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Eco-anxiety, connectedness to nature, and green equity investments

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Abstract

Green finance, in particular equity finance, is a way for developed economies to address climate change and foster environmental innovation. In this paper, we study the role of environment-related emotions in investment decision-making in green equity funds. We find that both eco-anxiety and connectedness to nature have an impact on the decision to invest in green equity funds, but, interestingly, they do not have an effect on the amount invested. Individual investors are influenced by their emotions and seem to benefit from the 'warm glow' effect regardless of the amount invested. Our results are consistent with a behavioral explanation of green investing.

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1. Introduction

In the context of growing concerns about climate change (Cepni *et al.*, 2022), in developed economies, increasing financial flows to green investments are seen as a necessity (Kreibiehl *et al.*, 2022). In addition to financial literacy (Anderson and Robinson, 2021) and the performance of funds (Døskeland and Pedersen, 2016), the drivers of green equity investing could also be emotional. Environmentally related emotions such as eco-anxiety and connectedness to nature have been documented to influence behaviors (Verplanken *et al.*, 2020; Mackay and Schmitt, 2019; Mayer and Frantz, 2004). These emotions can be negative, such as stress, fear, or worry, and are then labelled under the term of eco-anxiety (Clayton, 2020). On the contrary, people may feel quite close to their natural environment. This sense of belonging to nature, or connectedness to nature (Mayer and Frantz, 2004) is related to the positive emotion of well-being (Cervinka *et al.*, 2012). In the end, both emotions of eco-anxiety and connectedness to nature are related to pro-environmental behaviors such as careful use of natural resources or recycling (Mayer and Frantz, 2004; Verplanken *et al.*, 2020; Mackay and Schmitt, 2019). Meanwhile, individual investment in green equity funds is growing significantly and can also be considered as a pro-environmental behavior. Since emotions have been identified as drivers of investment by behavioral finance (Ackert *et al.*, 2003; Statman, 2018), we may also expect them to play a significant role in the decision to invest in green equity funds.

Since conducting large-scale studies on this topic is difficult, existing empirical studies have tried to indirectly infer investors' attitudes and emotions in financial markets (Caferra and Falcone, 2022; Deng *et al.* 2022)[1]. To the best of our knowledge, however, whether investors' emotions about nature influence green investment decisions has not yet been studied. In this paper, we try to fill this gap by investigating for the first time the role of environmentally related emotions, eco-anxiety and connectedness to nature, in the context of green equity funds. Drawing on an original survey of 671 French investors, we compare 340 green investors to 331 non-green investors with similar age, gender and location characteristics. We find, all else equal, that both eco-anxiety and connectedness to nature are significant determinants of green investment decisions. However, these environmental emotions do not influence the amount invested, meaning that the decision to invest in green funds itself may represent the emotional satisfaction felt by giving, regardless of the amount invested.

The rest of the paper is organized as follows. Section 2 describes the sample and the methodology. Section 3 presents the results and section 4 concludes.

2. Sample selection and variables

The data was collected through an online survey conducted by a well-established company, Panelabs (MIS Group), which specializes in data collection for research purposes. Our dataset is based on a representative sample and were extracted using the quota method. The quotas are age, gender and location in France. A restriction was imposed on respondents to be investors and to have a minimum amount invested in equity funds (€500). The quality of the answers is ensured by trap questions in the questionnaire, a minimum confidence score of the respondents[2], and monetary compensation. The survey was conducted in April-May 2022. To

[1] We thank one referee for these references.

[2] According to Panelabs, "panelists are tracked over time using a confidence score out of 10: a score of 10/10 assigned at registration, then lowered each time a questionable participation is recorded. E.g.: -1 point for a response time considered too fast, -10 points for an open answer such as "xwrcftz". Panelists with a score of < 10

mitigate sample bias, green and non-green investors are matched by gender, age, and geographic location in France. The final sample includes 340 green investors and 331 non-green investors.

We estimate the following Probit model to investigate the effects of environment-related emotions on the decision to invest in green equity funds:

$$P(Green\ Investment_i = 1 |\ Environmental\ emotion_i, Controls_i\ ) = \Phi(\beta_0 + \beta_1 Environmental\ emotion_i + \delta Controls_i) \quad (1)$$

Where $\Phi(\cdot)$ is the cumulative standard normal distribution function. When looking at the influence of emotions on the invested amount, we run a two-stage estimation, following the Heckman procedure. The selection model is similar to the preceding equation, while the second includes, for the investors that are selected as green investors, the inverse mills ratio (IMR):

$$Green\ Investment\ amount_i = \beta_0 + \beta_1 Environmental\ emotion_i + \delta Controls_i + IMR_I + \varepsilon_i \quad (2)$$

with *i* the respondent (*i* = 1 to 671).

Green investment is a binary variable equal to one if the respondent invests in a green equity fund (at least €500 invested in an article 9 fund), and zero otherwise. The definition of a green equity fund is based on the European Union taxonomy[3]. Article 5 of this taxonomy defines the disclosure requirements for an article 9 fund. An article 9 fund is defined in the European Union Sustainable Finance Disclosure Regulation (SFDR[4]). It is a fund that has an environmentally sustainable investment objective and therefore invests only in stocks of companies that contribute "substantially to one or more of the environmental objectives" or do "not significantly harm any of the environmental objectives" in accordance with a sustainable economic activity[5], for example renewable energy, or clean or climate-neutral mobility. As a result, such a fund has no financial performance claims. Becker *et al.* (2022) define an article 9 funds as "funds which have generated a real impact as their primary goal alongside a financial return".

Eco-anxiety is defined as the emotional distress related to climate and ecological crises (Hickman *et al.*, 2021). It is assessed by using the 13 questions of the Hogg Eco-Anxiety Scale (HEAS-13) on a four-category scale from "not at all" to "almost every day" (Hogg *et al.* 2021). Eco-anxiety is calculated as the average of the responses and its values are normalized to a scale of 0 to 1 by dividing by 4. This scale has been shown to be robust and encompasses the main facets of eco-anxiety (Hogg *et al.*, 2021).

In addition, we measure connectedness to nature with a connectedness to nature scale, which "measures one's experiential, emotional connection to nature" and "relationship with the natural world" (Mayer and Frantz, 2004). To avoid an overly long questionnaire, we use the short version proposed by Kleespies *et al.* (2021) which includes 5 questions on a 5-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree". Connectedness to nature is calculated as the average of the responses and its values are normalized to a scale of 0 to 1 by dividing by 5.

Overall, with respective alphas of 0.9087 and 0.8855, both HEAS-13 and connectedness to nature scales prove to be largely reliable in our context to evaluate eco-anxiety and connectedness to nature emotions.

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are less likely to be asked to participate and are subject to increased vigilance and panelists with a score of 0/10 are definitely excluded".

[3] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32020R0852

[4] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32019R2088&from=EN#d1e1311-1-1

[5] For a company to have a sustainable economic activity in the sense of the EU taxonomy, it must meet 3 conditions: i. contribute to at least one of the six environmental objectives (climate change mitigation; climate change adaptation; sustainable use and protection of water and marine resources; transition to a circular economy; pollution prevention and control; protection and restoration of biodiversity and ecosystems), ii. not undermine any of the other environmental objectives, iii. comply with the OECD and UN social safeguards.

Following recent papers (Rossi *et al.* 2019; Anderson and Robinson 2021), we include several control variables. Specifically, we use *Age* which measured in years and is computed as the difference between the date of the filing of the questionnaire and the date of birth of the respondent. *Female* is a dummy variable equal to one if the respondent is female, and zero otherwise. *Education* is measured by the number of years relative to the high-school degree (e.g., Master: 5). *Financial knowledge* is assessed with the answer to the question "I consider myself to have a good knowledge of financial investments" on a 7 Likert-scale. *Investment horizon* represents the answer to the question "My equity/equity fund investment horizon is" less that 1 year / 2-4 years /5-10 years / >10 years. *Net income* is the monthly net income after income tax and *Equity Portfolio* measures the total amount invested in equity portfolio[6].

3. Results

Table 1 presents some summary statistics. Mean age of a participant is roughly 50 years, financial knowledge is relatively high, mean education is 2 years after the Baccalauréat, the mean investment horizon is roughly 5 years, the average net income of households is €3,384 and the mean equity portfolio investment is €10,373. These statistics are consistent with French data about income (monthly mean net income in France in 2018 of €3,139). If we focus on green investors only, the mean invested amount in green funds is € 974 which represents 7.6 percent of their total portfolio.

Table 1 – Descriptive statistics

VARIABLES	N	Mean	Median	Q1	Q3	Max	Min
Green Investment	671	0.507	1.000	0.000	1.000	1.000	0.000
Ln (Green Amount)	671	3.487	0.000	0.000	7.601	11.290	0.000
Eco-anxiety	671	0.156	0.135	0.038	0.231	0.673	0.000
Connectedness to Nature	671	0.480	0.520	0.360	0.600	0.800	0.000
Female	671	0.507	1.000	0.000	1.000	1.000	0.000
Age	671	49.975	50.000	40.000	59.000	80.000	26.000
Financial Knowledge	671	4.332	5.000	3.000	5.000	7.000	1.000
Education	671	2.116	2.000	0.000	4.000	8.000	-3.000
Investment Horizon	671	2.584	3.000	2.000	3.000	4.000	1.000
Ln (Equity Portfolio)	671	9.247	9.210	8.294	10.309	11.918	6.215
Ln (Net Income)	671	8.127	8.161	7.824	8.412	9.210	5.991

To assess the impact of emotions on the decision to invest in green funds, we run Probit regressions to explain *Green Investment*. The results of these regressions are shown below in Table 2, columns (1) to (4). As expected, emotions play a significant role in explaining the decision to invest in green funds. In Column (1), we can see that the more eco-anxious people are, the more likely they are to invest in green funds. Column (2) shows similar results for connection to nature. The two emotions do not cancel each other out as we can see in Column (3), meaning that both negative (Eco-anxiety) and positive (Connectedness to nature) emotions are different dimensions that simultaneously exert an influence in the decision to invest in green assets. In this model (3), the average VIF is 1.13 and the maximum is 1.24, indicating that collinearity, especially between the measured emotions, is not an issue. A natural question

[6] Unfortunately, the exact wealth of respondents was not obtained nor controlled for, in line with previous studies studying individual investors such as Anderson and Robinson (2021). We believe, however, that we controlled for variables that are very correlated: the net income, the amount of the equity portfolio, age, education and financial knowledge. We thank the referee for this comment.

arises: are there interaction effects between these two emotions? In other words, do highly eco-anxious individuals, who are more connected to nature than others, overinvest in green funds? In Column (4), we examine the interaction between the two emotions by using *Eco-anxiety* × *Connectedness to Nature*[7]. With respect to our results, we find no evidence of a greater tendency to invest in green assets for those well connected to nature and with eco-anxious emotions.

Furthermore, a better financial knowledge and a higher amount invested in equity positively influence the decision to invest. This is consistent with results in the literature on green investing or stock investing and financial literacy (Anderson and Robinson 2021; Van Rooij *et al.* 2011). While the power of our model to explain the decision is low (8.5-9%), it is in line with previous results in the literature (Anderson and Robinson, 2021).

Table 2 – Eco-Anxiety, Connectedness to Nature and Green Investment

	(1) Green Investment	(2) Green Investment	(3) Green Investment	(4) Green Investment	(5) Ln (Green Amount)	(6) Green Amount Percentage
Eco-anxiety	0.345**		0.298**	0.296**	2.181	0.231
	(2.382)		(2.033)	(2.036)	(0.759)	(0.860)
Connectedness to Nature		0.261**	0.222**	0.221**	2.483	0.137
		(2.455)	(2.071)	(2.065)	(1.090)	(0.644)
Eco-anxiety × Connectedness to Nature				-0.526		
				(-0.654)		
Female	0.0471	0.0611*	0.0539	0.0546	0.510	0.0532
	(1.287)	(1.679)	(1.478)	(1.497)	(0.856)	(0.952)
Age	-0.000584	-0.00163	-0.00116	-0.00119	0.00433	0.000980
	(-0.376)	(-1.045)	(-0.739)	(-0.755)	(0.234)	(0.562)
Education	-0.00227	-0.00328	-0.00256	-0.00226	-0.0800	-0.0177**
	(-0.279)	(-0.403)	(-0.317)	(-0.280)	(-0.935)	(-2.179)
Financial Knowledge	0.0957***	0.0916***	0.0916***	0.0919***	0.543	0.0720
	(7.325)	(6.979)	(6.911)	(6.961)	(0.659)	(0.940)
Investment Horizon	0.0402*	0.0402*	0.0398*	0.0421*	0.233	0.0210
	(1.831)	(1.810)	(1.809)	(1.892)	(0.573)	(0.552)
Ln (Net Income)	-0.0215	-0.0334	-0.0236	-0.0238	0.145	0.0517
	(-0.484)	(-0.754)	(-0.532)	(-0.538)	(0.275)	(1.041)
Ln (Equity Portfolio)	0.0450***	0.0439***	0.0442***	0.0444***	0.950**	-0.0345
	(3.124)	(3.051)	(3.085)	(3.102)	(2.270)	(-0.886)
Constant					-11.13	-0.659
					(-0.920)	(-0.587)
/Mills Lambda					3.849	0.389
					(5.232)	(0.484)
Pseudo R^2	0.084	0.084	0.089	0.090		
N	671	671	671	671	671	671

This table presents the average marginal effects of the Probit model (Columns (1)-(4)) and Heckman second-step regressions (Columns (5)-(6)) of eco-anxiety and connectedness to nature and controls on Green Investment and Green Investment Amount. Green Investment is a dummy variable taking 1 if the respondent holds more that €500 of green equity funds in his portfolio. Ln (Green Amount) and Green Amount Percentage are respectively the natural log of the amount invested in green funds and its percentage of the overall portfolio. Net Income and Equity Portfolio are expressed in natural log to account for skewness.; *t* statistics in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[7] To avoid multicollinearity issues, we introduce the residuals of the orthogonalization of the product (Sauer 2014).

We now turn to the green amount invested (Columns (5) and (6)), both for the total amount and the percentage of the portfolio and present the second step of the Heckman sample selection model to account for any potential sample bias. As we can see in the Columns (5) and (6), the picture here is different. Whether green investment is considered in absolute (Column (5)) or relative (column (6)) terms, both emotions do not exert a significant effect on the amount invested. Restricting this analysis to the sample of green investors yields similar results. Hence, emotions about nature do not influence the size of the investment in green funds. One interpretation of this result may be that people who invest in green funds do so to reassure themselves that they are care about the planet and the climate, and benefit from this good conscience regardless of the amount invested.

4. Conclusion

Based on a survey of 671 French individual investors, our analysis of the decision to invest in green funds shows that emotions come into play when investing in green assets. Both negative emotions (ecoanxiety) and positive ones (connection to nature) influence the decision made by individuals. Although previous literature has highlighted the importance of financial objectives and moral values (Døskeland and Pedersen 2016) and financial literacy (Anderson and Robinson 2021) on green investments, our study contributes to a better understanding of individual investor behavior by confirming the importance of considering emotions towards the environment as a driver in the investment process, and thus reaffirming the role of behavioral finance in explaining investor decisions. Furthermore, Heeb *et al.* (2022) find that, while investors are willing to invest in green funds, they are not sensitive to the real impact of their investment. Our results on the lack of influence of emotions on the amount invested may be in line with this explanation, in the sense that investors may buy green investment to benefit from the “warm glow” effect, although the actual monetary engagement and impact on the environment are still superficial.

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