Climate Transition Beliefs *

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Abstract

We study expectations about the trajectory of the energy transition (climate transition beliefs) as drivers of "green" investment decisions and financial performance expectations. In a survey of U.S. retail investors (N=1,007), we document considerable heterogeneity in climate transition beliefs at different horizons. More optimistic climate transition beliefs are associated with higher expected green financial performance and preferences for green investments, especially for investors without strong pro-environmental attitudes. A pre-registered information provision experiment (N=3,003) provides causal evidence on the link between climate transition beliefs and investment behavior. By influencing the availability of capital for green projects, the prevailing narratives and beliefs around the energy transition can have self-fulfilling tendencies.

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1 Introduction

The transition to a low-carbon economy requires increasing clean energy investments to almost USD 4 trillion annually until 2030, four times the amount invested in 2022 (IEA, 2023d). Although many investors have stepped up their engagement on this front in recent years (e.g., Bloomberg, 2024), many challenges remain in understanding what can drive financial markets to fully commit to the energy transition.

This paper studies the role of subjective expectations about the trajectory of the energy transition—what we call "climate transition beliefs"—as a significant driver of green investments.[1] The existing literature analyzes green investments mainly through the lens of the cost of capital: If some investors have pro-environmental preferences, green firms can benefit from a lower cost of capital (Heinkel et al., 2001). Thus, in equilibrium, green investments should have lower expected and realized returns than conventional ones (Pástor et al., 2021, 2022). Similar conclusions follow from green firms' lower exposure to climate-related risks, which should command lower required returns (e.g., Bolton and Kacperczyk, 2021, 2023; Hsu et al., 2023). However, while often allowing for heterogeneous environmental preferences, the literature usually assumes that investors agree on *which equilibrium* to expect in terms of cash flows. The "complete agreement" assumption is innocuous when beliefs, although heterogeneous, are "on average" correct (Fama and French, 2007). But the energy transition is

[1] We use the name "climate transition beliefs" as it relates to the widespread concept of "climate transition risks". While the latter generally refers to the risks deriving from society's transition away from fossil fuels, climate transition beliefs are the expectations about whether and how quickly that transition will actually occur.

(in perspective) just one single, uncertain event: Differences in investors' opinions about its expected outcome do matter and are important to consider. This paper provides evidence of considerable heterogeneity in climate transition beliefs, which influences the formation of return expectations and investment decisions.

Climate transition beliefs are difficult to infer exclusively based on observational data. Hence, we employ survey and experimental techniques, which allow us to link beliefs to financial performance expectations cleanly. Our analyses proceed in two steps: a pre-registered survey (N=1,007), run in November 2023, and a pre-registered information provision experiment (N=3,003), run between January and February 2024. We conducted both analyses based on representative samples of U.S. retail investors.

The survey provides descriptive evidence of climate transition beliefs and their relationship with environmental preferences and investment perceptions. We proxy climate transition beliefs through subjective expectations on a particular dimension: the share of U.S. electricity generated using renewable energy sources (solar, wind, and hydroelectric power) at the 2030, 2040, and 2050 horizons. This methodological approach has two major advantages. First, the electricity sector is the largest source of global carbon emissions, and expanding renewable electricity generation is the single most crucial driver of the transition (e.g., IEA, 2023a). Second, it allows us to capture respondents' expectations about the very complex phenomenon of the energy transition through simple and concrete questions.

We start by documenting a considerable heterogeneity in climate transition beliefs: Younger,

female, and left-leaning investors are significantly more optimistic about the climate transition. Climate transition optimism correlates positively—but far from perfectly—with pro-environmental preferences, confirming that beliefs and preferences are distinct dimensions of human thinking. Transition optimism also correlates positively with climate concerns, that is, with pessimism about the physical impacts of climate change.

We then study the relationship between climate transition beliefs, green expected financial performance, and investment decisions. Climate transition optimists are more likely to invest in a green (compared to a conventional) fund and expect *both* higher returns and lower risks, as if they perceive the energy transition to be not yet adequately priced in by financial markets. These findings hold after controlling for individual characteristics and preferences such as age, income, political orientation, pro-environmental preferences, and climate concerns. The effects are of first-order economic importance: A one-standard-deviation higher *Climate transition beliefs 2050* is associated with an increase in relative green expected returns of almost one-third of a standard deviation. This is about 1.4 times the effect on green return expectations of one-standard-deviation higher pro-environmental preferences.

We also find that investors' climate transition beliefs interact in non-trivial ways with other climate-related attitudes: The positive effect of climate transition beliefs on green expected returns and investments is significantly more substantial for investors *without* strong pro-environmental preferences or climate change concerns. In other words, we find that green taste substitutes for beliefs in forming green investment expectations and preferences.

In the second step of our analysis, we run a pre-registered, randomized information provision experiment to establish the causal effect of climate transition beliefs on perceptions of green investments. Our strategy is similar to the one employed in the literature studying the impact of beliefs on various aspects of individual behavior (Haaland et al., 2023). We recruited a sample of 3,003 retail U.S. investors (who did not participate in the baseline survey), randomly split into three groups: "No Treatment," "Pessimism Treatment," and "Optimism Treatment." The No Treatment group completed a survey identical to the baseline one run in November 2023, effectively representing a second wave run after the 2023 United Nations Climate Change Conference (COP28) held in Dubai in December 2023.

For the two active treatment groups, before eliciting expectations about the energy transition and investment preferences, we showed one of two 90-second animated videos offering truthful yet opposing perspectives on the evolution of the energy transition. The Optimism Treatment video highlights the significant progress made by renewable energy technologies in recent years. The Pessimism Treatment video focuses instead on the remaining challenges of transitioning to a low-carbon economy.[2] We pre-registered the experiment, and the fieldwork occurred between January 22 and February 4, 2024.[3]

We start by comparing the responses in the No Treatment group (N=868) with those in the baseline survey run two months earlier, before COP28. We observe similar distributions

[2]The two videos can be watched at these links: `https://www.youtube.com/watch?v=zmAWD9uagmc` (Pessimism Treatment) and `https://www.youtube.com/watch?v=ye4kI4Se1ZE` (Optimism Treatment). The script of the videos is available in Appendix Table A12.

[3]The PDF of the pre-registration is available at `https://aspredicted.org/blind.php?x=DDD_KTF`.

of climate transition beliefs and confirm the main results obtained with the baseline survey. We then compare the average climate transition beliefs in the Pessimism (N=1,089) and Optimism (N=1,046) Treatment groups. Respondents randomly allocated to the Optimism Treatment group display more optimistic climate transition beliefs than those in the Pessimism Treatment group. For instance, the average *Climate transition beliefs 2050* in the Optimism treatment is 63.54% compared to 58.26% in the Pessimism treatment, a sizeable and statistically significant difference (two-sided t-test: $p < 0.001$). The results confirm the success of our information treatments in exogenously influencing beliefs in the desired directions.

Next, we analyze the second-stage treatment effects on investment perceptions. We find that respondents in the Optimistic treatment, relative to those in the Pessimism treatment, associate the green investment option with significantly higher returns (two-sided t-test: $p < 0.001$) and lower risk (two-sided t-test: $p < 0.01$). These results confirm the causal effect of climate transition beliefs on green financial expectations. This extra green expected performance leads to a slight, not statistically significant, increase in the share of respondents selecting the green fund (62.04% in Optimism Treatment vs. 60.79% in Pessimism Treatment). However, the significantly higher expected return (and lower risk) associated with the green fund in the Optimism Treatment group indicates the potential for an important increase in the intensity of green investments.

Our paper makes three main contributions. First, it highlights the role of belief hetero-

geneity about the energy transition in shaping expected returns and investment decisions. In asset pricing, the importance and effects of belief disagreement—for instance, in terms of optimism and pessimism in future economic conditions—have been long studied (e.g., Keynes, 1936, Harrison and Kreps, 1978, De Long et al., 1990, Fama and French, 2007, or, more recently, Martin and Papadimitriou, 2022). Indeed, survey evidence points to a large belief dispersion as a pervasive feature of financial markets (e.g., Puri and Robinson, 2007; Ben-David et al., 2013; Coibion et al., 2018; Giglio et al., 2021b).[4] However, despite the disruptive role of climate change and the energy transition on the economy, the role of heterogeneous climate transition beliefs on investment decisions remains vastly unexplored.[5] A few works offer insights. Pedersen et al. (2021) theoretically show that when environmental, social, and governance (ESG) scores simultaneously provide information about firm fundamentals and affect investor preferences, the expected returns on high-ESG stocks depend on the relative importance of investors' green preferences and green mispricing. The model in De Angelis et al. (2023) studies companies' incentives to reduce carbon emissions when some investors favor green firms for preference reasons but potentially also cash-flow

[4]Of course, existing evidence points to significant heterogeneity across individuals also on other dimensions relevant to financial markets, such as the level of risk aversion (e.g., Cohen and Einav, 2007), time preferences (e.g., Gollier and Zeckhauser, 2005), or preferences for truthfulness (e.g., Gibson et al., 2013). More recently, Jiang et al. (2024) study how the "Big Five" personality traits correlate with investors' preferences and decisions.

[5]Relatively more works consider heterogeneity in investor horizons. Starks et al. (2023) document a segmentation of institutional investors, with long-term investors having higher stakes in high-ESG firms and behaving more patiently toward them. Chen et al. (2020) find that institutions with longer investment horizons are more likely to influence portfolio firms' CSR policies positively. Ramelli et al. (2021) find that, in reaction to the 2016 Trump election, shorter-term investors rewarded high-carbon firms, while longer-term investors rewarded firms better positioned to face the boomerang in climate regulation post-Trump.

considerations. Cahen-Fourot et al. (2023) theoretically study how heterogeneity in beliefs about the speed of the energy transition can influence the share of low-carbon investments. Ramadorai and Zeni (2024)—based on responses to the Carbon Disclosure Project—show that heterogeneous firms' beliefs about future climate regulation influence their emissions reduction activities. To our knowledge, our study is the first to provide survey and experimental evidence on investor heterogeneity in climate transition beliefs and the effects on investment preferences.

Second, the paper contributes to the literature on sustainable investment behavior, particularly concerning climate change. It is well-documented that many investors prefer socially responsible (Hartzmark and Sussman, 2019; Bauer et al., 2021) and climate-conscious investment products (Ceccarelli et al., 2024). A growing body of literature investigates what lies behind this preference, often by directly surveying investors (e.g., Riedl and Smeets, 2017; Aron-Dine et al., 2023; Degryse et al., 2023; Giglio et al., 2023).[6] We contribute to this literature by studying a first-order factor driving the formation of heterogeneous green return expectations and, in turn, preferences for green investments: different beliefs about the fate and pace of the energy transition. Our insights into how climate transition beliefs

[6]Riedl and Smeets (2017) emphasize the role of investors' pro-social preferences (but also find a role for performance expectations). Anderson and Robinson (2022) study how pro-environmental attitudes influence green investments among Swedish households. Aron-Dine et al. (2023) survey a representative sample of German households and document substantial heterogeneity in taste for risk-free and risky green financial assets. Degryse et al. (2023), in a representative sample of the Dutch population, identify two types of ESG investors, some driven by social motives and some by financial considerations. Giglio et al. (2023) survey retail Vanguard investors and document significant heterogeneity in individual motives for ESG investing and in ESG return expectations.

and pro-environmental preferences interact in influencing investment decisions are relevant for advancing the theoretical and empirical "climate finance" literature (see Giglio et al., 2021a and Hong et al., 2020 for reviews) and better understanding the roles of "value" and "values" considerations in sustainable investing (Starks, 2023).

Finally, we contribute to the literature on the role of narratives in shaping beliefs and economic outcomes (Shiller, 2017; Hirshleifer, 2020). Goetzmann et al. (2022) show the effects of crash narratives on economic choices, while Bursztyn et al. (2023) study how narratives shaped behaviors during the COVID-19 pandemic. Dechezleprêtre et al. (2022) show how simple information treatments can influence individual attitudes toward climate change and policies. A growing literature employing information provision experiments exploits the power of narratives to study the causal effects of beliefs on individual behavior (see Haaland et al., 2023 for a review). Our paper is the first to show that more optimistic or pessimistic narratives and beliefs on the energy transition influence perceptions of green investment opportunities. This is particularly important because the availability of capital to finance green investments can, in turn, accelerate or delay the energy transition, potentially making climate transition beliefs a self-fulfilling prophecy (e.g., Battiston et al., 2021; Biais and Landier, 2022; Smulders and Zhou, 2022).

The rest of the paper is structured as follows. Section 2 describes the baseline survey conducted in November 2023 and a series of stylized facts about climate transition beliefs and investment behavior. Section 3 describes the experiment conducted in January 2024 and

discusses the main treatment effects and cross-sectional heterogeneity. Section 4 concludes.

2 Survey evidence

2.1 Survey design

In November 2023, we recruited 1,007 U.S. retail investors in collaboration with YouGov.[7] We restricted the sample to individuals in the YouGov U.S. panel holding either one among common stock, corporate bonds, stock or bond mutual funds, or exchange-traded funds (ETFs). Based on the resulting pool of potential respondents, we set sampling quotas on gender and age to make our sample broadly representative of U.S. retail investors. We pre-registered the survey, and the fieldwork occurred between November 23 and November 29, 2023 (before the start of the COP28 on November 30, 2023).[8] The median completion time was approximately 12 minutes.

The complete survey flow is available in Appendix Section 4, and the detailed variable description is in Appendix Table A1. We describe the most important survey questions and their corresponding variables in what follows.

[7]YouGov is a worldwide leader in online surveys, with a reputation for high-quality panel sampling. Recent works based on surveys run in partnership with YouGov include, for instance, Chapman et al. (2023), Haaland and Næss (2023), and Nordhaus and Rivers (2023).

[8]The PDF of the pre-registration is available at `https://aspredicted.org/XL7_RLF`. The survey complies with our institutions' "Ethical Soundness of Research Projects" checklists.

2.1.1 Climate concerns and environmental preferences

The first set of questions asks respondents about their climate concerns and environmental preferences. The variable *Pro-environmental preferences* reflects the response to the question "To what extent do you feel a personal responsibility to try to mitigate climate change?" on a 1-10 Likert scale. This question captures how much a person feels a personal obligation to contribute to solving an environmental problem, which widespread evidence identifies as an essential element for turning concerns into action (Poortinga et al., 2018). *Climate change worry* is the response to the question "To what extent are you worried about climate change?" on a 1-5 Likert scale. We also elicit respondents' second-order beliefs about future climate concerns, that is, their expectations of which share of the U.S. population will be worried or very worried about climate change by 2030, 2040, and 2050. This question reflects the concept that the climate transition is also a change in personal values and social norms (Andre et al., 2021; Besley and Persson, 2023), that some investors may anticipate more than others; these second-order beliefs may significantly influence investment decisions (e.g., Schmidt-Engelbertz and Vasudevan, 2023). We name the corresponding variables *Second-order climate change (CC) worry 2030 [2040][2050].*

2.1.2 Climate transition beliefs

Second, we ask respondents about their expectations about the energy transition. We proxy climate transition beliefs through expectations about the share of U.S. electricity generated

using renewable energy sources (solar, wind, and hydroelectric power). We use this approach for two main reasons. First, the electricity sector is critical in the transition to a low-carbon economy, being the single largest source of global carbon emissions. Consequently, expanding the share of renewables in electricity generation is considered the most critical driver of emission reduction in the following decades (e.g., IEA, 2023b). Second, it allows us to capture respondents' expectations about the complex phenomenon of the energy transition through relatively simple and concrete questions.

We first elicit respondents' prior knowledge about the percentage of U.S. electricity currently generated from renewable energy sources rather than fossil fuels and nuclear power (*Prior beliefs 2023*). We then inform respondents that, in 2022, according to official statistics, the share of U.S. electricity generated using renewable sources was around 22%, up from 10% in 2010 (e.g., U.S. EIA, 2023b), and ask them to express quantitative expectations about how large this share will be in 2030, 2040, and 2050.[9] We name the corresponding variables *Climate transition beliefs 2030[2040][2050]*. Next, we ask respondents how confident they are in their forecasts on a scale from 1 to 5 (*Confidence in beliefs*).

Following the recommendations of Haaland et al. (2023), we measure climate transition beliefs also through alternative approaches. *Transition beliefs 2050 – Qualitative* is the response to the question "To what extent do you agree or disagree with the following

[9]We inform respondents about the current share of U.S. renewable electricity generation to ensure that the observed heterogeneity in expectations does not derive from differences in information about the status quo (e.g., Reis, 2006; Coibion and Gorodnichenko, 2012) but from differences in subjective models about the future (e.g., Andre et al., 2022).

statement? In 2050, the U.S. will generate the majority (>50%) of its electricity needs from renewable energy sources like solar, wind, and hydroelectric power", from a 1 (Strongly agree) to 5 (Strongly disagree) scale. This alternative measure has the advantage of being even more accessible to understand than our primary measure of beliefs but less easily comparable across individuals. *Transition beliefs 2050 – Right tail* are the chances respondents attach to the possibility that in 2050, the share of U.S. electricity generation from renewable sources will be higher than 70%, while *Transition beliefs 2050 – Left tail)* are the chances that it will still be lower than 30%. These measures are a way to gauge the optimism or pessimism of respondents at specific points of the belief distribution.

Finally, we define the variable Δ *Climate trans. beliefs 2050-2030* as the difference between climate transition beliefs at the 2030 and 2050 horizons, scaled by 2030 beliefs.

2.1.3 Green investment expectations

After eliciting respondents' preferences and beliefs, we present them with two investment options: a conventional U.S. equity fund and a low-carbon (green) U.S. equity fund. Figure 1 shows the information that respondents receive. We randomize the position of the green fund as either Fund A or Fund B to avoid any potential order effects.

– Figure 1 –

The funds are anonymized, but their financial characteristics correspond to two real-world funds, the iShares MSCI USA UCITS ETF and its low-carbon version, the iShares

MSCI USA Low Carbon Target. The characteristics are as of November 2023. Regarding sustainability information, we decided to display Morningstar's Low Carbon label, whose effects on fund flows have been documented in previous research (Ceccarelli et al., 2024). The factsheets also show the two funds' percentage of the portfolio invested in firms active in fossil fuel activities (Fossil Fuel Involvement), one criterion behind the allocation of the Low Carbon label.

After asking respondents to read the factsheets carefully, we elicit their relative long-term expectations about the financial performance of the two funds. *Green expected return* is the response to the question "How do you expect the return of Fund A and Fund B to be over the next 10 years?" on a 5-point Likert scale, where 1 is "Fund A will have a much lower return than Fund B", and 5 is "Fund A will have a much higher return than Fund B" (considering the green fund always as Fund A). *Green expected risk* is the response to the question "How do you expect the risk of Fund A and Fund B to be over the next 10 years?" on a 5-point Likert scale, where 1 is "Fund A will be much less risky than Fund B" and 5 is "Fund A will be much more risky than Fund B" (considering the green fund always as Fund A).

Next, we ask respondents to hypothetically allocate USD 10,000 between either Fund A or Fund B for ten years.[10] *Green investment* is an indicator equal to 1 for respondents who

[10]In principle, we could have incentivized this choice by randomly selecting a few participants, implementing the investment choice on their behalf, and distributing the final capital to them after a specific time, as done, for instance, in Heeb et al. (2023b). However, we decided not to do that, mainly because any incentive would have required a significant shortening of the investment horizon to, for instance, one year only to allow the payment to participants within a reasonable time. We opted to keep the investment choice hypothetical and ask people to consider a 10-year horizon.

prefer investing in the green fund. Notice that we introduce this hypothetical investment decision *after* eliciting risk and return expectations. This approach allows us to avoid a potential "question order" bias (e.g., Stantcheva, 2023), which may lead respondents to post-rationalize their investment choice with performance expectations.

Finally, we elicit respondents' emotional responses to the investment decision, as done also in Heeb et al. (2023a). *Green investment emotions* reflects the response to the question "How do Fund A and Fund B compare regarding how it would feel to invest in them?" from 1 ("It feels much better to invest in Fund B") to 5 ("It feels much better to invest in Fund A"), considering the green fund as Fund A.

2.1.4 Other variables

Climate techno-optimism is the response to the question "To what extent do you agree with the following statement? New technologies will solve climate change without individuals having to make big changes in their lives." from 1 (Strongly disagree) to 5 (Strongly agree). The same question was part of the Spring 2023 wave of the Yale Program on Climate Change Communication (YPCCC) and George Mason University Center for Climate Change Communication (Mason4C) survey (Leiserowitz et al., 2023b).

In a final open-ended question, we allow respondents to share their considerations about the energy transition.

From YouGov, we obtain information about respondents' demographic characteristics

(age, gender, income, wealth, education), ZIP code of residency, and political affiliation.

From the Emissions & Generation Resource Integrated Database (eGRID) of the U.S. Environmental Protection Agency (EPA), we retrieve information about the 2021 electricity mix in 27 different U.S. sub-regions.[11] The variable *CO2 electricity (ZIP code)* is the annual CO2 total output emission rate (in kg/MWh) from electricity generation in the respondents' sub-region.

2.2 Sample characteristics

Panel A of Table 1 shows the demographic characteristics of the survey respondents.

Two-thirds of the participants are 55 and older, similar to the sample of Vanguard investors surveyed in Giglio et al. (2021b) (which has a median age of 66). Our sample is relatively gender-balanced, with 44% of female respondents. Almost 90% of respondents have at least a college education.

– Table 1 –

In terms of political preferences, 26% of respondents declare themselves as Republican, 43% as Democratic, and the remainder as either Independent or as "Other/don't know." Our sample participants are relatively high-earners, with less than a third of respondents having a (gross) yearly income smaller than USD 50k. Over half of the respondents report a wealth of over USD 250k, which aligns with the median Vanguard wealth of USD 230k

[11] The data is available at `https://www.epa.gov/egrid`..

reported in Giglio et al. (2021b). 11% and 23% of our respondents do not disclose their income and wealth, respectively. Regarding the geographical distribution of our sample, we have slightly more respondents from the South and West U.S. regions.

Panel B of Table 1 reports the summary statistics of the main variables of interest. Since the next session describes the distributions of the climate transition belief in detail, we here focus on the environmental attitude variables and the perceptions of the green investment option.

Our respondents have, on average, slightly positive pro-environmental attitudes, with a mean *Pro-environmental preferences* of 5.61 out of 10. Our respondents say to be worried about climate change, with a mean *Climate change worry* of 3.34 out of 5. *Climate change cause* has a mean of 3.10 out of 5, indicating that, on average, respondents believe climate change is caused slightly more by human activities than natural changes in the environment. *Climate techno-optimism* has a mean of 2.64 out of 5, indicating that our respondents generally do not believe that new technologies will solve climate change without individuals having to make big changes in their lives.[12]

Finally, we comment on the perceptions of the green investment option relative to the

[12]It is interesting to compare our responses to the survey run by the Yale Program on Climate Change Communication (YPCCC) and George Mason University Center for Climate Change Communication (Mason4C) in late October 2023 (N=1,033) (Leiserowitz et al., 2023a). According to their results, 63% of Americans feel a personal responsibility to help reduce global warming, 65% say to be at least "somewhat worried" about global warming, and 58% think global warming is mostly human-caused. Also, 56% of Americans do not think new technologies can solve global warming without individual action (Leiserowitz et al., 2023b). These results align well with our summary statistics despite the YPCCC-Mason4C survey focusing on the general U.S. population while we study a sample of U.S. retail investors.

conventional one. 61% of respondents expressed a preference for hypothetically investing in the green rather than in the conventional fund. On average, respondents expected the green fund to perform similarly to the conventional fund, with a mean *Green expected return* of 3.06/5 and a *Green expected risk* of 3.05/5. However, respondents who chose the green fund associated it with higher return (3.46/5) and lower risk (2.70/5); in comparison, those who chose the conventional fund associated the green one with lower return (2.42/5) and higher risk (3.60/5). In this sense, investors in the conventional fund have slightly higher performance expectations from their investment decisions (inverting the scale of *Green expected return*: 6-2.42=3.58) than investors in the green fund (3.46).

The average *Green investing emotions* of 3.28/5 indicates that, on average, respondents associated slightly more positive emotions with investing in the green rather than in the conventional fund. However, this average masks substantial heterogeneity: Respondents who chose the green fund clearly associated it with positive emotions (3.87/5), while those who chose the conventional fund associated it with less positive emotions (2.36/5). Hence, following the same logic applied above to returns, investors in the green fund experienced more positive feelings from their investment decisions (3.87) than those opting for the conventional fund (6-2.36=3.64).

2.3 Climate transition beliefs: Descriptive evidence and drivers

Figure 2 shows the distributions of our climate transition belief measures at the 2030, 2040, and 2050 horizons.

– Figure 2 –

On average, U.S. retail investors expect the share of renewable electricity generation to be around 41% by 2030, 50% by 2040, and 59% by 2050.[13] Importantly, we observe considerable heterogeneity across individuals. For instance, when considering the 2050 horizon, the standard deviation of the expected share of renewable electricity generation is around 22.5%, a sizeable magnitude when compared to its mean.

Climate transition beliefs correlate positively with pro-environmental preferences. However, their correlation is far from perfect, ranging from only .46 to .56, depending on the horizon considered. To illustrate, Table 2 reports the number of respondents above and below the medians of *Climate transition beliefs 2050* and *Pro-environmental preferences*. While many respondents lie on the diagonal (ranking either low or high levels on both dimensions), around a third of respondents have either optimistic climate transition beliefs but no strong environmental preferences (16%), or vice-versa, i.e., strong environmental preferences but low climate transition optimism (14%).

[13]These numbers are somewhat in the ballpark of the projections made by the U.S. Energy Information Administration (EIA) in March 2023 (U.S. EIA, 2023a): around 53.5% of electricity generation capacity from renewable sources by 2050, with considerable variations in this estimate under different scenarios. However, this does not mean that more optimistic expectations are necessarily "wrong". For instance, in 2012, the EIA forecasted the U.S. share of renewable electricity generation to be 15% in 2035 (U.S. EIA, 2012), a level then reached already in 2016, 19 years ahead of the forecast.

– Table 2 –

In Table 3, we provide further descriptive evidence by regressing *Climate transition beliefs 2050* on individual characteristics. (In this and the following analyses, we use 2050 as our preferred horizon because we are most interested in long-term expectations. We report the results with the 2030 and 2040 measures in the Appendix.) We find that younger (column 1), female (column 2), and higher income and less wealthy (column 3) investors express a significantly higher degree of climate transition optimism. We do not observe any significant effect of graduate education (column 4).

– Table 3 –

In column 5, we find that political preferences strongly correlate with climate transition beliefs. On average, Democrat investors expect the share of green electricity generation in 2050 to be around 16.5% higher than Republicans expect. Figure 3 shows the distributions of *Climate transition beliefs 2050* separately for the two groups of investors. Republican and Democrat investors show a noticeable discrepancy in their distribution of *Climate transition beliefs 2050*. This result confirms, in the context of the energy transition, the role of political preferences in shaping expectations about the future (e.g., Kempf and Tsoutsoura, 2021; Meeuwis et al., 2022; Mian et al., 2023). Of course, personal political preferences are at least partially rooted in the vision of the world proposed by the preferred political parties.

– Figure 3 –

Going back to Table 3, column 6 explores the role of the local electricity market of respondents. For instance, respondents who live in ZIP codes with a larger share of dirty (i.e., high-CO2 emitting) energy sources might be more pessimistic regarding the energy transition. To this end, we match participants' ZIP codes to the EPA's data on the carbon intensity of the local electricity generation. Indeed, areas with a higher CO2 intensity of electricity generation have a lower average climate transition optimism.

In column 7, we include all individual characteristics in a multivariate regression. The R^2 from this regression is particularly interesting: It indicates that observable demographic characteristics can explain only a small fraction (16%) of investor heterogeneity in expectations about the future development of the energy transition. The three most important variables in terms of explanatory power seem to be political affiliation, age, and income and wealth (in this order). However, climate transition beliefs appear mostly idiosyncratic to observed individual characteristics. The following section studies how this heterogeneity affects green investment beliefs and preferences.

2.4 The role of climate transition beliefs on green expected return, risk, and investments

This section explores the relationship between climate transaction beliefs, the expected financial performance of green investments, and green investment preferences.

Table 4 investigates the relationship between climate transition beliefs at the 2050 horizon

and the expected return on the green fund relative to the conventional one.

– Table 4 –

Investors with a higher degree of climate transition optimism have significantly higher green return expectations than other investors. The effect is of first-order economic importance: A one-standard deviation higher *Climate transition belief 2050* (22.48%) is associated with about one-third of a one-standard-deviation increase in green expected returns (0.2248 $\times$1.55=0.35). The magnitude of this effect decreases only mildly after controlling for individual characteristics (age, gender, education, income, wealth, political affiliation, and region) in column 2.

In columns 3 and 4, we further include individual pro-environmental preferences and climate change concerns in the regressions. Beliefs continue to have a positive and significant effect. In column 5, we find a similar result when also considering second-order beliefs on future climate change concerns.[14] Interestingly, second-order beliefs on future climate concerns are associated positively with green expected returns. This finding indicates that the progressive increase in climate concerns ("climate-concern shocks" in Pástor et al., 2022), and the resulting effects on the price of green assets, may not be that unexpected to many green investors.

Transition-optimistic investors might expect higher green returns as compensation for higher perceived risk exposure. We test this possibility in Table 5, where we explore the

[14]We do not include *Climate change worry* in this specification since it correlates strongly with *Pro-environmental preferences* ($.72, p < 0.001$).

relationship between climate transition beliefs at the 2050 horizon and the expected risk of the green investment. On average, investors with a higher degree of climate transition optimism expect green investments to be *less* risky than conventional ones. The economic magnitudes of the effects are similar to those documented for green expected returns. The finding that more climate transition optimistic investors believe that green investments will deliver higher returns and lower risk aligns with the experimental results in Hartzmark and Sussman (2019) about the perceived performance of sustainability mutual funds and the role of emotions. However, we stress that in the presence of heterogeneous beliefs, it may still be perfectly "rational" for investors to expect an investment aligned with their beliefs to be associated with both higher returns and lower risk (e.g., Fama and French, 2007). In other words, transition-optimistic investors may perceive the green fund as underpriced.[15]

– Table 5 –

Finally, in Table 6, we study if climate transition beliefs relate to preferences for green investing. Based on the estimate in column 1, a one-standard-deviation higher level of climate transition beliefs is associated with a 15.51 percentage point increase in the likelihood of choosing the green fund. This effect is economically sizeable, corresponding to about a quarter of the unconditional probability of investing in the green fund (61%).

[15]Our perceived mispricing interpretation is also consistent with Stroebel and Wurgler (2021), who document, in a survey of finance experts, a generalized opinion that asset markets are currently underestimating climate risks. Expecting greener stocks to have a higher return and lower risk is also consistent with investors' neglect of equilibrium pricing, as explored in Andre et al. (2023).

– Table 6 –

Interestingly, the effect's magnitude shrinks by up to two-thirds when we account for green expected returns, risk, or both in columns 4 to 6. This result indicates that risk and return expectations mediate the effect of climate transition beliefs on green investment preferences, in line with our interpretation.

2.5 Robustness

This section presents a series of robustness checks that confirm the validity of our findings.

First, our analyses so far considered individual transition beliefs at the 2050 horizon. However, Appendix Table A2 shows that the positive relationship between green expected returns and transition beliefs holds even when considering beliefs at the 2030 and 2040 horizons. Appendix Figure A1 shows this graphically through binned scatterplots.

Second, our findings on the drivers of green expected returns are robust to employing alternative measures of climate transition beliefs. In Appendix Table A3, we employ our qualitative measure of transition beliefs (*Climate transition beliefs 2050 – Qualitative*) based on respondents' perceived likelihood that, in 2050, the U.S. will generate the majority (>50%) of its electricity needs from renewable sources. In Appendix Table A4, we employ the alternative measures of climate transition beliefs based on the subjective expectations (in %) that, by 2050, the share of U.S. electricity generated from renewable sources will be lower than 30% (*Climate transition beliefs 2050 – Left tail*) and higher than 70% (*Climate*

transition beliefs 2050 – Right tail).[16]

Third, a potential concern is that general optimism might influence both expectations for the energy transition and returns expectations.[17] Given that general optimism should affect beliefs across all horizons, we can control for it by looking at within-respondent differences. To this end, in Appendix Table A5, we employ our measure capturing the change in beliefs between the 2030 and 2050 horizons (Δ *Climate trans. beliefs 2050-2030*).

Fourth, in Appendix Table A6, we replicate our analysis of expected returns, focusing exclusively on respondents who declared to be at least 'Somewhat confident' in their forecasts on the future evolution of the share of U.S. electricity generation from renewables.

Finally, in Appendix Table A7, we exclude respondents with poor prior knowledge about the current share of U.S. electricity generation from renewables. Specifically, we compute the absolute difference between *Prior beliefs 2023* and the actual 2023 share of U.S. renewable electricity generation (around 22%), excluding the sample's top 10% of participants with the poorest level of prior knowledge.

All the robustness checks confirm the positive relationship between climate transition optimism and green expected returns.

[16]Notice that the sign of the coefficient on the *Climate transition beliefs 2050 – Left tail* is negative since larger left tails reflect a larger degree of climate transition pessimism.

[17]General optimism is likely to influence return expectations of *both* the green and conventional funds and, hence, should essentially cancel out in our relative measure of expected returns.

2.6 Cross-sectional heterogeneity

How do climate transition beliefs interact with other climate-related personal traits in investment decisions? To answer, in Table 7, we regress *Green expected return* (columns 1 and 2), *Green investment* (columns 3 and 4), and *Green investment emotions* (columns 5 and 6) on our primary measure of climate transition beliefs interacted with pro-environmental preferences and climate concerns.

– Table 7 –

Given a certain level of transition beliefs, we find that stronger pro-environmental preferences (column 1) or climate change worries (column 2) reduce the effects of beliefs on green expected returns. We obtain similar results when considering the drivers of investing in the green rather than the conventional fund (columns 3 and 4).

Figure 4 illustrates the cross-sectional heterogeneity of our main results by splitting the sample into respondents with and without strong pro-environmental preferences. We define strong pro-environmental preferences based on the top quartile of *Pro-environmental preferences* (equal to a value of 8 out of 10, or higher). The sample split confirms that climate transition beliefs are a significant driver of green expected returns only among respondents *without* strong pro-environmental preferences. The difference is even starker when considering the preference for green investments (Panel B). Here, amongst investors with strong pro-environmental preferences, we even observe a slightly negative (marginally statistically

significant) effect of climate transition optimism on green investments (two-sided t-test: $p = 0.093$). Among respondents without strong pro-environmental preferences, climate transition optimism strongly influences green investments (two-sided t-test: $p < 0.001$).

– Figure 4 –

It is interesting to relate our empirical results with theoretical models à la Heinkel et al. (2001) or Pástor et al. (2021), which assume heterogeneous environmental taste but homogeneous beliefs. In our analyses, we do not find that investors with strong pro-environmental preferences, on average, expect a green investment to deliver lower returns than a conventional one. However, we find that for these environmentally conscious investors, the effect of their climate transition beliefs on green expected returns is significantly lower than it is for other investors. In other words, for them, "cash flow" considerations seem to be a relatively less critical driver of green return expectations and investment decisions.

To further highlight the role of green taste in investment decisions, in columns 5 and 6 of Table 7, we regress *Green investment emotions* on the interactions between pro-environmental preferences (or climate worry) and climate transition beliefs. As expected, both pro-environmental preferences and climate transition beliefs directly increase the positive emotions associated with green investing. However, the two dimensions interact negatively, suggesting that the felicity of high-environmental-preference individuals is less sensible to cash-flow expectations than other investors. (We obtain similar results when restricting the sample to respondents choosing the green investment.)

3 Experimental evidence

To test the causal role of climate transition beliefs, we run a pre-registered information provision experiment that exogenously changes the information sets of respondents. We use the exogenous variation in beliefs generated by the information treatments to identify the causal effect of climate transition beliefs on green expected financial performance and investments. The strategy is similar to the one employed in the literature studying the effects of beliefs on various aspects of individual behavior, e.g., Alesina et al. (2023), Colonnelli et al. (2023), Dechezleprêtre et al. (2022), and Roth and Wohlfart (2020).[18]

For the experiment, we recruited 3,003 U.S. retail investors from the same panel used for the baseline survey (i.e., YouGov respondents holding one among common stock, corporate bonds, stock or bond mutual funds, or ETFs). We exclude the individuals who completed the baseline survey from the panel to avoid potential learning effects. We pre-registered the survey, and the fieldwork occurred between January 22 and February 4, 2024.[19]

In what follows, we describe the experimental procedures and results.

3.1 Information treatments

The experiment includes all the exact questions as in the baseline survey. The only difference is the random allocation of respondents to one of three groups: a 'No Treatment,' an

[18]In designing the experiment, we greatly benefited from the suggestions and best practices from the literature reviewed in Haaland et al. (2023) and Stantcheva (2023).

[19]The pre-registration is available at this link: `https://aspredicted.org/blind.php?x=DDD_KTF`. The experiment complies with our institutions' "Ethical Soundness of Research Projects" checklists.

'Optimism Treatment,' and a 'Pessimism Treatment' group. As illustrated in Figure 5, we administered the treatments between the "1. Climate concerns and preferences" and "2. Climate transition beliefs" question sets, that is, before asking about expectations about the future development of the energy transition and investment perceptions.

– Figure 5 –

The No Treatment group's survey is identical to the one run in November 2023. It effectively represents a second wave of our baseline survey, allowing us to 1) replicate the main findings discussed in the previous section, 2) compare the evolution of climate transition beliefs after the 2023 United Nations Climate Change Conference (COP28) held in Dubai in December 2023 (UNFCCC, 2023), and 3) have a clear benchmark to interpret better the causal effects triggered by the two active treatments.[20]

For the Pessimism and Optimism Treatment groups, the treatments consist of one of two 90-second animated videos prepared in collaboration with Science Animated. The videos are both based on factual data but offer opposing perspectives on the evolution of the energy transition. Figure 6 shows selected screenshots of the two videos, while Table A12 in Appendix 4 reports the exact scripts. The two videos are available at these links:

[20] As noted in Haaland et al. (2023) and Stantcheva (2023), directly comparing a "passive" (no information provision) and an "active" (information provision) group may confound the effects of priming and belief updating, a usual challenge in information provision experiments. In this sense, comparing only between active treatment groups has the advantage of keeping the priming effect common across groups, isolating the pure effects of the information provision. However, having a pure control group also has advantages. For instance, in our setting, it allows us to assess whether the two treatments have heterogeneous effects based on the respondents' pro-environmental preferences. We decided to have three groups (a no-treatment group and two active treatment groups) to grasp the advantages of both approaches.

- Pessimism Treatment: https://www.youtube.com/watch?v=zmAWD9uagmc

- Optimism Treatment: https://www.youtube.com/watch?v=ye4kI4Se1ZE

– Figure 6 –

The Optimism Treatment video highlights the significant advance of renewable energy technologies in recent years, such as the tenfold decrease in the levelized cost of solar energy from 2010 to 2022 (IRENA, 2023b). It also informs that in 2022, renewables represented more than 80% of the new electricity capacity added globally every year, dwarfing investments in new fossil fuel projects (IRENA, 2023a). Finally, it emphasizes that renewables enjoy growing public support (e.g., Reuters, 2023), which may facilitate the adoption of even more public policies to accelerate clean energy solutions.

The Pessimism Treatment video focuses on challenges to the energy transition, such as the need to double the electric infrastructure by 2040 (IEA, 2023a). Next, it informs that, despite the rise of renewables, the absolute level of global investments in fossil fuels also grew between 2020 and 2023 (IEA, 2023c), and that fossil fuels still account for more than 80% of global energy production (EI, 2023). Finally, it mentions that the phase-out of fossil fuels faces growing public resistance in many countries, which may complicate the adoption of public policies to accelerate clean energy solutions.[21]

[21]Note that this statement does not contradict the information disclosed in the Optimist video. For instance, according to a Pew Research Center survey in June 2023, most Americans think the U.S. should prioritize the development of renewable energy over fossil fuel sources. At the same time, most said they are not ready to stop using fossil fuel energy sources altogether (PEW, 2023).

– Table 8 –

Table 8 shows summary statistics of the main outcome variables of interest by treatment group.[22]

3.2 Baseline vs. second-wave survey

This section analyzes the responses in the No Treatment group (N=868), an identical second wave of the baseline survey. The setting allows us to compare and control for the evolution of climate transition beliefs in the U.S. between the end of November 2023 and January 2024, before and after the COP28 (UNFCCC, 2023).[23]

Appendix Figure A2 shows that the distribution of *Climate transition beliefs 2050* (both also at other horizons) in the second wave is very similar to one in the baseline survey. In Appendix Table A2, we confirm in formal OLS regressions the lack of significant differences in *Climate transition beliefs 2050*, *Pro-environmental preferences*, or *Climate change worry* between the two waves.[24]

[22]The No Treatment group has fewer participants than the Pessimism and Optimism Treatment groups (868 vs. 1,089 and 1,046) due to a different attrition rate, i.e., the share of respondents starting but not completing the survey. Specifically, the attrition rate in the No Treatment group is approximately 22% (a rate in line with other surveys of similar length reviewed in Stantcheva, 2023) relative to 10% and 12% in the Pessimism and Optimism treatment groups, respectively. This difference—which does not bias our analyses as we mostly compare outcomes across the two active treatment groups—confirms that adding a short video to a survey increases participants' engagement.

[23]It is ex-ante unclear how the results of COP28 may have influenced beliefs (see, e.g., Sanderson, 2023). Some observers saw the climate mitigation glass half full, emphasizing the agreement by most countries to "transition away from fossil fuels" and triple renewable electricity capacity by 2030. Other observers saw it as half-empty due to the lack of a clear call to "phase out" fossil fuels.

[24]We also successfully replicate all the results in the baseline survey (discussed in Section 2). For brevity, we leave those unreported.

3.3 First stage effects on climate transition beliefs

Here, we compare the levels of climate transition beliefs in the Pessimism (N=1,089) and Optimism (N=1,046) Treatment.[25] For these analyses, we focus mainly on our two "active" treatment groups to control for the potential salience and priming effects induced by our treatment videos, as suggested in Haaland et al. (2023) and Stantcheva (2023). We will employ again the No Treatment group in Section 3.5 when exploring the cross-sectional heterogeneity of the reactions to the two treatments.

– Figure 7 –

Figure 7 shows that the average level of *Climate transition beliefs 2050* in the Optimism treatment is significantly higher than in the Pessimism treatment (63.54% vs 58.26%, two-sided t-test: $p < 0.001$).[26] We deem this five percentage point difference in the expected 2050 shares of renewable electricity generation to be economically meaningful but also not unreasonably high, confirming the effectiveness and overall balance of our information treatments.

Climate transition beliefs in the Optimism treatment are significantly more optimistic than in the Pessimism treatment also when considering the 2030 and 2040 horizons (Ap-

[25] Appendix Table A9 confirms that the two active groups are balanced across individual characteristics, consistent with random assignment. Apart from small differences in the wealth distribution, the age, gender, education, political affiliation, income, and region of respondents in the two treatments are virtually identical.

[26] The average *Climate transition beliefs 2050* in the No Treatment group is 58.55%. Compared to this, the average in the Optimism Treatment is 4.98 percentage points higher (two-sided t-test: $p < 0.001$), while we do not observe any significant difference in beliefs between the No Treatment and Pessimism Treatment groups.

pendix Figure A3) and alternative belief measures (Appendix Figure A4). Overall, the results indicate that our treatments had a significant first-stage effect on individual climate transition beliefs in the expected direction.

3.4 Second stage effects on green expected financial performance

We now focus on the second-stage treatment effects on green expected financial performance and investment preferences. Figure 8 shows the average *Green expected return* (Panel A), *Green expected risk* (Panel B), and *Green investment* (Panel C) in the Pessimism and Optimism treatment groups.

– Figure 8 –

Respondents in the Optimism Treatment expect the green investment option to deliver a significantly higher return than respondents in the Pessimism Treatment (3.20/5 vs. 3.02/5, two-sided t-test: $p < 0.001$). They also expect the green fund to have a lower risk (3.01/5 vs. 3.13/5, two-sided t-test: $p < 0.01$).[27] These results provide direct causal evidence of the role of heterogeneous climate transition beliefs in driving expected green financial performance.

Regarding investment preferences, 62.04% of respondents in the Optimism Treatment

[27]When compared to the No Treatment group, participants in the Pessimism Treatment group display lower green expected returns (3.02/5 vs. 3.14/5, two-sided t-test: $p < 0.05$). Participants in the Optimism Treatment group have higher green expected returns, but this difference is not statistically significant (3.20/5 vs. 3.14/5, two-sided t-test: $p = 0.23$). Again compared to the No Treatment group, participants in the Optimism Treatment have lower green expected risk (3.01/5 vs. 3.10/5, two-sided t-test: $p < 0.10$), while those in the Pessimism Treatment expect slightly higher green risks (3.13/5 vs. 3.10/5, two-sided t-test: $p = 0.51$).

chose the green fund relative to 60.79% in the Pessimism Treatment, with a difference of 1.61 percentage points that is not statistically significant (two-sided t-test: $p = 0.55$). However, notice that our measure of green investment only reflects the share of respondents who would prefer to invest in the green over the conventional fund, i.e., the *extensive* margin of green investing. While we do not directly measure the *intensive* margin, we find that the green expected return of respondents who select the green fund is 3.60/5 in the Optimism group against 3.45/5 in the Pessimism treatment group. We interpret this statistically significant difference (two-sided t-test: $p = 0.003$) as greater appetite for green investments under the Optimism condition.[28]

3.5 Heterogeneity in treatment effects

The upper Panels in Figure 9 show the heterogeneity in treatment effects on green expected return by splitting the sample into respondents with and without strong pro-environmental preferences, again defined based on the top quartile of *Pro-environmental preferences*. Here, we also use the outcomes from the No Treatment group as a benchmark to assess how respondents may have differentially reacted to one treatment or the other.

– Figure 9 –

We do not observe statistically significant differences in treatment effects between the

[28]Moreover, the not statistically significant treatment effect on the extensive margin of green investments reassures us of the limited role of a potential "experimenter demand" effect in our survey, a usual concern in social science experiments.

two groups. Nevertheless, an interesting pattern emerges. Participants with strong pro-environmental preferences (Panel A) show similar green return expectations in the Optimism Treatment as those in the No Treatment group, but have noticeably lower return expectations in the Pessimism treatment. Conversely, respondents without strong pro-environmental preferences (Panel B) reacted more similarly to the Optimism and Pessimism treatments, revising their expectations upwards and downwards relative to the No Treatment group.

Finally, Panels C and D in Figure 9 split the sample into climate techno-optimists and not climate techno-optimists based on whether they agree or not with the statement "New technologies will solve climate change without individuals having to make big changes in their lives" (*Climate techno-optimism* ≥ 4). Given their faith in future technologies, one would not expect climate techno-optimists to react much to our information treatments based on the strengths and challenges of existing solutions. Techno-optimists are also likely to believe that firms other than the ones currently included in the green fund will grasp the cash flow benefits of the energy transition. Indeed, the treatment effect on green expected returns is not statistically significant in the techno-optimist group. We interpret this as a placebo test providing further support to the validity of our findings.

4 Conclusion

The extant literature tends to analyze green investments mainly through the lens of the cost of capital, either looking at their non-pecuniary benefits or their climate-risk-hedging

attributes. In this paper, we focus instead on the "cash flow" dimension of green investing. We try to understand which type of long-term equilibrium investors envision and how their expectations influence their investment decisions today.

We provide survey evidence of considerable heterogeneity in investors' expectations regarding the state of the energy transition in 2030, 2040, and 2050. These "climate transition beliefs" capture a dimension of human thinking different from pro-environmental preferences and climate concerns. Investors with more optimistic climate transition beliefs associate green investments with higher returns and lower risk, and they are more likely to prefer a green over a conventional equity fund. Interestingly, the role of climate transition beliefs in driving green expected returns and investments is particularly important for investors without strong pro-environmental preferences.

Through a pre-registered information provision experiment, we provide causal evidence on the importance of climate transition beliefs in forming return expectations. A short, informative video about the progress of the energy transition, or the lack thereof, meaningfully shifts beliefs and, in turn, expectations about the financial performance of green assets.

The results remind us that the expected returns associated with green assets crucially depend——in addition to preferences and risk-hedging considerations——also on subjective cash flow expectations and our assumptions about their distribution.

Of course, in a world of heterogeneous expectations, investors with different opinions may all expect *ex-ante* to make the wisest investment choice, but only the future can tell who will

be proven right *ex-post*. The peculiarity of forecasting the energy transition is that "who will be proven right ex-post" depends, among other things, on green investment decisions *today*. In this sense, our findings stress the importance of credible climate commitments that can guide investors' expectations toward a low-carbon equilibrium.

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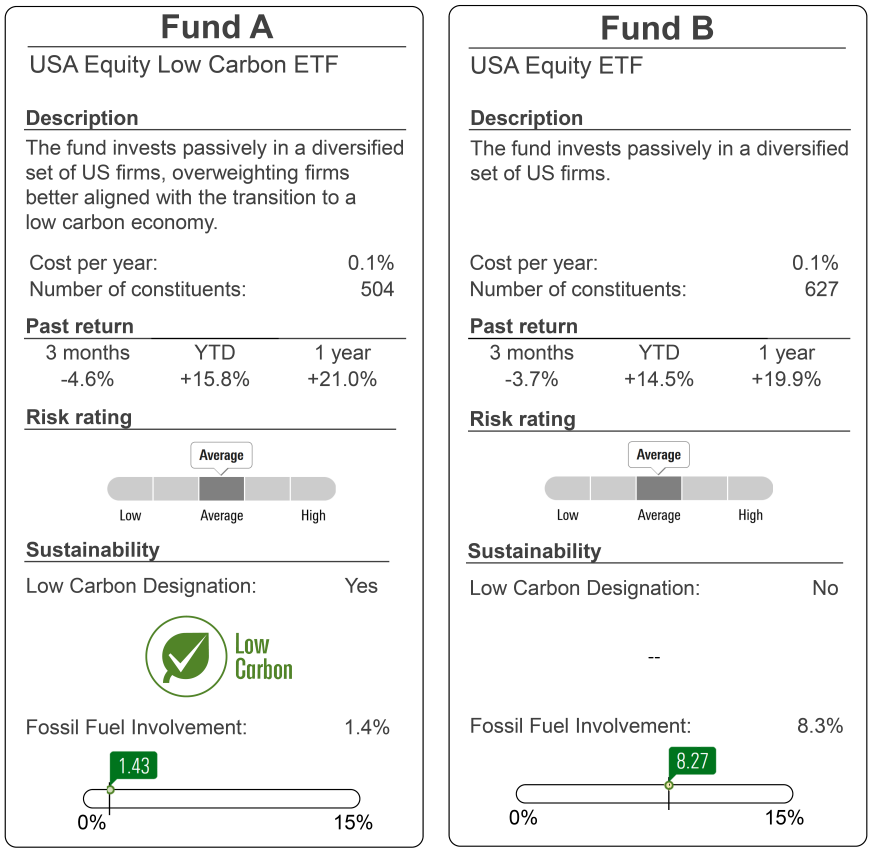
Figures

Figure 1: Investment options

This figure shows the two investment options presented to survey respondents. We randomized the low-carbon fund as Fund A or B to avoid potential order bias. The disclosed information reflects the performance of two existing funds as of November 2023: The iShares MSCI USA ETF and its low-carbon version, the iShares MSCI USA Low Carbon Target. We allowed respondents to make the image bigger to ensure perfect readability in all investment-related questions.



Notes:

- The Low Carbon Designation indicates funds with portfolios aligned with the transition to a low carbon economy.
- The Fossil Fuel Involvement score indicates the percentage of the portfolio invested in firms generating revenues from fossil fuels extraction or fossil fuel energy generation.
- Source: Morningstar.

Figure 2: Distribution of climate transition beliefs
This figure shows the distribution of climate transition beliefs at the 2030, 2040, and 2050 horizons. The variables reflect the answers to the question, "How much do you expect the share of U.S. electricity generation from renewable sources to be in 2030 [2040][2050]?".

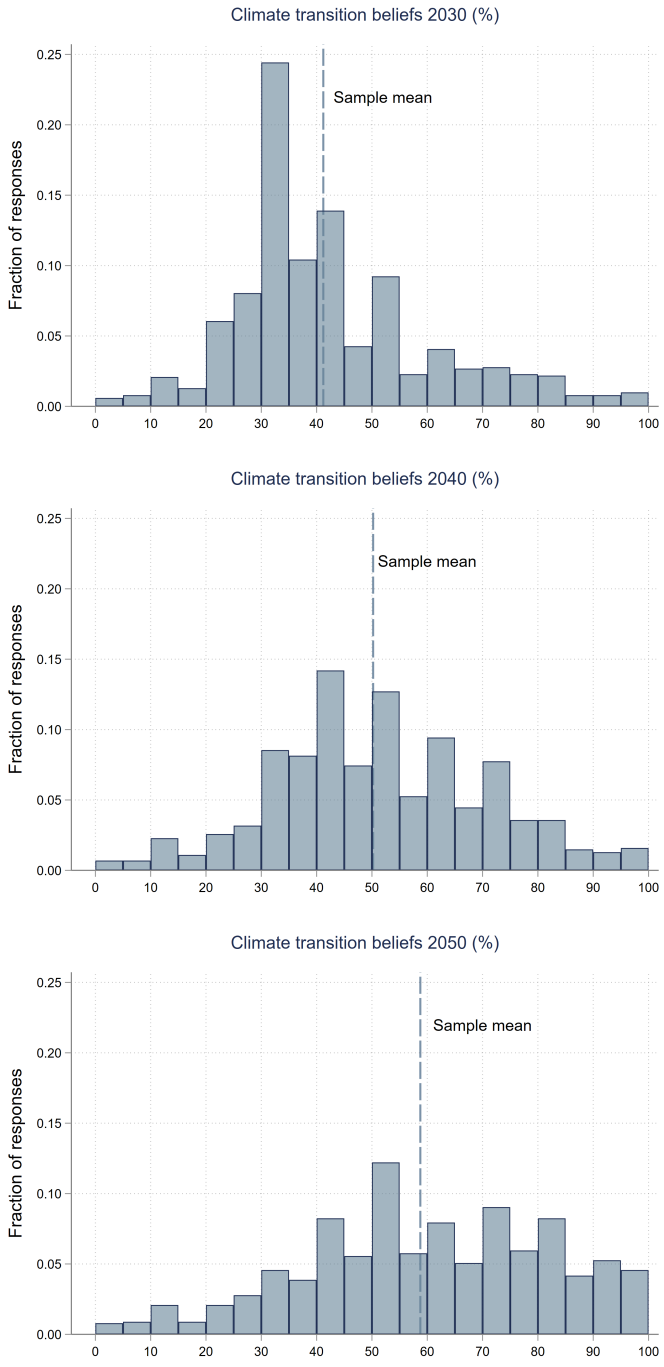


Figure 3: Political preferences and climate transition beliefs
This figure shows the distribution of climate transition beliefs at the 2050 horizon by Democrat and Republican political affiliation. *Climate transition beliefs 2050* is the response to the question "How much do you expect the share of U.S. electricity generation from renewable sources to be in 2050?".

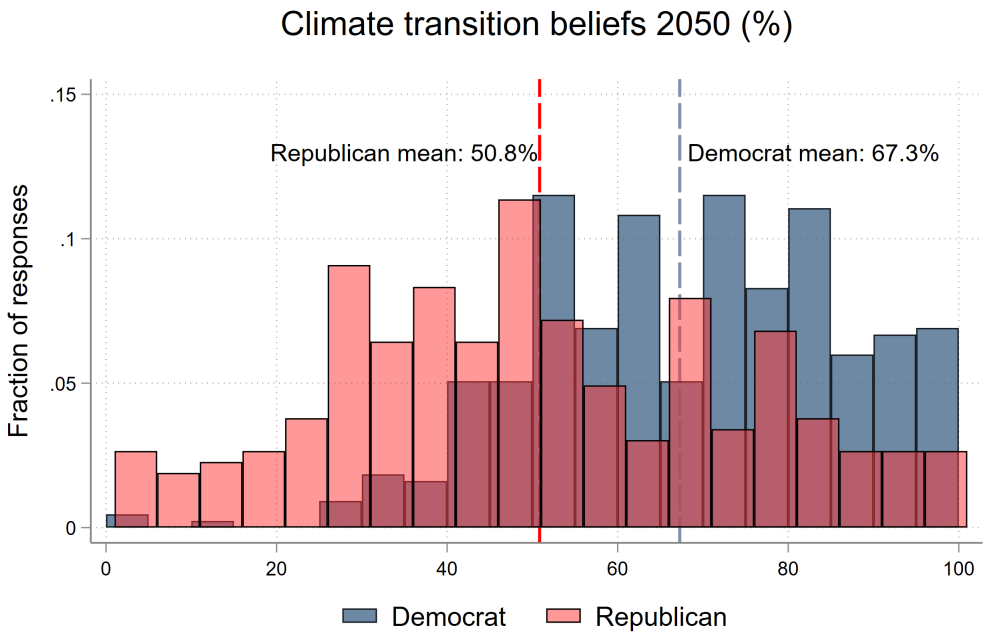


Figure 4: Cross-sectional heterogeneity: The role of pro-environmental preferences

These graphs show in binned scatter plots (with 20 bins) the relationship between *Climate transition beliefs 2050* and *Green expected return* (Panel A) or *Green investment* (Panel B) in the sub-sample of respondents with and without strong pro-environmental preferences. We define respondents with strong pro-environmental preferences as those in the top quartile of *Pro-environmental preferences*.

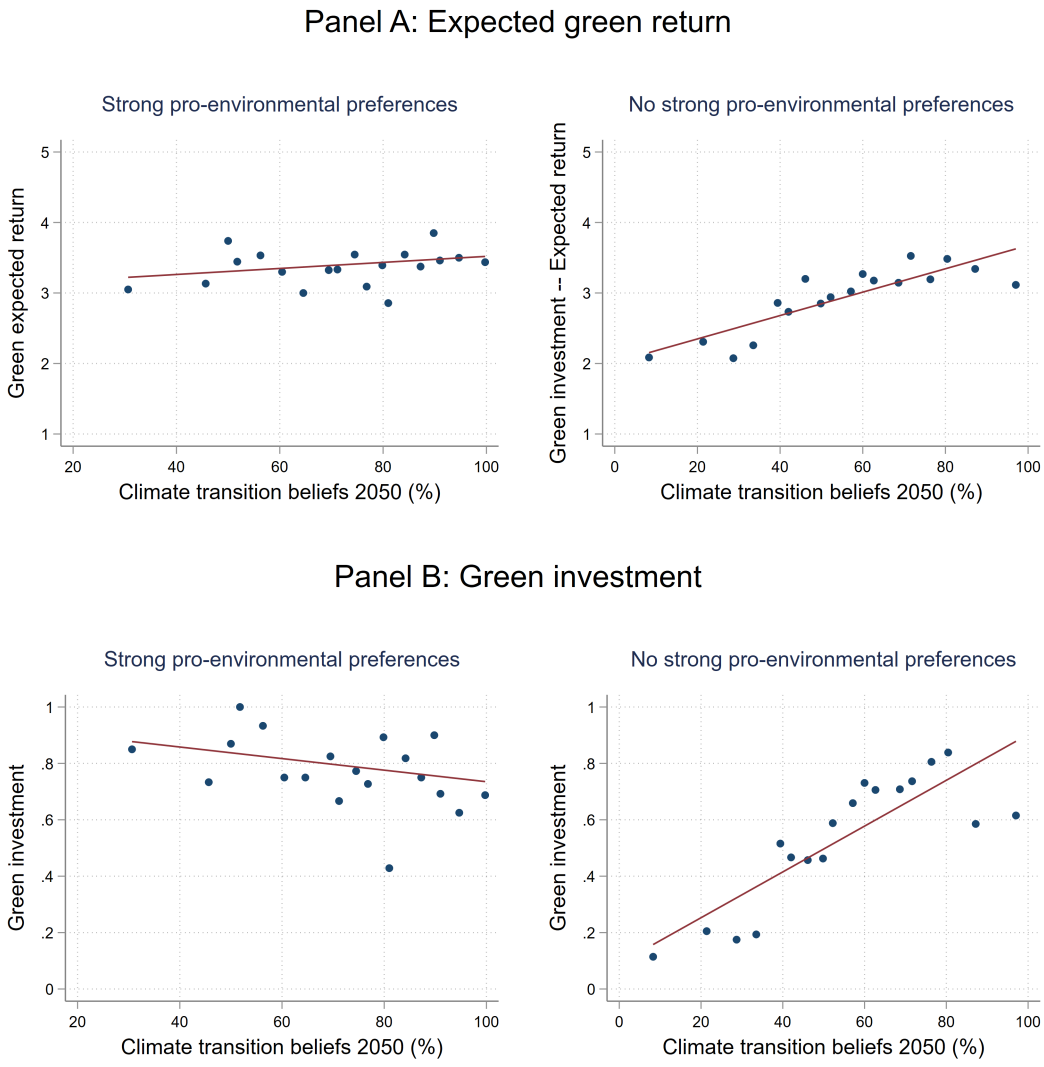


Figure 5: Experimental survey flow
This figure illustrates the flow of the experimental survey conducted between January and February 2024. The treatments were administrated before asking questions about climate transition beliefs and investment choices.

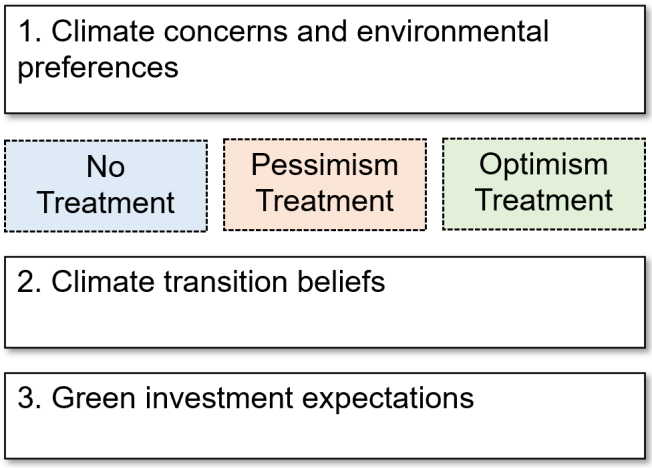
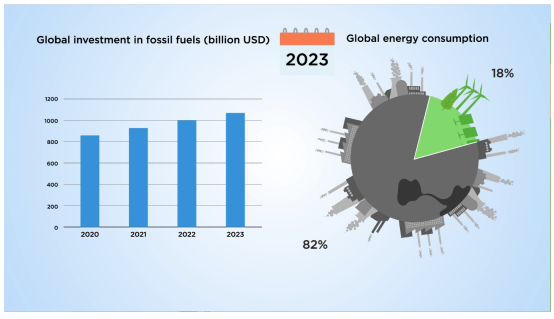


Figure 6: Treatment video screenshots
Panel A shows a selected screenshot from the Pessimism Treatment video when the voice-over says, "Investments in renewables have risen, but global investments in fossil fuels also grew in recent years to meet higher energy demand. Today, fossil fuels still represent more than 80% of global energy consumption." Panel B shows a selected screenshot from the Optimism Treatment video when the voice-over says, "Renewables already represent more than 80% of the new electricity capacity added globally every year, dwarfing investments in fossil fuel projects. According to experts, the shift to green energy is now unstoppable." The two videos are available at these links: `https://www.youtube.com/watch?v=zmAWD9uagmc` (Pessimism Treatment) and `https://www.youtube.com/watch?v=ye4kI4Se1ZE` (Optimism Treatment).

Panel A: Pessimism Treatment video



Panel B: Optimism Treatment video

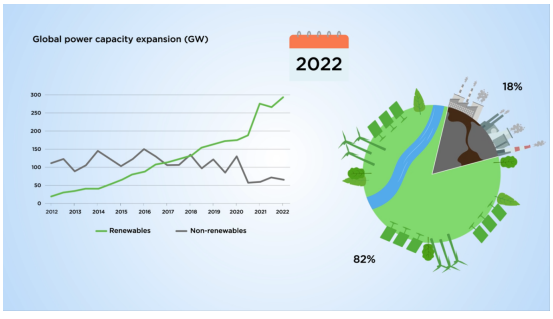


Figure 7: First-stage treatment effect on climate transition beliefs
This figure shows the average *Climate transition beliefs 2050* in the Pessimism and Optimism treatment groups. The bars indicate 95% confidence intervals. The difference in beliefs between treatments is statistically significant (two-sided t-test: $p < 0.001$).

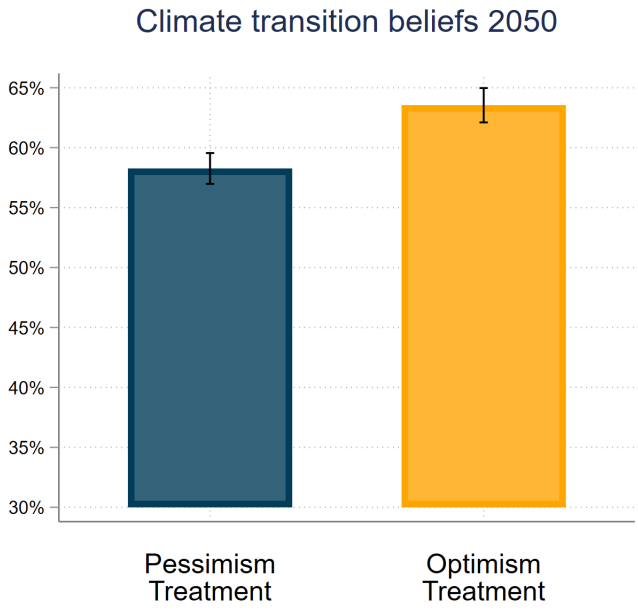
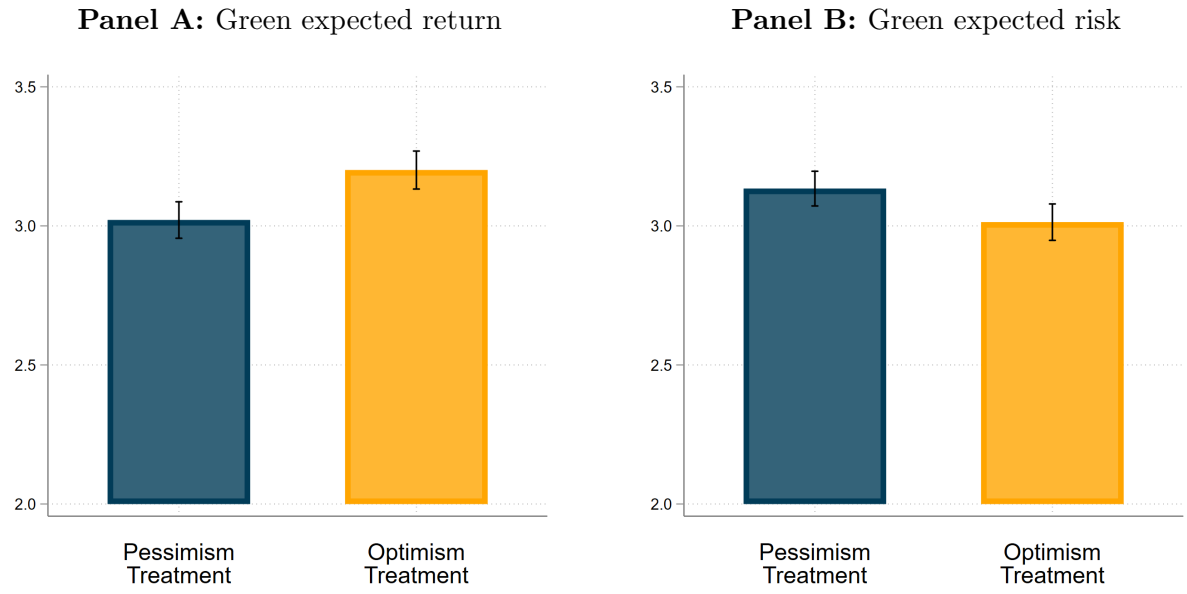


Figure 8: Second-stage treatment effects on green expected return, risk, and investment

This figure shows the average *Green expected return* (Panel A), *Green expected risk* (Panel B), and *Green Investment* (Panel C) in the Pessimism and Optimism treatment groups. The bars indicate 95% confidence intervals. The difference in *Green expected return* and *Green expected risk* between the two groups is statistically significant (two-sided t-test: $p < 0.001$ and $p < 0.01$, respectively), while the difference in *Green investment* is not (two-sided t-test: $p = 0.55$).



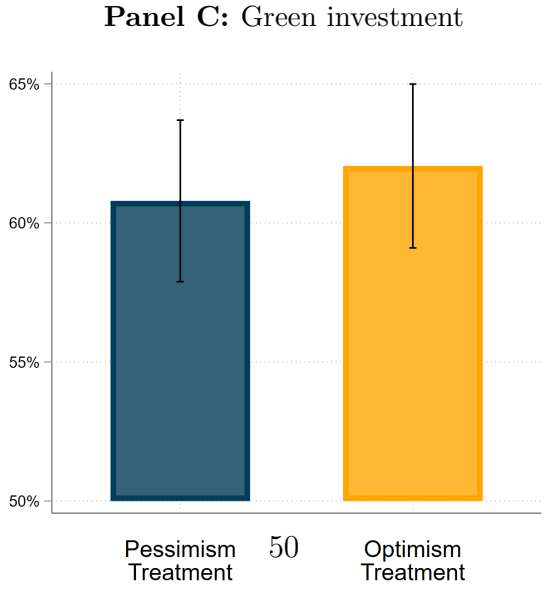
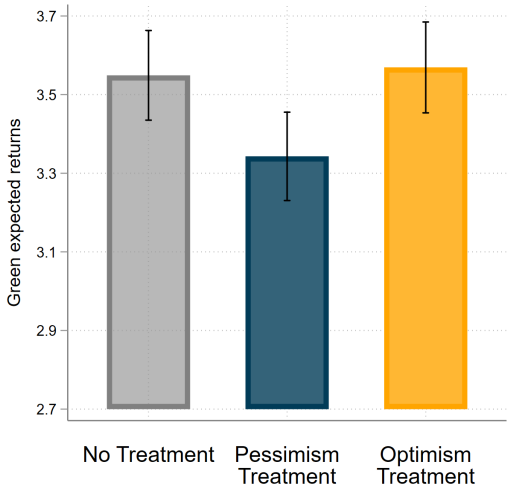
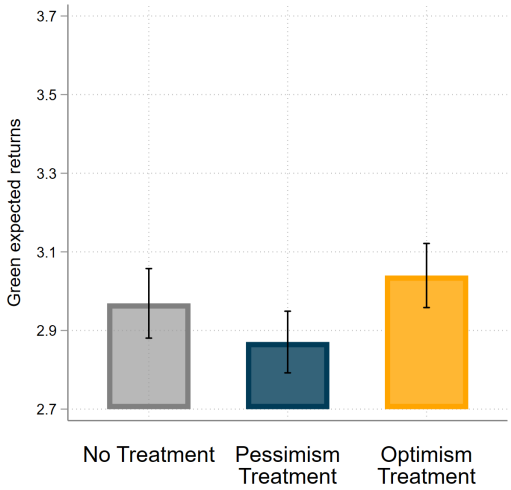


Figure 9: Heterogeneity in treatment effects on green expected return
This figure shows the average *Green expected return* in the No Treatment, Pessimism Treatment, and Optimism Treatment groups. Panels A and B employ the sub-samples of respondents with or without strong pro-environmental preferences, respectively. Panels C and D employ the sub-samples of respondents with or without strong climate techno-optimism, respectively. The bars indicate 95% confidence intervals.

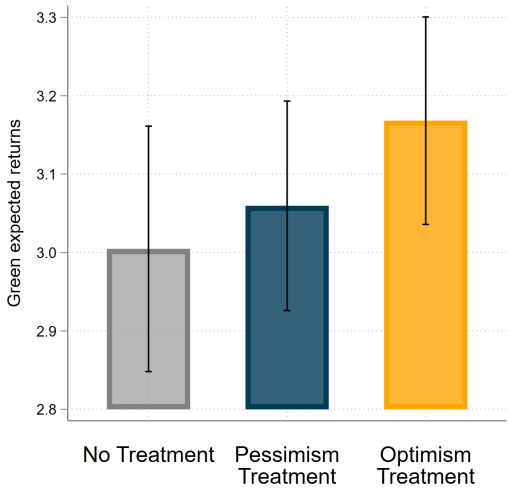
Panel A: Strong pro-environmental preferences



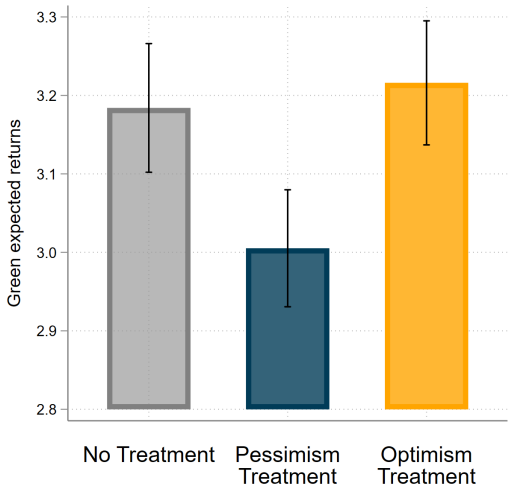
Panel B: No strong pro-environmental preferences



Panel C: Strong techno-optimism



Panel D: No strong techno-optimism



Tables

Table 1: Summary statistics
Panel A of this table shows summary statistics for the demographic characteristics of respondents to the baseline survey (N=1,007). Panel B shows summary statistics for the variables measured during the survey regarding climate-related attitudes, climate transition beliefs, and green investment expectations and preferences. Variable definitions are in Appendix Table A1.

Panel A: Demographic characteristics

	N	min	p25	mean	p50	p75	max	sd
Age:								
18 - 34	1,007	0.00	0.00	0.12	0.00	0.00	1.00	0.32
35 - 54	1,007	0.00	0.00	0.21	0.00	0.00	1.00	0.41
55+	1,007	0.00	0.00	0.67	1.00	1.00	1.00	0.47
Female	1,007	0.00	0.00	0.44	0.00	1.00	1.00	0.50
Graduate education	1,007	0.00	1.00	0.88	1.00	1.00	1.00	0.32
Republican	1,007	0.00	0.00	0.26	0.00	1.00	1.00	0.44
Democrat	1,007	0.00	0.00	0.43	0.00	1.00	1.00	0.50
Income:								
$10k - $49k	895	0.00	0.00	0.28	0.00	1.00	1.00	0.45
$50k - $99k	895	0.00	0.00	0.38	0.00	1.00	1.00	0.49
$100k+	895	0.00	0.00	0.34	0.00	1.00	1.00	0.47
No income info.	1,007	0.00	0.00	0.11	0.00	0.00	1.00	0.31
Wealth:								
$0 - $49k	734	0.00	0.00	0.14	0.00	0.00	1.00	0.35
$50k - $249k	734	0.00	0.00	0.23	0.00	0.00	1.00	0.42
$250k - $999k	734	0.00	0.00	0.34	0.00	1.00	1.00	0.47
$1m +	734	0.00	0.00	0.29	0.00	1.00	1.00	0.45
No welath info.	1,007	0.00	0.00	0.27	0.00	1.00	1.00	0.44
Region:								
Northeast	1,007	0.00	0.00	0.17	0.00	0.00	1.00	0.38
Midwest	1,007	0.00	0.00	0.20	0.00	0.00	1.00	0.40
South	1,007	0.00	0.00	0.33	0.00	1.00	1.00	0.47
West	1,007	0.00	0.00	0.29	0.00	1.00	1.00	0.46

Panel B: Climate transition beliefs, environmental attitudes, and green investment perception

	N	min	p25	mean	p50	p75	max	sd
Climate transition beliefs								
Prior beliefs 2023	1,007	0.00	0.20	0.34	0.30	0.43	1.00	0.22
Climate transition beliefs 2030	1,007	0.00	0.30	0.41	0.37	0.50	1.00	0.18
Climate transition beliefs 2040	1,007	0.01	0.38	0.50	0.50	0.63	1.00	0.19
Climate transition beliefs 2050	1,007	0.00	0.42	0.59	0.60	0.76	1.00	0.22
Confidence in beliefs	1,007	1.00	2.00	2.95	3.00	4.00	5.00	1.06
Climate trans. beliefs 2050 - Qualitative	1,007	1.00	3.00	3.45	4.00	4.00	5.00	1.09
Climate trans. beliefs 2050 - Left tail	1,007	0.00	10.00	31.44	25.00	50.00	100.00	25.44
Climate trans. beliefs 2050 - Right tail	1,007	0.00	10.00	26.38	25.00	40.00	95.00	19.59
Δ Climate trans. beliefs 2050-2030	1,006	-1.00	0.18	0.49	0.46	0.75	3.00	0.47
Environmental attitudes								
Pro-environmental preferences	1,007	1.00	3.00	5.61	6.00	8.00	10.00	2.92
Climate change worry	1,007	1.00	2.00	3.34	4.00	4.00	5.00	1.31
Climate change cause	1,007	1.00	2.00	3.10	3.00	4.00	5.00	1.14
Climate change deniar	1,007	0.00	0.00	0.03	0.00	0.00	1.00	0.16
Second-order CC worry 2030	1,007	0.00	0.52	0.65	0.71	0.80	1.00	0.23
Second-order CC worry 2040	1,007	0.00	0.50	0.69	0.80	0.90	1.00	0.28
Second-order CC worry 2050	1,007	0.00	0.50	0.71	0.85	0.96	1.00	0.31
Climate techno-optimism	1,007	1.00	2.00	2.64	2.00	4.00	5.00	1.27
Green investment perception								
Green investment	1,007	0.00	0.00	0.61	1.00	1.00	1.00	0.49
Green expected return	1,007	1.00	2.00	3.06	3.00	4.00	5.00	1.12
Green expected risk	1,007	1.00	2.00	3.05	3.00	4.00	5.00	1.07
Green investment emotions	1,007	1.00	2.00	3.28	3.00	4.00	5.00	1.19

Table 2: Relation between environmental preferences and transition beliefs
This two-by-two matrix shows the number of respondents in the baseline survey with *Pro-environmental preferences* and *Climate transition beliefs 2050* below or equal to the median and above the median.

	Climate transition beliefs 2050		
Pro-environmental preferences	Below or equal to the median	Above the median	Total
Below or equal to the median	393 (39%)	159 (16%)	552 (55%)
Above the median	145 (14%)	310 (31%)	455 (45%)
Total	538 (53%)	469 (47%)	1,007 (100%)

Table 3: Climate transition beliefs and individual characteristics
This table shows results from linear regressions of climate transition beliefs on several respondent characteristics. Variable definitions are in Appendix Table A1. t-statistics, based on robust standard errors, are reported in parentheses. ***, **, and * indicate that the parameter estimate significantly differs from zero at the 1%, 5%, and 10% level, respectively.

Dep. variable:	Climate transition beliefs 2050						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Age	-0.05***						-0.04***
	(-8.16)						(-5.75)
Female		0.03*					0.03**
		(1.79)					(1.97)
Income			0.01***				0.01***
			(4.30)				(3.17)
Wealth			-0.01***				-0.00
			(-3.32)				(-0.10)
No income info.			0.07**				0.06**
			(2.41)				(2.31)
No welath info.			-0.14***				-0.03
			(-4.18)				(-0.87)
Graduate education				0.02			0.01
				(0.69)			(0.57)
Democrat					0.14***		0.11***
					(8.75)		(7.16)
Republican					-0.03		-0.04**
					(-1.37)		(-2.03)
CO2 electrictiy (ZIP code)						-0.12**	-0.07
						(-2.22)	(-1.36)
Constant	0.78***	0.58***	0.62***	0.57***	0.54***	0.63***	0.66***
	(32.54)	(59.72)	(22.09)	(27.17)	(41.09)	(29.29)	(15.90)
Observations	1,007	1,007	1,007	1,007	1,007	1,004	1,004
R-squared	0.05	0.00	0.03	0.00	0.11	0.00	0.16

Table 4: Climate transition beliefs and expected returns

This table shows results from linear regressions of the return expectations for the green investment on climate transition beliefs. Column 2 adds controls for respondent characteristics (age, gender, education, income, wealth, political affiliation, and region). Column 3 additionally controls for the pro-environmental preferences. Columns 4 and 5 also control for climate change worry and second-order beliefs on climate change worry, respectively. Variable definitions are in Appendix Table A1. t-statistics, based on robust standard errors, are reported in parentheses. ***, **, and * indicate that the parameter estimate significantly differs from zero at the 1%, 5%, and 10% level, respectively.

Dep. variable:	Green expected return				
	(1)	(2)	(3)	(4)	(5)
Climate transition beliefs 2050	1.55***	1.40***	0.90***	0.71***	0.57***
	(9.85)	(8.25)	(4.71)	(3.79)	(2.85)
Pro-environmental preferences			0.09***	0.02	0.06***
			(5.55)	(1.06)	(3.55)
Climate change worry				0.24***	
				(5.57)	
Second-order CC worry 2050					0.65***
					(4.20)
Observations	1,007	1,007	1,007	1,007	1,007
R-squared	0.10	0.12	0.15	0.18	0.17
Controls	No	Yes	Yes	Yes	Yes

Table 5: Climate transition beliefs and expected risk

This table shows results from linear regressions of the risk expectations for the green investment on climate transition beliefs. Column 2 adds controls for respondent characteristics (age, gender, education, income, wealth, political affiliation, and region). Column 3 additionally controls for the pro-environmental preferences. Columns 4 and 5 also control for climate change worry and second-order beliefs on future climate change concerns, respectively. Variable definitions are in Appendix Table A1. t-statistics, based on robust standard errors, are reported in parentheses. ***, **, and * indicate that the parameter estimate significantly differs from zero at the 1%, 5%, and 10% level, respectively.

Dep. variable:	Green expected risk				
	(1)	(2)	(3)	(4)	(5)
Climate transition beliefs 2050	-1.56***	-1.35***	-0.90***	-0.79***	-0.72***
	(-9.92)	(-8.20)	(-4.88)	(-4.26)	(-3.67)
Pro-environmental preferences			-0.08***	-0.04**	-0.07***
			(-5.49)	(-2.31)	(-4.27)
Climate change worry				-0.14***	
				(-3.41)	
Second-order CC worry 2050					-0.34**
					(-2.18)
Observations	1,007	1,007	1,007	1,007	1,007
R-squared	0.11	0.13	0.16	0.16	0.16
Controls	No	Yes	Yes	Yes	Yes

Table 6: Climate transition beliefs and green investment

This table shows results from linear regressions of an indicator for participants who choose to invest in the green investment on climate transition beliefs. Column 2 adds controls for respondent characteristics (age, gender, education, income, wealth, political affiliation, and region). Columns 3-5 additionally control for green expected return or/and risk. Variable definitions are in Appendix Table A1. t-statistics, based on robust standard errors, are reported in parentheses. ***, **, and * indicate that the parameter estimate significantly differs from zero at the 1%, 5%, and 10% level, respectively.

Dep. variable:	Green investment				
	(1)	(2)	(3)	(4)	(5)
Climate transition beliefs 2050	0.69***	0.51***	0.29***	0.32***	0.17**
	(10.79)	(7.52)	(4.28)	(4.67)	(2.46)
Green expected return			0.16***		0.14***
			(11.98)		(10.46)
Green expected risk				-0.14***	-0.11***
				(-9.86)	(-8.19)
Observations	1,007	1,007	1,007	1,007	1,007
R-squared	0.10	0.18	0.30	0.26	0.35
Controls	No	Yes	Yes	Yes	Yes

Table 7: The role of pro-environmental preferences and climate concerns
This table explores the interaction effects between climate transition beliefs and preferences. The dependent variable is *Green expected return* in columns 1 and 2, *Green investment* in columns 3 and 4, and *Green investment emotions* in columns 5 and 6. The main explanatory variables are the interaction effects between climate transition beliefs and pro-environmental preferences (columns 1, 3, and 5) and between climate transition beliefs and climate change worry (columns 2, 4, and 6). All models control for respondent characteristics (age, gender, education, income, wealth, political affiliation, and region). Variable definitions are in Appendix Table A1. t-statistics, based on robust standard errors, are reported in parentheses. ***, **, and * indicate that the parameter estimate significantly differs from zero at the 1%, 5%, and 10% level, respectively.

Dep. variable:	Green expected return		Green investment		Green inv. emotions	
	(1)	(2)	(3)	(4)	(5)	(6)
Climate transition beliefs 2050 × × Pro-environmental preferences	-0.17***		-0.12***		-0.29***	
	(-3.03)		(-6.37)		(-5.48)	
Climate transition beliefs 2050 × × Climate change worry		-0.26**		-0.17***		-0.45***
		(-2.16)		(-3.81)		(-4.17)
Pro-environmental preferences	0.18***		0.12***		0.34***	
	(5.14)		(10.17)		(10.41)	
Climate change worry		0.40***		0.25***		0.72***
		(5.53)		(10.19)		(11.38)
Climate transition beliefs 2050	1.78***	1.58***	0.87***	0.67***	2.19***	1.96***
	(5.33)	(3.79)	(6.86)	(4.00)	(6.91)	(5.15)
Observations	1,007	1,007	1,007	1,007	1,007	1,007
R-squared	0.16	0.18	0.26	0.29	0.34	0.38
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Table 8: Experimental evidence: Summary statistics of outcome variables
This table shows summary statistics of climate transition beliefs and green investment perception variables for respondents to the experimental survey run in January-February 2024 (N=3,003). Panel A shows statistics based on respondents in the No Treatment group, while Panels B and C look at respondents in the Pessimism and Optimism Treatment groups, respectively. Variable definitions are in Appendix Table A1.

Panel A: No Treatment

	N	min	p25	mean	p50	p75	max	sd
Climate transition beliefs 2030	868	0.00	0.30	0.39	0.35	0.48	1.00	0.16
Climate transition beliefs 2040	868	0.00	0.38	0.49	0.49	0.61	1.00	0.19
Climate transition beliefs 2050	868	0.00	0.42	0.59	0.60	0.78	1.00	0.23
Green investment	868	0.00	0.00	0.62	1.00	1.00	1.00	0.49
Green expected return	868	1.00	2.00	3.14	3.00	4.00	5.00	1.09
Green expected risk	868	1.00	2.00	3.10	3.00	4.00	5.00	1.05

Panel B: Pessimism Treatment

	N	min	p25	mean	p50	p75	max	sd
Climate transition beliefs 2030	1,089	0.00	0.30	0.39	0.34	0.43	1.00	0.17
Climate transition beliefs 2040	1,089	0.00	0.36	0.49	0.45	0.60	1.00	0.19
Climate transition beliefs 2050	1,089	0.00	0.43	0.58	0.58	0.75	1.00	0.22
Green investment	1,089	0.00	0.00	0.61	1.00	1.00	1.00	0.49
Green expected return	1,089	1.00	2.00	3.02	3.00	4.00	5.00	1.10
Green expected risk	1,089	1.00	2.00	3.13	3.00	4.00	5.00	1.05

Panel C: Optimism Treatment

	N	min	p25	mean	p50	p75	max	sd
Climate transition beliefs 2030	1,046	0.00	0.30	0.44	0.40	0.52	1.00	0.19
Climate transition beliefs 2040	1,046	0.00	0.40	0.54	0.50	0.70	1.00	0.21
Climate transition beliefs 2050	1,046	0.00	0.47	0.64	0.68	0.81	1.00	0.24
Green investment	1,046	0.00	0.00	0.62	1.00	1.00	1.00	0.49
Green expected return	1,046	1.00	2.00	3.20	3.00	4.00	5.00	1.13
Green expected risk	1,046	1.00	2.00	3.01	3.00	4.00	5.00	1.08

Internet Appendix

Figure A1: Climate transition beliefs and green expected returns
These graphs show in binned scatter plots (with 20 bins) the relationship between *Green expected return* and *Climate transition beliefs* at the 2030, 2040, and 2050 horizons.

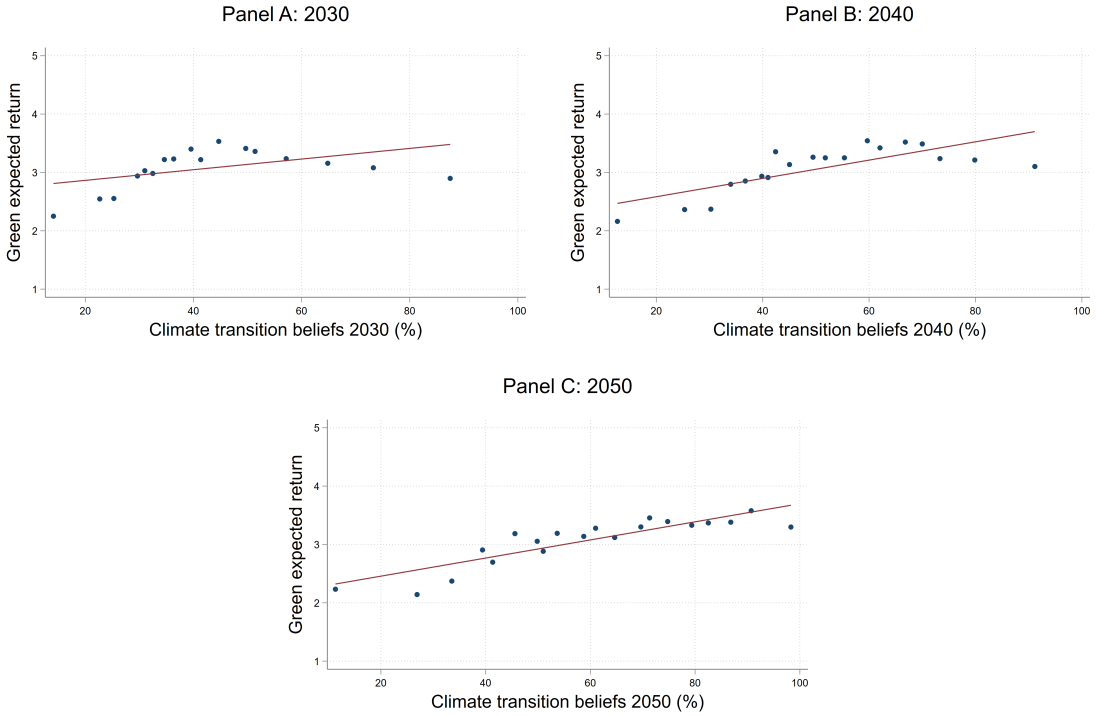


Figure A2: Climate transition beliefs 2050 - Baseline and second wave
This figure shows the distribution of climate transition beliefs 2050, separately for respondents of the baseline (in gray) and second wave (in blue).

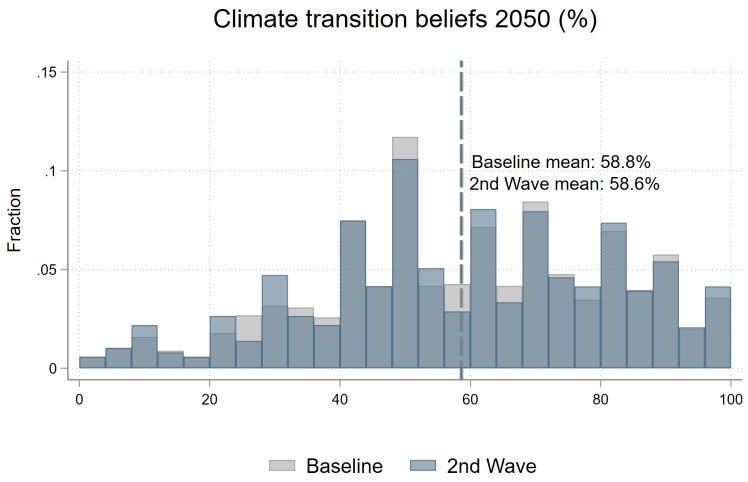
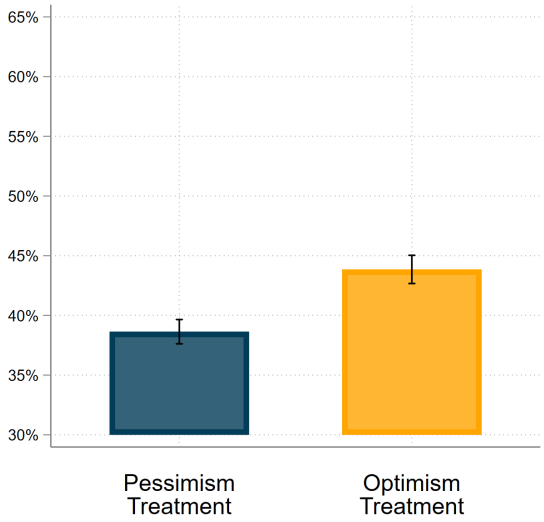


Figure A3: Treatment effect on climate transition beliefs – Alternative horizons These graphs show the average climate transition beliefs at the 2030 and 2040 horizons in the Pessimism and Optimism treatment groups. The bars indicate 95% confidence intervals. The difference in beliefs between treatments is statistically significant (two-sided t-test: $p < 0.001$, for both the 2030 and 2040 horizons).

Panel A: Climate transition beliefs 2030



Panel B: Climate transition beliefs 2040

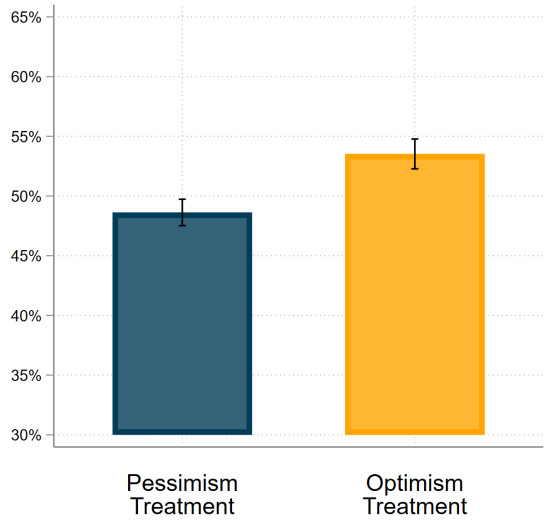
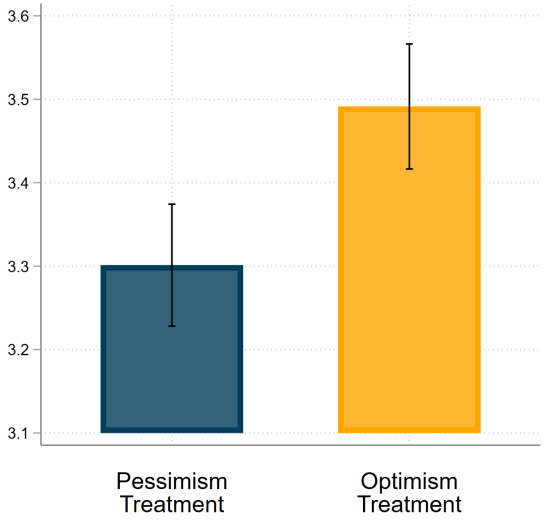
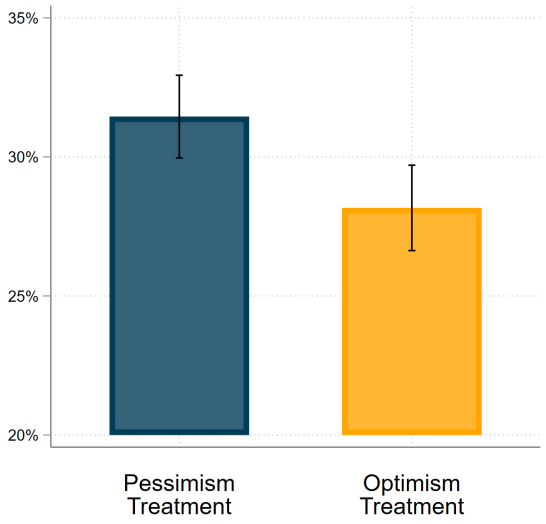


Figure A4: Treatment effect on climate transition beliefs – Alternative measures
This figure shows the average *Climate transition beliefs 2050 – Qualitative*, *Climate transition beliefs 2050 – Left tail*, and *Climate transition beliefs 2050 – Right tail* in the Pessimism and Optimism Treatment groups. The bars indicate 95% confidence intervals. The difference in beliefs between treatments is statistically significant ($p < 0.001$ for the qualitative and right tail and $p < 0.01$ for the left tail measure, based on two-sided t-tests).

Panel A: Climate transition beliefs
Qualitative



Panel B: Climate transition beliefs
Left tail



Panel C: Climate transition beliefs
Right tail

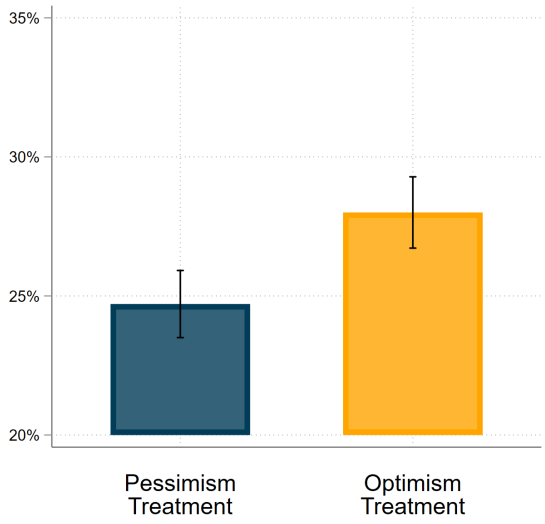


Table A1: Variable definitions

Variable	Description
Environmental attitudes	
Climate change cause	Answer to "Do you think that climate change is caused by natural changes in the environment, human activities, or both?" from 1 (Entirely by natural changes in the environment) to 5 (Entirely by human activities).
Climate change worry	Answer to "To what extent are you worried about climate change?" from 1 (Not at all worried) to 5 (Very worried).
Pro-environmental preferences	Answer to "To what extent do you feel a personal responsibility to try to mitigate climate change?" from 1 (Not at all) to 10 (A great deal).
Second-order CC worry 2030 [2040][2050]	Answers to " According to one study conducted in 2023, around 66% of Americans say that they are either worried or very worried about climate change. How large do you expect this percentage to be in 2030? [2040][2050]?".
Climate transition beliefs	
Prior beliefs 2023	Answer to "In your opinion, what share of the total electricity currently generated in the U.S. comes from renewable energy sources (such as solar, wind, and hydroelectric power), rather than fossil fuels and nuclear power? Please provide your best guess".
Climate transition beliefs 2030 [2040][2050]	Answers to "According to official statistics, in 2022, the share of U.S. electricity generated using renewable sources (such as solar, wind, and hydroelectric power) was around 22%, up from 10% in 2010. How much do you expect the share of U.S. electricity generation from renewable sources to be in 2030 [2040][2050]?". We divide the responses (in %) by 100 to ease the interpretation of the estimated coefficients in our regressions.
Confidence in beliefs	Answer to "How confident are you with the estimates you just made about the future development of U.S. electricity generation from renewable sources?" from 1 (Very confident) to 5 (Not at all confident). We classify "Don't know" responses as neutral (3).
Climate transition beliefs 2050 – Qualitative	Answer to "To what extent do you agree or disagree with the following statement? In 2050, the U.S. will generate the majority (>50%) of its electricity needs from renewable energy sources like solar, wind, and hydroelectric power" from 1 (Strongly disagree) to 5 (Strongly agree). We classify "Don't know" responses as neutral (3).

Climate transition beliefs 2050 – Right tail	Subjective probabilities (in %) associated with the scenario "In 2050 the share of U.S. electricity generation from renewable sources will be higher than 70% ".
Climate transition beliefs 2050 – Left tail	Subjective probabilities (in %) associated with the scenario "In 2050 the share of U.S. electricity generation from renewable sources will still be lower than 30%".
Δ *Climate trans. beliefs 2050-2030*	Difference between *Climate transition beliefs 2050* and *Climate transition beliefs 2030*, divided by *Climate transition beliefs 2030*.
Climate techno-optimism	Answers to "To what extent do you agree or disagree with the following statement? New technologies will solve climate change without individuals having to make big changes in their lives" from 1 (Strongly disagree) to 5 (Strongly agree). We classify "Don't know" responses as neutral (3).

Investment preferences

Green expected return	Answer to "How do you expect the return of Fund A and Fund B to be over the next 10 years?" from 1 (Fund A will have a much lower return) to 5 (Fund A will have a much higher return), considering the low carbon fund as Fund A. In the survey, the positioning of the low-carbon fund was randomized to avoid any potential order bias. We classify "Don't know" responses as neutral (3).
Green expected risk	Answer to "How do you expect the risk of Fund A and Fund B to be over the next 10 years?" from 1 (Fund A will be much less risky than Fund B) to 5 (Fund A will be much more risky than Fund B), considering the low carbon fund as Fund A. We classify "Don't know" responses as neutral (3).
Green investment	Indicator equal 1 for respondents who chose the low-carbon fund in response to "Please imagine you have to invest 10,000 USD for a period of 10 years. You have only two investment options: Fund A or Fund B...If you had to choose, in which fund would you invest?"
Green investment emotions	Answer to "How do Fund A and Fund B compare regarding how it would feel to invest in them?" from 1 (It feels much better to invest in Fund B) to 5 (It feels much better to invest in Fund A), considering the low carbon fund as Fund A. We classify "Don't know" responses as neutral (3).

Demographics and individual characteristics	
Age	Age in the following buckets: 1 [18-24], 2 [25-34], 3 [35-44], 4 [45-54], 5 [55+].
Female	Indicator equal 1 for female respondents, and 0 otherwise.
Higher education	Indicator equal to 1 if the respondent reported a tertiary education, and 0 otherwise.
Republican	Indicator equal to 1 if the respondent reported Republican political preferences, and 0 otherwise.
Democrat	Indicator equal to 1 if the respondent reported Democratic political preferences, and 0 otherwise.
Income	Self-reported personal gross income in 16 buckets ranging from *"Less than USD 10,000"* (1) to *"USD 500,000 or more"* (16). For "Prefer not to answer" replies, we set *Income* to 0 and the indicator variable *Untold income* to 1.
Untold income	Indicator equal to 1 if the respondent preferred not to self-report the gross income, and 0 otherwise.
Wealth	Self-reported personal gross income in 16 buckets ranging from *"Under USD 5,000"* (1) to *"USD 10,000,000 or more"* (11). For "Prefer not to answer" replies, we set *Wealth* to 0 and the indicator variable *Untold wealth* to 1.
Untold wealth	Indicator equal to 1 if the respondent preferred not to self-report the total persona wealth, and 0 otherwise.
Other variables	
CO2 electricity (ZIP code)	Annual CO2 total output emission rate (in kg/MWh) in 2021 from electricity generation in the respondent's zip code area as reported in the Emissions & Generation Resource Integrated Database (eGRID) of the U.S. Environmental Protection Agency (EPA).

Table A2: Robustness: Climate transition beliefs and expected returns - Different horizons

This table shows results from linear regressions of the return expectations for the green investment on respondents' climate transition beliefs at different horizons: 2030 (columns 1 and 2), 2040 (columns 3 and 4), and 2050 (columns 5 and 6). Even columns control for respondent characteristics (age, gender, education, income, wealth, political affiliation, and region). Variable definitions are in Appendix Table A1. t-statistics, based on robust standard errors, are reported in parentheses. ***, **, and * indicate that the parameter estimate significantly differs from zero at the 1%, 5%, and 10% level, respectively.

Dep. variable:	Green expected return					
	(1)	(2)	(3)	(4)	(5)	(6)
Climate transition beliefs 2030	0.91***	0.71***				
	(4.15)	(2.91)				
Climate transition beliefs 2040			1.57***	1.45***		
			(8.35)	(7.17)		
Climate transition beliefs 2050					1.55***	1.40***
					(9.85)	(8.25)
Observations	1,007	1,007	1,007	1,007	1,007	1,007
R-squared	0.02	0.07	0.07	0.11	0.10	0.12
Controls	No	Yes	No	Yes	No	Yes

Table A3: Robustness: Climate transition beliefs and expected returns – Qualitative

This table shows results from linear regressions of the return expectations for the green investment on *Climate transition beliefs 2050 – Qualitative* and controls for respondent characteristics (age, gender, education, income, wealth, political affiliation, and region). Column 2 additionally controls for the pro-environmental preferences. Columns 3 and 4 also control for climate change worry and second-order beliefs on 2050 climate change concerns, respectively. Variable definitions are in Appendix Table A1. t-statistics, based on robust standard errors, are reported in parentheses. ***, **, and * indicate that the parameter estimate is significantly different from zero at the 1%, 5%, and 10% level, respectively.

Dep. variable:	Green expected return			
	(1)	(2)	(3)	(4)
Climate transition beliefs 2050 - Qualitative	0.32***	0.23***	0.20***	0.19***
	(8.43)	(5.60)	(4.98)	(4.64)
Pro-environmental preference		0.09***	0.02	0.05***
		(5.64)	(0.95)	(3.12)
Climate change worry			0.23***	
			(5.53)	
Second-order CC worry 2050				0.67***
				(4.48)
Observations	1,007	1,007	1,007	1,007
R-squared	0.13	0.16	0.19	0.18
Controls	Yes	Yes	Yes	Yes

Table A4: Robustness: Climate transition beliefs and expected returns - Tails
This table shows results from linear regressions of the return expectations for the green investment on the tails of respondents' climate transition beliefs and controls for respondent characteristics (age, gender, education, income, wealth, political affiliation, and region). The main variable of interest in Panel A is the right tail of the climate transition beliefs (i.e., the expected probability that over 70% of electricity will be renewable by 2050), while in Panel B, it is the left tail (i.e., the expected probability that less than 30% of electricity will be renewable). Column 2 additionally controls for the pro-environmental preferences. Columns 3 and 4 also control for climate change worry and second-order beliefs on 2050 climate change concerns, respectively. Variable definitions are in Appendix Table A1. t-statistics, based on robust standard errors, are reported in parentheses. ***, **, and * indicate that the parameter estimate is significantly different from zero at the 1%, 5%, and 10% level, respectively.

Panel A: Right tail

Dep. variable:	Green expected return			
	(1)	(2)	(3)	(4)
Climate transition beliefs 2050 - Right tail	0.86***	0.56***	0.53***	0.46**
	(4.60)	(3.05)	(2.91)	(2.56)
Pro-environmental preference		0.12***	0.03*	0.07***
		(8.10)	(1.65)	(4.07)
Climate change worry			0.27***	
			(6.23)	
Second-order CC worry 2050				0.79***
				(5.38)
Observations	1,007	1,007	1,007	1,007
R-squared	0.08	0.14	0.17	0.17
Controls	Yes	Yes	Yes	Yes

Panel B: Left tail

Dep. variable:	Green expected return			
	(1)	(2)	(3)	(4)
Climate transition beliefs 2050 - Left tail	-1.49***	-1.22***	-1.10***	-1.07***
	(-11.59)	(-9.14)	(-8.29)	(-7.72)
Pro-environmental preference		0.09***	0.03	0.06***
		(6.14)	(1.36)	(3.81)
Climate change worry			0.21***	
			(5.13)	
Second-order CC worry 2050				0.51***
				(3.52)
Observations	1,007	1,007	1,007	1,007
R-squared	0.16	0.19	0.21	0.20
Controls	Yes	Yes	Yes	Yes

Table A5: Robustness: Climate transition beliefs and expected returns - General optimism

This table shows results from linear regressions of the return expectations for the green investment on Δ *climate trans. beliefs 2050-2030*. All regressions control for respondent characteristics (age, gender, education, income, wealth, political affiliation, and region). Column 2 additionally controls for the pro-environmental preferences. Columns 3 and 4 also control for climate change worry and second-order beliefs on 2050 climate change concerns, respectively. Variable definitions are in Appendix Table A1. t-statistics, based on robust standard errors, are reported in parentheses. ***, **, and * indicate that the parameter estimate is significantly different from zero at the 1%, 5%, and 10% level, respectively.

Dep. variable:	Green expected return			
	(1)	(2)	(3)	(4)
Δ climate trans. beliefs 2050-2030	0.49***	0.40***	0.34***	0.32***
	(6.29)	(5.28)	(4.64)	(4.26)
Pro-environmental preference		0.11***	0.04**	0.07***
		(8.07)	(1.99)	(4.34)
Climate change worry			0.24***	
			(5.48)	
Second-order CC worry 2050				0.70***
				(4.70)
Observations	1,006	1,006	1,006	1,006
R-squared	0.10	0.16	0.18	0.18
Controls	Yes	Yes	Yes	Yes

Table A6: Robustness: Climate transition beliefs and expected returns - Somewhat confident or higher

This table shows results from linear regressions of the return expectations for the green investment on respondents' climate transition beliefs and controls for respondent characteristics (age, gender, education, income, wealth, political affiliation, and region). Column 2 additionally controls for the pro-environmental preferences. Columns 3 and 4 also control for climate change worry and second-order beliefs on 2050 climate change concerns, respectively. The regressions consider only respondents who are at least "somewhat confident" in their climate transition beliefs. Variable definitions are in Appendix Table A1. t-statistics, based on robust standard errors, are reported in parentheses. ***, **, and * indicate that the parameter estimate is significantly different from zero at the 1%, 5%, and 10% level, respectively.

Dep. variable:	Green expected return			
	(1)	(2)	(3)	(4)
Climate transition beliefs 2050	1.60***	1.02***	0.88***	0.80***
	(7.73)	(4.24)	(3.72)	(3.16)
Pro-environmental preference		0.10***	0.04*	0.08***
		(4.78)	(1.71)	(3.59)
Climate change worry			0.19***	
			(3.54)	
Second-order CC worry 2050				0.43**
				(2.24)
Observations	691	691	691	691
R-squared	0.14	0.17	0.18	0.17
Controls	Yes	Yes	Yes	Yes

Table A7: Robustness: Climate transition beliefs and expected returns - Prior knowledge

This table shows results from linear regressions of the return expectations for the green investment on respondents' climate transition beliefs and controls for respondent characteristics (age, gender, education, income, wealth, political affiliation, and region). Column 2 additionally controls for the pro-environmental preferences. Columns 3 and 4 also control for climate change worry and second-order beliefs on 2050 climate change concerns, respectively. We exclude from the sample respondents with the 10% worst level of accuracy in terms of prior energy transition knowledge. Variable definitions are in Appendix Table A1. t-statistics, based on robust standard errors, are reported in parentheses. ***, **, and * indicate that the parameter estimate is significantly different from zero at the 1%, 5%, and 10% level, respectively.

Dep. variable:	Green expected return			
	(1)	(2)	(3)	(4)
Climate transition beliefs 2050	1.17***	0.75***	0.59***	0.48**
	(6.02)	(3.57)	(2.90)	(2.23)
Pro-environmental preference		0.08***	0.01	0.06***
		(4.84)	(0.53)	(3.33)
Climate change worry			0.25***	
			(5.31)	
Second-order CC worry 2050				0.58***
				(3.25)
Observations	888	888	888	888
R-squared	0.08	0.10	0.13	0.11
Controls	Yes	Yes	Yes	Yes

Table A8: Baseline and second wave

This table shows results from linear regressions of climate transition beliefs (columns 1 and 2), return expectations for the green investment (columns 3 and 4), and risk expectations for the green investment (columns 5 and 6) on an indicator for respondents from the second wave of our survey. All columns control for respondent characteristics (age, gender, education, income, wealth, political affiliation, and region). Variable definitions are in Appendix Table A1. t-statistics, based on robust standard errors, are reported in parentheses. ***, **, and * indicate that the parameter estimate significantly differs from zero at the 1%, 5%, and 10% level, respectively.

Dep. variable:	Climate trans. beliefs 2050		Pro-environmental pref.		Climate change worry	
	(1)	(2)	(3)	(4)	(5)	(6)
2nd Wave	-0.19	0.15	-0.21	-0.18	-0.03	-0.03
	(-0.18)	(0.15)	(-1.57)	(-1.59)	(-0.50)	(-0.54)
Observations	1,875	1,875	1,875	1,875	1,875	1,875
R-squared	0.00	0.16	0.00	0.30	0.00	0.33
Controls	No	Yes	No	Yes	No	Yes

Table A9: Demographics characteristics by treatment group
This table shows t-tests of respondent characteristics (age, gender, education, income, wealth, political affiliation, and region) in the Pessimism and Optimism treatments. Variables are defined in Appendix Table A1.

	Optimism Treatment	Pessimism Treatment	Δ	p-Values	N
Age:					
18 - 34	0.14	0.13	0.00	0.96	2,135
35 - 54	0.22	0.22	0.01	0.66	2,135
55+	0.64	0.65	-0.01	0.67	2,135
Female	0.44	0.45	-0.00	0.83	2,135
Graduate education	0.87	0.88	-0.00	0.88	2,135
Republican	0.25	0.26	-0.01	0.52	2,135
Democrat	0.41	0.40	0.01	0.62	2,135
Income:					
$10k - $49k	0.30	0.30	0.00	0.93	1,877
$50k - $99k	0.33	0.36	-0.02	0.30	1,877
$100k+	0.36	0.34	0.02	0.34	1,877
No income info.	0.12	0.12	0.00	0.94	2,135
Wealth:					
$0 - $49k	0.11	0.15	-0.03	0.05	1,627
$50k - $249k	0.24	0.20	0.04	0.04	1,627
$250k - $999k	0.38	0.34	0.05	0.04	1,627
$1m +	0.26	0.32	-0.06	0.01	1,627
No welath info.	0.25	0.22	0.03	0.08	2,135
Region:					
Northeast	0.20	0.18	0.01	0.43	2,135
Midwest	0.22	0.21	0.01	0.59	2,135
South	0.34	0.34	0.00	0.94	2,135
West	0.25	0.27	-0.02	0.20	2,135

Table A10: Treatment effects on climate transition beliefs

This table shows results from linear regressions of climate transition beliefs (at the 2030, 2040, and 2050 horizon) on an indicator for respondents in the optimism treatment. All columns additionally control for pro-environmental preferences, climate change worry, and respondent characteristics (age, gender, education, income, wealth, political affiliation, and region). Columns 1 and 2 additionally control for respondent characteristics (age, gender, education, income, wealth, political affiliation, and region). Variable definitions are in Appendix Table A1. t-statistics, based on robust standard errors, are reported in parentheses. ***, **, and * indicate that the parameter estimate significantly differs from zero at the 1%, 5%, and 10% level, respectively.

Dep. variable:	Climate transition beliefs		
	2030	2040	2050
	(1)	(2)	(3)
Optimism Treatment	0.05***	0.05***	0.06***
	(7.74)	(7.31)	(7.34)
Pro-environmental preference	0.02***	0.02***	0.02***
	(7.29)	(7.54)	(7.21)
Climate change worry	0.01**	0.03***	0.05***
	(2.09)	(6.35)	(10.05)
Observations	2,135	2,135	2,135
R-squared	0.29	0.32	0.38
Controls	Yes	Yes	Yes

Table A11: Treatment effects on green expected returns, risk, and green investment

This table shows results from linear regressions of, respectively, return expectations for the green investment (column 1), risk expectations for the green investment (column 2), and investing in the green fund (column 3) on an indicator for respondents in the optimism treatment. Columns 1 to 3 additionally control for pro-environmental preferences and climate change worry. All even columns additionally control for respondent characteristics (age, gender, education, income, wealth, political affiliation, and region). Variable definitions are in Appendix Table A1. t-statistics, based on robust standard errors, are reported in parentheses. ***, **, and * indicate that the parameter estimate significantly differs from zero at the 1%, 5%, and 10% level, respectively.

Dep. variable:	Green exp. returns	Green exp. risk	Green investment
	(1)	(2)	(3)
Optimism Treatment	0.20***	-0.13***	0.01
	(4.50)	(-3.22)	(0.52)
Pro-environmental preference	0.04***	-0.05***	
	(2.83)	(-4.00)	
Climate change worry	0.23***	-0.19***	
	(7.23)	(-6.54)	
Observations	2,135	2,135	2,135
R-squared	0.17	0.18	0.13
Controls	Yes	Yes	Yes

Survey questionnaire

Screen 1: Welcome message

YouGov

This survey is about your thoughts on climate change and investment decisions. The results will be used for academic purposes. Our research is non-partisan.

Your YouGov Account will be credited with 50 points for completing the survey.

We have tested the survey and found that, on average it takes around 8-10 minutes to complete. This time may vary depending on factors such as your Internet connection speed and the answers you give.

It is crucial for our research that your responses are honest and that you read the questions carefully before answering.

There are no right or wrong answers. We are only interested in your opinion.

Screen 2: Climate change cause

YouGov

Climate change describes the notion that the world's climate is changing due to long-term temperature increases in the Earth's atmosphere.

Do you think that climate change is caused by natural changes in the environment, human activities, or both?

- ○ Entirely by natural changes in the environment
- ○ Mainly by natural changes in the environment
- ○ About equally by natural changes in the environment and human activities
- ○ Mainly by human activities
- ○ Entirely by human activities
- ○ Not applicable - I do not think climate change is happening
- ○ Don't know

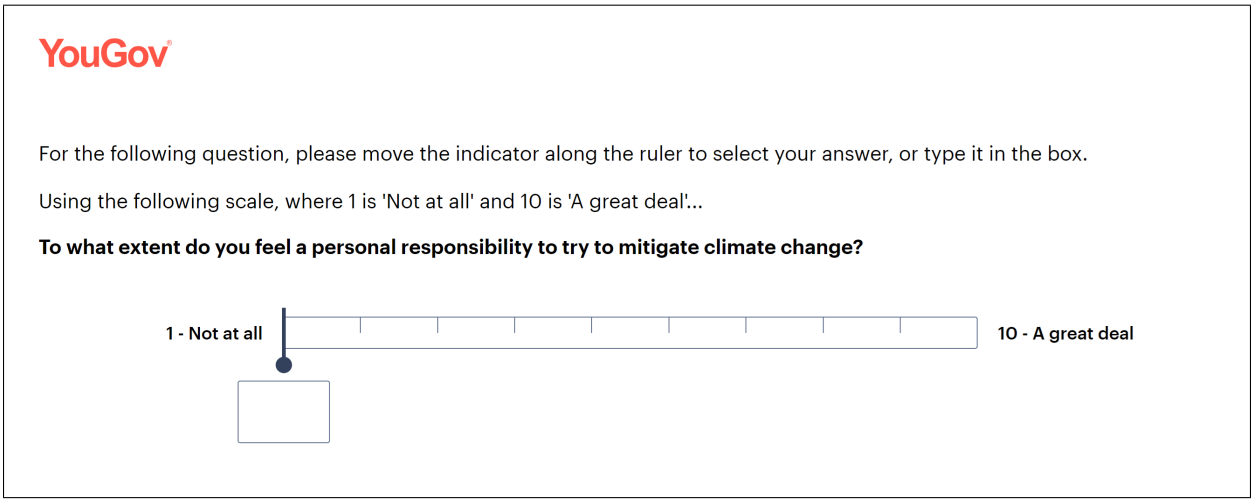
Screen 3: Climate change concerns

YouGov

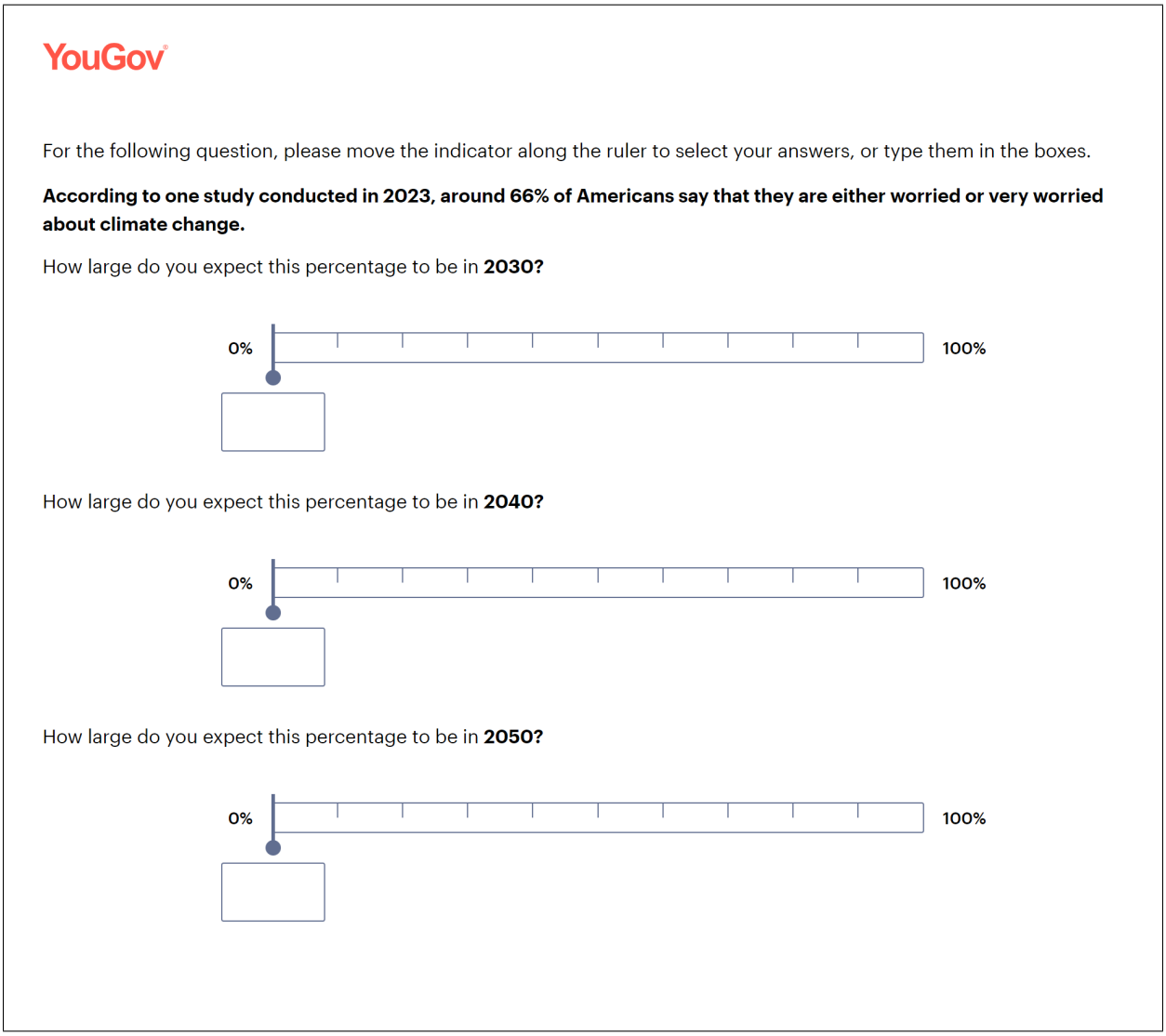
Using the following scale, where 1 in 'Not at all worried' and 5 is 'Very worried'...

To what extent are you worried about climate change?

Screen 4: Pro-environmental personal norms



Screen 5: Second-order beliefs on future climate concerns



Screen 6: Section introduction

YouGov

The next set of questions are about the energy transition, that is, the process of reducing our society's reliance on fossil fuels (coal, oil, and natural gas).

Some questions require thinking about what you expect for the future. We understand forecasting the future is difficult, but please give your best estimate.

Even if you are unfamiliar with the topic, that is perfectly fine. Just provide your best guess based on your intuition and knowledge. Your opinions are very valuable for our research.

Screen 7: Energy prior knowledge

YouGov

For the following question, please move the indicator along the ruler to select your answer, or type it in the box.

In your opinion, what share of the total electricity currently generated in the U.S. comes from renewable energy sources (such as solar, wind, and hydroelectric power), rather than fossil fuels and nuclear power? Please provide your best guess.

Screen 8: Climate transition beliefs (quantitative)

YouGov

For the following question, please move the indicator along the ruler to select your answers, or type them in the boxes.

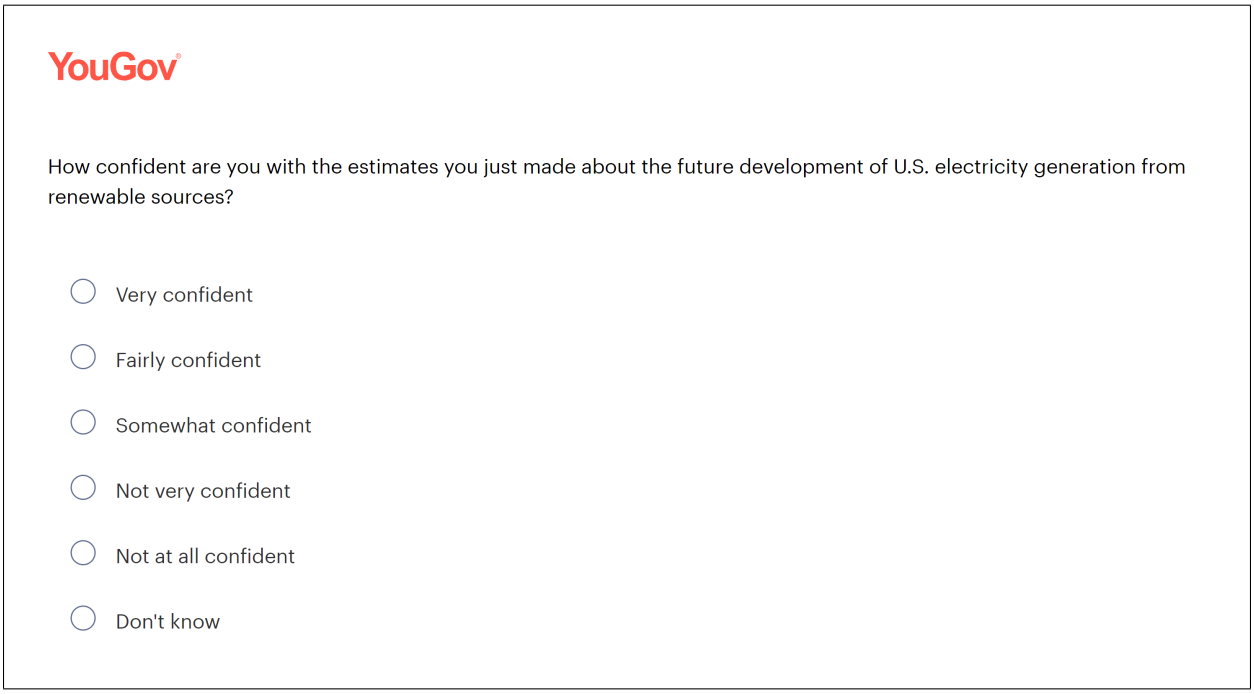
According to official statistics, in 2022, the share of U.S. electricity generated using renewable sources (such as solar, wind, and hydroelectric power) was around 22%, up from 10% in 2010

How much do you expect the share of U.S. electricity generation from renewable sources to be in **2030?**

How much do you expect the share of U.S. electricity generation from renewable sources to be in **2040?**

How much do you expect the share of U.S. electricity generation from renewable sources to be in **2050?**

Screen 9: Confidence in beliefs



Screen 10: Climate transition beliefs (qualitative)

YouGov

As a reminder, according to official statistics, in 2022, the share of U.S. electricity generated using renewable sources (such as solar, wind, and hydroelectric power) was around 22%, up from 10% in 2010.

To what extent do you agree or disagree with the following statement?

"In 2050, the U.S. will generate the majority (>50%) of its electricity needs from renewable energy sources like solar, wind, and hydroelectric power"

- ○ Strongly agree
- ○ Tend to agree
- ○ Neither agree nor disagree
- ○ Tend to disagree
- ○ Strongly disagree
- ○ Don't know

Screen 11: Climate transition beliefs (probabilistic)

YouGov

As a reminder, according to official statistics, in 2022, the share of U.S. electricity generated using renewable sources (such as solar, wind, and hydroelectric power) was around 22%, up from 10% in 2010.

Based on your perception, how likely do you think that these three possible scenarios will occur in 2050?

There is a [ ] % chance that in 2050 the share of U.S. electricity generation from renewable sources will still be **lower than 30%.**

There is a [ ] % chance that in 2050 the share of U.S. electricity generation from renewable sources will be **somewhere between 30% and 70%.**

There is a [ ] % chance that in 2050 the share of U.S. electricity generation from renewable sources will be **higher than 70%.**

Screen 12: Section: Investment preferences

YouGov

We will now present you with information on two real investment funds. We will ask about your perception of these two funds and which of the two funds you would invest in.

This is just a hypothetical scenario with no real financial consequences for you. However, please think about the following questions as if you had to make a real investment decision.

Again, even if you feel unfamiliar with the topic, that is fine. We appreciate your honest and thoughtful responses.

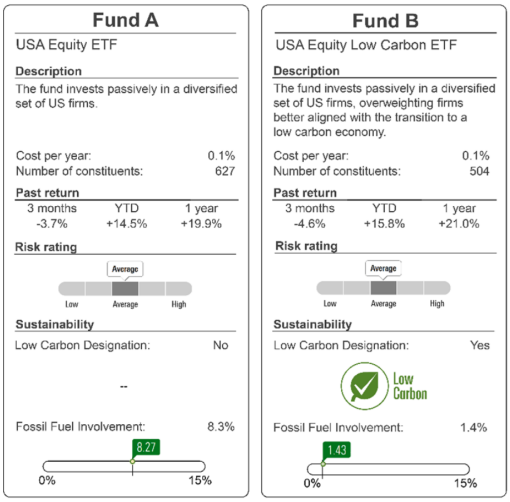
Please forward to continue.

Screen 13: Investment options

YouGov

Below is some basic information on two investment funds investing in the U.S. stock market. Please click on the image to view it at full size. When you've finished looking at the image, click the "X" at the top to close the image.

You will be able to move on after 15 seconds, but please take all the time needed to read the information carefully.

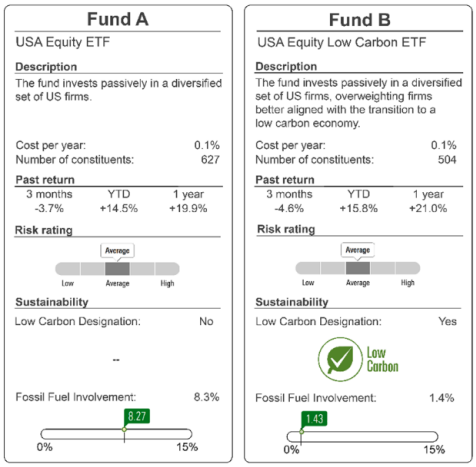


Notes:
- The Low Carbon Designation indicates funds with portfolios aligned with the transition to a low carbon economy.
- The Fossil Fuel Involvement score indicates the percentage of the portfolio invested in firms generating revenues from fossil fuels extraction or fossil fuel energy generation.
- Source: Morningstar.

Screen 14: Expected returns

YouGov

For the following questions, you can continue to click on the image to view it at full size. When you've finished looking at the image, click the "X" at the top to close the image.



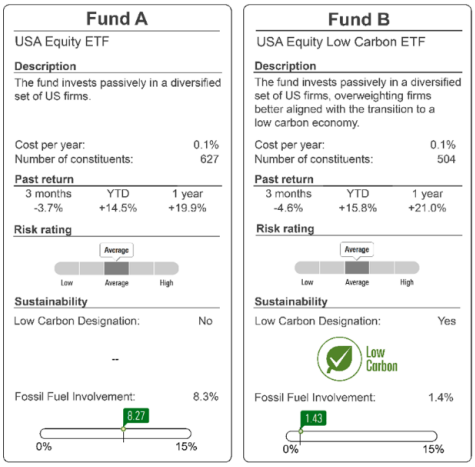
How do you expect the return of Fund A and Fund B to be over the next 10 years?

Note: The expected return is the change in value that you expect to receive from an investment over a certain period. It includes both dividends and capital gain/losses.

- ○ Fund A will have a much lower return than Fund B
- ○ Fund A will have a lower return than Fund B
- ○ Fund A will have a similar return to Fund B
- ○ Fund A will have a higher return than Fund B
- ○ Fund A will have a much higher return than Fund B
- ○ Don't know

Screen 15: Expected risk

YouGov



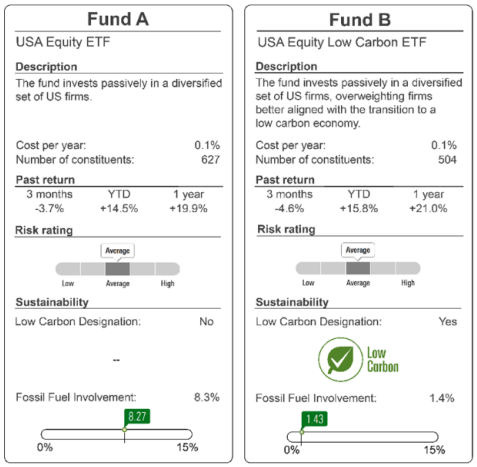
How do you expect the risk of Fund A and Fund B to be over the next 10 years?

Note: The risk of an investment is a measure of the likelihood that its actual return will be different from the one you expect, including the possibility of losing some of the invested capital.

- ○ Fund A will be much less risky than Fund B
- ○ Fund A will be less risky than Fund B
- ○ Fund A will be equally risky as Fund B
- ○ Fund A will be more risky than Fund B
- ○ Fund A will be much more risky than Fund B
- ○ Don't know

Screen 16: Investment choice

YouGov



Notes:
- The Low Carbon Designation indicates funds with portfolios aligned with the transition to a low carbon economy.
- The Fossil Fuel Involvement score indicates the percentage of the portfolio invested in firms generating revenues from fossil fuels extraction or fossil fuel energy generation.
- Source: Morningstar.

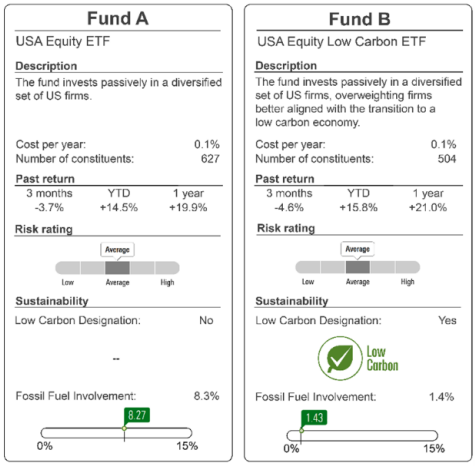
Please imagine you have to invest 10,000 USD for a period of 10 years. You have only two investment options: Fund A or Fund B...

If you had to choose, in which fund would you invest?

- ○ Fund A
- ○ Fund B

Screen 17: Self-reported emotions

YouGov



Using the following scale where 1 is 'It feels much better to invest in Fund A' and 5 is 'It feels much better in invest in Fund B'...

How do Fund A and Fund B compare regarding how it would feel to invest in them?

1 - It feels much better to invest in Fund A

5 - It feels much better to invest in Fund B

☐ Not sure

Screen 18: Climate techno-optimism

YouGov

To what extent do you agree or disagree with the following statement?

"New technologies will solve climate change without individuals having to make big changes in their lives."

- ○ Strongly agree
- ○ Tend to agree
- ○ Neither agree nor disagree
- ○ Tend to disagree
- ○ Strongly disagree
- ○ Don't know

Screen 19: Open-ended question

YouGov

When thinking about the energy transition, that is, the process of reducing our reliance on fossil fuels for energy needs, what are your main considerations? (Please write as much as you like in the box below.)

☐ No particular considerations

Treatment videos

Table A12: Scripts of the treatment videos

Pessimism treatment	Optimism treatment
In this short video, we would like to provide you with more information about the energy transition.	In this short video, we would like to provide you with more information about the energy transition.
Around three-quarters of our total global carbon emissions come from burning fossil fuels for energy needs.	Around three-quarters of our total global carbon emissions come from burning fossil fuels for energy needs.
So, to fight climate change, it's crucial to shift to cleaner energy sources.	So, to fight climate change, it's crucial to shift to cleaner energy sources.
Despite the progress made in recent years, significant challenges remain in making the energy transition happen.	Despite some challenges remaining, we already made significant progress in making the energy transition happen.
Renewable energy technologies have improved but are not yet ready to replace fossil fuels.	Renewable energy technologies have become much more efficient and already started replacing fossil fuels.
For instance, did you know that the energy transition requires doubling the electric infrastructure by 2040? Plus, batteries to store clean energy are still limited and expensive.	For instance, did you know that the cost of solar energy has decreased by more than 10 times since 2010? And cutting-edge batteries to store clean energy are becoming significantly cheaper too.
Investments in renewables have risen, but global investments in fossil fuels also grew in recent years to meet higher energy demand. Today, fossil fuels still represent more than 80% of global energy consumption.	Renewables already represent more than 80% of the new electricity capacity added globally every year, dwarfing investments in fossil fuel projects. According to experts, the shift to green energy is now unstoppable.
What's more, polls indicate that the phase-out of fossil fuels face growing public resistance in many countries.	What's more, polls indicate that renewables enjoy growing public support in many countries.
In the next few years, this may complicate the adoption of new public policies to accelerate clean energy solutions.	In the next few years, this is likely to facilitate the adoption of even more public policies to accelerate clean energy solutions.
Thank you for your attention and for continuing our survey. We appreciate your opinion!	Thank you for your attention and for continuing our survey. We appreciate your opinion!

Figure A5: Treatment videos: Additional page
The randomized treatment video is administered between Screens 7 and 8 of the baseline survey (see Appendix Section 4), after the "1. Climate concerns and preferences" question set, and before the "2. Climate transition beliefs" and "3. Investment" question sets.

YouGov

We would now like to show you a short animated video about the energy transition. Please pay attention to the information provided, as it will help you to continue the survey.

The video will appear on the next page. Please click play to start it. Please be prepared to watch and listen by ensuring that your window is maximized and you have the volume turned up.

You can watch the video as many times as you like. When the video has finished playing, you will be able to click forward to continue with the survey.

Please click forward to continue.

YouGov