Risk-return trade-offs in the context of environmental impact:
a lab-in-the-field experiment with finance professionals

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Abstract

We assess the impact of environmental externalities on portfolio decisions in a lab-in-the-field experiment on finance professionals and students. Participants are prone to accept lower returns for positive environmental impact but will not bear increased risk. They show asymmetric pro-environmental preferences depending on the sign of the externality. Finance professionals are more pro-environment than students, particularly regarding positive externalities, and less influenced by a ranking signal about environmental performance. Control tasks show that experimental measures of pro-social and environmental preferences have less influence on portfolios than market practices for professionals but are significant predictors for students.

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1 Introduction

Green is the new black of the finance industry. Environmental concerns, especially related to climate change (Reboredo and Otero, 2021), constitute an important element of socially responsible investment (SRI). Much evidence shows that social and environmental values take a growing place in investing decisions, at the individual level (Jansson and Biel, 2011; Riedl and Smeets, 2017; Brière and Ramelli, 2020) and for various institutional investors (Jansson and Biel, 2011; Bauer et al., 2021; Barber et al., 2021). Investors would knowingly accept lower expected financial returns in exchange for nonpecuniary benefits from investing in assets with pro-social externalities (Coqueret, 2021). Pro-social preferences theory (e.g., Bénabou and Tirole, 2010) finds confirmation in empirical data (Fama and French, 2007; Jeffers et al., 2021), surveys (Brodback et al., 2019), field experiments (Brodback et al., 2021; Heeb et al., 2022), and laboratory experiments (Brodback et al., 2020; Bonnefon et al., 2022). Socially responsible signaling can even be strong enough to lower performance expectations from investors (Zhang, 2021) or misguide investors toward inefficient capital allocation in both financial and social returns (Green and Roth, 2021).

The picture becomes more complex when risk enters, as the three dimensions of risk, return, and impact are intertwined. Jeffers et al. (2021) show that impact funds have substantially lower market beta than venture capital funds, and Biasin et al. (2022) show that social impact investment must be seriously considered for portfolio variance minimization. The Covid-19 shock has also proven that pro-social preferences are more fragile under stress (Döttling and Kim, 2021), pushing investors to avoid an additional environmental, social, and governance (ESG) risk to financial losses (Ferriani and Natoli, 2021), even if SRI may have outperformed benchmarks in this period (Capelle-Blancard et al., 2021; Lööf et al., 2021). Those characteristics illustrate the difficulty of assessing the relationship between risk aversion, return-seeking and pro-social preferences separately.

In the present paper, we offer an experiment with a sample of 279 student subjects, and replicated it in a lab-in-the-field setting with a sample of 190 finance professionals, to explore the interaction of pro-environmental preferences with classical risk–return financial preferences. Participants faced repeated individual investment tasks where experimental assets vary along the dimensions of return, risk, and environmental externalities, the latter generated by investing in specific colored assets (green and brown). In particular,

professionals participated in the experiment in conditions closely related to their work environment within banks and asset management companies, which provides a unique sample tested in a controlled environment.

Pooling our data, we analyze revealed preferences through three trade-offs: the risk–return trade-off, the return-impact trade-off (where impact means a relatively positive environmental externality) and, finally, the risk–impact trade-off. We confirm results found in the literature about the first two: participants naturally arbitrate between return and risk and show significant attraction to both return and environmental impact, arbitrating between the two dimensions in asset allocations. However, our principal contribution is to show that individuals do not bear a higher risk for improved environmental impact. In particular, when portfolios are more risky (e.g., in the presence of background, systematic risk), participants tend to compensate for the higher riskiness by seeking higher returns and thus diminish the environmental benefit. This finding echoes Brodback et al. (2020), who emphasize that bad outcomes generate less willingness to pay for SRI, and Bansal et al. (2021), who suggest that investors have a wealth-dependent preference for social responsibility, which leads to a decreased demand for SRI during bad times. The connection between bad financial outcomes and lower desirability of externalities extends to risky outcomes.

In the experiment with finance professionals, the core task was to allocate a fixed budget of 100€[1] between two assets, which mimics a simple portfolio choice task. Each asset was characterized by three attributes: return (between 10% and 40%), standard deviation (between 0% and 50%) and environmental impact (explained below). The core task was repeated 35 times, by systematically varying each of the dimensions, to provide a rich data set that allowed us to identify the three trade-offs. We frame an asset's environmental impact, either as delegated philanthropy, or as delegated misanthropy. Delegated philanthropy (Baron, 2007; Bénabou and Tirole, 2010) is a standard experimental tool to simulate SRI or charitable giving (Heimann et al., 2011; Koppel and Regner, 2011; Eckel et al., 2017; Brodback et al., 2020; Humphrey et al., 2021). Participants are usually offered the chance to donate to a charity (e.g., the Red Cross or the WWF). In our setting, investing in a green asset leads to a donation to an environmentally virtuous third party by the experimenter. We take the mirror image of such donation for defining a brown asset, based on "delegated misanthropy": investing in a brown asset leads to a donation to an environmentally vicious third party by the experimenter.

[1]In practice we used the experimental currency "ecu", but the rate was 1 ecu = 1 euro for the professionals while it was 1 ecu = 0.2 euros for the students.

By opposition to delegated philanthropy, which is based on the willingness to sacrifice material payoff to achieve social goals, we set a compensation mechanism that eases the moral cost of delegated misanthropy. We do this by introducing a "brown premium" on the returns of brown assets. Thereby, participants can either invest in a high-return brown asset that generates a negative externality on society[2] or avoid it by waiving the brown premium and investing in a lower return asset with a better environmental externality.[3] We find that participants are more reluctant to invest in brown assets than they are willing to invest in the corresponding green assets, *ceteris paribus*. Such difference in invested shares, between environmentally virtuous and vicious, may lie in different psychological and cognitive motives, akin to loss aversion in prospect theory (Kahneman and Tversky, 1979; Tversky and Kahneman, 1991).[4]

We combine experimental data from standard student subjects (hereafter the STUD sample) with data from finance professionals (hereafter the PRO sample) sampled in a lab-in-the-field setting. The key reason for using simultaneously conventional subjects and professional subjects, is that each type of subjects provides specific validity on a distinct dimension. The lab setting offers high internal validity, because it allows us to isolate the three trade-offs in a highly controlled environment, but at the cost of a low external validity. The lab-in-the-field setting, in which finance professionals performed the portfolio tasks in their natural environment, provides high external validity at the cost of a lesser control. In addition, finance professionals' behavior is highly interesting as they advise clients, trade in the markets, invest in assets, being at the core of the financial system. In a complementary way, students are younger people who represent the new climate-sensitive generation (McDougle et al., 2011)[5], thus offering important

[2]Delegated misanthropy is implemented by a donation to an association of the fossil energy industry.

[3]Our mechanisms are somehow comparable to those of the "Click for a Charity" experiment of Ariely et al. (2009). The authors study how the donations depend on the beneficiary, either the Red Cross considered as a "good" cause by most participants, or the National Rifle Association considered as a bad cause by the majority of participants. Negative externalities were also studied in market experiments by Falk and Szech (2013) (killing mice) and by Bartling et al. (2015) and Bartling et al. (2019) (avoiding a CHF 60 donation to fund a surgery of a leprosy patient in India).

[4]Asymmetry in SRI was recently investigated in Humphrey et al. (2021), and an analog with sin assets is studied in Chew and Li (2021), who show that aversion to vicious investment is larger than attraction to virtuous investment. Our results are in line with Humphrey et al. (2021), who show that negative externalities produce a larger impact on students' investment decisions than positive externalities. However, in their paper, the negative externality is a deduction from a donation to non-profit organizations and does not produce a salient negative externality that can generate a direct negative loss onto the society, as in our design. Furthermore, their design does not offer the possibility of trading between two assets with positive returns, standard deviations and correlations that vary according to situations.

[5]For a recent survey on climate concerns and generational differences, see https://news.gallup.com/poll/234314/global-warming-age-gap-younger-americans-worried.aspx.

information on future investment behaviors. Besides, they represent a less specialized population closer to the households, who account for a growing share of the market.[6] Because the two settings offer valuable complementarities, combining them has become a widespread practice in the experimental finance literature (see e.g., Haigh and List, 2005; Kirchler et al., 2018; Gajewski et al., 2020; Weitzel et al., 2020; Holmen et al., 2021; Bottasso et al., 2022). We find that the three trade-offs are qualitatively similar in both samples, but that finance professionals exhibit stronger pro-environmental preferences than students, in particular regarding green assets.

In contrast to the STUD sample, the PRO sample contains some specific heterogeneity related to jobs and investment strategies, which deserves special attention. The PRO sample gathers professionals from investment banks and asset management companies, who occupy different jobs. We invited therefore the finance professionals to respond to a specific questionnaire at the end of the experiment about their profession, investment strategy, and other finance-related questions. The outcome is a unique data set that allows us to relate, investment strategies revealed in the experiment, to jobs and out-of-the-lab investment strategies. We highlight that professionals' portfolio allocations in the lab depend strongly on their kind of job and on the type of portfolio strategy they use. We rely on categories that are similar to the fundamentalist vs. chartist opposition. It appears that finance professionals who are used to considering extra-financial information and who have longer decision-making horizons, tend to be more sensitive to the environmental impact of their portfolio in the lab. This finding suggests that, beyond the personal traits that are specific to finance professionals (Holmen et al., 2021), their position in the industry and their daily practice are crucial determinants of their trade-offs in the lab. This may be because some jobs and strategies attract specific profiles, i.e., there is selection (Lagarde and Blaauw, 2014), or because they reinforce particular professional norms (Cohn et al., 2014).

We test the robustness of our main finding by introducing two instruments that were intended to promote trade-offs in favor of the greener asset: (1) a "ranking treatment", in which each participant was informed about her rank in terms of the proportion of the budget invested in the greener asset, and (2) a "tax treatment" in which subjects had to pay a tax in proportion to their poor environmental performance. The ranking treatment aimed to trigger pride or shame through ranking information about the environmental performance of one's portfolio. According to social comparison theory (Festinger, 1954),

[6]For example, in the French market, according to the Autorité des marchés financiers (AMF), the number of active retail investors has doubled between 2019 and 2021 (Chatillon et al., 2021).

upward social comparisons improve individuals' abilities and provide self-enhancement with new targets (List, 2006; Kirchler et al., 2018). The tax treatment was a penalty on the brown premium through a tax cut on expected profits that decrease with environmental performance. We observe that financial professionals are less sensitive to treatments than students, especially in contexts involving a negative environmental impact.

Throughout our analyses, we control for various behavioral traits, opinions, and socio-demographic data. Following the core investment task, participants took part in several control tasks and answered questionnaires. These tasks are taken from the mainstream literature to elicit five individual traits: risk preference (Noussair et al., 2014), cognitive ability (CRT, Frederick, 2005), strategic skill (the 11-20 game of Alaoui and Penta, 2016), pro-sociability (SVO, Murphy et al., 2011), and pro-environmental opinion (the NEP scale of Dunlap et al., 2000). While these tasks are mainly used as control variables to account for a likely heterogeneity between finance professionals and students, we are also specifically interested in their pro-social and pro-environmental preferences. As already shown by Riedl and Smeets (2017), these two dimensions may affect participants' portfolio decisions. We show that this is the case with students, but the allocations of finance professionals are not correlated to their answers in those auxiliary tasks.

The rest of the paper is structured as follows. Section 2 introduces the portfolio choice task together with our main predictions. Section 3 presents the data and the core result about trade-offs. Section 4 then analyses the econometric patterns in the investment task in terms of colors (green vs. brown), samples (PRO vs. STUD), and the effect of treatments. Section 5 details the control tasks and the demographic data and redoes the analysis with that information to provide individual predictors of investment choices. Section 6 concludes.

2 Preferences over return, risk and environmental impact

The principle of the experimental portfolio choice task follows a long strand of experimental literature, from the seminal work by Gneezy and Potters (1997) to more recent work, e.g. Kirchler et al. (2018): participants are asked to allocate a fixed budget between two assets. The novelty of our experiment is that in almost all such tasks, one and only one asset generates an environmental externality. In subsection 2.1 we provide details about the task, in subsection 2.2 we state our core predictions, and in subsection 2.3 we detail the protocol and sampling procedures.

2.1 Portfolio task

Let us present the basic task. Participants are asked to allocate a fixed budget between two infinitely divisible assets: asset 1, with an expected return μ_1 and a standard deviation σ_1, and asset 2, with an expected return μ_2 and a standard deviation σ_2. If we denote by $\lambda \in [0, 1]$ the proportion of the budget invested in some asset, such as asset 1, the portfolio's expected return is $\mu_p = \mu_2 + \lambda(\mu_1 - \mu_2)$. Participants composed such portfolios 35 times, following the order of the screens summarized in Table 1. Asset 1 was always the neutral asset, while asset 2 was either green or brown (except for screen 3). For our subsequent analyses, we define λ as the proportion of the budget invested in the "greenest" (or "least brown") asset. In neutral versus green allocations, the greenest asset is the green asset, while in the neutral versus brown allocations, the greener asset is the neutral one.

Table 1: Asset characteristics in the portfolio choice task

	Situation 1		Situation 2		Situation 3		
Screen	$C(\mu_1, \sigma_1)$	$C(\mu_2, \sigma_2)$	$C(\mu_1, \sigma_1)$	$C(\mu_2, \sigma_2)$	$C(\mu_1, \sigma_1)$	$C(\mu_2, \sigma_2)$	correl.
1	N(15,0)	G(10,0)					
2	N(15,0)	B(20,0)					
3	N(15,0)	N(20,25)	N(15,0)	N(30,25)	N(15,0)	N(30,50)	
4	N(15,0)	G(10,25)	N(15,0)	G(20,25)	N(15,0)	G(20,50)	
5	N(15,0)	B(30,25)	N(15,0)	B(40,25)	N(15,0)	B(40,50)	
6	N(20,25)	G(10,0)	N(30,25)	G(10,0)	N(30,50)	G(10,0)	
7	N(20,25)	B(20,0)	N(30,25)	B(20,0)	N(30,50)	B(20,0)	
8	N(20,25)	G(10,25)	N(30,25)	G(20,25)	N(30,50)	G(20,50)	1
9	N(20,25)	G(10,25)	N(30,25)	G(20,25)	N(30,50)	G(20,50)	0
10	N(20,25)	G(10,25)	N(30,25)	G(20,25)	N(30,50)	G(20,50)	-1
11	N(20,25)	B(30,25)	N(30,25)	B(40,25)	N(30,50)	B(40,50)	1
12	N(20,25)	B(30,25)	N(30,25)	B(40,25)	N(30,50)	B(40,50)	0
13	N(20,25)	B(30,25)	N(30,25)	B(40,25)	N(30,50)	B(40,50)	-1

Description: Up to three situations that required a single portfolio decision for each situation were displayed simultaneously in 13 successive screens. Notation $C(\mu_i, \sigma_i)$ refers to asset i (1, 2) with color C (N = neutral, G = green, B = brown), gross expected return μ_i (in percent) and standard deviation σ_i (in percent). Correlation between the two assets is provided if $\min(\sigma_1, \sigma_2) > 0$.

We deliberately chose to carry the sequence of the tasks in a non-random order[7], in

[7]Even if we cannot exclude the possibility that the order of the tasks influenced the participants, there is no reason to believe that it influenced the choice in a specific direction. Second, keeping the

order to increase the level of complexity gradually and smoothly, and control thereby for learning. We suspected that participants would progressively adjust their skills to the rising sophistication of the experiment, as they learned to make treadeoffs with the experimental assets. The experiment began very simply, without considering the risk dimension. In the first two allocation tasks (screens 1 and 2), the assets are riskless, and their returns are known. Those two cases lead to the trivial choice, $\lambda = 0$, for a profit-maximizing participant indifferent to the externality of the assets. In contrast, a participant who cares about the environmental externality, which is proportional to λ (see the protocol in subsection 2.3), will refrain from investing the whole budget in the more economically attractive browner asset and instead invest some in the greener asset, that is, the green asset in screen 1 and the neutral asset in screen 2.

Then, integrating the risk dimension for one asset only (screens 3 to 7), participants faced a trade-off between a risk-free asset and a risky asset of any color. In this second phase of the experiment, the only risky asset is modeled by a Bernoulli fair lottery. The 15 allocation situations vary in expected return, standard deviation, and color. The portfolio's standard deviation is simply proportional to the amount invested in the risky asset, a linear function of λ. Participants thus had to deal with risk and the arbitrage between return and environmental impact.

Finally, the third and last part is more complex as it involves two risky assets in 18 different situations. In these cases, the two assets have the same standard deviation for convenience, but an additional parameter must be considered, which is the correlation regime $\rho \in \{-1, 0, 1\}$ between returns. While $\rho = 1$ implies bearing an unavoidable risk for participants, they can diversify their portfolio to reduce risk when $\rho = 0$, and even cancel it when $\rho = -1$. In that setting, participants deal with return, risk and environmental impact, with either diversifiable or non-diversifiable risk.[8]

same ordering for the analysis of subsamples (Section 4.2) and treatments (Section 4.3) guarantees that induced effects are not related to specific orderings. Three situations were simultaneously displayed for each screen from 3rd to 13th, and the only differences among them were variations in returns and standard deviations. By offering three situations on the same screen, we encourage participants to arbitrate coherently, depending on changes in returns and standard deviations of the assets. All relevant information was displayed on the screen in real time, according to the allocation proposed by the participant (see the protocol in Section 2.3).

[8]Regarding the complexity of the experiment, previous research has illustrated that individuals may have difficulties understanding volatility or correlations (Enke and Zimmermann, 2019) and sometimes rely on other risk metrics, such as the probability of experiencing losses (Holzmeister et al., 2020). This difficulty might generate two issues. First, participants could be confused about the information on these financial properties and, therefore, rely on more understandable data concerning donations. As a result, the importance of the externality could be overestimated. However, we emphasize that this experiment was mainly targeted at financial market professionals who deal with all these metrics on a daily basis in

2.2 Predictions

Participants must deal with three dimensions: return, risk and environmental impact. They are confronted with a trade-off between a positive environmental impact and maximizing a portfolio's return. They are also expected to avoid or reduce the risk of their portfolio, along the line of standard portfolio theory (Kroll et al., 1984; Markowitz, 2010) and as usual in experiments involving lotteries (Holt and Laury, 2002).

Our core research question and our core result are how those three dimensions are treated together in a portfolio task. As suggested in the introduction, financial asset holders might be willing to give up part of the expected return for environmental benefits. This possibility must be confirmed. It is also unknown if investors are willing to accept a higher risk for such benefits. Furthermore, the tradeoffs between risk, return and environmental impact may depend on the type of subjects.

We build on two testable hypotheses regarding λ. For notational convenience, we identify the financial characteristics return and risk by μ_g and σ_g for the greener asset and by μ_b and σ_b for the browner asset. The first hypothesis (financial preferences) states that the overall proportion invested in the greener asset by all participants depends on the assets' returns, μ_g and μ_b, and their standard deviations, σ_g and σ_b.

Hypothesis 1 (Regular financial preferences)**.**

In composing their portfolios, participants seek return and avoid risk. This is revealed through:

1. *an increase of the share λ if the expected return of the greener asset, μ_g, increases, and a decrease of λ if the return of the browner asset, μ_b, increases;*
2. *a decrease of λ if the risk of the greener asset, σ_g, increases, and an increase of λ if the risk of the browner asset, σ_b, increases.*

The second hypothesis relates to pro-environmental preferences. Assuming that Hypothesis 1 holds, the perception and appreciation of return and risk characteristics of an asset may differ according to the color of that asset. First, it may impact λ through a higher propensity to forgo larger returns to hold a higher proportion of greener assets,

a trading room or a risk management department, which makes these concepts easier for them to grasp. Any university student and professional who had difficulty understanding the metrics could ask the staff questions at any time. We have systematically answered all questions of comprehension. Second, financial professionals may have a better understanding of volatility and correlations than students, which could potentially account for differences in behavior. However, if this gap exists in the laboratory, it is also likely to exist in the real world, as professionals are more familiar with these properties than laypeople. This fully supports the need to include professional and lay participants in an experimental setting when investigating these concepts and observing their impact on investment behavior.

and second, through a higher risk tolerance toward greener assets. In other words, participants may have a higher willingness to pay, or a higher willingness to bear risk, or both, to hold a larger share of green assets as they become greener.

Hypothesis 2 (Pro-environmental preferences)**.**

Participants prefer the greener over the browner asset in such a way that:

1. *Reluctance of asset substitution:*
   λ decreases if a green (brown) asset is replaced by an equivalent neutral asset, that is, when a participant moves from a green (brown) versus neutral situation to a neutral versus neutral one, ceteris paribus*.*
2. *Return asymmetry:*
   A change of the expected return of the greener asset affects λ more than an equal change of the expected return of the browner asset.
3. *Risk asymmetry:*
   A change of the standard deviation of the greener asset affects λ less than an equal change of the standard deviation of the browner asset.

Hypothesis 2.1 states pro-environmental preferences in a taxonomic manner, i.e., an intrinsic preference that an asset be green rather than neutral, or neutral rather than brown. It relies on the underlying mechanism that λ expresses both a preference for the greener asset and an aversion towards the browner asset. To establish empirically this property, we take as benchmarks the trade-offs involving two neutral assets (screen 3 decisions in Table 1), which we compare to the equivalent trade-offs for which one the two assets is colored (screens 4 and 5 in Table 1).

Hypothesis 2.2 states asymmetric pro-environmental preferences with respect to expected return: individuals' choices of λ reflect greater sensitivity to the greener asset's expected return than to the return of the browner asset. In other words, for an individual to be indifferent between greener and browner assets' expected returns, his required level of the former needs to be lower than that of the latter. That is precisely what we express as a revealed pro-environmental preference impact through asset returns. A similar prediction applies to a change in the standard deviation (Hypothesis 2.3): λ is more resilient to changes in the standard deviation of a green asset than that of a brown asset.

Notice that Hypothesis 1 contradicts either Hypotheses 2.2 or 2.3: investors cannot hold all three together. Participants thus face a trilemma. In regard of the standard risk–return trade-off, an increase in a portfolio's risk should lead participants to ask for a compensating premium expressed in a higher return (Hypothesis 1), which is obtained by

reducing λ. Mechanically, as $\mu_g < \mu_b$[9], the associated positive (negative) environmental impact is reduced (increased) if the value of λ is lowered.

To what extent are these two channels, i.e., the sacrifice of expected return (Hypothesis 2.2) or the acceptance of increased riskiness (Hypothesis 2.3), equally likely to serve as a compensatory variation for the moral benefit of investing in the greener asset? Put differently, is environmental friendliness equally expressed in the acceptance of lower returns as in the acceptance of higher risks? Finally, is environmental friendliness expressed similarly in the PRO and STUD samples?

The latter question leads us to state our third hypothesis about the absence of a subject-pool effect concerning revealed preferences.

Hypothesis 3 (No "green generation" effect)**.**

Students' revealed preferences are neither greener nor browner that those of finance professionals.

Hypothesis 3 is justified on grounds of contradictory arguments. First, there are several reasons in favor of the students being greenest. The STUD pool contains younger subjects, who are more concerned, as a generation, by environmental issues, in particular with respect to their future lives, a fact that we name "green generation" effect. Supporting evidence is provided by Fransson and Gärling (1999) and by Dunlap et al. (2000). On top of that, the trade-offs made by financial professionals, reflect both their own preferences and the preferences and expectations of their customers or/and employers, even if indirectly. Through their professional experience, based on real portfolio choices or investments strategies, finance professionals might have integrated, maybe unconsciously, their customers' and employers' performance expectations, in terms of return, risk and environmental impact. Furthermore, the main issue of fiduciary duties is evolving. If up to now these have been focused on purely financial dimensions, the 2019 PRI report[10] redefines the key fiduciary duties of the twenty-first century as "Understand and incorporate beneficiaries' and savers' sustainability-related preferences, regardless of whether these preferences are financially material." The report also points out that investors who fail to integrate ESG issues are in violation of their fiduciary duties and are facing increased risk of legal claims. All of these elements can have an influence on professionals' preferences.

[9] In this experiment μ_g is always lower than μ_b.

[10] with over 4000 financial institution signatories and 130 US trillion dollars under management: https://www.unpri.org/download?ac=9792

Second, there are arguments in favor of professionals being greenest. Indeed, the previous argument can be simply reversed: more and more customers are vigilant about the environmental impact of their financial investments, a fact that is necessarily reflected in the professionals' decisions, and which might also affect their own preferences. Because our mechanism relates on delegation, social preferences may interfere to some extent with environmental preferences. In that respect, some studies found that students are more selfish and less pro-social than non-student subjects (Engel, 2011; Belot et al., 2015). However, evidence about differences in social preferences is mixed. For instance, Exadaktylos et al. (2013) found no differences in three classical games (dictator, ultimatum and trust) between students and the general population, and Alm et al. (2015) found no difference in experiments on tax compliance between students and the general population. Fréchette and Schotter (2015) surveyed experimental papers that compare professionals and students behavior in exactly the same experimental setting: they report no difference with respect to theoretical predictions.

2.3 Practical procedures and sampling

The full description of the experimental design, with the corresponding screenshots and the instructions, is provided in Appendix A. The experimental design has been approved by the Institutional Review Board (IRB) of xxx (University of xxx, for blind review).

After an explanatory introduction, participants faced the 35 explicitly independent allocation situations summarized in Table 1. In each situation, participants had to allocate 100 experimental currency units (ECUs) between two assets. They only had to choose the (round) percentage to invest in the neutral asset. Participants were aware of the conversion rate between the experimental currency and euros at the beginning of the experiment. The conversion rate differed between the STU and the PRO samples (see the discussion below about actual payments). For each screen, participants were informed about the color of each asset and the corresponding beneficiary of their donation. The expected return and the standard deviation of each asset were also displayed. Once an allocation was proposed by a participant, the corresponding portfolio's characteristics were displayed in real time: its expected return[11] , standard deviation, realizable outcomes

[11] Gross returns of each asset and net variables of the portfolio's characteristics (i.e., the expected net return, minimum and maximum net returns) were also displayed in the tax treatment to avoid any manual computations by the participants, and to simplify their comprehension of the tax. In the other treatments (without tax), there is no need to distinguish between gross and net returns.

with associated probabilities and the donated amount.

Payment of the portfolio task and donation. We relied on the "random payment method" (RPM thereafter): one of the 35 situations was randomly selected to be paid out in euros (conditionally on being eligible for payment; see the difference between the two samples below). The RPM is supposed to make each portfolio choice independent of the others (Cubitt et al., 1998). This incentive scheme removes the possibility of wealth and portfolio effects and suppresses hedging opportunities (Bardsley et al., 2009).

The externality was constructed as follows: in the case of a positive (respectively, negative) externality, the experimenter committed to donating $50 \times \lambda$ ECUs to a pro-environmental association[12] (respectively, an anti-environmental association, *such as* a fossil fuel association[13]). For example, investing 60% of the budget in the green asset leads to a donation of 30 ECUs to the pro-environmental association. The conversion rate was the same for the donation and the participants' potential reward. Once the participant had entered a portfolio composition, the amount the experimenter proposed to donate was provided in real time. The amount of the donation for the association was calculated and then transferred to the association, based on the randomly selected situation for payment to the participant. Notice that the amount is fixed and independent of the colored asset's random outcome, in contrast to Brodback et al. (2020).

Samples. Our experiment applies to two samples: the PRO sample, comprising 190 finance professionals, and the STUD sample, involving 279 students. The experiment with the PRO sample was carried out in October 2019 in Casablanca (Morocco), in major Moroccan banks and asset management companies, using a mobile laboratory with tablets. Students participated in sessions organized in 2020 at the Laboratory for Experimental Economics of xxx located in the University of xxx. All the lab sessions were conducted in compliance with the ethical code of conduct and the rules of the xxx, and the field sessions complied with the ethical rules of the employers of the PRO sample

[12] This association is a worldwide social enterprise enabling sustainable reforestation across the globe through crowdfunding. Their goal is to protect, rehabilitate, and develop forests around the world. More information is available upon request (name, weblink of the association, and amount transferred). Additional information for reviewers: the association is Reforest'Action: https://www.reforestaction.com/en.

[13] An international association of producers of oil and gas, which is a consortium promoting the use of fossil fuels, such as gas from shale. More information is available upon request (name, weblink of the association, and amount transferred). Additional information for reviewers: the association is the International Association of Oil & Gas Producers: https://www.iogp.org/.

participants. Detailed descriptive statistics about the two samples (PRO and STUD) are provided in Section 5 and in the Internet Appendix B.1.

In the PRO sample, only one participant of 10 was randomly selected to be paid out for real, generating high incentives to finance professionals. Twenty professionals were selected, with an average payment of 216.81 euros. We used this scheme for two reasons. First, transactions were managed by the Moroccan Association of Trading Rooms (AMSM), which minimized the logistics burden. Second, many studies (Harrison et al., 2007; Andersen et al., 2014; Beaud and Willinger, 2015; Charness et al., 2016) have shown that "paying one," that is, a subset of participants, is as effective as "paying all." To provide a strong monetary incentive, note that the average level of payment has been designed to be higher than the remuneration of experienced Moroccan trading floor professionals.[14] Finally, relative to the hourly rate in the considered countries, the amount aligns with payments made in previous experiments involving professionals, such as Cohn et al. (2015) and Kirchler et al. (2018).[15]

In the STUD sample, all participants were paid 13.45 euros on average (including the gratuity for participating).[16] Additional information can be found in Internet Appendix B. Like we did for professionals, we offered a very attractive remuneration, about 70% higher than the French minimum net wage of 8.03 euros in 2020.

The differences between the two samples are discussed in detail in Section 4.2, partic-

[14]Being extremely conservative, we considered the net average level of salary in a trading room in Morocco for a professional with more than 10 years of experience (Computations are based on the 2019 Mickael Page remuneration study for Morocco, see https://casablancafinancecity.com/wp-content/uploads/2020/02/Michael_Page_2019_Morocco_Salary_Survey_Low_Res.pdf). Trading room professionals earn on average 36,812 dirhams per month. Additionally, we consider the Moroccan legal annual basis of 2288 hours and do not count overtime hours in the denominator as it would reduce the hourly wage. Finally, we apply the average euro/dirham exchange rate of October 2019. The net hourly wage is 18.23 euros, versus 21.68 euros of expected earnings for this 45-minute experiment, or 216.81 euros of average realized payment for the selected participants. Therefore, we are very confident in the level of motivation generated by this substantial, high level of remuneration.

[15]As a comparison, Kirchler et al. (2018) paid, in Europe, one participant out of five with an average payment of 52 euros, which is around 260 euros for the selected participants, for a 45-minute experiment, approximately the same time spent during our experiment.

[16]We could have selected only a subset, as we did for the professionals. However, the participants were part of the pool of volunteers registered to participate in experiments organized by the xxx Experimental Economics Laboratory. If possible (i.e., if it is not the research question or something mandatory in the experimental protocol), the rule is to avoid not paying a participant for participating in an experiment, as this could affect the participation rate for future experiments. Even if the "pay one" procedure does not affect motivation in an isolated experiment, it could adversely affect the volunteer pool and create sampling bias if only the subset of individuals intrinsically motivated by science enrolls in future experiments. Finally, given that many studies, such as Charness et al. (2016), do not find any behavior differences when "paying one" and "paying all," we ensure that the data from the two samples are comparable from this perspective.

Table 2: Impact of assets characteristics on λ

$\lambda \sim$	μ_g	μ_b	σ_g	σ_b	$\{\rho = 1\}$	$\{\rho = 0\}$	$\{\rho = -1\}$
Estimate	1.06	-0.73	-0.45	0.45	-8.93	-7.75	-3.59
Std. Dev.	(0.08)	(0.08)	(0.04)	(0.04)	(1.10)	(1.09)	(1.01)
p-value	.00	.00	.00	.00	.00	.00	.00

Description: average marginal effects (AME) in a random-effect Tobit panel regression with robust cluster standard errors at the subject level (provided in parenthesis), with λ as the explained variable; 15,008 observations are used. Variables $\mu_b, \mu_g, \sigma_b, \sigma_g$ are the expected return and standard deviation of the greener and browner asset respectively. Correlation $\{\rho = 1\}$ (*resp* $\{\rho = 0\}$ *and* $\{\rho = -1\}$) is a categorical variable controlling for correlation between the two assets (= 0 for screens 1 to 7, = 1 for screens 10 and 13, = 2 for screens 9 and 12, = 3 for screens 8 and 11 in Table 1). Control variables tested but not included in the table: *Ranking treatment*, *Tax treatment*, *Green*, *Student*, *risk*, *Prudence*, *Temperance*, *SVO*, *NEP*, *k-level* and *CRT* (for details, see Section 4 and 5).

ularly the question of the cultural difference between the two samples. The heterogeneity between samples is managed with a control variable in the econometric study of Section 3 below.

3 Testing predictions: main results regarding hypotheses

Presently, the portfolio task is tested on the pooled data, aggregating the observations from the PRO and STUD samples, and from various treatments (see subsection 4.3) which do not influence the results obtained here. Our analysis is grounded on econometric modeling of λ as a function of the characteristics of financial situations (this involves 15,008 observations).

Because the share invested in an asset varies between 0% and 100%, participants' decisions are censored from below and above. In fact, 24% of all observed portfolios contained a single asset. This suggests that, if short-selling and leveraging had been available, both "negative" holdings and holdings above 100% might have been observed. To account for censuring, we rely on a Tobit model for panel data (technical details can be found in Appendix C.3). Table 2 summarizes the results that are discussed hereafter by providing the average marginal effects (AME) for each asset characteristic. All complementary tests of the section are displayed in Appendix C.3.2.

Table 2 first shows that Hypothesis 1 is validated unequivocally: our subjects have regular financial preferences. The coefficients for the expected return and the standard deviation are significantly non-zero at the 1% level, with signs as predicted by Hypothesis 1.1 and 1.2, for the greener and the browner asset respectively. Participants take a greater

proportion of an asset if its expected return increases or if its standard deviation decreases.

Relying on that result, we then focus on the second hypothesis regarding pro-environmental preferences. The first piece of evidence relates to the claim made in subsection 2.1 that a profit-maximizing agent, with no environmental considerations, would invest his whole endowment in the browner asset if no risk is involved. In the first two non-risky situations (screens 1 and 2 in Table 1), most participants hold a strictly positive quantity of the greener asset: the average λ for those two situations combined is 51.80%. Participants thus accept a fixed monetary loss as compensation for a higher positive (or lower negative) environmental externality. Similarly, in situations where the correlation between assets is $\rho = 1$, i.e., risk reduction is not feasible (screens 8 and 11), assets only differ in color and expected return. An agent seeking to maximize only the expected return would put all the initial endowment in the brown asset. The average λ in those tasks is 48.53%, confirming the previous result.

The second piece of evidence treats Hypothesis 2.1, i.e., reluctance of asset substitution, specifically. The experiment provides several portfolio allocations that only differ in the color of available assets, that is, allowing *ceteris paribus* comparisons. This is what Table 3 presents, taking each sample and green or brown contexts separately. It shows that Hypothesis 2.1 is validated at the 1% level, except for students in green versus neutral situations.

Table 3: Within subject comparison by change of color (baseline treatment)

Sample	Allocation 1			Allocation 2			statistics	p-value
	greener	browner	λ_1	greener	browner	λ_2		
PRO ($n = 66$)	G(20, 25)	N(15,0)	50.33	N(20, 25)	N(15, 0)	42.50	561.0	0.0035
PRO ($n = 66$)	N(15,0)	B(30, 25)	64.55	N(15,0)	N(30,25)	51.30	484.0	0.0065
STUD ($n = 103$)	G(20, 25)	N(15,0)	43.06	N(20, 25)	N(15, 0)	47.98	1552.0	0.3852
STUD ($n = 103$)	N(15,0)	B(30, 25)	57.79	N(15,0)	N(30,25)	44.17	981.0	0.0022

Description: p-value for the Wilcoxon–Mann–Whitney test with paired data, with $H_0 : \lambda_1 = \lambda_2$ where λ_i stands for λ in allocation $i = 1, 2$ as denoted in the table. Notation C(μ, σ) stands for asset with the following characteristics: C = for green, = N for neutral and = B for brown, with expected return μ and standard deviation σ. Hypothesis 2.1 expects $\lambda_1 > \lambda_2$ in all lines of the table.

The last piece of evidence focuses on testing if either Hypothesis 2.2 (return asymmetry) or Hypothesis 2.3 (risk asymmetry) holds. This relies on comparing coefficients in Table 2.[17]

[17]This is possible because we chose to report average marginal effects (AME) in the core paper rather than coefficient estimates (reported in Appendix C.3). Marginal effects can then easily be interpreted

Hypothesis 1 states that an increase in the expected return of any asset increases its proportion in the portfolio. However, if both assets in the portfolio undergo a similar increase in the expected return, effects compensate unless coefficients significantly differ. Table 2 shows that the AME for the expected return μ_g of the greener asset is larger (in absolute value) than the AME for the expected return μ_b of the browner asset. The Wald test rejects equality of AMEs ($p < 0.01$), and the values are as predicted by 2.2. Accordingly, under a systematic positive market shock, participants react by putting a greater proportion λ into the greener asset. Participants are more sensitive to return when considering a greener asset than a browner one.[18]

Therefore, we showed that Hypothesis 2.1 holds: participants invest a larger share in the greener asset than they would if they were indifferent to externalities. We also showed that Hypothesis 2.2 holds: the return from a greener asset is more attractive than that of a browner asset by having a greater positive effect for each yield point. Relative to the trilemma, does that mean that Hypothesis 2.3 is invalidated?

Looking at the AMEs for the standard deviations in Table 2, which are sensibly equal (up to the sign) for the greener and the browner asset, it seems that participants are indifferent to the externality of assets when it comes to riskiness. However, this does not consider another risk parameter: the three correlation-regime AMEs.[19] Because a majority of allocations with risky assets involve correlation (18 of 30), they capture effects that are specific to the presence of risk. The fact that those AMEs are all significantly and highly negative suggests that in the presence of two risky assets, participants invest much less in the greener asset than they do when one of the assets is riskless. It thus seems that an increase in portfolio risk leads participants to reduce their positive environmental externality or to increase their negative one. Another simultaneous effect to consider is the incentive to diversify the portfolio in the case of non-positive correlation regimes. Statistics[20] indicate that participants show a portfolio composition very close to the minimal variance allocation ($\lambda = 50\%$), suggesting that the risk minimization goal dominates the positive environmental impact goal.

If participants have higher risk tolerance with respect to the greener asset, as put forth in Hypothesis 2.3, it is largely offset by the "regularity" of their financial preferences, which

and compared to each other with a Wald test.

[18] As explained previously, the estimated coefficients or AME read precisely as marginal (relative) effects but because the expected return variable is always positive, its coefficients can also be interpreted in the regression as absolute and indicate a preference for the greener asset over the browner asset.

[19] Since two risky assets have the same standard deviation in situations involving correlation, the latter can easily be analyzed independently, as a specific regime, from standard deviation itself.

[20] See Appendix C.1 and Figure 1 below

is established by the confirmation of Hypothesis 1. This is a crucial finding. In phase two of the experiment, participants arbitrate between risk and return by choosing λ, but in the experiment, the greener asset can be either the riskless or the risky asset, so that λ is not pushed in any particular direction. In the third phase of the experiment, however, participants face two risky assets with the same standard deviation. The increase in the portfolio risk, in particular when $\rho = 1$, leads participants to seek compensation in return (Hypothesis 1), which imposes holding less of the greener asset. Such behavior clearly rejects hypothesis 2.3.

4 Testing predictions: Refinements and robustness

In this section, we challenge the above central result by varying two dimensions. The first and most important refinement, detailed in subsection 4.1, is the distinction between green and brown contexts, that is, green–neutral trade-offs versus neutral–brown trade-offs. The second dimension, detailed in subsection 4.2, concerns differences between PRO and STUD samples. In subsection 4.3, we challenge the robustness of the main results, by introducing two alterations of the baseline portfolio task: a ranking treatment and tax treatment. Both treatments provide an incentive towards green asset holding: a non-pecuniary incentive for the ranking treatment and a pecuniary incentive for the tax treatment. Those incentives are expected to reinforce the pro-environmental behavior we observed in Section 2, by incentivizing trade-offs in favour of a positive environmental impact.

This takes the form of a 2×2 full factorial design that is analyzed by repeating the analysis of Table 2 for subsamples and introducing a control variable for the treatments. The results are reported in Table 4 below. Column (1) takes back the results of Table 2 by adding the control variables for subsamples and treatments. Columns (2), (4), and (6) provide estimates only in green contexts, while columns (3), (5), and (7) provide estimates in brown contexts. Columns (2) and (3) contain the coefficients for the pooled samples PRO and STUD and for all treatments. Columns (4) and (5) contain the coefficients for the PRO sample only and columns (6) and (7) for the STUD sample only.

Treatments are listed as categorical variables in the *Sample characteristics* section of the table. That section of Table 4 also includes categorical variables for samples (PRO vs. STUD) and context (green vs. brown) to provide control in the analysis of pooled contexts (column (1)) and pooled samples (columns (1) to (3)).

A quick look at the upper part, (*Asset Characteristics*), of Table 4 confirms that

Hypothesis 1, i.e., regularity of financial preferences, holds overall and for any of the subsamples at the 1% level. From this basis, we thus concentrate on the specific pro-environmental preferences for various strata.

4.1 Green vs. brown contexts

As explained above, green and brown assets are connected to a donation from the experimenter to an association. For the case of green assets, it refers to the mechanism of delegated philanthropy (Bénabou and Tirole, 2010) in similar experimental protocols (Heimann et al., 2011; Koppel and Regner, 2011; Eckel et al., 2017; Brodback et al., 2020; Humphrey et al., 2021). The principle underlying the mechanism of delegated philanthropy is that the donor is compensated for the donation (i.e., a material loss) by an altruistic reward, such as a warm glow (Andreoni, 1990). However, from a practical point of view, there are three outcomes: a loss for the donor, a donation for the association, and a potential benefit for society if the revenue is invested.

This does not pose any challenge in green contexts but does in brown contexts. The counterpart for a brown asset that generates a negative externality is to provide material compensation to the donor to relieve the moral cost of guilt[21] in inflicting a potential loss onto society. That is, by designing the brown asset as a symmetric asset to the green, we also create three potential outcomes: material compensation for the donor (a higher expected return), revenue for the association, and a potential loss for society if the revenue is invested.[22]

First, evidence shows that, on average, λ is greater in brown than in green contexts. The *Green* dummy variable at the pooled samples level (column (1)) is significantly negative at the 1% level, providing a gross estimate of that result: participants put 9.40% less on average into the greener asset in green contexts than in brown contexts. The evidence put forth in Section 3 in favor of Hypothesis 2.1 shows several significant

[21] Battigalli and Dufwenberg (2007) develop a model of guilt aversion in games. More generally, there is a fundamental difference between green and brown situations: in a green situation, participants must arbitrate to generate positive externalities; in the brown situations, they must arbitrate to avoid negative externalities. Avoiding a negative consequence to a third party may trigger different cognitive processes than generating a positive consequence to a third party (Greene and Haidt, 2002; Krüger, 2015; Białek and De Neys, 2017).

[22] With delegated philanthropy, participants are asked to make a direct transfer from the portfolio monetary loss to the philanthropic donation (Heimann et al., 2011; Koppel and Regner, 2011; Eckel et al., 2017). Such a mechanism is not valid with delegated misanthropy, which generates both a donation to the association revenue and a surplus profit. That is why we restrain ourselves from suggesting a monetary equivalence by decoupling the exact level of donation, fixed to half of the proportion invested in the colored asset, and the specific premium of colored assets.

Table 4: Impact of assets and sample characteristics on λ

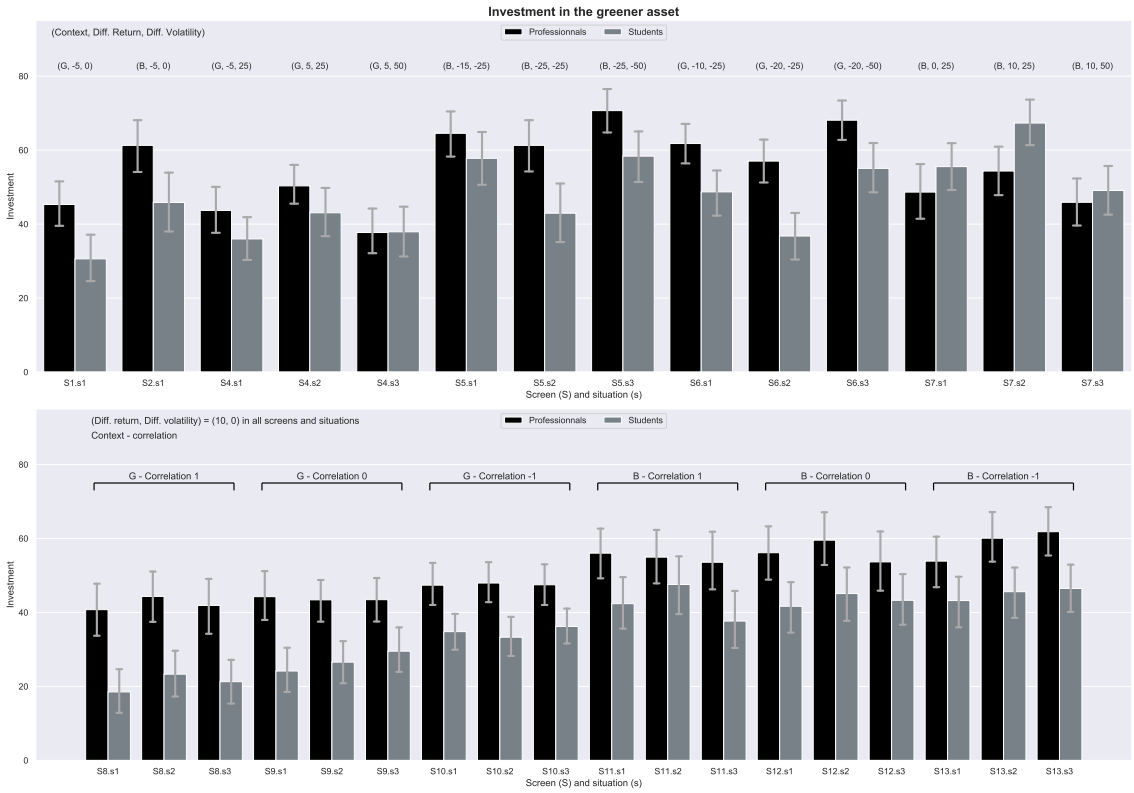
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample	ALL	ALL	ALL	PRO	PRO	STUD	STUD
Context	All	Green	Brown	Green	Brown	Green	Brown
N	15,008	7,504	7,504	3,040	3,040	4,464	4,464
Asset characteristics							
Expected return of greener asset	1.06**	0.81**	1.30**	0.64**	0.90**	0.92**	1.59**
	(0.08)	(0.09)	(0.11)	(0.14)	(0.13)	(0.12)	(0.17)
Expected return of browner asset	-0.73**	-0.61**	-0.92**	-0.53**	-0.55**	-0.67**	-1.19**
	(0.08)	(0.09)	(0.10)	(0.13)	(0.11)	(0.13)	(0.16)
Standard deviation of greener asset	-0.45**	-0.32**	-0.63**	-0.37**	-0.57**	-0.28**	-0.67**
	(0.04)	(0.03)	(0.05)	(0.05)	(0.06)	(0.05)	(0.07)
Standard deviation of browner asset	0.45**	0.47**	0.47**	0.48**	0.41**	0.46**	0.53**
	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.07)
Correlation $\rho = 1$	-8.93**	-13.56**	-3.56*	-7.47**	-0.75	-17.73**	-5.85**
	(1.10)	(1.37)	(1.48)	(1.98)	(1.77)	(1.85)	(2.25)
Correlation $\rho = 0$	-7.75**	-13.21**	-1.52	-8.23**	2.25	-16.63**	-4.56*
	(1.09)	(1.30)	(1.47)	(1.73)	(1.70)	(1.84)	(2.25)
Correlation $\rho = -1$	-3.59**	-7.08**	0.30	-4.88**	3.75	-8.52**	-2.38
	(1.01)	(1.26)	(1.46)	(1.83)	(1.81)	(1.71)	(2.17)
Sample characteristics							
Ranking treatment	6.52**	8.62**	3.57	4.35	2.45	11.07**	4.51
	(2.13)	(2.21)	(3.47)	(3.11)	(4.63)	(3.07)	(4.92)
Tax treatment	14.41**	16.61**	11.58**	6.34*	-1.09	22.65**	21.40**
	(1.88)	(2.17)	(3.39)	(2.78)	(4.19)	(3.04)	(5.07)
Student	-5.31**	-6.99**	-2.42				
	(1.80)	(1.82)	(2.68)				
Green	-9.40**						
	(1.43)						

*, ** account for 5% and 1% significance levels, respectively.

Description: average marginal effects (AME) in a random-effect Tobit panel regression with robust cluster standard errors at the subject level (provided in parenthesis). The explained variable is λ. Contexts denote those used for estimation: *Green* contexts denote screens 1, 4, 6, 8, 9 and 10 of Table 1; *Brown* contexts denote screens 2, 5, 7, 11, 12 and 13. *All* adds *Green* and *Brown* (screen 3 is excluded from analysis). N is the number of related observations (samples and situations in the context). The *Green* dummy variable controls for the subsets of screens (= 1 for Green screens and 0 for Brown). *Student* dummy variable controls for the type of sample (= 0 if subject belongs to PRO, = 1 if subject belongs to STUD). *Correlation* $\rho \in \{1, 0, -1\}$ is as in Table 2. Control variables tested but not included in the table: *risk*, *prudence*, *temperance*, *SVO*, *NEP*, *k-level* and *CRT* (for details, see Section 5). We remove from the regression analysis the three situations in screen 3, for which participants were faced with two neutral assets. This leaves 32 situations with 469 participants, i.e., 15,008 observations.

differences when we separate green from brown contexts. The average λ for the first allocation task (green context) is 42.85%, whereas it is 60.74% in the second task (brown context). A more detailed look is provided by Figure 1. The figure shows that investments are lower in green contexts than in brown ones for similar situations in terms of return spread and standard deviation. Table 3 already distinguished green and brown contexts with higher statistics in the latter than in the former.

Figure 1: Average λ per allocation in the baseline treatment



Description of both panels: average λ for PRO and STUD participants separately in Sxsy where S and s stand for screen x and situation y, in reference to Table 1. Further information: G and B stand for green and brown contexts, followed by the difference in expected return and standard deviation between the greener and the browner assets. The upper panel shows the results from screens 1 through 7, and the lower panel shows the results from screens 8 through 13 involving a correlation ρ.

The econometric analysis of Hypothesis 2.2 and 2.3 can also be repeated column-wise to compare columns. If we turn to AMEs for the expected return first (Hypothesis 2.2), we notice three results. First, the result of Section 3 holds in all columns, that is, in both green and brown contexts and for both professionals and students. Column-wise,

the AME of the expected return of the greener asset (first line) is greater (in absolute value) than the AME of the expected return of the browner asset (second line).

Second, we compare the values in green and brown contexts, sample-wise (i.e., column (2) vs. (3), (4) vs. (5) and (6) vs. (7)). We observe that the AMEs for the expected return of the greener or the browner asset take greater (absolute) values in brown contexts than in green ones. Tests confirm this result for the ALL sample (5% level) and for students (5% level).[23] This shows that financial preferences show greater sensitivity in brown contexts than in green ones, especially for students. In other words, Hypothesis 1 is confirmed column-wise.

Third, the sum of AMEs (or the spread between absolute values) of the expected return of the greener and the browner asset, taken column-wise, is greater in brown contexts than in green ones (idem, column (2) vs. (3), (4) vs. (5) and (6) vs. (7)). This result has a clear interpretation; that is, an increase in the expected return of both assets will have a greater (and positive) impact on λ in brown contexts than in green ones. In other words, the effect stated by Hypothesis 2.2 is stronger with a negative externality than with a positive externality.

We are left with Hypothesis 2.3 that was already disproved in aggregate. Comparing the AMEs of the standard deviations of the greener and browner assets in different contexts but sample-wise (i.e., column (2) vs. (3), (4) vs. (5) and (6) vs. (7)), we are left with the same conclusion: participants faced with an equivalent increase in the level of risk for both assets decrease the proportion of λ. The econometric analysis provides different rationales in green and brown contexts, however.[24]

The overall conclusion is a refinement of our core result of Section 2. Participants reveal an asymmetric perception of green and brown assets. Pro-environmental preferences appear (i.e., Hypothesis 2.1 holds), but they are stronger in brown contexts than in green ones. The trade-off between expected return and environmental impact remains (i.e., Hypothesis 2.2 holds) and is more salient in brown contexts. The predominance of the trade-off between expected return and risk over the trade-off between risk and envi-

[23] For column (2) vs. (3): $p \leq .001$ when comparing the expected return of greener assets; $p \leq .037$ when comparing the expected return of browner assets. For columns (4) vs. (5): $p \geq .13$ when comparing greener assets, $p \geq .95$ when comparing browner assets in both contexts. For column (6) vs. (7): $p \leq .003$ when comparing greener assets; $p \leq .019$ when comparing browner assets in both contexts. All tests are displayed in Internet Appendix C.3.2.

[24] In green contexts, coefficients take values along what Hypothesis 2.3 suggests, if it was not the effect of correlation. We refer to the interpretation already provided in Section 3. There is no observable risk–environmental impact trade-off. The interpretation is more straightforward in brown contexts and relies only on standard deviation coefficients (correlation variable coefficients are non-significantly different from zero at any level).

ronmental impact (i.e., the solution of the trilemma when Hypothesis 2.3 does not hold) shows in both contexts but appears less ambiguously in brown contexts. In other words, participants' aversion to brown is stronger than their attraction to green.

4.2 Finance professionals vs. students

Our data allow us to address the external validity issue of experimental finance: can the results obtained in the laboratory be generalized to populations confronted with real market conditions every day? Moreover, although the study of professionals is crucial, as their impact on financial markets is significant through their direct investments and advice to clients, it is also necessary to consider the investments of non-professional individuals, who account for a growing share of the markets.

In the present case, if the preferences highlighted in Section 2 concern students as much as finance professionals, the data show several discrepancies between samples. At first, students assign a lower λ, on average, than professionals. This is shown with the Student dummy variable in columns (1) to (3) in Table 4, which is significantly negative in green contexts. Figure 1 illustrates also that fact, for allocations taken separately: λ is usually the smallest for students in green contexts in the baseline treatment (detailed statistics are available in Internet Appendix C.1).

We can also repeat some results of Section 4.1. The asymmetry between the green and brown contexts seems stronger among students than finance professionals. Let us simply focus on the comparison of AMEs for expected returns, which are needed to compare the validity of Hypotheses 1 and 2.2 in green and brown contexts. In the brown context only, AMEs are significantly greater (in absolute value) for students than for professionals (that is, comparing column (4) with (6) and column (5) with (7) line-wise) at the 1% level. Students show more sensitive financial preferences than professionals, but only in brown contexts. The spread between greener assets' and browner assets' expected returns is also larger for students than for professionals in the green contexts, which corroborates Hypothesis 2.2. In echo to the previous section, the presence of brown assets reveals salient concerns for expected return (i.e., relative to Hypothesis 1.1). This is shown more strongly with students than with professionals. To sum up, in the green context, students invest significantly less in the green asset than do finance professionals, and they show a larger green-versus-brown asymmetry, invalidating our hypothesis 3 of no significant difference between the two samples.

How does this result echo the literature? Experimental evidence about differences

between students and professionals is mixed. Several papers highlight differences (Haigh and List, 2005; Holmen et al., 2021; Bottasso et al., 2022), while others find similar patterns in student and finance professional samples (Weitzel et al., 2020). Most of these studies address issues related to risk-taking, speculation and bubble formation, price expectations, and questions of rationality and cognitive biases in markets (for a recent review, see Huber et al., 2022). The literature comparing professional and student behavior when considering some of the potential dimensions that may impact behavior in investments with environmental externalities, namely social and environmental preferences, does not provide a clear picture. Regarding social preferences, Engel (2011), in a meta-study, and Cappelen et al. (2015), showed that students give significantly less in the dictator game than the rest of the population (lay people). Falk et al. (2018) observed no significant relationship between age and individuals' levels of altruism. Regarding environmental preferences, Hawcroft and Milfont (2010) find no difference between students and more representative populations in a large meta-analysis, whereas some studies show that younger people have higher environmental preferences (Fransson and Gärling, 1999; Dunlap et al., 2000).

4.3 Incentive-based treatments

The context (green or brown) and the participants' sample (PRO or STUD) reveal variations of the general pro-environmental financial preferences exhibited in Section 2. These variations in the strength of pro-environmental concern, suggest that it is possible to manipulate those preferences with appropriate incentives.

In this subsection we discuss the two types of incentives described in Section 2.1: a non-pecuniary incentive that targets individuals' self-image based on a ranking feedback about the level of portfolio externality, and a pecuniary incentive based on a tax function that penalizes the return on the browner asset. In the PRO sample, 66 participants faced the baseline treatment, 63 the ranking treatment, and 61 the tax treatment. In the STUD sample, 103 faced the baseline treatment, 84 the ranking treatment, and 92 the tax treatment. It is important to highlight that treatments do not interact with the situations and their order. Neither do they interact with the asset characteristics, environmental externalities (context), or the donation mechanism which are under the control of the experimenter, i.e., exogenously fixed. The characteristics are introduced in the analysis through a categorical variable only. Their complexity and potential policy application deserve a dedicated study that goes beyond the scope of the present paper.

The instructions of the 3 treatments are given in Internet Appendix A.3.

Ranking treatment. Social comparison and social norms ground a long-standing component of decision theory (Festinger, 1954). Recent developments in social trading (Kirchler et al., 2018; Liu and Ma, 2020) show that performance rankings play a key role among financial traders, in particular by affecting risk-taking (Bault et al., 2008) by enhancing competition. Grades, indices, and rankings also apply in SRI. We expected that ranking information would act as an incentive for self-enhancement by stimulating competition in the environmental dimension.

Presently, the ranking treatment provides a real-time private ranking of the participants' choice of λ compared to a database of 50 pre-recorded values collected from the same sample in the baseline treatment.[25] This serves as a proxy for the relative environmental performance of the portfolio choice of participants under this ranking treatment. This information may serve as a social or moral reference when constructing one's portfolio.

The ranking treatment variable has a significantly positive effect on λ for the pooled sample (ALL). However, the result does not hold for the subsamples. The coefficient of the ranking treatment dummy is positive in each regression, but its significance occurs mostly in situations in the green context in the STUD sample. The standard error of the coefficient is too large in other regressions to conclude with confidence that ranking has a significant effect. This result is striking because, as we just explained, the ranking is constructed as a comparison with a subsample in the baseline treatment. As we mentioned earlier, students in the baseline treatment invest less in the green asset than finance professionals. Students also invest less than finance professionals in the neutral asset in brown contexts. Therefore, students in the ranking treatment need less " effort" to reach a low rank (a better ranking): they can rise more easily to a low rank with a low λ, in

[25] In the ranking treatment, a section has been added to the instructions. In this section, we explained to the participants that the experiment had already been conducted previously with a sample of 50 participants and that their investment in green and brown assets would be compared to those in that sample, to rank their "environmental performance". We provided two examples to explain how the ranking was calculated, based on the two assets involved in the frame (green vs. neutral or neutral vs. brown, see instructions in Internet Appendix A.3). To create the benchmark sample, we randomly selected 50 participants from the observations collected in the baseline treatment with the same category of participants (professionals or students). We kept the same benchmark sample in all sessions of the ranking treatment. Therefore, the decisions of all participants in the ranking treatment were compared to the decisions of a sample of 50 participants facing exactly the same frames and situations. The only difference is that the participants in the benchmark sample made their choices, without (i) knowing that their decisions would be used in another treatment, and (ii) without social comparison.

green or brown contexts, and reach a lower rank than finance professionals could. This gives additional weight to the conclusion that ranking affects only students and only in a green context. This is another instance of green vs. brown asymmetry and an additional difference between professionals and students.

Tax treatment. Taxation is one of the straightest instruments to curb economic behavior. Environmental taxes are prevalent in environmental economics (Nordhaus, 1992; Bovenberg and De Mooij, 1994; Goulder, 2013). Presently, the tax is generated in real time by participants' decisions about λ. It is given by a linearly increasing tax rate on the browner asset's expected return, so that the final portfolio's expected return is a concave function of λ, increasing on $[0, 1/2]$ and decreasing after.[26] This convex tax on financial return is expected to affect participants heterogeneously: the less participants are willing to initially put into the greener asset, the higher the incentive generated by the tax to increase λ. Convex taxes on financial transactions have been widely investigated in theory and practice (Green and Sheshinski, 1978; Subrahmanyam, 1998; Matheson, 2011; Burman et al., 2016). Sarkar (2008) shows that convex taxation is a credible financial representation of corporate taxes (see also Graham, 2003). It also constitutes an efficient incentive scheme, implemented in pricing design for principal–agent relations (Alasseur et al., 2020) or in the presence of behavioral biases undervaluing the costs of sin products (Gerster and Kramm, 2019).

The tax treatment dummy is positive and significant in all regressions, except for finance professionals in brown contexts (column (5)), for which it is negative and non-significant. Therefore, the hypothesis of tax sensitivity seems to be confirmed in almost all situations. There may be an inverse relationship between the size of the tax variable coefficient and the tax-free intention to invest in the greener asset because of the convexity of the tax. The average value of λ in the baseline treatment is $\lambda = 52.54\%$ and $\lambda = 40.80\%$ for finance professionals and students respectively. This comports with the values obtained for the tax variable: the lower the λ in the baseline treatment, the stronger the effect of the tax. As noted above, this effect is particularly strong on students because, in the tax treatment (26 of 32 situations), they invest a larger share in the greener asset

[26] The formula is the following. Let $\Delta\mu = \mu_b - \mu_g$ be the spread of the expected return between the browner asset and the greener asset. The final net expected return of the participant's portfolio is no longer that provided in Section 2.1 but

$$\mu_p = \lambda\mu_g + (1-\lambda)(\mu_b - (1-\lambda)\Delta\mu) = \mu_g + (1-\lambda)\Delta\mu - (1-\lambda)^2\Delta\mu.$$

than finance professionals invest. This reversal of positions, which does not appear with the ranking treatment, shows that students are more sensitive to the tax treatment than finance professionals. In the green context, students and finance professionals invest more of their endowment in the greener asset in the tax treatment than in the baseline treatment while only students do in the brown contexts. This provides additional arguments in favor of the green vs. brown asymmetry and the difference of behaviors between pools.

5 Exploratory analysis: The determinants of individual preferences

In the previous sections, we focused exclusively on the portfolio task by analyzing how various situation parameters influence the composition of portfolios. Some clear, robust patterns appeared at the aggregate level for the pooled samples, but small differences appear when distinguishing between positive and negative environmental externalities and between financial professionals and students. What are the reasons for these patterns in portfolio choices? In the remainder of the paper, we aim to deepen our understanding of the portfolio preferences exhibited in Sections 3 and 4, by conducting an exploratory analysis that extends the econometric study to individual data. For that purpose, several sets of variables are added to the basic model in the form of additional tasks.

After selecting the portfolio, all participants were asked to complete three tasks to measure social preferences and potential predictors of investment behavior: (i) the social value orientation task (SVO) to measure pro-sociability (Murphy et al., 2011), (ii) a survey about environmental opinion based on the New Environmental Paradigm (Dunlap et al., 2000), and (iii) a socioeconomic and demographic questionnaire.

Three control tasks were also included: (i) a lottery choice task to elicit risk preferences (Noussair et al., 2014), (ii) the one-shot 11–20 game to control for strategic skills (Arad and Rubinstein, 2012; Alaoui and Penta, 2016), and (iii) the cognitive reflection test (CRT) to measure cognitive ability (Frederick, 2005; Toplak et al., 2011; Korniotis and Kumar, 2010).

SVO, risk, cognitive and strategic tasks were incentivized in that one was randomly selected to be paid out for real, in addition to the core investment task.[27] All these tasks

[27] Again, this incentive scheme offers the opportunity to eliminate any potential wealth and portfolio effects and remove hedging opportunities (Bardsley et al., 2009). The euro–ECU exchange rate (1 ECU = 1 euro for PRO, 1 ECU = 0.04 euros for STUD), and the probability of being paid (1 for STUD and 1/10 for PRO) for the supplementary task were the same as in the portfolio task for each sample.

are detailed in Appendix A.4 and A.5.

In subsection 5.1, we note pro-social (SVO) and environmental (NEP) preferences. Finally, in subsection 5.2, we focus on the socioeconomic and demographic questionnaire. The other individual data collected from other auxiliary tasks, such as risk, cognitive and strategic attitudes, are used as control variables.

The analysis consists in repeating the econometric analysis of Section 3 with the addition of questionnaire data. Table 5 provides the AME computed from estimates.[28]

The econometric results now consist of six regressions: columns (1) to (3) relate to the PRO sample and columns (4) to (6) to the STUD sample, with the respective decomposition in green (columns 2 and 5) and brown (columns 3 and 6) situations. For the sake of clarity, we show the AMEs for the SVO and NEP for discussion, but we hide all other variables that were analyzed in Section 3.

5.1 Pro-social and pro-environmental preferences

Social Value. As extensively discussed by Riedl and Smeets (2017), social preferences strongly influence SRI. Riedl and Smeets (2017) relied on the standard investment game of Berg et al. (1995) to elicit trusting behavior. We follow their track, but we rely on a different task to capture pro-sociability, the SVO score introduced by Murphy et al. (2011).

The SVO score is based on a distribution task between self and others. Each participant is asked to choose a payoff distribution, within a set of options, between himself and an anonymous counterpart randomly selected from the participants in the experiment. In the short version of the SVO elicitation task used in our experiment, the distribution choice was repeated six times with a different set of options in each round. In the PRO sample, pairs were formed at the end of the day, as the number of participants in a session was unknown in advance, whereas in the STUD sample, participants were randomly paired at the beginning of the corresponding task. One of the six screens presenting the choices was randomly selected for payment.

The six choices are averaged and aggregated to determine a score (see Internet Appendix A.5.2). Higher scores are associated with more pro-social individuals. Pro-sociability is likely to positively influence λ because pro-social individuals care more about others' well-being.

[28] Internet Appendix C.3 provides the estimates in another table.

Table 5: Impact of pro-social and environmental preferences and demographics

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	PRO	PRO	PRO	STUD	STUD	STUD
Context	All	Green	Brown	All	Green	Brown
N	6048	3024	3024	8928	4464	4464
Preferences						
SVO	0.12	0.08	0.17	0.19**	0.35**	-0.01
	(0.08)	(0.07)	(0.11)	(0.07)	(0.08)	(0.13)
NEP	0.05	-0.10	0.26	0.45*	0.24	0.68*
	(0.18)	(0.18)	(0.24)	(0.18)	(0.21)	(0.30)
Finance jobs						
Sales Trading	-0.35	2.31	-3.29			
	(3.23)	(3.15)	(4.59)			
Portfolio Manager	-6.81	-1.44	-12.54*			
	(4.96)	(5.14)	(6.04)			
Analyst	15.35**	15.09**	16.18*			
	(4.36)	(4.62)	(6.57)			
Support functions and others	3.63	7.07	0.15			
	(4.31)	(4.62)	(6.57)			
Investment Strategies						
Value investing	10.85*	6.68	15.58*			
	(4.47)	(4.17)	(6.17)			
Mispricing	18.07**	12.86*	23.34**			
	(4.75)	(5.84)	(5.97)			
Global Macro	10.36*	4.50	17.14**			
	(4.14)	(3.71)	(5.91)			
Market Making	11.10**	5.32	16.95**			
	(3.52)	(3.37)	(5.46)			
None	1.13	-3.56	6.07			
	(4.07)	(4.04)	(5.08)			
Others	10.12*	5.43	16.99*			
	(5.17)	(4.84)	(7.86)			
Disciplines						
Humanities				10.61	-1.92	21.28
				(7.76)	(8.40)	(14.62)
Formal Sciences				6.13	1.47	11.58
				(4.45)	(4.80)	(7.18)
Economics				5.45	1.11	9.99
				(4.04)	(4.40)	(5.60)
Health				12.58**	6.05	18.35*
				(4.70)	(4.96)	(7.97)
Natural Sciences				8.38	3.49	12.48
				(5.52)	(5.38)	(7.51)
Social sciences				7.83	4.63	12.85
				(5.39)	(4.60)	(9.37)
Others				14.55*	11.43	18.37
				(6.33)	(7.71)	(12.28)

*, ** account for 5% and 1% significance levels, respectively.
Average marginal effects (AME) in a random-effect Tobit panel regression with robust cluster standard errors at the subject level (provided in parenthesis). **Method and Analysis** are identical to Table 4. All variables included in the specifications of Table 4 are included as control variables. Variables for the PRO sample: *Finance jobs* and *investment strategies* are detailed in Table 6. Additional control variables included but not shown are *employer*, *asset class*, and *market type*, as defined in Table 6. Variables for the STUD sample: Disciplines are defined in Section 5.2.2. Control variables included but not shown are *age* (in years), *gender* (= 0 for female, = 1 for male), and *student level* (in years). One professional did not answer the questionnaire. Therefore, we lost 32 observations for the professional columns between this table and the previous one.

Environmental opinion. Eliciting pro-environmental preferences raises a new challenge for researchers and survey designers (Lange et al., 2018). To our knowledge, an experimentally validated task for eliciting pro-environmental preferences is currently unavailable. However, a canonical survey, the New Environmental Paradigm (NEP scale) of Dunlap et al. (2000), has been used in thousands of studies for this purpose.

The NEP scale is based on 15 Likert-type questions related to five environmental dimensions (see Internet Appendix A.5.5). The standard approach quantifies each answer on a scale from 1 to 5. Therefore, the total score ranges from 15 to 75: the higher the score, the stronger the pro-environmental orientation.

Results. A look at variables related to preferences shows that measures of pro-social and pro-environmental leanings do not affect the portfolio choices of finance professionals. Interestingly, these variables are highly significant for students, and they have the expected sign. However, the SVO is positively correlated with the share invested in the greener asset only in green contexts, while the NEP is positively correlated only in brown contexts. No significant effects were found in the converse situations. A careful look at the NEP questionnaire in Internet Appendix A.5.5 shows that it is particularly oriented to the human origin of environmental degradation and is less oriented toward attenuation or repairing impacts. In contrast, the SVO task is about sharing a monetary endowment with another subject. This relates strongly to the delegated philanthropy mechanism in the green context, where the donation carries a positive moral connotation. For students at least, this may show that the SVO task may not be suited for testing negative social and or environmental externalities, and the experimental literature is still in search of a protocol for measuring environmental preferences.

As we said earlier, control tasks do not substantially modify the results of Table 4. In short, let us mention that the variables are rarely significant at the 5% level in more than one context and one sample.

5.2 Socioeconomic and demographic data

The PRO and STUD samples reflect the socioeconomic traits of the populations they were drawn from. Each sample took a final but specific survey after the experiment. Therefore, the variables that are specific to each sample might also have a specific influence on those participants' portfolio choices.

5.2.1 The PRO sample

In partnership with the Moroccan association of trading rooms (AMSM), which supported us during the experimental sessions with professionals, we had access to many large banks and asset management companies operating in Casablanca (the first financial center in the African continent on the Global Financial Centers Index (GFCI)). We first discussed the ethical conditions of the experiment with the AMSM and then organized our visit to the different institutions, following their respective agreements. Professionals volunteered to participate. At the end of the experiment, we explained to the professionals that we were interested in understanding their investment behavior in the financial markets. The vast majority of the professionals we met were enthusiastic about participating in the experiment and said they would volunteer to do it again in the future. A particular characteristic of our PRO pool of participants is that it was mostly drawn from practitioners of financial markets. Therefore, we asked multiple-choice questions about the type of job (traders, risk managers, etc.), the employer (bank, hedge fund, etc.), past experience, and investment strategy. For ethical and compliance reasons, banks and asset management companies did not allow us to collect data on age and gender. However, we found that these two control variables had no significant effect on investments in green or brown assets in our student sample. In addition, Tatarnikova et al. (2021) showed in an investment task that there were no gender and age effects in the proportions of investment in green and brown assets among financial professionals. The professionals' questionnaire is provided in Internet Appendix A.6.

We categorized *a priori* our PRO sample according to the participants' jobs. The proposed categorization is reported in Table 6. The categories provided in that table are not arbitrary. They obey informal rules relative to the knowledge of the *a priori* categories. We used the following logic for finance jobs and past experience categorical variables. Operators of financial markets are categorized under market trading activities, whereas sales trading refers to client-related activities. Portfolio and asset managers manage funds of assets (stocks, bonds, derivatives, commodities, and forex) for clients such as individuals, companies, and banks. The "analyst" category pools all the jobs that mainly require analyzing large sets of financial and economic data to make predictions or control risky positions in support of decision making and trading. These jobs mainly rely on analytical skills with multiple dimensions, using some macroeconomic and financial fundamentals. They do not directly intervene in financial markets.

Analysts are practitioners who consider much more long-term and multidimensional

Table 6: Categorization of the PRO sample

New category	includes
Finance Job & Past experience	
Market Trading*	Proprietary trading, market maker, jobs with trading activities
Sales trading	Sales trader, sales
Portfolio manager	Asset manager, portfolio manager
Analyst	Strategist, economist, financial analyst (buy/sell side), risk analyst, jobs with analyst skills
Support functions and others	Support and related functions, middle office job, business manager, trade finance, private banker, senior banker, other
Employer	
Bank*	Bank
Other	Asset management company, trading company, broker, hedge fund, work for your own, private equity company, other
Investment strategy	
Pattern following*	Technical analysis, trend following
Value investing	Value investing
Mispricing	Event driven, arbitrageur, scalping
Global macro	Global macro
Market making	Market making
None	None
Others	Merger arbitrage, others, no answer
Asset class	
Money market*	Money market
Forex market	Forex market, currencies
Equity	Equity
Bonds	Bonds, fixed income and related derivatives
Others	Commodities, private equity, real estate, hedge fund, other

Note: * stands for the reference category in the regression.
The distribution of the different variables are displayed in Appendix B.1, Figure 8.

extra-financial (or economic) information than market traders (or sales traders) usually do. Taking care of such considerations probably leaves more space for environmental concerns. More generally, the nature of the job and the finance professionals' exposure to different business cultures might shape their preferences (Cohn et al., 2014). Second, reverse causality may also apply, revealing (self-)selection to specific financial jobs and positions (Lagarde and Blaauw, 2014).

In terms of investment strategies, "pattern following" refers to trading strategies focusing on time series configurations of quoted prices, such as following trends or technical analysis, on a time scale that can include intraday trading (a somewhat chartist approach). The mispricing category includes strategies based on short-term error-adjustment dynamics in prices and volatility. They can be grounded on financial knowledge other than price

dynamics. "Value investing" and "global macro" refer to longer time horizons, and they include more extra-financial information (fundamentalist approaches based on corporate valuation and macroeconomic outlook, respectively).

The interpretation follows the one proposed for jobs. Technical analysis and trend following (pattern-following category) are the main strategy categories that rely exclusively on short-term price movements and exclude *a priori* any asset picking based on corporate finance data, macroeconomic analysis, or extra-financial information. Indeed, focusing exclusively on price dynamics without integrating other parameters may explain why finance professionals using these strategies could not integrate environmental externalities and, instead, focus only on the risk and profitability of the asset. In brief, the categorization of jobs and investment strategies follows the usual division between the fundamentalist and the chartist approaches relatively closely.

Without any *a priori* hypothesis on the impact of questionnaire data on portfolio choices, we refrain from over-interpreting the possible effects of the variables described in subsection 5.2, and remain very cautious in the discussion of these first findings. Morevover, sub-samples in each job and strategy are relatively small. New experiments will therefore be required to assess these results in an hypothesis-testing approach. The two samples were drawn from different populations in different countries, and they must be analyzed separately.

Results. Substantial differences in the level of λ can be found for different jobs and investment strategies. AMEs show that analysts are the professionals who differ significantly from market traders in both green and brown situations; they invest significantly more in the greener assets (above 15 percentage points in both green and brown contexts). Portfolio and asset managers invest almost 29 percentage points more in the brown assets than analysts, all things being equal.

Looking at investment strategies, participants who rely on technical analysis and trend following (pattern-following category) invest significantly more in the browner asset than all other defined types of strategies. However, in the green context, only event-driven, arbitrage and scalping strategies (mispricing category) are significantly different from technical analysis and trend following.[29]

Together, jobs and strategies reflect a very high heterogeneity of investment in the

[29]Scalping is often referred to as a technical analysis practice. However, it relies on careful stock selection and repeated fast buy–sell orders and order book dynamics to be profitable. Therefore, it is also closely related to arbitrage methods.

greener asset by finance professionals. This heterogeneity is prominent over the possible variations in revealed pro-social and pro-environmental preferences measured by the SVO or the NEP scales.[30] This result indicates that an experimenter may know much more about environment-related financial decisions by looking at finance professional participants' positions and practice than by testing the participants with associated tasks or surveys. The large difference between market traders and portfolio managers on one side and analysts on the other side, or between trend followers and traders who follow other strategies, could indicate that jobs and strategies including long-term and multidimensional information might enhance green preferences or attract individuals with specific green leanings. This has great consequences for further studies.

5.2.2 The STUD sample

The STUD sample was drawn from a large participant pool of voluntarily registered student participants. Participants were asked standard questions about age, gender, years of study, and discipline. We use the A.M. discipline categories of health and the folk-known division of liberal arts (humanities, formal sciences, natural sciences, social sciences). We also distinguish business and management (the reference category, hereafter management) on one side and economics and finance (hereafter economics) on the other side. This serves a possible explanatory purpose: those two categories are an important recruiting pool in the finance profession and represent reasonably large subsamples. We use only the disciplines in the analysis and put aside the other variables as controls because age, gender and years of study are not significant.

Results. As with jobs and strategies, students' disciplines show a small effect, which could be the result of (i) the process and content of learning that differs across disciplines, and (ii) student (self-)selection based on the choice of specific disciplines to study. Indeed, health sciences is significantly different from management in brown situations exclusively. The only singular effect, although it is not significant, is that all coefficients are positive, except for humanities in a green context. That means that management students show the highest propensity to hold the brown asset, that is, the most profitable one. Students' disciplines could have shown a similar heterogeneity between categories if the variance

[30] For example, the SVO value has an amplitude of 80. Multiplied by the AME of the SVO, the average effect on λ in brown contexts, for example, is 13.6 between a participant with a minimal SVO score and another participant with a maximal SVO score. This effect is less than the effect generated by different job categories.

within each discipline was not as great as it is; age and gender have no effect on portfolio choices.

This observation provides the last piece of evidence in favor of a professional–student discrepancy. Students' portfolio choices clearly reflect pro-social and pro-environmental preferences, but they are mostly dissociated from the discipline of study. In contrast, finance professionals' portfolio choices crucially depend on their positions and practices, and those choices are dissociated from their revealed pro-social preferences and their stated pro-environmental sensitivity.

6 Discussion and conclusion

We investigated the interplay between return, risk, and environmental impact of assets in a virtual portfolio composition experiment. By asking for 35 such compositions from 190 finance professionals and 279 students of many disciplines and by collecting behavioral and demographic data from additional tasks, we can determine common patterns and strong disparities between finance professionals and students.

Before commenting on the results we detailed in the previous sections, it is necessary to argue about our scientific approach. The question of replicability of social sciences and economics experiments is widely discussed (Camerer et al., 2018, 2016). Recently Strømland (2019) showed that preregistration improves the effect size estimation and reproducibility in experimental economics. Nosek et al. (2018) clearly pointed how important it is to distinguish postdiction[31] and prediction[32] to maintain scientific credibility. Preregistration precisely improves this credibility by achieving that objective. At the time we designed the experiment, preregistration was uncommon among economists. However, we would like to emphasize that the 3 main hypotheses of the paper detailed in the Predictions Subsection 2.2, as well as the main analysis and robustness tests (Sections 3 and 4), were constructed before the experiment was carried out, and are part of hypothesis testing (prediction). Besides, some of these hypotheses have not been confirmed (risk asymmetry, no "green generation" effect, ranking treatment effect). Finally, Section 5 is an exploratory approach and highlights some interesting hypotheses (regarding trading strategies and professionals' jobs) that would be interesting to better understand and test in future research.

[31] i.e., hypothesis-generation and the "use of data to generate hypotheses about why something occurred".

[32] i.e., hypothesis-testing and the "acquisition of data to test ideas about what will occur".

Portfolio patterns exhibited in the experiment mix conclusions from standard portfolio theory (attraction to return, aversion to risk) with overall pro-environmental preferences. While pro-environmental performance of portfolios involves the acceptance of lower expected returns, our main innovative and robust result is that risk, however, tends to temper pro-environmental investment intentions. In risky environments, participants have a clear rising interest in brown assets and those that have higher expected returns. The fact that risk may negatively affect positive-impact investment seems to us as a relevant track for future research.

We also assess similarities and significant asymmetries between green and brown assets, and show that finance professionals are more reluctant to take on the browner asset than students, in particular in green contexts. While being cautious about comparing professionals and students, we observe that the former show better environmental performance in portfolio composition than the latter. Professionals are less influenced by ranking information or tax penalties on asset returns. Social behavior and environmental opinion assessments are not significant predictors of the finance professionals' investment decisions. As a very exciting exploratory result, the category of financial job and the investment strategy followed in that job are strong predictors of average portfolio compositions.

Our two samples were selected from different cultures (France and Morocco), which account for some of the observed behavioral differences in our experiments. However, this difference must be put into perspective. First, links between culture and social preferences are not obvious. Looking at geographic features, Falk et al. (2018) do not find a statistical link between absolute latitude, geographic conditions, and level of altruism. Altruism is also not correlated with cultural items, with the exception of family ties. Second, the experiment has been carried out in French for both samples to prevent any differences in linguistic interpretation and favor convergence of preferences (Ogunnaike et al., 2010). Many finance professionals in Morocco have studied in France, and the French language is widely used by the Moroccan finance community.[33] Third, the French and Moroccan banking cultures are very similar. Indeed, the PRO sample is largely composed of participants working in Moroccan financial institutions that have strong ties with French companies (cross-shareholdings or subsidiaries between the two countries' institutions).[34] Finally, the academic literature that seeks to understand the differences

[33]With 43,500 Moroccan students in France, Morocco is the leading country of origin of foreign students in France, accounting for 12% of all international students; see https://ressources.campusfrance.org/publications/chiffres_cles/fr/chiffres_cles_2021_fr.pdf)

[34]The interplay between personal traits and business culture is not well understood and is a fertile

between finance professionals, students and the general population frequently compares samples of professionals and students of different nationalities[35] (Kirchler et al., 2018; Schwaiger et al., 2020; Huber et al., 2021). Our study is not at odds with the latter. That said, potential differences in culture and stake size between professionals and students, combined with unobserved variables that could potentially drive these behaviors, suggest that extreme prudence should be used in comparing these two samples. Further research is needed to validate or refute those first results.

Although our experiment was mainly designed for finance professionals, it raises the issue of the generalizability of our findings. We provided some first answers in the comparison with the students portfolio choices, that showed marked contrasts. But heterogeneity exists even in the PRO sample itself, as we showed. This indicates that an experimenter might know much more about environment-related financial decisions by looking at finance professional participants' positions and practice than by testing the participants with associated tasks or surveys. The large difference between market traders and portfolio managers on one side and analysts on the other side, or between trend followers and traders who follow other strategies, could indicate that jobs and strategies including long-term and multidimensional information might enhance green preferences or attract individuals with specific green leanings. Finally, we stress the importance of looking at such details, as the literature is particularly interested in the singularities of finance professionals compared to laypeople (Haigh and List, 2005; Frechette, 2015; Weitzel et al., 2020; Holmen et al., 2021; Bottasso et al., 2022).

A key novelty of our experimental design is to model assets with negative environmental externalities, in contrast to most studies that focus on SRI. The latter exclusively consider the positive impact of assets and products. Several recent papers proposed mechanisms to implement negative externalities in the lab, such as killing mice Falk and Szech (2013) or avoiding a donation to fund a surgery of a leprosy patient in India (Bartling et al., 2015, 2019). We contribute to this strand of literature by proposing a mechanism that draws a parallel with delegated philanthropy. As a new protocol for negative ex-

ground for future research (Guiso et al., 2015a). Modern corporations, such as firms or banks, can shape the corporation's culture through selection and recruitment. Therefore, it is likely that modern corporations have a strong impact on culture, as assessed by an experiment in the field, perhaps more than local culture has on the corporation. It is also very likely that the most successful corporate culture models are imitated by competitors and spread in the population. In any case, corporate culture is likely to be a key determinant of a firm's performance (Guiso et al., 2015b), and that being a finance professional is a more relevant trait than being an employee of a Moroccan or a French bank.

[35]Bchir (2014) compares French students with Tunisian farmers in a public good game. He controls for the cultural difference by adding a Tunisian students subject pool. French and Tunisian students are not different, but are equally less cooperative than Tunisian farmers.

ternalities, our mechanism of delegated misanthropy raises some challenges: our findings may be caused by fundamental differences in how participants perceive the externality and how they trade off their (unobservable) moral cost for return. Eventually, the donation mechanism is associated with losses in green contexts and surpluses in brown ones, and this by itself generates asymmetry because of loss aversion (Kahneman and Tversky, 1979; Tversky and Kahneman, 1991).

We set the donation parameter at 50% to avoid extreme values, e.g. 10% or 80%. This calibration was reached after conducting several discussions with financial professionals and researchers. The aim was to propose a salient externality, involving significant transfers to third parties, in order to induce participants to perform meaningful and costly trade-offs between return/risk and environmental impact. This is in line with the concept of arbitrage by finance professionals, between ESG ratings (or carbon footprint, level of energy consumption, level of pollution emitted) of the company, together with its market risk and return. Setting the externality at a too low rate would have made the arbitrages insignificant, while setting it at a too high rate would have forced them by making the arbitrage too favorable. Regarding the robustness section, it is of interest to note that the externality, risk and return parameters are not modified in the baseline and ranking treatments, so that the differences in behavior are not directly related to the level of the externality. On the other hand, the tax treatment leads to a modification of the net return, which directly changes the relationship among the 3 parameters and might explain why participants invest more in green. It would be thus very valuable in future research to vary the externality parameter as widely as possible to identify the "dose-response function" of the externality tradeoffs.

Our findings suggest several tracks for future research. We already pointed out the importance of the reluctance to trade off risk for positive-impact investments. A deeper understanding of the behavioral mechanisms involved in those trade-offs would be valuable. With respect to methodology, there exists a huge variety of negative externalities, as well as a variety of types of rankings that can be implemented. Different combinations of them offer potential avenues for future research. An important challenge will be to understand how different types of externalities asymmetrically affect the love for green and the hate for brown.

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Internet Appendix

A Experimental tasks

A.1 Portfolio task

A.1.1 Translated instructions from French to English (professional version)

This first part is composed of 13 independent rounds. There is no link between the rounds.

Portfolio composition

At the beginning of each round you will be endowed with €100.00, which you will have to entirely invest in two assets, asset 1 and asset 2, in order to compose a portfolio. To compose your portfolio, enter the amount of your investment in Asset 1. This amount must be an integer between 0 and 100. The amount of your investment in Asset 2 will be calculated automatically (100 - the amount invested in Asset 1). During the first two rounds, you will only have to compose one portfolio. From round 3 onward, you will have three portfolios to compose in each round. This is specified in the instructions that follow.

Types of assets

There are three types of assets: neutral, green and brown. Each of these assets can be either riskless or risky. The expected return and standard deviation of each asset will be given in the asset description.

- A **green asset** A green asset is an environmentally responsible asset. For any amount you invest in a green asset we commit to pay half of the amount to [Green company](*). Example: you invest €50.00 in a green asset, we will pay €25.00 to [Green company]. (*) [Green company] enables individuals and companies to take concrete action in favour of reforestation throughout the world.
- A **brown asset**A brown asset is an environmentally irresponsible asset. For any amount you invest in a brown asset we commit to pay half of the amount to [Brown association](*). Example: you invest €50.00 in a brown asset, we will pay €25.00 to [Brown association]. (*) [Brown association] is an international organisation of oil and gas producers, one of their technical areas of expertise is shale gas.
- A **neutral asset** does not give rise to any action on our part.

Realized return

A riskless asset will have a realized return equal to the expected return. A risky asset will have a realized return that will be equal, with a 50/50 chance, to either the expected return plus its standard deviation or the expected return minus its standard deviation. If we note R the expected return of the asset and E its standard deviation, the realized return is equal to R + E with 50/50 chance or R - E with 50/50 chance. Example: for an asset with an expected return of 40% and a standard deviation of 50%, its realized return will be equal, with 50/50 chance, to 40% + 50% = 90% or 40% - 50% = -10%. Value of the portfolio The initial value of the portfolio is equal to €100.00. The final value of the portfolio is equal to €100.00 plus the proportion of each asset multiplied by its realized return. Example: your portfolio is composed of 35% Asset 1 and 65 % Asset 2. The value of the portfolio is equal to €100.00 + 35% of the realized return of Asset 1 + 65% of the realized return of Asset 2. Your gain for this part At the end of the experiment, if you are selected to be paid (1 chance out of 10), one of the rounds of this part will be drawn at random. If it is round 1 or 2, the value of your portfolio for this round will be your payoff for this part. If it is a round between round 3 and round 13, a second draw will determine the portfolio (1, 2, or 3) that will be used to determine your payoff for the round and therefore your payoff for this part.

Portfolio value

The initial value of the portfolio is 100.00 ECU. The final value of the portfolio is equal to 100.00 ECU plus the proportion of each asset multiplied by its realized return.

Example: Your portfolio is composed of 35% of asset 1 and 65% of asset 2. The portfolio's value is equal to 100.00 ECU + 35% of the realized return of asset 1 + 65% of the realized return of asset 2.

Gain in the game

At the end of the experiment, if you are selected to be paid (1 chance out of 10), one of the rounds of this part will be drawn at random. If it is round 1 or 2, the value of your portfolio for this round will be your payoff for this part. If it is a round between round 3 and round 13, a second draw will determine the portfolio (1, 2, or 3) that will be used to determine your payoff for the round and therefore your payoff for this part.

A.2 Screenshot of a screen from the portfolio task

Figure 2 displays one screen of the portfolio task as an example. The detailed instructions of the 3 treatments are provided in the next subsection. All characteristics of the 13 screens are provided in Table 1.

Figure 2: Screenshot of a frame in the portfolio task (frame 4)

A.3 Internet links to the instructions for all treatments

A.3.1 Baseline treatment

http://leem.umontpellier.fr/files/appendix/stranded_asset/screenshots_PRO_baseline.pdf

A.3.2 Ranking treatment

http://leem.umontpellier.fr/files/appendix/stranded_asset/screenshots_PRO_ranking.pdf

A.3.3 Tax treatment

http://leem.umontpellier.fr/files/appendix/stranded_asset/screenshots_PRO_tax.pdf

A.4 Control tasks

Task 1 was intended to measure risk preferences, following the higher-order risk-preferences methodology of Noussair et al. (2014) (relevant details are provided in Internet Appendix A.5.1). Respondents were given 15 binary choice questions involving compound lotteries to measure their risk aversion, prudence, and temperance. Risk aversion is related to the moment of the second order of the underlying risk distribution, while prudence and temperance relate to the third (skewness) and fourth moment (kurtosis) of the distribution. Skewness and kurtosis are dimensions absent from the portfolio task. But as shown by Bottasso et al. (2022), risk, prudence, and temperance are linked in the choices of finance professionals. Respective measures might then provide significant information regarding the participants' relation to risk in portfolio decisions. The task provides three round scores between 0 and 5 for the three dimensions.

The second task is the Social Value Orientation introduced by Murphy et al. (2011) and detailed in Internet Appendix A.5.2. It provides a real number between -20 and 60 which relates to behaviors between being competitive and altruistic. We develop this task below.

The third task is the version of the 11–20 game, originally designed by Arad and Rubinstein (2012) and modified by Alaoui and Penta (2016). It is detailed in Internet Appendix A.5.3. It is a one-shot, two-player game to assess each participant's level-k strategic depth of reasoning (Arad and Rubinstein, 2012), in a fashion similar to the beauty contest game (Brañas-Garza et al., 2012).

The fourth task is the cognitive reflection test, hereafter CRT (Frederick, 2005; Toplak et al., 2011; Korniotis and Kumar, 2010). It has seven numerical questions to measure cognitive and concentration skills. It provides a round score between 0 and 7. Corgnet et al. (2018) showed that such skills are predictors of investors' performance. The third and fourth tasks are related to strategic skills and cognition. They are thus valid control variables for participants' heterogeneous choices.

The last task is a survey of 15 questions of 5 modalities between disagreement and agreement (the NEP scale of Dunlap et al. (2000)). They relate to environmental opinion and provide a round number between 15 and 75 that reflects pro-environmental preferences.

In the previous section, these variables were added as control variables. Regressions that omit those variables provide coefficients that are almost identical to that of Table 4, so that any disparities are not caused by those variables. Our results are therefore robust

to individual heterogeneity induced by the control tasks. Still, it can be expected in the same fashion as Holmen et al. (2021), that finance professionals obtain different results, at least partly, for these tasks than other populations (in our case, students).

Two of the tasks are of particular interest in relation to our hypothesis of green preference. Following Riedl and Smeets (2017), we focus on the influence of revealed pro-sociability and expressed pro-environmental preferences on λ.

A.5 Detailed description of the control tasks

A.5.1 Higher order risk preferences

The risk, prudence, and temperance task (RPT task) developed by Noussair et al. (2014), and also used by Bottasso et al. (2022) with financial market professionals, has 15 binary choices to elicit levels of risk aversion, prudence and temperance. Five questions are dedicated to each of the three dimensions.

Table 7 displays the 15 questions. Notation [a_b] indicates an equiprobable lottery in which either a or b is added to the previous total, each with a probability of 0.5 (Bottasso et al., 2022).

1. For the elicitation of risk aversion, the choice is between a sure amount and a lottery (Figure 3).
2. The elicitation of prudence relies on two-stage lotteries. Each choice involves the same two sure outcomes (low and high). For one option, a second-stage lottery is attached to the low outcome, and for the other option, the same lottery is attached to the high outcome. A prudent participant chooses the option for which the lottery is attached to the high outcome (Figure 4).
3. Finally, to elicit temperance, two second-stage lotteries are attached to the outcome of the first-stage lottery: they are either attached to the same outcome or spread over the two outcomes. A temperate individual chooses to spread the additional risk according to the second-stage lottery (Figure 5).

The most straightforward treatment of this task is to count the number of choices revealing respectively more risk averse, more prudent, and more tempered preferences. Each of the three scores is thus a round number between 0 and 5.

Table 7: List of choice tasks in the RPT task

Name of task	Left lottery	Right lottery
Riskav 1	20	[65_5]
Riskav 2	25	[65_5]
Riskav 3	30	[65_5]
Riskav 4	35	[65_5]
Riskav 5	40	[65_5]
Prud 1	[(90 + [20_-20])_60]	[90_(60 + [20_-20])]
Prud 2	[(90 + [10_-10])_60]	[90_(60 + [10_-10])]
Prud 3	[(90 + [40_-40])_60]	[90_(60 + [40_-40])]
Prud 4	[(135 + [30_-30])_90]	[135_(90 + [30_-30])]
Prud 5	[(65 + [20_-20])_35]	[65_(35 + [20_-20])]
Temp 1	[(90 + [30_-30])_(90 + [30_-30])]	[90_(90 + [30_-30] + [30_-30])]
Temp 2	[(90 + [30_-30])_(90 + [10_-10])]	[90_(90 + [30_-30] + [10_-10])]
Temp 3	[(90 + [30_-30])_(90 + [50_-50])]	[90_(90 + [30_-30] + [50_-50])]
Temp 4	[(30 + [10_-10])_(30 + [10_-10])]	[30_(30 + [10_-10] + [10_-10])]
Temp 5	[(70 + [30_-30])_(70 + [30_-30])]	[70_(70 + [30_-30] + [30_-30])]

Description: As in Bottasso et al. (2022), [a_b] indicates an equiprobable lottery in which either a or b is received. Choice of the left lottery indicates the more risk averse, prudent and temperate, respectively.

Figure 3: Choices 1 to 5 to elicit risk aversion in the RPT task.

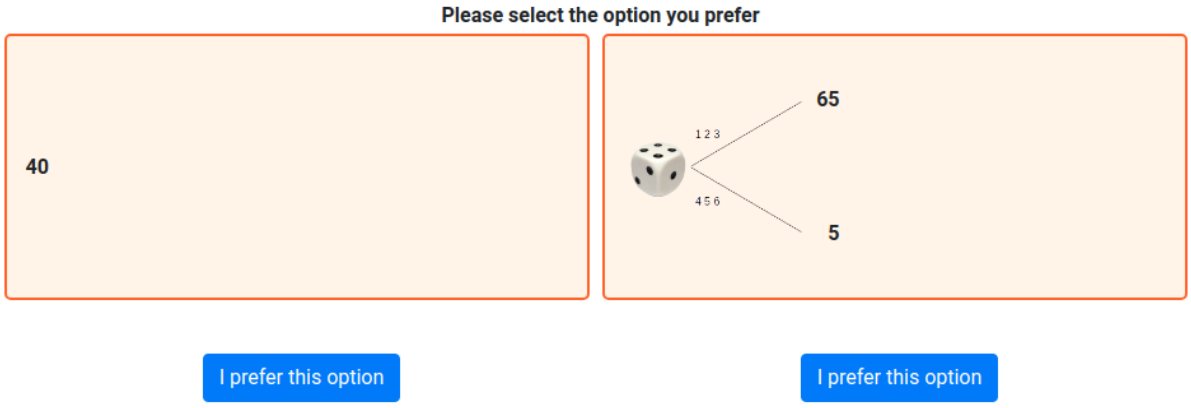


Figure 4: Choices 6 to 10 to elicit prudence in the RPT task.

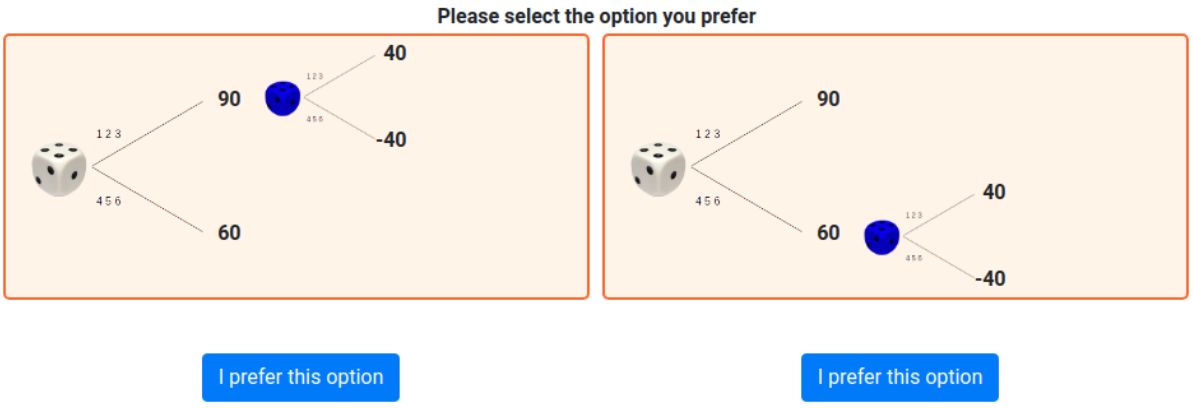
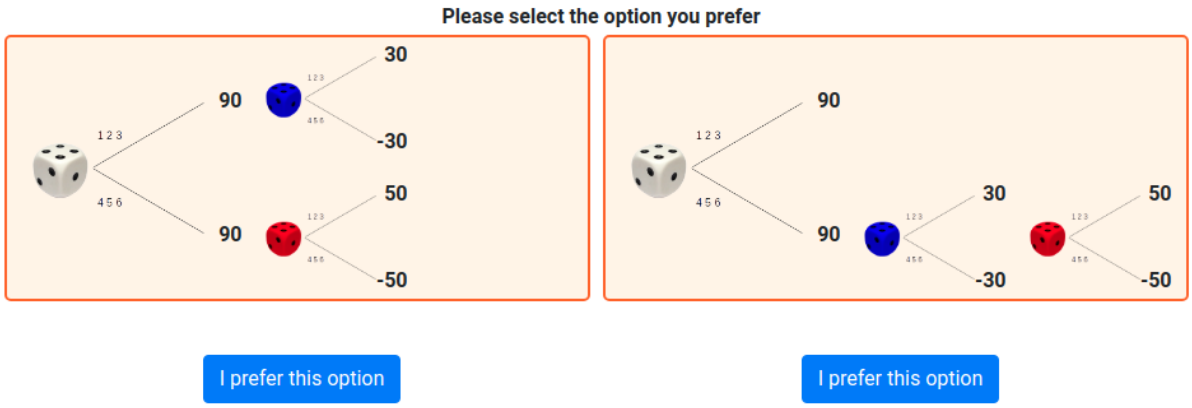


Figure 5: Choices 11 to 15 to elicit temperance in the RPT task.



A.5.2 Prosociability

The Social Value Orientation (SVO) task was introduced by Murphy et al. (2011) to measure pro- and anti-social preferences. The task consists in choosing a payoff distribution between self and an anonymous counterpart from a set of nine possible distributions. We rely on the six-item version of the SVO to provide a specific non-negative aggregate score, which allows us to determine the SVO score. The SVO score is computed as a function of the average self-allocation $\bar{A}_s$ and the average transfer to the counterpart $\bar{A}_o$:

$$\text{SVO} = \arctan\left(\frac{\bar{A}_o - 50}{\bar{A}_s - 50}\right).$$

The result is an angle between $-20°$ and $60°$. Following Murphy et al. (2011), respondents can be categorized as competitive, individualist, pro-social, or altruist, depending on the interval in which the SVO score is located. We use the direct (continuous) score as an explanatory variable, and we check for robustness with the categorization proposed by Murphy et al. (2011). The instructions displayed on the participants' screen are given below, as well as a screenshot of the decision screen (Figure 6).

> This third part consists of 6 periods. In each period, you have to decide how to divide a sum of money between you and a person participating in this experiment. You can't identify the other person and she can't identify you. There is no right or wrong response, and the data will be treated anonymously. For each of the 6 periods, indicate the allocation you would like to prefer by clicking on the corresponding button. Within each pair, randomly formed by the computer, there will be two successive draws. A first draw will determine the period to be used for remuneration. Then, a second draw will select one of the two in the pair so that her decision will apply to the pair, so either your decision will apply or the other's decision will apply. The amounts on the screens are expressed in ECU.

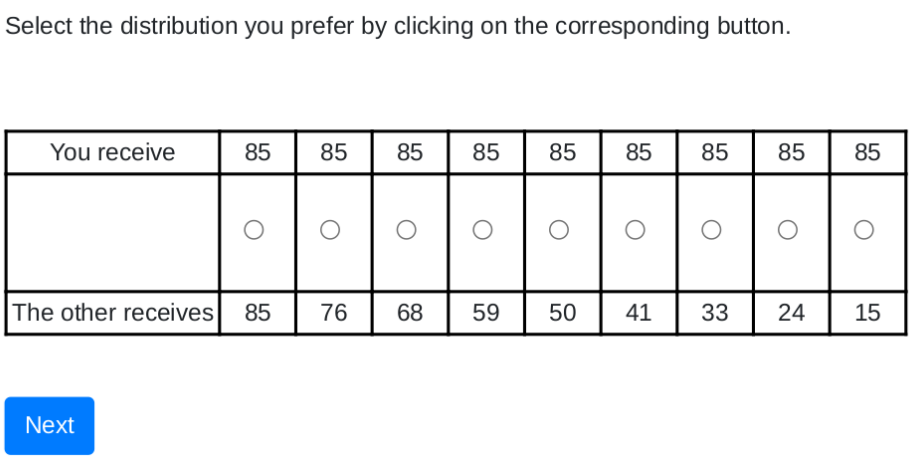
A.5.3 Strategic thinking

In a third additional task, we measured the depth of reasoning using the 11-20 game from Alaoui and Penta (2016).

The game involves two players, assigned randomly to each other. Each one independently picks an integer number between 11 and 20. Three rules define the nominal reward of the player:

(a) he/she receives the chosen number,

Figure 6: Screenshot of the SVO task (first allocation)



(b) if his/her number is exactly one unit less the opponent's number, he/she receives an extra 20,

(c) if his/her number is exactly his/her opponent's number, he/she receives an extra 10.

The simple game grounded on (a) and (b) has been introduced by Arad and Rubinstein (2012), as a one-shot game designed to assess the depth of strategic thinking. Level-0 (non strategic) optimal choice is given by considering only condition (a), and leads to choice 20. According to condition (b), Level-k reasoning, for $k \geq 1$, follows from the best response to Level-$(k-1)$, and leads to choose the number $20-k$, or number 21 for Level-10. The cycle of best-responses is broken by condition (c). The condition (c) has been introduced by Alaoui and Penta (2016) to change the unique mixed Nash equilibrium of the original game of Arad and Rubinstein (2012) in a pure Nash equilibrium at 11[36]. The instructions of the game, displayed on participants' screen, are given below.

[36]In order to study the individual strategic level, a pure Nash equilibrium, that is, an explicit choice of a number, is obviously preferable to a mixed Nash Equilibrium.

There is only one decision in this part. You must choose an integer between 11 and 20. You will receive the amount in euros that you choose. In addition, at the end of the experiment, pairs of participants will be randomly formed, and the selected numbers will be compared.
If you choose the same number as the other member of your pair, you will receive an additional 10 €. If you choose a number that is exactly one less than the other member of your pair, you receive an additional 20 €.
Examples:

- If you choose 17 and the other member of your pair has chosen 19, then you receive 17 € and he receives 19 €.
- If you choose 12 and the other member of your pair has chosen 13, then you will receive 32 € and he will receive 13 €.
- If you choose 16 and the other member of your pair has chosen 16, then you will receive 26 € and he will receive 26 €.

A.5.4 Cognitive and Reflection Task

We relied on a standard seven questions cognitive reflection test (Frederick, 2005; Korniotis and Kumar, 2010; Toplak et al., 2011). The answer to each question is either right of wrong. This task provides therefore a score between 0 to 7, which serves as a proxy for abstract reasoning, problem-solving and mathematical formalization. The seven questions are given below. They were displayed on the same screen, one below the other.

1. If it takes 2 nurses 2 minutes to measure the blood pressure of 2 patients, how long would it take 200 nurses to measure the blood pressure of 200 patients? ____minutes. [Correct answer: 2 minutes; intuitive answer: 200 minutes]
2. Soup and salad cost €5.50 in total. The soup costs €5 more than the salad. How much does the salad cost? ____(in cents of €). [Correct answer: €0.25; intuitive answer: €0.5]
3. Sally is making sun tea. Every hour, the concentration of the tea doubles. If it takes 6 hours for the tea to be ready, how long would it take for the tea to reach half of the final concentration? ____hours. [Correct answer: 5 hours; intuitive answer: 3 hours]
4. If John can drink one barrel of water in 6 days, and Mary can drink one barrel of water in 12 days, how long would it take them to drink one barrel of water together? ____days. [correct answer: 4 days; intuitive answer: 9]
5. Jerry received both the 15th highest and the 15th lowest mark in the class. How many students are in the class? ____students. [correct answer: 29 students; intuitive answer: 30]
6. A man buys a pig for €60, sells it for €70, buys it back for €80, and sells it finally for €90. How much has he made? ____€. [correct answer: €20; intuitive answer: €10]
7. Simon decided to invest €8,000 in the stock market one day early in 2008. Six months after he invested, on July 17, the stocks he had purchased were down 50%. Fortunately for Simon, from July 17 to October 17, the stocks he had purchased went up 75%. At this point, Simon: (a) has broken even in the stock market, (b) is ahead of where he began, (c) has lost money. [correct answer: c, because the value at this point is €7,000; intuitive response b].

A.5.5 Pro-environmental opinion

We relied on the New Environmenal Paradigm (NEP) to assess participants' environmental friendliness. The NEP scale (Dunlap et al., 2000) is a very popular 15-question survey to evaluate opinion about environmental issues. Answers to each question vary from "fully disagree" to "fully agree" on a 5-levels Likert scale. The simplest and usual treatment of the data is to quantify answers from 1 to 5, in order to provide a total score on the range from 15 to 75.

1. We are approaching the limit of the number of people the earth can support.
2. Humans have the right to modify the natural environment to suit their needs.
3. When humans interfere with nature it often produces disastrous consequences.
4. Human ingenuity will insure that we do NOT make the earth unlivable.
5. Humans are severely abusing the environment
6. The earth has plenty of natural resources if we just learn how to develop them.
7. Plants and animals have as much right as humans to exist.
8. The balance of nature is strong enough to cope with impacts of modern industrial nations.
9. Despite our special abilities humans are still participant to the laws of nature.
10. The so-called "ecological crisis" facing humankind has been greatly exaggerated.
11. The earth is like a spaceship with very limited room and resources.
12. Humans were meant to rule over the rest of nature.
13. The balance of nature is very delicate and easily upset.
14. Humans will eventually learn enough about how nature works to be able to control it.
15. If things continue on their present course, we will soon experience a major ecological catastrophe.

A.6 Financial market professional questionnaire

A dropdown menu was attached to each question, the list of possible answers are given into the brackets.

1. What is your current job? [1: Prop Trader; 2: Sales Trader; 3: Sales; 4: Market Maker; 5: Asset/Portfolio Manager; 6: Strategist/Economist; 7: Financial Analyst (buy side, sell side); 8: Risk analyst; 9: Private equity Manager; 10: Other]
2. What is your employer? [1: Bank; 2: Asset management company; 3: Trading company; 4: Broker; 5: Hedge fund; 6: Work for your own; 7: Private equity company; 8: Other]
3. In which jobs in finance do you have your main experiences? (You can choose various jobs) ? [1: Prop Trader; 2: Sales Trader; 3: Sales; 4: Market Maker; 5: Asset/Portfolio Manager; 6: Strategist/Economist; 7: Financial Analyst (buy side, sell side); 8: Risk analyst; 9: Private equity Manager; 10: Other]
4. What is the main strategy you employ to trade assets? [1: Technical Analysis; 2: Value investing; 3: Trend following; 4: Event Driven; 5: Global Macro; 6: Arbitrageur; 7: Market Making; 8: Scalping; 9: Merger Arbitrage; 10: Other; 11: None]
5. On which asset class are your working on? [1: Money Market; 2: Forex Market; 3: Commodities; 4: Equity; 5: Bonds (Fixed Income); 6: Private Equity: 7: Real estate; 8: Hedge Fund; 9: Other]
6. Do you work on: [1: Spot Market; 2: Market Derivatives; 3: Both; 4: Other]
7. What is the nationality of your company? [answer:]

B Data collection

B.1 Samples

The PRO sample We collected the data of the PRO sample in major investment banks and asset management companies, in October 2019, using a mobile laboratory with tablets. We conducted experiments in compliance with the ethical rules of the experimental economics laboratory of Montpellier (LEEM) and in accordance with the deontological and compliance rules of the banks.[37] This study has also been approved by the Institutional Review Board (IRB) of the Center of Environmental Economics of Montpellier (University of Montpelier). We used oTree software (Chen et al., 2016) to run the experiment. Figure 7 illustrates the typical environment in which the PRO data were collected. A total of 190 financial market professionals participated in the experiment: 66 of them were assigned to the baseline treatment, 63 to the ranking treatment and 61 to the tax treatment. Most of the participants worked in trading activities (proprietary traders, sales traders, asset managers, sales, trading room managers, quantitative engineers, structurers, financial analysts), while others were employed in support functions such as financial management or audit. Figure 8 shows the distribution of the jobs for the entire PRO sample. Finally, many of the members of the bank management board also took part in the experiment.[38]

Figure 7: Meeting rooms used as a laboratory

The STUD sample The STUD sample consists of students from University of Montpellier. The data were collected during 2020, at the Laboratory for Experimental Eco-

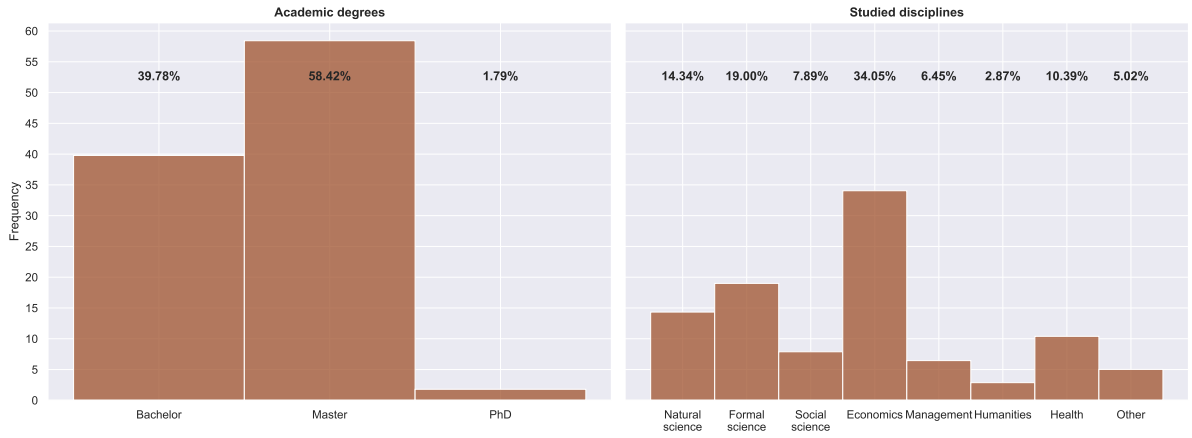
[37] For reasons of confidentiality, we can not provide any further information publicly, however, we are at the disposition of the reviewers to give them of any additional information they may require.

[38] 74.2% of the participants work for a bank and 25.8% for "other" (mainly asset management companies or bank subsidiaries dedicated to asset management and portfolio management)

Figure 8: Financial categories of the professional sample

nomics of Montpellier.[39] 279 student participants (45.16% of women, with an average age of 23.86 years) were involved in the experiment: 103 in the baseline treatment, 84 in the ranking treatment and 92 in the tax treatment. Figure 9 shows the distribution of academic degrees and studied disciplines in the STUD sample.

Figure 9: Academic degrees and studied disciplines in the student sample



B.2 Practical procedures

The practical procedures for the PRO and the STUD samples differ in two respects. First, they differ with respect to the final questionnaire that followed the control tasks. For the PRO sample, the questions were related to current employment and professional experience in the field of finance, while for the STUD sample, the questions were related to their studies and socio-demographic information.

[39] LEEM, http://leem.umontpellier.fr. The participant pool is managed by the ORSEE platform (Greiner, 2015).

Second, the two samples differ with respect to how participants were matched and compensated for the experiment. In the STUD sample, we organized standard sessions with an even number of participants so that we could form pairs of players for the SVO task and the 11–20 task.

In addition, all participants were paid for one (randomly chosen) portfolio choice task and one (randomly selected) control task. For the PRO sample, we could neither anticipate the number of participants in a session nor at what time they would attend the session. We, therefore, needed to rely on the strategy method for the SVO and the 11–20 tasks. Pairs were formed at the end of each session. In addition, only one participant out of 10 was randomly selected to be paid out for real. Selected participants were paid for one of the portfolio choice task and one control task, both randomly selected. We proceeded that way to provide strong incentives to the finance professional participants. For both samples, we relied on a random selection of the tasks to be paid. This procedure is common among experimentalists as it was demonstrated to be incentive-compatible (Starmer and Sugden, 1991; Charness et al., 2016; Clot et al., 2018). On average, a student earned 8.10 euros, and a (selected to be paid) finance professional 216.81 euros.

C Analysis

C.1 Portfolio task

The following table is used in Section 3.

Table 8: Mean (*std*) investment in the greenest asset, by treatment and sample

			Baseline				**Ranking**				**Tax**			
			Professionals		**Students**		**Professionals**		**Students**		**Professionals**		**Students**	
Screen	**Assets**	ρ	**mean**	***std***	**mean**	***std***	**mean**	***std***	**mean**	***std***	**mean**	***std***	**mean**	***std***
1	N (15, 0) vs G (10, 0)		45.30	*24.91*	30.60	*31.89*	48.24	*27.60*	41.31	*31.96*	46.34	*24.78*	50.23	*27.25*
2	N (15, 0) vs B (20, 0)		61.29	*28.67*	45.85	*41.42*	65.70	*28.48*	64.46	*33.85*	61.46	*27.28*	69.77	*25.55*
4	N (15, 0) vs G (10, 25)		43.70	*26.40*	35.99	*31.42*	44.08	*24.21*	40.31	*30.33*	44.20	*23.15*	39.42	*29.96*
	N (15, 0) vs G (20, 25)		50.33	*21.85*	43.06	*33.80*	55.81	*22.48*	52.75	*29.45*	52.70	*25.23*	58.11	*29.04*
	N (15, 0) vs G (20, 50)		37.73	*25.69*	37.91	*36.23*	41.78	*25.74*	50.10	*35.08*	44.11	*31.89*	50.22	*35.71*
5	N (15, 0) vs B (30, 25)		64.55	*25.29*	57.79	*36.68*	67.51	*24.74*	58.06	*36.29*	57.31	*26.82*	69.37	*29.03*
	N (15, 0) vs B (40, 25)		61.29	*29.05*	42.95	*40.53*	60.13	*25.82*	48.45	*38.90*	60.67	*24.31*	69.66	*27.43*
	N (15, 0) vs B (40, 50)		70.68	*25.30*	58.38	*35.56*	71.38	*27.13*	58.89	*33.88*	68.49	*23.97*	72.48	*26.74*
6	N (20, 25) vs G (10, 0)		61.79	*21.76*	48.71	*33.38*	61.89	*25.06*	64.62	*29.80*	63.43	*22.85*	61.14	*27.22*
	N (30, 25) vs G (10, 0)		57.03	*24.22*	36.78	*34.57*	54.84	*23.99*	53.13	*33.90*	61.10	*23.87*	64.78	*24.17*
	N (30, 50) vs G (10, 0)		68.09	*22.82*	55.07	*35.20*	70.35	*22.56*	69.20	*30.52*	70.75	*22.95*	70.61	*27.39*
7	N (20, 25) vs B (20, 0)		48.65	*31.42*	55.54	*32.72*	52.75	*28.75*	48.74	*34.53*	49.43	*29.29*	53.34	*35.58*
	N (30, 25) vs B (20, 0)		54.35	*28.20*	67.32	*33.42*	62.94	*25.92*	62.87	*32.42*	62.20	*29.49*	70.18	*30.72*
	N (30, 50) vs B (20, 0)		45.89	*28.12*	49.09	*34.60*	51.38	*26.54*	47.14	*32.95*	48.03	*32.80*	57.35	*33.62*
8	N (20, 25) vs G (10, 25)		40.76	*29.67*	18.51	*29.74*	49.70	*30.87*	37.00	*34.08*	53.56	*24.17*	51.88	*29.37*
	N (30, 25) vs G (20, 25)	1	44.33	*28.34*	23.32	*30.96*	46.30	*29.17*	41.39	*34.91*	49.10	*24.39*	52.45	*27.96*
	N (30, 50) vs G (20, 50)		41.89	*30.83*	21.28	*31.95*	49.38	*30.51*	36.27	*36.11*	51.84	*25.10*	53.96	*28.80*
9	N (20, 25) vs G (10, 25)		44.27	*27.59*	24.17	*30.63*	45.52	*27.60*	32.67	*29.48*	50.69	*22.60*	50.52	*28.12*
	N (30, 25) vs G (20, 25)	0	43.41	*24.07*	26.57	*31.25*	46.97	*27.33*	35.23	*30.85*	46.48	*24.36*	50.35	*30.39*
	N (30, 50) vs G (20, 50)		43.45	*24.16*	29.53	*33.26*	46.73	*27.04*	37.23	*32.34*	51.59	*23.80*	53.21	*30.15*
10	N (20, 25) vs G (10, 25)		47.38	*25.44*	34.82	*26.17*	48.59	*25.30*	45.60	*27.94*	48.02	*21.51*	51.72	*26.81*
	N (30, 25) vs G (20, 25)	-1	47.95	*23.11*	33.31	*27.04*	50.51	*26.57*	41.60	*31.01*	52.39	*23.92*	51.97	*27.37*
	N (30, 50) vs G (20, 50)		47.48	*22.61*	36.20	*25.18*	53.37	*26.74*	48.77	*27.57*	52.70	*21.61*	56.39	*25.58*
11	N (20, 25) vs B (30, 25)		56.03	*29.75*	42.37	*36.15*	59.25	*24.41*	48.63	*36.98*	53.64	*27.29*	62.88	*29.94*
	N (30, 25) vs B (40, 25)	1	54.95	*30.50*	47.56	*38.52*	62.22	*27.56*	51.70	*38.93*	59.77	*27.40*	60.70	*32.29*
	N (30, 50) vs B (40, 50)		53.58	*32.15*	37.67	*40.33*	57.38	*28.66*	47.14	*38.24*	50.95	*29.01*	62.74	*29.42*
12	N (20, 25) vs B (30, 25)		56.15	*32.05*	41.68	*34.69*	62.17	*27.30*	49.17	*36.53*	58.61	*27.86*	65.85	*29.08*
	N (30, 25) vs B (40, 25)	0	59.55	*30.90*	45.11	*37.14*	62.67	*27.52*	53.35	*37.48*	59.54	*26.52*	63.60	*30.85*
	N (30, 50) vs B (40, 50)		53.67	*33.54*	43.29	*36.13*	58.17	*30.15*	49.26	*37.39*	58.38	*26.05*	60.23	*31.78*
13	N (20, 25) vs B (30, 25)		53.88	*29.50*	43.21	*35.04*	62.57	*26.99*	52.76	*34.31*	57.97	*23.69*	60.76	*28.95*
	N (30, 25) vs B (40, 25)	-1	60.08	*28.23*	45.61	*35.74*	61.75	*26.86*	58.39	*34.20*	63.49	*23.79*	62.96	*30.55*
	N (30, 50) vs B (40, 50)		61.83	*26.56*	46.49	*32.80*	63.84	*25.04*	57.99	*31.00*	59.21	*22.37*	59.86	*29.72*
Overall			52.54	*28.52*	40.80	*35.76*	56.12	*27.75*	49.51	*34.71*	55.25	*26.27*	59.02	*30.23*

C.2 Control tasks

Table 9 reports the mean of the variable of interest for each of the control tasks, for both samples, as well as a column that displays the difference between the two samples and a column that reports the p-value of a two-sided t-test (H0 is the two samples have an equal mean).

Table 9: Summary statistics for the control tasks

	Professionals	Students	Diff.	p-value
Risk aversion	2.537	2.803	-0.266	.065
Prudence	3.079	3.480	-0.401	.009**
Temperance	2.405	2.642	-0.237	.145
SVO	20.517	18.083	2.434	.080
CRT	3.516	3.319	0.197	.306
Eleven-twenty (choice)	15.821	16.509	-0.688	.007**
Eleven-twenty (expected payoff)	18.994	19.869	-0.875	.005**
NEP	56.826	56.283	0.543	.417

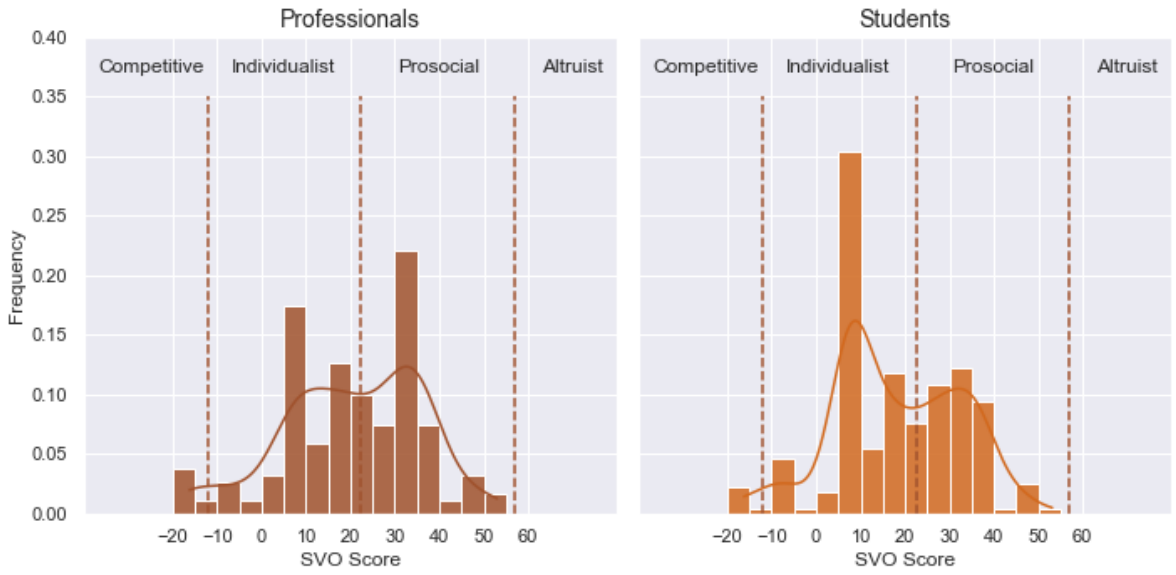
** 1%, * 5%

Students seem to be more risk averse and prudent than professionals but there is no difference between the two samples in terms of temperance. A Pearson correlation test shows there is no correlation between risk aversion and prudence ($r = 0.048$, $p = .512$ for professionals and $r = -0.009$, $p = .877$ for students) but a positive correlation between prudence and temperance ($r = 0.280$, $p < .001$ and $r = 0.262$, $p < .001$, respectively).

The average SVO score of professionals is slightly higher compared to the students, the difference is significant at the 10% level. But this score is also used to determine the class of behaviour to which the participant belongs, ranging from competitive, individualistic, pro-social or altruistic (see Murphy et al., 2011, for a detailed explanation). Figure 10 reports the distribution of the scores for the two samples. None of the participants in either sample revealed to be altruistic. On the other end of the spectrum, financial professionals do not appear to be more competitive than students (4.21% of the professionals and 2.15% of the students). Then, professionals are equally divided between individualists (47.37%) and pro-social (48.42%), while 57.35% of students are individualists and 40.50% are pro-social. Overall, based on a Kolmogorov-Smirnov test, we can reject the hypothesis that the two distributions are identical ($p = .042$).

The average CRT score of professionals is slightly higher than that of students, but is more homogeneous in the latter sample, especially for the highest scores. A Kolmogorov-

Figure 10: Distribution of the SVO score in both samples



Smirnov test does not reveal any significant difference, however ($p = .112$).

Finally, Figure 11 shows that both populations exhibit a similar distribution for the NEP score, meaning that they have similar concerns about environmental issues (Kolmogorov-Smirnov test, $p = .431$).

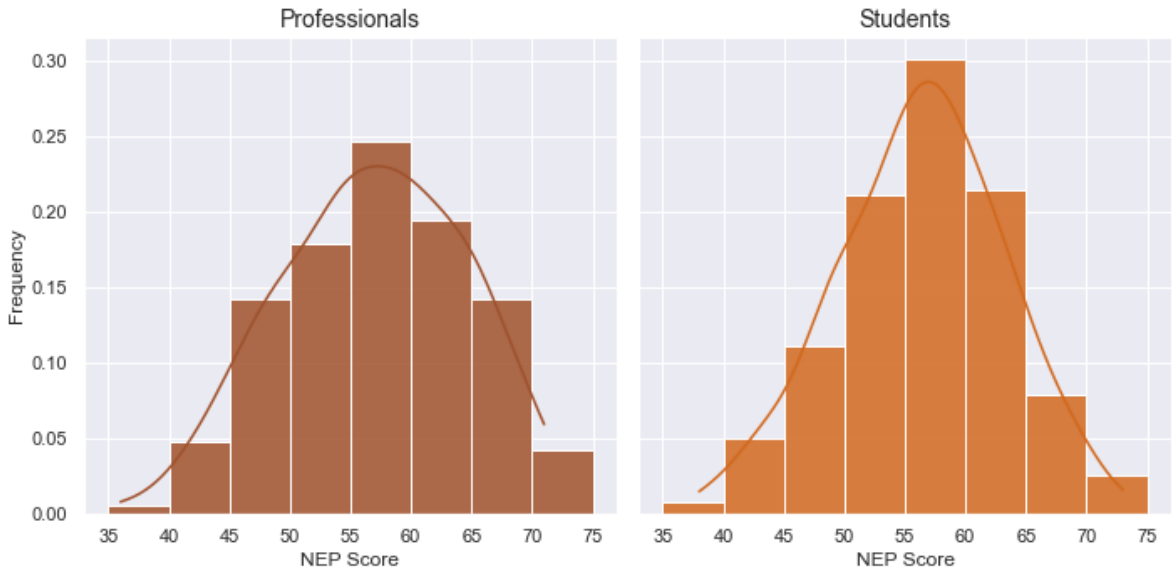
To summarize the results from the control tasks, professionals are less risk-averse and less prudent than students. They are more pro-social, and they are less successful at guessing the depth of reasoning of their cohort members. On the other hand, the two samples appear to have a similar profile in terms of temperance, cognitive abilities and environmental concern.

C.3 Econometric analysis

C.3.1 Regression analysis

As noted in Table 4, the regression method is as follows. We compute estimated coefficients in a random-effect (RE) Tobit panel regression with robust clustered standard errors at the participant level. This accounts for potential heteroskedasticity and serial correlation of errors (in parenthesis). Estimations were done with StataCorp software

Figure 11: Distribution of the NEP scale score, by sample



(2019).[40]

As usual, *, ** , *** account for 10%, 5% and 1% significance level respectively. The last lines, χ^2 and p-value, stand for the model non-null significance test.

In the analysis, the dependent variable is the proportion invested in the greener asset (λ). Context denotes screens used for estimation: *Green* context relates to screens 1,4,6,8,9, and 10; *Brown* context relates to screens 2,5,7,11,12, and 13. *All* combines *Green* and *Brown* (screen 3 is excluded from the analysis). N is the number of related observations (samples and selected screens).

Table 10 refers to the estimation in Section 2, while Table 11 refers to the estimation in Section 5.

The *Green* dummy variable refers to the *Green* context ($Green = 1$ for Green context and 0 for Brown context). The *Student* dummy variable controls for the POOL type ($Student = 1$ if the participant belongs to the STUD sample, and 1 if he belongs to the PRO sample). *Correlation* is a categorical variable which equals 0 for screens 1 to 7, 1 for screens 8 and 11, 2 for screens 9 and 12, and 3 for screens 10 and 13.

Variables specific to the PRO sample, such as finance jobs and investment strategies are presented in Table 6, while variables specific to the STUD sample, such as disciplines

[40]Stata: Release 16. Statistical Software. College Station, TX: StataCorp LLC. Further information on this class of models is available at https://www.stata.com/manuals/memetobit.pdf.

are presented in Subsubsection 5.2.2.

In Table 11, all the variables present in Table 10 are taken as control variables, except *SVO* and *NEP* which are shown (*cf.* Appendix C.2 for descriptive statistics). In addition, *Employer type* (=0 if "bank", =1 otherwise), *Asset Class* (categories: "Money market", "Forex market", "Equity", "Bonds and FI", "Others"), *Market type* (categories: "spot market", "derivatives", "both", "others")[41], *Age* (in years), *Gender* (=0 for female, =1 for male) and *Student level* (in years)[42] are hidden control variables in Table 11.

[41] All of these variables are for professionals.
[42] These last 3 variables are for students.

Table 10: Estimated coefficients of Table 4

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample	ALL	ALL	ALL	PRO	PRO	STUD	STUD
Screens	All	Green	Brown	Green	Brown	Green	Brown
N	15008	7504	7504	3040	3040	4464	4464
Asset characteristics							
Expected return	1.19**	0.92**	1.43**	0.66**	0.93**	1.13**	1.85**
of greener asset	(0.09)	(0.11)	(0.13)	(0.15)	(0.14)	(0.15)	(0.20)
Expected return	-0.81**	-0.70**	-1.01**	-0.56**	-0.57**	-0.82**	-1.38**
of browner asset	(0.09)	(0.11)	(0.11)	(0.13)	(0.12)	(0.16)	(0.19)
Standard deviation	-0.51**	-0.36**	-0.69**	-0.39**	-0.59**	-0.34**	-0.78**
of greener asset	(0.04)	(0.04)	(0.05)	(0.06)	(0.06)	(0.06)	(0.08)
Standard deviation	0.50**	0.54**	0.52**	0.50**	0.42**	0.57**	0.61**
of browner asset	(0.04)	(0.04)	(0.05)	(0.06)	(0.05)	(0.07)	(0.08)
Correlation 1	-10.01**	-15.44**	-3.94*	-7.79**	-0.78	-21.82**	-6.80*
	(1.28)	(1.64)	(1.64)	(2.08)	(1.84)	(2.47)	(2.65)
Correlation 0	-8.66**	-15.02**	-1.67	-8.60**	-2.33	-20.36**	-5.28*
	(1.26)	(1.56)	(1.62)	(1.83)	(1.76)	(2.44)	(2.63)
Correlation -1	-3.97**	-7.89**	0.32	-5.07**	3.87*	-10.05**	-2.74
	(1.13)	(1.42)	(1.60)	(1.90)	(1.87)	(2.07)	(2.51)
Sample characteristics							
Ranking treatment	7.41**	10.01**	3.99	4.56	2.53	14.09**	5.39
	(2.41)	(2.57)	(3.87)	(3.26)	(4.78)	(3.91)	(5.87)
Tax treatment	16.04**	18.81**	12.69**	6.62*	-1.13	27.44**	24.46**
	(2.12)	(2.50)	(3.74)	(2.92)	(4.35)	(3.78)	(5.85)
Student	-5.92**	-7.89**	-2.67				
	(2.00)	(2.06)	(2.95)				
Green	-10.47**						
	(1.59)						
Control variables							
Intercept	37.38**	38.24**	25.44	55.08**	45.59**	16.89	1.93
	(9.45)	(9.20)	(13.56)	(12.53)	(16.97)	(12.63)	(18.57)
Risk aversion	-1.16	-0.15	-2.32**	-0.29	-0.94	0.02	-3.64**
	(0.64)	(0.69)	(1.04)	(0.88)	(1.32)	(1.01)	(1.51)
Prudence	0.44	-0.01	0.69	0.65	-0.49	-0.79	1.06
	(0.64)	(0.62)	(1.01)	(0.87)	(1.29)	(0.86)	(1.49)
Temperance	-0.91	-1.10	-0.49	-0.81	-1.03	-1.40	0.11
	(0.58)	(0.62)	(0.94)	(0.80)	(1.23)	(0.90)	(1.38)
SVO	0.24**	0.31**	0.17	0.11	0.24*	0.43**	0.01
	(0.06)	(0.06)	(0.10)	(0.08)	(0.11)	(0.10)	(0.16)
NEP	0.37*	0.17	0.62**	-0.02	0.27	0.33	1.06**
	(0.15)	(0.15)	(0.22)	(0.20)	(0.28)	(0.21)	(0.30)
CRT	-0.25	-1.67**	1.51	-1.53*	1.88*	1.60*	1.61
	(0.48)	(0.52)	(0.81)	(0.62)	(0.95)	(0.77)	(1.23)
k-level	-0.26	-0.34	-0.99	0.23	-1.41*	-0.61	-0.93
	(0.33)	(0.42)	(0.53)	(0.50)	(0.69)	(0.61)	(0.77)
σ^2(Intercept)	369.73**	431.32**	1004.35**	257.15**	534.59**	560.91**	1411.10**
	(38.76)	(52.34)	(104.97)	(33.26)	(69.68)	(97.65)	(200.70)
σ^2(residual)	1162.16**	843.55**	902.87**	523.00**	509.43**	1125.58**	1266.65**
	(63.55)	(45.70)	(53.69)	(38.29)	(40.72)	(79.38)	(97.26)
χ^2	367.37	326.30	231.49	114.90	136.44	242.66	149.80
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 11: Estimated coefficients of table 5

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	PRO	PRO	PRO	STUD	STUD	STUD
Screens	All	Green	Brown	All	Green	Brown
N	6048	3024	3024	8928	4464	4464
SVO	0.12	0.09	0.17	0.23**	0.43**	-0.01
	(0.08)	(0.08)	(0.11)	(0.09)	(0.10)	(0.15)
NEP	0.05	-0.11	0.26	0.53*	0.29	0.79*
	(0.18)	(0.18)	(0.25)	(0.21)	(0.25)	(0.35)
Finance jobs						
Sales trading	-0.36	2.43	-3.41			
	(3.38)	(3.32)	(4.75)			
Portfolio Manager	-7.21	-1.53	-13.19*			
	(5.29)	(5.46)	(6.44)			
Analyst	15.75**	15.58**	16.49*			
	(4.47)	(4.89)	(6.54)			
Support functions & others	3.77	7.38	0.15			
	(4.48)	(4.82)	(6.78)			
Investment strategies						
Value Investing	11.37*	6.99	16.30*			
	(4.66)	(4.34)	(6.43)			
Mispricing	18.77**	13.32*	24.20**			
	(4.92)	(6.02)	(6.21)			
Global Macro	10.87*	4.72	17.89**			
	(4.33)	(3.89)	(6.15)			
None	1.20	-3.79	6.44			
	(4.34)	(4.33)	(5.39)			
Market Making	11.63**	5.57	17.70**			
	(3.70)	(3.53)	(5.70)			
Others	10.61*	5.68	17.74*			
	(5.39)	(5.05)	(8.12)			
Disciplines						
Humanities				12.78	-2.43	24.89
				(9.18)	(10.70)	(16.40)
Formal Sciences				7.51	1.83	13.92
				(5.50)	(5.98)	(8.66)
Economics				6.70	1.38	12.07
				(5.04)	(5.49)	(6.86)
Health				15.06**	7.37	21.62*
				(5.72)	(6.10)	(9.39)
Natural Sciences				10.18	4.29	14.95
				(6.71)	(6.64)	(9.01)
Social Sciences				9.53	5.67	15.38
				(6.55)	(5.68)	(11.02)
Others				17.31*	13.64	21.64
				(7.42)	(9.04)	(13.99)
Intercept	42.46**	48.51**	27.49	22.52	10.67	25.36
	(12.64)	(12.12)	(17.13)	(20.62)	(23.27)	(33.79)
σ^2(Intercept)	211.83**	200.12**	424.26**	406.77**	546.93**	1373.83**
	(25.67)	(24.97)	(52.79)	(60.42)	(96.64)	(199.74)
σ^2(residual)	636.82**	525.22**	512.31**	1649.37**	1125.48**	1266.40**
	(40.74)	(38.55)	(40.95)	(119.87)	(79.37)	(97.23)
χ^2	213.28	176.14	174.06	276.77	268.98	160.56
p-value	0.00	0.00	0.00	0.00	0.00	0.00

C.3.2 Coefficient analysis

Table 12 describes the tests that are performed on the estimates to test the equality of two parameters in the regression displayed in Table 10. Applied tests are Wald tests with H_0 assuming equality of two parameters in the same random-effect Tobit panel regression. The table displays p-values, with bold font when value is below 5%, indicating that the two parameters are significantly different at this level.

Table 12: Tests of parameters of greener vs browner assets in the same regression

	P-values	
Line and column	Expected Return	Standard Deviation
L1C1 vs - L2C1	**0.0000**	
L1C2 vs - L2C2	**0.0010**	
L1C3 vs - L2C3	**0.0000**	
L1C4 vs - L2C4	0.2373	
L1C5 vs - L2C5	**0.0003**	
L1C6 vs - L2C6	**0.0014**	
L1C7 vs - L2C7	**0.0000**	
L3C1 vs - L4C1		0.8419
L3C2 vs - L4C2		**0.0000**
L3C3 vs - L4C3		**0.0000**
L3C4 vs - L4C4		**0.0119**
L3C5 vs - L4C5		**0.0001**
L3C6 vs - L4C6		**0.0000**
L3C7 vs - L4C7		**0.0036**

Description: LxCy stands for the line x and the column y in Table 4. Lines 1 and 2 refer to expected return of the greener asset and browner asset respectively, lines 3 and 4 to the standard deviation of the greener and browner asset respectively. Columns 1 to 7 are described at the beginning of section 3.

In Table 13, we study differences in specifications between groups. To achieve it, we test if the coefficients (slopes) of the variable under study (e.g., expected return of the greener asset, standard deviation of the browner asset) are significantly different between groups (green versus brown contexts, professional versus student population).

We follow the methodology proposed by Wooldridge (2016), a regression model with qualitative information, by investigating the interaction coefficient between (1) the variable under study and (2) the dummy variable which enables to distinguish the two groups under consideration (Dummy *Group*). By default, we let all the variables and constant differ between groups, by including all the interaction coefficients between the studied

groups and the explanatory variables. The general equation is the following:

$$\begin{aligned}\lambda = \beta_0 &+ \beta_1 ReturnGreener + \beta_2 ReturnBrowner + \beta_3 StandardDevGreener \\ &+ \beta_4 StandardDevBrowner + \beta_5 Correlation0 + \beta_6 Correlation1 \\ &+ \beta_7 Correlationminus1 + \beta_8 Ranking + \beta_9 Tax + \beta_{10} Risk \\ &+ \beta_{11} Prudence + \beta_{12} Temperance + \beta_{13} SVO + \beta_{14} NEP \\ &+ \beta_{15} CRT + \beta_{16} LevelK + \delta_0 Group + \delta_1 Group.ReturnGreener \\ &+ \delta_2 Group.ReturnBrowner + \delta_3 Group.StandardDevGreener \\ &+ \delta_4 Group.StandardDevBrowner + \delta_5 Group.Correlation0 \\ &+ \delta_6 Group.Correlation1 + \delta_7 Group.Correlationminus1 + \delta_8 Group.Ranking \\ &+ \delta_9 Group.Tax + \delta_{10} Group.Risk + \delta_{11} Group.Prudence + \delta_{12} Group.Temperance \\ &+ \delta_{13} Group.SVO + \delta_{14} Group.NEP + \delta_{15} Group.CRT + \delta_{16} Group.LevelK \end{aligned} \tag{1}$$

Estimates are computed based on a random effects Tobit regression in a panel data framework, with robust cluster standard errors at the participant level, to account for the within-cluster error correlations and the heteroskedasticity, such as displayed in Section C.3.

The null hypothesis (H0) is that the two groups have coefficients (slopes) that do not significantly differ on the variable of interest. The alternative hypothesis (H1) is that the coefficients significantly differ between the two groups on the variable of interest. To perform this test, we observe the interaction coefficients between the dummy variable *Group* and the selected variable under study (for example if *ReturnGreener*, δ_1 in Equation 1). If the interaction coefficient is significantly different from 0, then we can conclude that the two coefficients (slopes) differ between groups.

Table 13: Tests of parameters in different regressions

	Interaction coefficients and p-values (in parentheses)					
Line and column	EX RET GR vs BR	SD DEV GR vs BR	Asymmetry neutral	EX RET PRO vs STUD	SD DEV PRO vs STUD	STUD GR vs BR
L1C2 vs L1C3	**-0.45**					
	(0.001)					
L1C4 vs L1C5	-0.25					
	(0.134)					
L1C6 vs L1C7	**-0.63**					
	(0.003)					
L2C2 vs L2C3	**0.27**					
	(0.037)					
L2C4 vs L2C5	0.01					
	(0.953)					
L2C6 vs L2C7	**0.49**					
	(0.019)					
L3C2 vs L3C3		**0.31**				
		(0.000)				
L3C4 vs L3C5		**0.19**				
		(0.006)				
L3C6 vs L3C7		**0.41**				
		(0.000)				
L4C2 vs L4C3		0.04				
		(0.481)				
L4C4 vs L4C5		0.09				
		(0.105)				
L4C6 vs L4C7		-0.01				
		(0.879)				
L4C2 vs -L3C3			**-0.14**			
			(0.005)			
L4C4 vs -L3C5			-0.09			
			(0.145)			
L4C6 vs -L3C7			**-0.18**			
			(0.017)			
L1C4 vs L1C6 (green)				0.39		
				(0.062)		
L1C5 vs L1C7 (brown)				**0.75**		
				(0.001)		
L2C4 vs L2C6 (green)				-0.21		
				(0.312)		
L2C5 vs L2C7 (brown)				**-0.71**		
				(0.001)		
L3C4 vs L3C6 (green)					0.07	
					(0.408)	
L3C5 vs L3C7 (brown)					-0.12	
					(0.227)	
L4C4 vs L4C6 (green)					0.04	
					(0.627)	
L4C5 vs L4C7 (brown)					0.14	
					(0.126)	
L8C2 vs L8C3						-4.40
						(0.118)

Interaction coefficients are displayed, and p-values are shown in parentheses.