy, are directly associated with the choice of sustainable financial products.

Table 7: Determinants of sustainable investments - marginal effects probit regression

	(1) Probit	(2) Probit	(3) Probit	(4) 2SRI	(5) 2SRI
SFL: open	0.021***		0.026***		0.154**
	(0.008)		(0.008)		(0.078)
SFL: closed	0.026***	0.028***		0.096*	
	(0.006)	(0.006)		(0.055)	
Sustainability literacy	−0.004	−0.003	−0.001	−0.014	−0.013
	(0.008)	(0.008)	(0.008)	(0.012)	(0.011)
Financial literacy	0.015	0.018	0.021	−0.002	−0.006
	(0.016)	(0.016)	(0.016)	(0.023)	(0.023)
Age	−0.001	−0.001	−0.001	0.001	−0.002*
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Female	0.015	0.019	0.007	0.038	−0.009
	(0.020)	(0.020)	(0.021)	(0.026)	(0.023)
University educ	0.050**	0.056***	0.057***	0.034	0.022
	(0.020)	(0.020)	(0.020)	(0.026)	(0.029)
Pensioner	0.029	0.026	0.035	0.012	0.051
	(0.032)	(0.032)	(0.032)	(0.034)	(0.034)
Married	−0.004	−0.004	−0.004	−0.005	−0.002
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
HH-size	0.000	0.000	0.000	0.001	0.002
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Log income	0.002	0.002	0.009	−0.014	0.003
	(0.026)	(0.026)	(0.026)	(0.029)	(0.026)
Log wealth	0.055***	0.055***	0.057***	0.049***	0.055***
	(0.009)	(0.009)	(0.009)	(0.010)	(0.009)
Donation: environ	0.052***	0.056***	0.056***	0.043**	0.030
	(0.019)	(0.019)	(0.019)	(0.022)	(0.025)
Donation: social	0.034	0.037	0.035	0.032	0.006
	(0.023)	(0.023)	(0.023)	(0.023)	(0.029)
Risk preference	0.025***	0.025***	0.028***	0.016*	0.024***
	(0.004)	(0.004)	(0.004)	(0.009)	(0.005)
Time preference	0.006	0.007	0.007	0.005	0.001
	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
Altruism	0.008*	0.008*	0.008	0.007	0.005
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Trust	0.004	0.004	0.003	0.006	0.002
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Importance climate	0.019***	0.020***	0.019***	0.021***	0.012*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
Num.Obs.	2159	2159	2159	2159	2159
Log.Lik.	−1124.768	−1128.549	−1134.275	−1127.816	−1132.945

Note: *p<0.1; **p<0.05; ***p<0.01

Each column shows the average marginal effects of a probit regression, where the dependent variable is a dummy that takes the value of 1 if the survey-respondent holds sustainable investment products and 0 otherwise. Columns (4) and (5) show the second stage of a 2SRI model (according to Terza et al. (2008)) with the exposure to newspaper articles on ESG as instrument for the closed and open measures of SFL.

information, we defined a respondent as a regular reader of a newspaper if he or she reads the paper with a frequency of once per week or more often. Next, we searched for each newspaper the number of articles that contain the acronym "ESG" as a proxy to the exposure to sustainable finance. Given that most Swiss newspapers have less than one article per week on ESG, we assume that the survey respondents did not choose to be a regular reader of a newspaper because of its ESG-coverage. As last step, we normalized the number of articles by the newspaper with the highest exposure and created the sum of normalized articles per regular reader. The number of readers per newspaper and the number of articles on "ESG" can be found in Table D.1 (Appendix). Our choice of instrument is hereby similar to Klapper et al. (2013) who use the number of available newspapers as instrument for financial literacy. Newspaper availability hereby serves as a proxy for exposure to information and economic knowledge. Related to the exposure to information, Fort et al. (2016) use information provision by certain banks to their clients as instrument. According to Jappelli and Padula (2013), acquiring financial literacy is costly. Hence, easier access to information lowers the cost and burden of acquiring financial literacy. The coverage of sustainable finance by the major Swiss-German newspapers constitutes a similarly easy access to information on ESG to regular readers and reduces their cost of acquiring SFL.

The results obtained from the estimation of Model 2, using the 2RSI approach and individually instrumenting the two indicators for SFL (indicators based on closed- and open-ended questions), are reported in columns (4) and (5) in Table 7.[22] Consistent with Lusardi and Mitchell (2014), the coefficients with the IV are larger than in the baseline model and support the suggestive evidence that the level of SFL influences the respondents' choice for sustainable investments.[23]

To analyze the complementary nature of the open and closed SFL measures more deeply, we substitute the SFL measure from Model 2 with the clusters obtained in section 3. The clusters allocate investors into one of 4 groups, depending on the combination of high and low scores in both SFL measures. The results in Table 8 report the marginal effects of the SFL clusters and the other literacy measures. The coefficients indicate that both measures are complementary: if both scores are high, these individuals are 13% more likely to own ESG products compared to the reference

[22]The first stage regressions of the 2SRI models are presented in Appendix C, Table D.2. The coefficient of the ESG-exposure instrument is significantly different from zero.

[23]The results of the IV are robust to choosing a 2-year time-frame for the exposure to ESG in newspaper articles.

Table 8: SFL clusters and sustainable investments - marginal effects probit regression

	(1)
SFL: high open - high closed	0.134***
	(0.029)
SFL: high open - low closed	0.066**
	(0.028)
SFL: low open - high closed	0.066**
	(0.027)
Sustainability literacy	−0.002
	(0.008)
Financial literacy	0.017
	(0.016)
Covariates	Yes
Num.Obs.	2159
Log.Lik.	−1129.357

Note: *p<0.1; **p<0.05; ***p<0.01
This regression estimates Model 2 with both the open and closed SFL-score combined. The combination of open and closed SFL is included with 4 groups that capture the possible combinations of high and low literacy in both scores. The reference group are investors that score low in both SFL measures.

when both scores are low. If only one score is high and the other one low, this difference drops to 6.6 %. Interestingly, this effect is the same irrespective which of the two SFL measures is high or low. The complementary character of both measures implies that using only the closed SFL score would ignore investors that score low on the closed question but high on the open measure. This group, which consists of one quarter of the sample, would be falsely associated with a low SFL. On the other hand, it is not enough to score high in one of both SFL measures. The strongest association with owning ESG-products is associated with the combination of high scores in both the open and closed SFL measure.

To extend our results, we follow Pedersen et al. (2021) and identify four types of private investors, using SFL in combination with donations to environmental organizations. ESG-motivated investors have a high SFL-score and donated to an environmental organization. ESG-aware investors also show a high SFL-score but did not donate to an environmental organization. Investors with low SFL-scores correspond to the ESG-unaware type in Pedersen et al. (2021). In our case, these investors are split

into two groups, depending on whether they donated or not. As with the combinations for open- and closed SFL-measures, we use k-means to group investors and obtain groups of similar size. We estimate Model 2 by introducing a series of interaction variables between the level of SFL and donation. This model specification allows us to provide information on the effect of the different types of investors on the decision to invest in ESG products. The results are reported in Table B.1 in columns (1) and (2), using the closed or open SFL measure. As shown by Pedersen et al. (2021), our results also suggest that ESG-motivated investors own the highest amount of ESG-products. ESG-aware investors own less ESG-products than ESG-motivated investors, but more than the reference consisting of investors with low SFL and no donations. The ESG-unaware type is split into two groups: investors with low SFL and no donations and investors with low SFL but who donated to an environmental organization. The latter type shows a similar ESG-engagement as the ESG-aware investors, and the reference type, with no donations and low SFL is associated with the smallest amount of ESG-products.

As final analysis, we use Model 2 to investigate the impact of the topics, obtained from the open-ended question, on sustainable investing. To this end, we replace the indicator of SFL, obtained from the answer to the open-ended question on sustainable finance, with a set of indicator-variables that represent the most important topics mentioned by the respondents in their text answer. We included a dummy variable for each topic that takes the value of 1 if the respondents mentioned the respective topic in their answer and 0 otherwise.

Table 9 presents the results of this specification with individual topic indicators. As in the previous setting, we have two specifications: column (1) includes the closed SFL measure, column (2) consists only of the open-ended topics. Similar to the previous results, including the closed-ended question on SFL does not significantly influence the coefficients from the open-ended question. Most of the mentioned topics do not show a significant correlation with owning sustainable finance products, which means that these topics are mentioned at a similar frequency by both investor groups.

The topic “Governance” and explicitly mentioning “ESG” have a weakly statistically significant effect on owning sustainable products. This weak correlation could be an expression of superior

knowledge of sustainable investors, as mentioning "Governance" and "ESG" requires a more profound knowledge compared to, for example, "Environment." This is also reflected in the topic shares, where "Governance" and "ESG" are only mentioned by 6% (and 2% respectively) of the respondents. As expected, participants who wrote that they do not know the difference between traditional and sustainable finance products are far less likely to own these products. The coefficient for this topic is the largest among all in absolute size and highly significant. The topic that is most strongly associated with sustainable investments is the exclusion of dangerous products with an average marginal effect of 0.1 and a high statistical significance. Compared to the coefficient of the closed question on SFL, the individual topics from the open-ended question have a much higher magnitude.

In summary, the empirical results reported in the Tables 7, 8 and 9 provide suggestive evidence that in order to promote the adoption of sustainable financial products, it is essential to increase the knowledge about these products. Moreover, the empirical analysis based on the most frequent topics obtained from the open-ended question approach suggests that investors, in their judgment of sustainable finance investments, give particular weight to excluding dangerous products (such as weapons or tobacco). However, as shown, e.g., in Berk and van Binsbergen (2021), sustainable investing based on exclusion has neither theoretically nor empirically a significant impact on the financial situation of companies and, therefore, will hardly have induce a change on their behavior.

5 Conclusion

With the increasing importance of sustainable investments in the financial market, retail investors will inevitably be confronted with sustainable investment options when deciding how to allocate their assets. However, there is no formal and generally accepted standard that defines these financial products as sustainable. For this reason, individual retail investors' knowledge of sustainability and its inclusion in financial products becomes an essential factor in making informed investment decisions and achieving efficient market outcomes. When this knowledge is absent or insufficient, retail investors become prone to possibly misleading marketing and manipulation by financial providers.

We propose a new measure to assess the investors' knowledge of sustainable finance products, termed "sustainable finance literacy." We surveyed Swiss retail investors to measure sustainable

Table 9: Topics of sustainable investments - marginal effects probit regression

	(1)	(2)
Topic: Environment	0.036	0.035
	(0.024)	(0.024)
Topic: Social	−0.008	−0.003
	(0.021)	(0.021)
Topic: Governance	0.061*	0.064*
	(0.035)	(0.035)
Topic: Long term	−0.050	−0.051
	(0.033)	(0.033)
Topic: Exclusion Dangerous	0.098***	0.105***
	(0.032)	(0.033)
Topic: Impact	−0.001	0.002
	(0.034)	(0.034)
Topic: Financial Sustainability	−0.003	0.001
	(0.033)	(0.033)
Topic: Certification	−0.012	−0.007
	(0.030)	(0.030)
Topic: Ethical	0.018	0.019
	(0.028)	(0.029)
Topic: Innovation	0.037	0.038
	(0.035)	(0.035)
Topic: Less return	0.009	0.005
	(0.055)	(0.056)
Topic: ESG	0.072	0.103*
	(0.060)	(0.060)
Topic: Greenwashing	0.019	0.028
	(0.033)	(0.033)
Topic: Do not know	−0.122***	−0.136***
	(0.044)	(0.044)
Topic: Revealed do not know	0.017	0.012
	(0.051)	(0.051)
Topic: No answer	0.059	0.054
	(0.065)	(0.065)
SFL: closed	0.024***	
	(0.006)	
Covariates	Yes	Yes
Num.Obs.	2159	2159
Log.Lik.	−1109.860	−1117.704

Note: *p<0.1; **p<0.05; ***p<0.01

Each column shows the average marginal effects of a probit regression, where the dependent variable is a dummy that takes the value of 1 if the survey-respondent holds sustainable investment products and 0 otherwise. The "Topic" variables are dummy variables that take the value of 1 if the topic was mentioned in the open-ended response.

finance literacy and evaluate its relation to investment choices. Although their classical financial literacy turns out to be high, their knowledge about general sustainability and their level of sustainable finance literacy is low. Nevertheless, our results provide suggestive evidence that the level of sustainable finance literacy is an essential determinant for owning sustainable finance products. In

contrast, financial literacy and sustainability literacy do not have a statistically significant effect on holding sustainable assets.

Using our novel approach based on open-ended text responses, we find that these results complement those obtained with closed-ended questions. The two measures are not highly correlated with each other and contribute equally in explaining ESG-ownership. While the traditional multiple choice questions describe a more technical aspect of SFL, the open-ended measure has a more general scope and is equally important. This observation could be relevant in designing curricula for financial education and for information campaigns on sustainable investing. Moreover, open-ended text questions allowed us to uncover which characteristics respondents most strongly associated with sustainable investment products: when asked to describe the difference between traditional and sustainable finance products, the most frequently mentioned topics were environmental and social characteristics, while, for instance, governance was far less important. Most strikingly, the open-ended measure does not show the gender gap (with higher scores for males) observed in all of our multiple-choice measures. Hence, our finding indicates that women may not convey their true knowledge in questionnaires based on closed questions. This result suggests that future work aimed at measuring knowledge levels in the financial sector should also use open-ended questions, as they can offer insightful and complementary findings. Although the field of NLP methods is rapidly evolving and offers opportunities for future improvement, our work is a promising first step in unlocking the potential of analyzing open questions.

Finally, we find a low level of knowledge about sustainable finance in a survey of financially engaged households, which have a high degree of classical financial literacy. This sobering result reveals that the speed at which sustainable investing has gained traction and become mainstream has put retail investors at a disadvantage. Our findings bear two important implications for financial supervisors and regulatory authorities. To compensate for the retail investors' information disadvantage, it is high time to establish transparent and legally binding regulatory standards beyond a loose set of voluntary recommendations. However, rules alone are not sufficient. It is equally critical to launch information campaigns on sustainable finance to increase public awareness and the under-

standing of sustainable investments. Ultimately, retail investors have great potential to contribute to a sustainable transformation of the economy.

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Appendix

A SFL and Sustainability Literacy

In this section, we show that SFL and sustainability literacy measure two distinct concepts and that only SFL is associated with ESG-ownership. First, the difference between both measures is reflected in the low correlation of 0.25 with the closed SFL measure and 0.19 with the open measure. Next, we use the measure for SFL in combination with the measure of sustainability literacy to identify four groups of investors. As with the open and closed SFL-scores, we apply the same logic to cluster investors into four groups depending on the percentiles of their sustainability literacy and SFL-scores. Using a k-means clustering algorithm, we obtain four approximately equally sized groups representing four distinct high and low literacy combinations (the size of the groups can be found in Table A.1).

In a final step, we estimate Model 2 in 3 specifications: without SFL but with sustainability literacy, the 4 groups based on the closed SFL and the 4 groups based on the open SFL. The results are presented in Table A.2. Column (1) presents the results without SFL. As in the main specifications, both financial literacy and sustainability literacy are not statistically significant. Columns (2) and (3) include the combination of sustainability literacy and SFL, either with the closed measure in column (2), or with the open measure in column (3). In both cases, the ESG ownership is only correlated with clusters that contain high SFL-types, irrespective of their level of sustainability literacy. This indicates that sustainability literacy measures a different kind of knowledge distinct from SFL and does not influence ESG-ownership.

Table A.1: Clusters of SFL in combination with sustainability literacy (Sustlit)

Variables	Corr.	Observations per cluster			
Sustlit SFL - Closed	0.25	Sustlit: low SFL (C): low 471	Sustlit: high SFL (C): low 985	Sustlit: low SFL (C): high 579	Sustlit: high SFL (C): high 1024
Sustlit SFL - Open	0.19	Sustlit: low SFL (O): low 632	Sustlit: high SFL (O): low 977	Sustlit: low SFL (O): high 418	Sustlit: high SFL (O): high 1032

Note: *p<0.1; **p<0.05; ***p<0.01

This table presents the four groups, defined by the combination of SFL and sustainability literacy. The groups were obtained by first transforming both scores into percentiles and then applying a k-means clustering algorithm. The first row is based on the closed SFL measure and the second row on the open-ended SFL measure.

Table A.2: ESG ownership and clusters of SFL and sustainability literacy

	(1)	(2)	(3)
Sustlit: high - SFL(C): high		0.083***	
		(0.031)	
Sustlit: high - SFL(C): low		0.016	
		(0.030)	
Sustlit: low - SFL(C): high		0.065*	
		(0.033)	
Sustlit: high - SFL(O): high			0.068**
			(0.028)
Sustlit: high - SFL(O): low			0.018
			(0.027)
Sustlit: low - SFL(O): high			0.075**
			(0.033)
Sustainability literacy	0.002		
	(0.008)		
Financial literacy	0.026	0.019	0.021
	(0.016)	(0.016)	(0.016)
Covariates	Yes	Yes	Yes
Num.Obs.	2159	2159	2159
Log.Lik.	−1139.942	−1133.868	−1135.013

Note: *p<0.1; **p<0.05; ***p<0.01

Column (1) presents the results from Model 2 without SFL. Columns (2) and (3) present the results from Model 2 including 4 groups based on the combinations of high and low scores for SFL and sustainability literacy. The reference group consists of investors with low scores in both measures. Column (2) is based on the closed SFL measure and column (3) on the open SFL measure.

B Investor types

Table B.1: Investor types and ESG-ownership

	(1)	(2)
Donate env: Y - SFL(C): high	0.143***	
	(0.030)	
Donate env: N - SFL(C): high	0.069***	
	(0.026)	
Donate env: Y - SFL(C): low	0.072**	
	(0.029)	
Donate env: Y - SFL(O): high		0.116***
		(0.027)
Donate env: N - SFL(O): high		0.058**
		(0.025)
Donate env: Y - SFL(O): low		0.058**
		(0.027)
Sustainability literacy	−0.001	0.000
	(0.008)	(0.008)
Financial literacy	0.020	0.022
	(0.016)	(0.016)
Covariates	Yes	Yes
Num.Obs.	2159	2159
Log.Lik.	−1133.663	−1135.264

Note: *p<0.1; **p<0.05; ***p<0.01

Columns (1) and (2) present the results from Model 2 including 4 groups based on the combinations of high and low scores for SFL and donations to environmental organizations, similar to Pedersen et al. (2021). The reference group consists of investors with a low score in SFL and no donations. Column (1) is based on the closed SFL measure and column (2) on the open SFL measure.

C Additional tables

Table C.1: Determinants of open-ended response topics - 1/4

	Environment (1)	Social (2)	Governance (3)	ESG (4)
Age	0.003***	0.001	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.000)
Female	−0.007	0.047**	0.016	−0.001
	(0.022)	(0.020)	(0.011)	(0.007)
University educ	0.026	0.064***	0.042***	0.024***
	(0.022)	(0.020)	(0.012)	(0.008)
Pensioner	−0.047	−0.022	−0.014	−0.012
	(0.037)	(0.033)	(0.018)	(0.013)
Married	0.029	0.009	0.011	−0.003
	(0.025)	(0.023)	(0.013)	(0.007)
HH-size	−0.018*	−0.011	−0.010*	0.003
	(0.010)	(0.009)	(0.006)	(0.002)
Log income	0.084***	0.032	0.014	0.000
	(0.028)	(0.027)	(0.015)	(0.009)
Log wealth	−0.005	0.005	0.008	0.006**
	(0.011)	(0.010)	(0.005)	(0.003)
Donate env.	0.074***	0.055***	0.014	−0.006
	(0.022)	(0.020)	(0.011)	(0.006)
Donate soc.	0.060**	0.051**	0.020	0.004
	(0.025)	(0.024)	(0.014)	(0.007)
Risk pref.	0.011**	0.001	0.002	0.004***
	(0.005)	(0.004)	(0.002)	(0.002)
Time pref.	0.011*	0.010*	0.003	0.002
	(0.006)	(0.005)	(0.003)	(0.002)
Altruism	0.009*	0.010**	0.003	−0.001
	(0.005)	(0.005)	(0.003)	(0.002)
Trust	0.001	0.002	0.000	0.001
	(0.004)	(0.004)	(0.002)	(0.001)
Climate imp.	0.021***	0.017***	−0.001	0.004*
	(0.005)	(0.005)	(0.003)	(0.002)
Num.Obs.	2159	2159	2159	2159
Log.Lik.	−1365.217	−1194.021	−479.904	−182.368

Note: *p<0.1; **p<0.05; ***p<0.01

Each column shows the average marginal effects of a probit regression, where the dependent variable is a dummy that takes the value of 1 if the survey-respondent mentioned the respective topic in the open-ended text answer.

Table C.2: Determinants of open-ended response topics - 1/4

	Ethical	Innovation	Exclusion dangerous	Impact
	(1)	(2)	(3)	(4)
Age	−0.001	0.000	−0.001	−0.001**
	(0.001)	(0.001)	(0.001)	(0.001)
Female	0.015	−0.009	−0.002	0.022*
	(0.014)	(0.012)	(0.012)	(0.012)
University educ	0.028**	0.008	0.027**	0.012
	(0.014)	(0.012)	(0.012)	(0.012)
Pensioner	0.013	−0.001	−0.024	−0.013
	(0.025)	(0.019)	(0.021)	(0.021)
Married	−0.003	0.000	−0.010	−0.003
	(0.016)	(0.013)	(0.013)	(0.014)
HH-size	0.003	−0.001	0.000	−0.012**
	(0.006)	(0.005)	(0.005)	(0.006)
Log income	0.016	0.001	−0.003	0.007
	(0.019)	(0.015)	(0.016)	(0.015)
Log wealth	−0.020***	0.003	0.009*	0.003
	(0.007)	(0.005)	(0.005)	(0.006)
Donate env.	0.018	0.019*	0.001	−0.004
	(0.014)	(0.012)	(0.012)	(0.012)
Donate soc.	0.014	0.002	0.017	0.011
	(0.017)	(0.013)	(0.014)	(0.014)
Risk pref.	−0.003	0.002	0.008***	−0.001
	(0.003)	(0.003)	(0.003)	(0.003)
Time pref.	0.004	0.002	0.008**	0.002
	(0.004)	(0.003)	(0.003)	(0.003)
Altruism	0.005	0.001	0.000	0.002
	(0.004)	(0.003)	(0.003)	(0.003)
Trust	0.000	0.001	0.000	0.002
	(0.003)	(0.002)	(0.002)	(0.002)
Climate imp.	0.008**	0.002	0.009***	0.010***
	(0.004)	(0.003)	(0.003)	(0.003)
Num.Obs.	2159	2159	2159	2159
Log.Lik.	−708.478	−511.539	−517.616	−529.818

Note: *p<0.1; **p<0.05; ***p<0.01

Each column shows the average marginal effects of a probit regression, where the dependent variable is a dummy that takes the value of 1 if the survey-respondent mentioned the respective topic in the open-ended text answer.

Table C.3: Determinants of open-ended response topics - 3/4

	Long term (1)	Financial sustainability (2)	Less return (3)	Certification (4)	Greenwashing (5)
Age	0.000	0.001	0.000	0.001	0.001
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Female	0.001	−0.020	0.008	0.005	−0.031**
	(0.013)	(0.014)	(0.008)	(0.014)	(0.014)
University educ	−0.009	−0.002	0.011	0.063***	0.027**
	(0.013)	(0.013)	(0.008)	(0.014)	(0.013)
Pensioner	−0.022	0.016	−0.007	−0.001	−0.009
	(0.022)	(0.021)	(0.012)	(0.023)	(0.021)
Married	−0.011	−0.027*	0.013	−0.014	−0.002
	(0.015)	(0.015)	(0.009)	(0.015)	(0.015)
HH-size	0.003	0.014**	0.002	0.009	0.000
	(0.006)	(0.006)	(0.003)	(0.006)	(0.006)
Log income	0.000	−0.038**	−0.012	0.037**	−0.010
	(0.017)	(0.017)	(0.010)	(0.019)	(0.017)
Log wealth	−0.003	0.004	0.000	−0.001	0.008
	(0.006)	(0.006)	(0.004)	(0.006)	(0.006)
Donate env.	−0.015	0.009	0.018**	0.015	−0.013
	(0.013)	(0.013)	(0.008)	(0.014)	(0.013)
Donate soc.	0.024	−0.008	0.011	0.015	0.030*
	(0.015)	(0.015)	(0.009)	(0.016)	(0.015)
Risk pref.	−0.002	0.001	0.000	0.003	0.007**
	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
Time pref.	0.009**	0.005	0.004*	−0.004	−0.001
	(0.004)	(0.004)	(0.002)	(0.004)	(0.003)
Altruism	0.000	−0.005	−0.003	0.000	−0.001
	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
Trust	−0.002	0.003	0.000	0.003	−0.005**
	(0.002)	(0.002)	(0.001)	(0.003)	(0.002)
Climate imp.	0.000	−0.003	−0.003*	0.011***	−0.009***
	(0.003)	(0.003)	(0.002)	(0.004)	(0.003)
Num.Obs.	2159	2159	2159	2159	2159
Log.Lik.	−617.329	−619.378	−252.880	−650.510	−605.721

Note: *p<0.1; **p<0.05; ***p<0.01

Each column shows the average marginal effects of a probit regression, where the dependent variable is a dummy that takes the value of 1 if the survey-respondent mentioned the respective topic in the open-ended text answer.

Table C.4: Determinants of open-ended response topics - 4/4

	Do not know	Do not know (Revealed)	No answer
	(1)	(2)	(3)
(4)			
Age	−0.001	−0.001**	−0.001**
	(0.001)	(0.000)	(0.000)
Female	0.051***	0.003	−0.008
	(0.014)	(0.009)	(0.007)
University educ	−0.044***	−0.007	0.000
	(0.014)	(0.009)	(0.007)
Pensioner	0.043*	−0.011	0.010
	(0.023)	(0.018)	(0.014)
Married	0.016	−0.003	0.000
	(0.015)	(0.011)	(0.008)
HH-size	−0.009	−0.007*	0.004
	(0.006)	(0.004)	(0.003)
Log income	−0.024	−0.004	−0.009
	(0.017)	(0.012)	(0.009)
Log wealth	−0.013*	0.003	0.001
	(0.007)	(0.005)	(0.004)
Donate env.	−0.036**	−0.005	−0.012
	(0.014)	(0.009)	(0.008)
Donate soc.	−0.038***	−0.012	−0.011
	(0.015)	(0.010)	(0.007)
Risk pref.	−0.012***	0.000	−0.005***
	(0.003)	(0.002)	(0.002)
Time pref.	−0.005	0.001	−0.003*
	(0.003)	(0.002)	(0.002)
Altruism	−0.001	0.001	0.000
	(0.003)	(0.002)	(0.002)
Trust	−0.002	0.001	0.001
	(0.003)	(0.002)	(0.001)
Climate imp.	−0.009***	−0.005***	−0.001
	(0.003)	(0.002)	(0.001)
Num.Obs.	2159	2159	2159
Log.Lik.	−635.619	−352.542	−226.392

Note: *p<0.1; **p<0.05; ***p<0.01

Each column shows the average marginal effects of a probit regression, where the dependent variable is a dummy that takes the value of 1 if the survey-respondent mentioned the respective topic in the open-ended text answer.

D Instrumental Variables

Table D.1: Instrument: number of press-articles containing "ESG"

Newspaper	% regular readers	*number articles containing "ESG"*	
		09/30/2020-09/30/2021	09/30/2019-09/30/2021
Neue Zürcher Zeitung (NZZ)	17	61	93
Tagesanzeiger	20	29	37
Berner Zeitung	7	22	28
Blick	14	7	12
Aargauer Zeitung	6	4	11
Luzerner Zeitung	2	4	10
St. Galler Tagblatt	2	4	10
20 Minuten	40	1	1

Note: This table shows the number of newspaper articles that contain the acronym "ESG" for the period of one year and two years prior to the survey. The articles were researched using the database "swissdox". The percentage of regular readers were obtained from the survey company, which defines a regular reader as reading the newspaper once per week or more frequently. Note that the newspaper "20 Minuten" is a special case because it is freely available and distributed in the public transport and other public places.

Table D.2: 2SRI first stage, marginal effects Poisson regression

	(1) SFL - closed	(2) SFL - open
Newspapers: ESG exposure	0.134**	0.143***
	(0.065)	(0.053)
Sustainability literacy	0.154***	0.086***
	(0.029)	(0.024)
Financial literacy	0.369***	0.243***
	(0.064)	(0.052)
Age	−0.023***	0.003
	(0.003)	(0.003)
Female	−0.293***	0.120*
	(0.078)	(0.062)
University educ	0.319***	0.249***
	(0.075)	(0.062)
Pensioner	0.186	−0.113
	(0.128)	(0.099)
Married	0.026	−0.003
	(0.083)	(0.068)
HH-size	−0.017	−0.021
	(0.032)	(0.027)
Log income	0.223**	0.034
	(0.099)	(0.081)
Log wealth	0.067*	0.002
	(0.035)	(0.029)
Donation: environ	0.182**	0.176***
	(0.073)	(0.060)
Donation: social	0.076	0.240***
	(0.084)	(0.073)
Risk preference	0.129***	0.029**
	(0.016)	(0.013)
Time preference	0.027	0.048***
	(0.020)	(0.017)
Altruism	0.022	0.020
	(0.018)	(0.015)
Trust	−0.031**	0.005
	(0.014)	(0.011)
Importance climate	−0.013	0.056***
	(0.016)	(0.015)
Num.Obs.	2159	2159
Log.Lik.	−3851.250	−3200.718

Note: *p<0.1; **p<0.05; ***p<0.01

This table shows the results of the first stage of a 2SRI estimation, with the average marginal effects from a Poisson regression. Column (1) shows the results for the closed measure for SFL and column (2) for the open measure.

E Literacy questionnaires

Financial literacy

We measure financial literacy by applying the widely used three questions by Lusardi and Mitchell (2008). The percentage of respondents that chose each option is in parenthesis and the correct option is underlined.

1. Assume you have CHF 100 in a savings account, and you get 2% interest per year on that savings account. No further deposits or withdrawals will be made to this account. What would be the account balance after 5 years?

a) More than CHF 102 [87.0%]

b) Exactly CHF 102 [4.2%]

c) Less than CHF 102 [6.2%]

d) I don't know. [2.6%]

2. Now assume that you receive 1% interest per year instead and that inflation is 2% in the same period. How much could you afford after a year of the money in the account?

a) More than today [4.3%]

b) Same as today [3.3%]

c) Less than today [86.2%]

d) I don't know. [6.2%]

3. Is the following statement right or wrong: "Buying shares of a single company usually offers a safer return than buying shares of multiple companies."

a) Correct [2.2%]

b) False [88.1%]

c) I don't know. [9.7%]

Sustainability literacy

The percentage of respondents that chose each option is in parenthesis and the correct option is underlined.

1. Which of the following topics are included in the United Nations (UN) Sustainable Development Goals Development? (Multiple options possible)

a) Economic growth [35.2%]

b) Social participation [68.7%]

c) Environmental protection [87.1%]

18% of the respondents chose all 3 options, which was the correct answer.

2. Which of the following definitions do you think best describes sustainable development?

a) Ensure universal access to education, health, and social services. [17.8%]

b) Meeting today's needs by minimizing the impact on the environment. [44.7%]

c) Meeting today's needs without limiting future generations. [34.5%]

d) I don't know. [3.0%]

3. What is the most common cause of pollution of streams and rivers worldwide?

a) Waste disposal by cities. [6.9%]

b) Industrial waste and landfills. [50.0%]

c) Draining surface water flowing from roads, paved areas and fields. [21.8%]

d) Waste in the immediate vicinity of streams and rivers. [12.7%]

e) I don't know. [8.7%]

4. Which of the following options is the main reason for the decline in fish stocks in the Atlantic Ocean?

a) Fisheries strive to maximise their catch. [57.6%]

b) Global climate change. [11.7%]

c) Lower fertility of fish. [1.6%]

d) Marine pollution. [25.8%]

e) I don't know. [3.2%]

5. In 2019, in Switzerland the poverty threshold was below a monthly income CHF 2279 for an individual and CHF 3976 for a household with two adults and two children under the age of 14. What percentage of the Swiss population was below the poverty threshold in 2019?

a) 1-5% [16.9%]

b) 6-10% [42.0%]

c) 11-15% [20.3%]

d) more than 15% [9.4%]

e) I don't know [11.3%]

6. What was the average annual GDP growth rate in Switzerland between 2015 and 2019?

a) less than 1% [3.9%]

b) 1-1.9% [33.7%]

c) 2-3% [27.3%]

d) more than 3% [4.9%]

e) I don't know. [30.2%]

Sustainable Finance Literacy

The percentage of respondents that chose each option is in parenthesis and the correct option is underlined.

1. In the context of sustainable financial investments, the (english) acronym "ESG" is often used. What do you think the abbreviation "ESG" stands for?

a) Environmental and Social Goals [3.5%]

b) Environmental and Sustainable Goals [12.7%]

c) Environmental, Social and Governance [26.4%]

d) Environmental, Sustainable and Governance [15.8%]

e) I don't know. [41.5%]

2. Does a product advertised in Switzerland as a "sustainable financial product" have to meet uniform criteria, set by the state regulatory authorities?

a) Yes [31.9%]

b) No [41.0%]

c) I don't know. [27.1%]

3. Are you aware of a label (or certificate, or proof) that certifies a sustainable financial product (from governmental or non-governmental organizations)?

a) Yes [12.7%]

b) No [87.3%]

4. Let's say a company has a low environmental footprint but has poor social and employee practices. Would it be possible to call the shares of this company a "sustainable" financial product in the financial markets?

a) Yes [32.3%]

b) No [46.2%]

c) I don't know. [21.5%]

5. In how many of the 3 ESG components (Environment, Social, Corporate Governance) does a company have to be sustainable in order to be considered a sustainable company on the financial markets?

a) only one of the elements [4.5%]

b) 2 elements [12.2%]

c) all 3 elements [46.1%]

d) I don't know. [37.3%]

6. An investment in a sustainable fund that includes companies with a low CO2 footprint directly reduces global CO2 emissions.

a) Yes [31.8%]

b) No [52.2%]

c) I don't know. [16.0%]

7. Do financial institutions that offer sustainable products always proactively influence the sustainability behavior of the invested companies (e.g., by participating in the annual shareholders' meeting)?

a) Yes [12.7%]

b) No [47.9%]

c) I don't know. [39.3%]

8. Is there a difference for you between "sustainable investing" and "impact investing?"

a) Yes [20.1%]

b) No [7.8%]

c) I don't know. [72.0%]

F Variable definition

Table F.1: Definition of variables obtained from the survey company

Variable	Description
Female	A dummy variable that takes the value of 1 if the respondent identifies as female and 0 otherwise.
Age	Age in years.
University Degree	A dummy variable that takes the value of 1 if the respondent holds a university degree and 0 otherwise.
Pensioner	A dummy variable that takes the value of 1 if the respondent's current employment status is "pensioner" and 0 otherwise.
Married	A dummy variable that takes the value of 1 if the respondent is married and 0 otherwise.
Household size	The number of people currently living in the respondent's household.
Income	Respondents were classified into 6 intervals for their monthly income: "less than 3,000 CHF," "3,000 - 4'500 CHF," "4'501 - 6,000 CHF," "6,001 - 9,000 CHF," "9,001 - 12,000 CHF" and "more than 12,000 CHF." We converted the intervals in a continuous variable by taking the average value for the interval when possible. The new continuous income variable thus takes the values: 3,000 CHF, 3'750 CHF, 5'250 CHF, 7'500 CHF, 10'500 CHF and 14,000 CHF.
Wealth	Respondents were classified into 7 intervals for their wealth: "less than 50,000 CHF," "50,000 - 100,000 CHF," "100,000 - 250,000 CHF," "250,00 - 500,000 CHF," "500,000 - 1,000,000 CHF," "1,000,000 - 5,000,000 CHF" and "more than 5,000,000 CHF." We converted the intervals in a continuous variable by taking the average value for the interval when possible. The new continuous income variable thus takes the values: 50,000 CHF, 75,000 CHF, 175,000 CHF, 375,000 CHF, 750,000 CHF, 3,000,000 CHF and 5,000,000 CHF.

Note: This table describes the variables that the survey company collected on the members of their panel. The survey company provided these background variables on the sample of respondents to the authors of this paper..

Table F.2: Definition of variables from the survey

Variable	Description
Risk Preferences	"How willing or unwilling are you to take risks when making decisions in your life?" (0 = "Completely unwilling to taking risks,"10 = "Very willing to take risks"), following Falk et al. (2016).
Time Preferences	"How willing are you to give up something that is beneficial for you today in order to benefit more from that in the future?," on a 10-point scale (1 = "Completely unwilling" to 10 = "Very willing to do so"), following Falk et al. (2016).
Altruism	"How would you assess your willingness to share something with others without expecting anything direct and immediate in return?" (1 ="Completely unwilling" to 10 = "Very willing to do so"), following Falk et al. (2016).
Trust	"As long as I am not convinced otherwise, I always assume that other people only have the best in mind." (0="No approval at all," 10="Very strong approval"), following Falk et al. (2016).
Climate Awareness	"Climate change is a serious problem that needs to be solved." (0=" No approval at all ",10="Very strong approval"), following Heeb et al. (2021).
Donate social	"Have you made at least one donation to a social institution in the last 12 months (e.g., Salvation Army, Swiss Solidarity, SOS Children's Villages, etc.)?"
Donate environment	"Have you made at least one donation to an environmental organization in the last 12 months (e.g., Greenpeace, WWF, myclimate, etc.)?"
Own sustainable financial product	A dummy variable that takes the value of 1 if the respondent answered "yes" to the following question: "Do you own sustainable financial products?" (the other options were "No," "I don't know" and "I prefer not to answer."

Note: This table describes the variables that were collected directly in the survey. All variables were collected after the respondents answered the open and closed questions on the different literacy measures.