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Is Sustainable Investing a Question of Money?

Insights from German Private Households

Master Thesis

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List of abbreviations

AIC	-	Akaike information criterion
AME	-	Average marginal effect
AUM	-	Assets under management
ESG	-	Environmental, social and governance
ETF	-	Exchange traded fund
Eurosif	-	European Sustainable Investment Forum
FNG	-	Forum Nachhaltige Geldanlagen
GSIA	-	Global Sustainable Investment Alliance
SIB	-	Social impact bond
SRI	-	Socially responsible investing
VIF	-	Variance inflation factor

1. Introduction

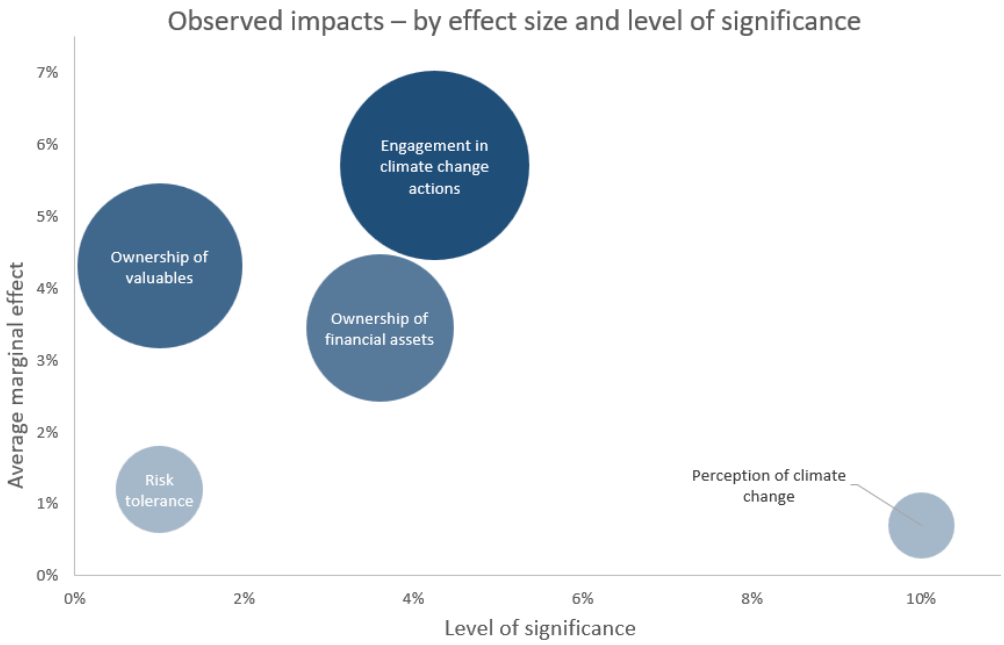
What drives German households to engage in sustainable investing? During the past decades, the landscape of investing has shifted towards more sustainability as investors become increasingly aware of the impact their financial decisions have on the environment and society (GSIA, 2023; FNG, 2023). Sustainable investing serves to drive companies towards eco-friendlier practices and allows investors to align investments with their environmental and social values, striving for positive impacts like reduced carbon emissions and improved human rights in supply chains (Busch, Bauer and Orlitzky, 2016; Marti, Fuchs, DesJardine, Slager and Gond, 2023; Richardson, 2013). Thus, it fosters (inter-) national climate protection along with the achievement of the Sustainable Development Goals (Gutsche, Wetzel and Ziegler, 2023). As sustainable investing has gained prominence and environmental, social and governmental (ESG) principles become more integrated into investment decisions, it is crucial to understand the factors that drive private households' motivations toward sustainable investing. It is yet to be investigated if financial considerations primarily drive their decision to invest sustainably, or if other motivational factors dominate their investment decision. This thesis aims to answer this research question by analyzing German private households. Additionally, the thesis aims to identify the level of awareness and understanding of sustainable investing among German private households. It further aims to identify how German households, that invest sustainably, behave beyond the financial realm. To shed light on the motivations to invest sustainably, this thesis reviews previous research and empirically analyzes a survey conducted by the Deutsche Bundesbank.

Despite its growing popularity, sustainable investing still remains a field characterized by various terms and acronyms, which are used interchangeably or get defined differently (Fulton, Kahn and Sharples, 2012; Swedroe and Adams, 2022). This leads to misunderstandings and inconsistencies regarding what can be referred to as sustainable investment, thus complicating the study of sustainable investing. It further challenges investors who aim to align their portfolios with sustainability goals. Therefore, this thesis aims to provide a clear picture of sustainable investing by clarifying its different approaches and explaining the ESG criteria. Further, an overview of sustainable investment products and ratings will be provided, followed by a summary of how sustainable investing has evolved during the past decades, both globally and specifically within Germany. A literature review will then highlight the current state of research regarding

the factors influencing private households in their decision to invest sustainably. Based on this review, hypotheses about the motives for sustainable investing are derived and afterwards tested using data from a 2020 Deutsche Bundesbank survey. The thesis concludes by critically examining the empirical results and the validity of the regression models, thus addressing dataset and regression model limitations. The empirical findings of this thesis will further be compared and contextualized to previous research.

Following the described approach, this thesis shows that the decision to invest sustainably is influenced by multiple financial and nonfinancial factors. According to this thesis findings, nonfinancial factors like risk tolerance and perception of climate change happen to drive the decision to invest sustainably. Participation in certain climate change actions has a significant impact too. With respect to financial considerations, the ownership of valuables and financial assets impacts a households' decision towards sustainable investing. Interestingly, demographics do not appear to have a significant impact. These results refer to a broad sample of German private households. When focusing specifically on households that own particular financial assets, different results emerged. The illustration beneath captures the main findings regarding the analysis of the broader sample.

Figure F1: Main findings



For ownership of financial assets and engagement in climate change actions, the mean value was calculated for all considered variables with significant effects. As an exam-

ple, the impact of participation in climate change actions on sustainable investing is relatively strong and significant at the five percent level, whereas the impact caused by higher levels of risk tolerance is lower in effect size but comparatively more significant.

This thesis sheds light into understanding motivations that drive sustainable investing among German households. By pointing out which German households are willing to align financial goals with environmental and social values, its main findings do not only contribute to academic knowledge but also provide practical implications.

2. What is Sustainable investing?

As this thesis is all about sustainable investing, it is necessary to understand what this really is. Sustainable investing refers to a range of long-term oriented investing approaches where investors aim to achieve financial returns while promoting social or environmental values (Schoenmaker, 2018; Stobierski, 2022; Swedroe and Adams, 2022). This includes various investment approaches, such as ESG investing, socially responsible investing (SRI), impact investing, ethical investing and even more (Prabhu and Yesugade, 2023). Central to many of these sustainable investment styles is the consideration of ESG criteria of investments within the decision-making process (Baker, Holzhauer and Nofsinger, 2022).

Unfortunately, the delineation of sustainable investing and the distinction between the different investing approaches presents significant challenges. As sustainable investing has massively evolved during the last decades, it is now a field with a substantial number of terms and acronyms, that are used interchangeably or get defined differently (Fulton et al., 2012; Swedroe and Adams 2022). Over time, ESG investing has even blurred into sustainable investing, as many papers use both terms synonymously (Zhou and Christianson, 2019; Baker at al., 2022; Swedroe and Adams, 2022). This overlapping usage of terms leads to a considerable potential for misunderstanding and confusion (Fulton et al., 2012). Consequently, delineating each approach from the broader concept of sustainable investing has become a difficult task.

To close this gap, the following sections aim to provide clear definitions of SRI, ESG investing and impact investing, which are the predominant approaches of sustainable investing (Swedroe and Adams, 2022). Furthermore, ESG criteria along with ESG ratings get explained. Additionally, an overview over popular sustainable investment

products is presented, offering a comprehensive perspective on the current landscape of sustainable investing practices.

2.1. Definition of ESG investing, socially responsible investing and impact investing

ESG investing refers to a subset of investments within the broader domain of sustainable investing (Prabhu and Yesugade, 2023). This sustainable investing approach relies on environmental, social and governance criteria of assets and aims to integrate them into a portfolio to the extent that they are material to the investment performance (Caplan, Griswold and Jarvis, 2013; Giglio, Maggiori, Stroebel, Tan, Utkus and Xu, 2023). ESG investing allows to forecast the future financial performance of companies and to evaluate corporate behavior, as ESG criteria serve to measure the societal impact and sustainability of an investment in a certain company (Bradley, 2021; Prabhu and Yesugade, 2023). Further, it is a tool for identifying non-financial risks that may impact an asset's value (Bradley, 2021). The aim of ESG investing is not only to generate long-term financial returns, but to also foster long-term social returns (Boffo and Patalano, 2020; Lei, Xue, Liu and Ye, 2023. In the realm of financial returns, ESG investments aim to maximize the shareholder value and to mitigate risk (Boffo and Patalano, 2020; Hill, 2020). In order to serve societal returns, ESG investing contributes to broader societal goals, particularly concerning environmental and social benefits, such as gender equality and human and worker rights (Boffo and Patalano, 2020). ESG investing is an active approach where investors proactively identify and incorporate investments based on ESG criteria into their portfolios (Caplan et al., 2013; Hill, 2020; Bradley, 2021).

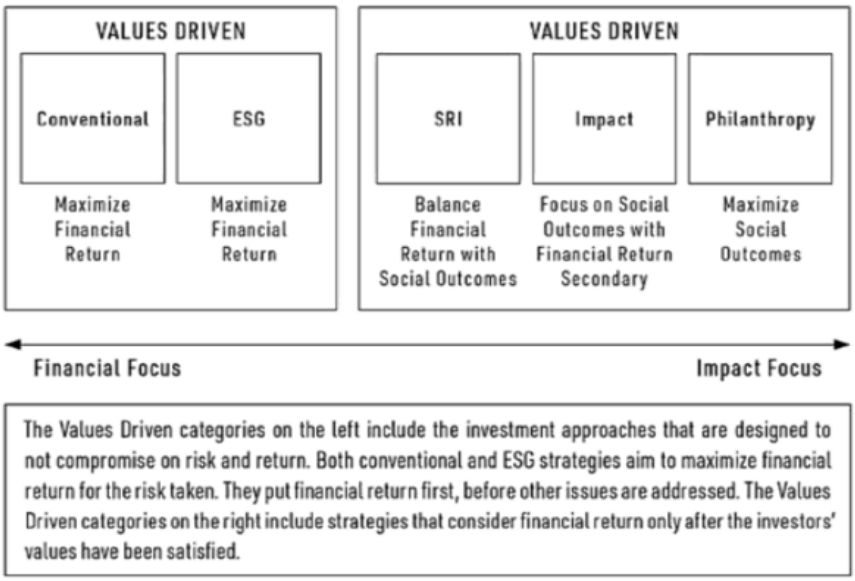
Since many years, ESG investing is often used as an umbrella term to describe any investing style that has an element of social and environmental purpose (Hill, 2020) and is therefore often used synonymously with SRI (Bradley, 2021). That makes a distinction between ESG and other sustainable investment approaches a hard thing to do.

SRI is similar to ESG investing in the way that it is also a sustainable investing approach that incorporates ESG criteria. But in difference to ESG, SRI focuses more on the social returns and less on financial returns (Starr, 2008; Boffo and Patalano, 2020; Zhou, 2023). It is a passive approach based on negative screening, which means avoiding to include certain industries or stocks into the portfolio that are deemed inconsistent with ESG standards (Caplan et al., 2013; Hill, 2020; Bradley, 2021; Humphrey and Tan,

2014). Typically, companies get excluded from being an investment opportunity, that produce or sell harmful substances or engage in harmful activities, like violating human rights or pollution (Bradley, 2021, Humphrey and Tan, 2014).

Besides ESG and SRI, the third most common form of sustainable investing is impact investing. In contrast to ESG and SRI, impact investing involves investments in projects or companies with mission related social or environmental goals (Caplan et al., 2013). Unlike ESG and SRI, impact investing aims to generate a measurable, positive environmental or social impact through the investments (Bradley, 2021; Haberstock, 2019).

Figure F2: Comparison of ESG, SRI and impact investing



The above illustration (Swedroe and Adams, 2022, p. 6) shows the degrees to which the different sustainable investment approaches prioritize financial or social aspects. Among the three mentioned approaches, ESG focusses the strongest on financial factors. Compared to that, SRI shifts more focus towards social values. Impact investing, on the other hand, clearly prioritizes social aspects and rather neglects financial ones. SRI and impact investing are more focused on aligning investment portfolios with investor's personal values, whereas ESG investing serves to enhance the financial performance of investments (Caplan, 2013).

As SRI and ESG investing are ESG criteria-based investment approaches that share foundational principles, this thesis will primarily focus on these two methodologies in the literature review, but less on impact investing due to its more specific application.

2.2. ESG Criteria

After the most common approaches of sustainable investing have been defined, this section explains ESG criteria in more detail. ESG criteria, often also called ESG factors, are used to identify material risks and growth opportunities of investment options (Bradley, 2021). They help to better determine a company's future financial performance (Bradley, 2021).

The environmental aspect of ESG describes a company's use of natural resources and its effect on the environment, in terms of direct operations and supply chains (Bradley, 2021). This component also assesses a company's approach of protecting the natural environment (Bradley, 2021). Thus, community health, pollution, and waste generation are examples for environmental risks and opportunities. If a company violates waste disposal regulations, this may lead to litigation and prosecution, while harming biodiversity can cause negative publicity and customer backlash, causing significant risks for investors (Jinga, 2021).

The second component of ESG are social aspects of an investment or a company (Bradley, 2021). Prominent examples for social aspects are human rights, health and safety, labor standards, diversity, inclusion, and data privacy (Bradley, 2021). Investors often favor companies that offer safe work environments and contribute to their communities as they view them as less risky due to potential benefits like higher productivity and talent attraction. Conversely, ignoring safety or community concerns may poses significant financial risks (Jinga, 2021). However, till now, the wider market struggles to agree on the specific scope of which issues should be taking into account (Bradley, 2021).

Corporate governance, the last component, describes how a company manages the varied expectations of stakeholders, including shareholders, employees, customers, suppliers, financiers, and the community (Bradley, 2021). A company with robust governance structures that operates within regulations and policies is perceived as transparent and fair (Jinga, 2021). Thus, good governance can mitigate the risk of mismanagement, corruption or regulatory penalties (Jinga, 2021).

Unlike common financial ratios, there is no common set of ratios that clearly define what a good "E", "S", or "G" score does look like. Indeed, some of the criteria may be more important to some stocks than to others. For example, the environmental risks

relevant to a bank will be less significant than those facing a mining company, while in case of a bank, governance risks may be more material (Bradley, 2021).

The following table provides an overview over the most common environmental, social and governance ESG criteria.

Figure F3: Overview over the ESG criteria

(Source: CFA Institute, ESG Factors: https://www.cfainstitute.org/en/rpc-overview/esg-investing)

2.3. Sustainable investment products and their ESG rating

If investors search for a way to incorporate ESG criteria into their investments, they can choose between several investment products. Most of the sustainable investment products are variations of traditional investment products and indexes, such as the S&P 500 or FTSE 100 indexes (Bradley, 2021).

One way to incorporate ESG criteria into a portfolio is to buy stocks with high ESG ratings. ESG ratings allow to identify where companies sit relative to each other, regarding their ESG issues (Bradley, 2021). Thus, investors can consider stocks that are “best-in-class” from an ESG score perspective, or they may exclude certain stocks entirely if, for example, their environmental score doesn’t reflect their values (Bradley, 2021).

Additionally, investors interested in ESG criteria have lots of fund options, including pension funds, SRI funds, mutual funds, ESG ETFs and ESG index funds. Notable examples for ESG related pension funds include the world's largest pension fund, Japan's GPIF, with $1.1 trillion in assets, and Europe's second-largest pension fund, the Dutch ABP, which focuses on reducing carbon emissions (Bernow, Klampner and Magnin,

2017). National and international ESG related pension funds, as well as SRI and ESG funds, aim for financial returns alongside social objectives, excluding sectors like weapons, gambling, or tobacco (Renneboog, Ter Horst and Zhang, 2011; Rossi, Sansone, Van Soest and Torricelli, 2019). ESG funds select companies with high ESG ratings, using either internal assessments or ESG scorings of external providers, despite the lack of an industry consensus on material non-financial factors (Bradley, 2021).

When looking at bonds, there are numerous types of sustainable bonds that serve ESG criteria. Very common are so called "green bonds". Green bonds are "fixed-income securities that raise capital to support projects or activities with specific climate or environmental sustainability purposes" (Inderst and Stewart, 2018, p. 32). According to the International Capital Market Association (ICMA), green bonds address key areas of environmental concern such as natural resources depletion, loss of biodiversity, as well as air, water or soil pollution (ICMA, 2017). Corporations, local and national governments, as well as international organizations can be issuers of green bonds (Gerard, 2019). Besides green bonds there are also social bonds and social impact bonds. Social bonds relate to social and financial aspects and are used to fund projects like education, education facilities and health care (Inderst and Stewart, 2018). In contrast to social bonds, social impact bonds (SIBs) are not bonds in the traditional sense, as they do not offer a fixed rate of return (Inderst and Stewart, 2018). An SIB is more of an inter-organizational arrangement that is used to develop, deliver and finance a new public service (Berndt and Wirth, 2018).

To get information about the amount of ESG criteria incorporation in certain investment products, ESG ratings from established ESG raters can be used. The sustainability evaluation of a company, or an asset, is normally blended into a single ESG score (Bradley, 2021). It is important to note that different rating providers use different rating methodologies and may rank different aspects of sustainability of a company (Boffo and Patalano, 2020). By now, there are over 100 ESG data providers (Fish, Kim and Venkatraman, 2019; Li and Polychronopoulos, 2020). Prominent examples are Bloomberg, FTSE, MSCI, Sustainalytics, Refinitiv or S&P's Trucost. How providers obtain and purchase raw data differs heavily between them (Bradley, 2021).

Rating organizations do not only differ in how to measure the various ESG criteria. They also differ on what criteria are deemed worthy of measurement (Cornell, 2020).

Bloomberg's ESG data, for example, covers over 120 environmental, social, and governance indicators, while MSCI covers less than 40 (Cornell, 2020). The following table provides an overview on which criteria are considered by certain rating providers (Boffo and Patalano, 2020, p. 22).

Figure F4: ESG criteria considered by different rating providers

Pillar	Thomson Reuters	MSCI	Bloomberg
Environmental	Resource Use	Climate Change	Carbon Emissions
	Emissions	Natural resources	Climate change effects
	Innovation	Pollution & waste	Pollution
		Environmental opportunities	Waste disposal
			Renewable energy
			Resource depletion
Social	Workforce	Human capital	Supply chain
	Human Rights	Product liability	Discrimination
	Community	Stakeholder opposition	Political contributions
	Product Responsibility	Social opportunities	Diversity
			Human rights
			Community relations
Governance	Management	Corporate governance	Cumulative voting
	Shareholders	Corporate behaviour	Executive compensation
	CSR strategy		Shareholders' rights
			Takeover defence
			Staggered boards
			Independent directors
Key metrics and submetrics	186	34	>120

As these providers use different metrics and do also use different criteria, it is no surprise, that several studies came to the conclusion that ESG scores of different rating providers differ a lot (e.g. Berg, Koelbel and Rigobon, 2022; Gibson, Krueger and Schmidt, 2021; Semenova and Hassel, 2015). The following table provides a good example of how different rating providers rate the same companies (Billio, Costola, Hristova, Latino and Pelizzon, 2021, p. 1432):

Figure F5: ESG ratings by different rating providers

Company	Sustainalytics	RobecoSAM	Refinitiv	MSCI
Nissan Motor Co., Ltd	6	77	72	CCC
Verizon Communications Inc.	91	20	67	BB
Oracle Corp. Jpn	78	8	63	BB
Goodman Group	86	21	58	AA

Having a standardized view of how one company ranks relative to another is missing (Bradley, 2021). Thus, individual ESG ratings are not comparable across providers. It is therefore necessary to keep in mind, that different ESG scores have different information value, when looking for ESG related investments.

3. Development of ESG investing worldwide and in Germany

Until the global awareness of ESG issues, sustainable investing, and especially ESG investing, was a slow burn for many years (Bradley, 2021). But during the past 20 years, the number of asset managers offering ESG strategies has grown immensely (Archer, 2024; Bradley, 2021; GSIA, 2023).

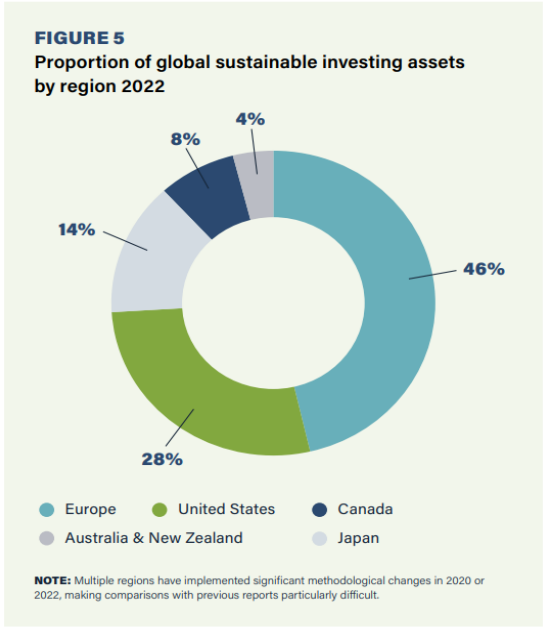
In the 20th century, responsible investing, an early form of sustainable investing, predominantly focused on allocating capital towards companies that did not profit from war or regimes with poor human rights records (Bradley, 2021). Within the 21st century, the sustainable investment ethos evolved to a broader spectrum of concerns, notably those regarding climate change, diversity or inclusion initiatives and established as "ESG" (Bradley, 2021). Especially after the 2008-2010 financial crisis, the awareness of ESG heighted and assets under management (AUM) for funds investing according to ESG criteria rose significantly (El Ghoul, Karoui, Patel and Ramani, 2023).

Figure F6 (left) and F7 (right): Development of sustainable investing worldwide; proportion of sustainable investing by region

FIGURE 1
Snapshot of global sustainable investing assets, 2016– 2022 (USD billions)

REGION	2016	2018	2020	2022
Europe	12,040	14,075	12,017	14,054
Canada	1,086	1,699	2,423	2,358
Australia & New Zealand	516	734	906	1,220
Japan	474	2,180	2,874	4,289
Sub-total (USD Billions)	14,115	18,688	18,220	21,921
% change		*32%*	*-3%*	*20%*
United States	8,723	11,995	17,081	8,400
Total (USD Billions)	22,838	30,683	35,301	30,321
% change		*34%*	*15%*	*-14%*

Global sustainable investment at **$30.3 trillion**

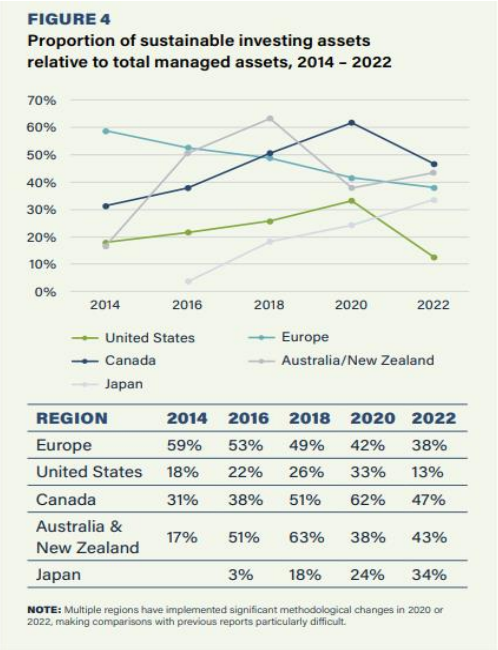


(GSIA, 2023, p. 10) (GSIA, 2023, p. 12)

According to the Global Sustainable Investment Alliance, $30,3 trillion was globally invested in sustainable assets in 2022 (GSIA, 2023). The above illustration F7 shows, that Europe and the United States represent the majority of sustainable investing assets,

which is indicative of their market size. Sustainable investing in Europe experienced an upward trend from $12 trillion in 2016 to $14 trillion in 2022. This growth has led Europe's share of sustainable assets relative to total managed assets, to an increase from 34 percent in 2020 to 46 percent by 2022. However, the growth of sustainable investing in Europe did not manage to keep pace with the broader market growth (*Figure F8*). The proportion of global sustainable investing assets are beginning to shift, with Japan's share increasing from 8 percent to 14 percent from 2020 to 2022 (GSIA, 2023). Additionally, Australia and New Zealand's share increased from 3 percent to 8 percent.

Figure F8: Proportion of sustainable investing assets by country



REGION	2014	2016	2018	2020	2022
Europe	59%	53%	49%	42%	38%
United States	18%	22%	26%	33%	13%
Canada	31%	38%	51%	62%	47%
Australia & New Zealand	17%	51%	63%	38%	43%
Japan		3%	18%	24%	34%

NOTE: Multiple regions have implemented significant methodological changes in 2020 or 2022, making comparisons with previous reports particularly difficult.

(GSIA, 2023, p. 11)

In Germany, the volume of sustainable investments has also significantly increased in recent years, showing German households become more aware of sustainable investing. According to the Deutsche Bundesbank (2019), the volume of sustainable investment rose by more than 70 percent between 2014 and 2018. Sustainable investments continue to grow in Germany. The total amount of sustainable investments reached a new record high of 578 billion euros in Germany by the end of 2022 (FNG, 2023).

Over the last decade, besides institutional investors, also retail investors have shown increasing interest in sustainable investing (Eurosif, 2022). Retail investors held 25 percent of the global socially responsible investment portfolio at the end of 2017 (GSIA, 2018). Compared to 2012 they held eleven percent more in 2017 (GSIA, 2018).

While PricewaterhouseCoopers (2022) predicts ESG-focused investments to hit $33.9 trillion by 2026, Bloomberg Intelligence (2021) forecasts global ESG assets to even exceed $53 trillion by 2025, surpassing a third of total global AUM.

Several developments explain the growth of ESG investing. Firstly, non-investors societal demands have changed (Boffo and Patalano, 2020). This change has led to an increase in corporate social responsibility among companies and even governmental entities, fostering a culture of reporting on practices and standards which may not directly correlate with short-term financial gains, but are meant to enhance long-term value through the strengthening of reputation, brand loyalty and talent retention (Boffo and Patalano, 2020). Secondly, there has been an increased demand from investors for data related to environmental, social, and governance factors, emphasizing the importance of taking action in good practices (Boffo and Patalano, 2020). Thirdly, ESG investors wish for responsible investing that adopts a sustainable perspective, which not only leverages the risk management aspects of ESG but also aligns better with their societal values (Boffo and Patalano, 2020). Karoui and Nguyen (2022) further stated that financial market crises, the prevalence of financial scandals and the challenges of the climate crisis also led investors to invest more in socially responsible investments options.

Overall, there is a trend both globally and in Germany observable, according to which sustainable investments are steadily increasing. Hence, the awareness of German households towards sustainable investing has risen sharply in recent years. Further, the growth in sustainable AUM is expected to continue.

4. Motives for sustainable investing – current state in literature

To answer the questions, which households engage in sustainable investing and what motivates them, previous empirical findings need to be analyzed in order to investigate whether financial incentives are the primary motivators, or if other values may dominate a households investment decision towards sustainability.

Despite the considerable volume of literature on sustainable investing, the predominant focus still lies on the perspective of managers. Studies on retail investors are comparatively rare to find (Petelczyc, 2022). In addition, most studies address the performance measurement of sustainable investments (Kapil and Rawal, 2023; Petelczyc, 2022).

Although most studies focus on examining the performance of sustainable investments and the perspective of institutional investors, in recent years increasing number of papers investigated what motivates retail investors to invest sustainably. However, so far there have been only few studies that specifically address German private households. Only Dorfleitner and Utz (2014), Brunen and Laubach (2022), Gutsche et al. (2023), Gutsche, Köbrich and Ziegler (2019) as well as Gutsche and Ziegler (2019) did focus on German private households in their studies. Most studies regarding motives for private households to invest sustainably address the Dutch, or the American financial market.

The literature to date has shown that there is no single dominant motive for sustainable investing, but rather that there are varying motivations and influencing factors. According to previous literature, motives for sustainable investing vary between financial, non-financial motives and demographics (e.g. Beal, Goyen and Phillips, 2005; Benson and Humphrey, 2008; Nilsson, 2008). However, there are many contradictions in the literature to date, as several studies have come to different conclusions.

The aim of the following sections is to analyze previous research, identify research gaps and findings and derive hypotheses regarding the impact of various financial, non-financial and demographic factors on the motivation of private households to invest sustainably.

4.1. Wealth factors/ financial factors

4.1.1. Financial performance expectations

What may drive a household's decision towards sustainable investing are expectations about the profitability of a certain investment option. However, empirical evidence regarding the effect of return expectations on sustainable investing remains contradictory.

Several studies demonstrate that the individual perception of the relative performance of conventional versus sustainable investments can influence investment decisions (e.g. Nilsson, 2008; Riedl and Smeets, 2017; Gutsche et al., 2019). For example, Nilsson (2008) found that investors who favor sustainable investments, are not only motivated by altruism but also by the belief that ethical mutual funds can perform at or above average. Thus, higher return expectations were found to enhance the likelihood of holding sustainable investments, whereas lower return expectations decrease it (Bauer, Ruof and

Smeets, 2021; Brunen and Laubach, 2022; Haber, Kepler, Larcker, Seru and Tayan, 2022). Investors with greater optimism about ESG returns tend to invest more money in ESG funds according to Giglio et al. (2023). The mentioned findings are in line with those of Kapil and Rawal (2023) who observed that profit-oriented investors do heavily focus on financially viable ESG investments. Additionally, egoistic individuals were found to only be willing to invest sustainably if it offers a high return rate by Brodback, Guenster and Mezger (2019.

What makes sustainable investing less appealing to performance-driven investors is that it limits the universe of diversification as it leaves out certain investment opportunities (Renneboog et al., 2011). Riedl and Smeets (2017) observed that socially responsible investors typically expect SRI funds to yield lower returns, achieve inferior sharpe ratios, and incur higher fees compared to conventional funds. In addition, Giglio et al. (2023) showed that the average retail investor expects ESG investments to yield negative returns. Further, investors deeming high returns as less important, were found to be more likely to hold a great proportion of socially responsible investments in their portfolio by Dorfleitner and Utz (2014). Pasewark and Riley (2010) did also observe socially oriented investors to accept lower returns. Sustainable investors therefore must have a willingness to accept suboptimal financial results in order to align investments with their values and preferences on social responsibility (Renneboog et al., 2011; Riedl and Smeets, 2017). In line with this thought is the finding of Giglio et al. (2023), who observed several motivations for ESG investing among retail investors. Only seven percent of retail investors reported that they were motivated by return expectations. 45 percent did not see any reason to invest in ESG, while 25 percent were motivated by ethical considerations and 22 percent by climate hedging.

These findings indicate, that the decision for incorporating ESG criteria may partly, but not only be driven by financial motives like return expectations. Supported is this assumption by further studies like Bollen (2007), Benson and Humphrey (2008), and Hartzmark and Sussman (2019). All of them found that sustainable investors in the United States exhibit less concern for returns compared to conventional investors. This indicates a prominence of non-financial motives in sustainable investment decisions.

In summary, many studies like those by Bauer et al. (2021) and Giglio et al. (2023) indicate a significant influence of return expectations on the decision to invest sustaina-

bly, whereas multiple other studies, like Riedl and Smeets (2017), demonstrate that sustainable investors are willing to accept lower returns in order to invest according to their personal values. Hence, their personal values seem to overweight financial considerations. Given these contradicting findings, it can be assumed that while return expectations impact sustainable investment decisions, they do not solely determine them, leading to the following hypothesis:

H1: Performance expectations regarding a sustainable investment do significantly impact the likelihood of holding sustainable investments among German households, with high expectations enhancing and low expectations decreasing the likelihood.

4.1.2. Financial constraints

This section aims to answer the question if wealthy households are more likely to incorporate ESG criteria into their portfolios. Literature regarding the influence of wealth factors remains inconclusive as some studies suggest no significant impact, others suggest a positive significant impact and even other studies suggest a negative significant impact. Most of the studies measured a household's wealth by its income. However, some researchers considered homeownership and portfolio size as indicators for wealth (e.g. D´Hondt, Merli and Roger, 2022; Delsen and Lehr, 2019; Gutsche et al., 2023).

As already mentioned, some studies found no significant impact for wealth factors on sustainable investing at all. For example, Delsen and Lehr (2019, p. 253) stated that "sustainability is no luxury good", as they did not find any influence for homeownership or income on the decision towards sustainable investing. Beside this finding, there are further studies by Nielsson (2008), Gutsche et al. (2023), Williams (2007), McLachlan and Gardner (2004), De Silva and Pownall (2014), which all could not observe any significant impact of income on sustainable investing. Additionally, Wins and Zwergel (2016), who carried out a survey across the United States, the United Kingdom and Europe, did also not observe any significant impact of income.

In contrast to the above findings, Gutsche, Nakai and Arimura (2021) observed that households with an income above the median are more likely to engage in sustainable investing. According to them, wealthier households tend to have a greater awareness of sustainable investment options due to their higher amount of investable money and

openness to exploring new investment opportunities. Further, Getzner and Grabner-Krauter (2004) found that individuals with higher income tend to be more likely to invest in green shares. As D´Hondt et al. (2022) observed lower exposure to ESG factors during the Covid-19 crisis period, they suggested ESG investing to be a luxury good for most investors. This is in line with Döttling and Kim (2021), who also posit ESG investments to be a luxury good. Dorfleitner and Utz (2014) further highlighted the importance of wealth, showing that individuals with larger investment portfolios are more familiar with sustainable investments. They also found individuals with higher investment volumes to be more likely to invest in companies aligning with their moral values.

Over the past years contradicting findings emerged, as a rising number of studies found a significant negative impact of wealth factors on sustainable investing. In addition to their finding of lower exposure to ESG during the Covid-19 crisis, D´Hondt et al. (2022) further observed that wealthier retail investors as well as retail investors with a higher trading frequency, showed significantly lower exposure to ESG. To measure wealth, they used portfolio size as a proxy. Aligning with this finding, Bauer et al. (2021) observed that higher-income individuals are slightly less likely to choose sustainable investments. Partly supported is this finding by Dorfleitner and Utz (2014), who observed that the social regard of investments is more important to less affluent individuals. In addition, they found investors who are willing to sacrifice returns to have a very low investment volume (Dorfleitner and Utz, 2014). In line with this, Bauer and Smeets (2015), who utilized survey data from clients of Dutch banks, found higher levels of social identification among low-wealth investors. This is further supported by Rosen, Sandler and Shani (1991), who showed socially responsible investors to be less affluent than conventional investors. These findings also match Junkus and Berry's (2010) profile of socially responsible investors, as they also found sustainable investors to be less wealthy compared to conventional investors.

Very interesting is the finding of Giglio et al. from 2023. They observed that less wealthy investors are generally less likely to invest in ESG funds. But when they do, they tend to allocate a larger portion of their portfolio to ESG funds, compared to wealthier investors.

What may explain the different findings is that respondents with high investment volumes tend to be more familiar with investing itself and therefore also with sustainable

investments, whereas less affluent respondents emphasize the social regard of investments as more important to them (Dorfleitner and Utz, 2014; Gutsche et al., 2021).

In summary, literature shows an incongruent picture of the relationship between wealth factors and sustainable investment behavior. While some studies indicate a non-significant impact, others do indicate a positive, and even others a negative impact. There is definitely a need for more empirical research to shed more light on the relationship between wealth factors and the decision to engage in sustainable investing. Given the diverse and contradictory findings in previous research, the following hypothesis adopts a no-impact approach, suggesting wealth factors to exert no impact:

H2: Wealthier households are not more likely to engage in sustainable investing compared to less wealthy households.

4.1.3. Financial literacy

Since a few years, the impact of financial literacy on sustainable investment decisions has been analyzed with rising interest. D´Hondt et al. (2022) observed a strong negative correlation between subjective financial literacy and stock portfolio scores in social and environmental factors. This implies that individuals with higher financial literacy have a reduced engagement to SRI. Interestingly, their finding for the environmental and social factor does not hold true for the governance factor. They identified a contrasting, positive relationship between financial literacy and engagement to the governance factor of SRI. This suggests that understanding governance-related nonfinancial information might require a certain level of financial literacy or interest in financial matters (D´Hondt et al., 2022). The authors therefore advise for a separate consideration of the three ESG criteria.

Gutsche et al. (2021), who also found that higher levels of financial literacy decrease the likelihood of holding sustainable investments, provide an interesting perspective. They note that financial literacy includes familiarity with financial theories and concepts such as risk and diversification. They argue that financially literate investors may be aware of the fact that sustainable investment strategies can restrict the range of investable assets. Consequently, such investors may avoid sustainable investments as they desire to diversify unsystematic risk and avoid the restricted investment universe accompanied by sus-

tainable investment strategies (Gutsche et al., 2021). In line with that, Rossi et al. (2019) reported that self-perceived financially literate individuals exhibit less interest in SRI products, compared to their less literate counterparts.

In contrast to that, Gutsche et al., (2023) found a significantly positive effect of financial literacy on sustainable investing. As it is easier for financial literate persons to search, identify, and understand relevant information before making investment decisions, they are assumed to have lower information costs than those with less financial knowledge (Gutsche and Zwergel, 2020). Further, Gutsche et al. (2021) argue that individuals with advanced financial knowledge are likely to be better informed about new products and trends within the financial market, causing them to be more aware of sustainable investments. However, they found contrary evidence, as noted above.

In conclusion, most studies suggest that higher financial literacy is associated with reduced engagement to sustainable investing. Noteworthy is that one of the ESG criteria seems to differ from the others as financial literacy does not decrease the likelihood of holding governance related sustainable assets, but it does decrease the likelihood for holding assets with environmental and social aspects. The hypothesis regarding the influence of financial literacy is:

H3: Households with higher financial knowledge are less likely to have engaged in sustainable investing.

4.2. Non-financial factors

4.2.1. Social, political and environmental values

Social preferences have a significant impact on many economic decisions. They are key in understanding what incentivizes people and can explain why people are willing to sacrifice financial returns in order to increase social welfare (Charness and Rabin, 2002; Fehr and Fischbacher, 2002; Bandiera, Barankay and Rasul, 2005; Pasewark and Riley, 2010). Thus, they might also drive a household's motivation to invest sustainably. During the past few years, the impact of personal values on sustainable investment decisions has been the subject of a rising number of studies.

Empirical research has shown that many investors view their investments not only as financial instruments but also as consumer goods (Borgers and Pownall, 2014; Rossi et

al., 2019; Barber, Morse and Yasuda, 2021). Lots of investors are willing to forgo some financial return in favor of achieving social or environmental goals (Borgers and Pownall, 2014; Rossi et al., 2019; Barber et al., 2021). Hence, many ESG investors see lower returns as a trade-off for aligning investments with their ethical and social beliefs (Kapil and Rawal, 2023). The degree to which investors are willing to sacrifice financial returns appears to depend on their personal and political values as well as their social preferences, as suggested by studies from Bollen (2007), Bauer and Smeets (2015), Jansson, Sanberg, Biel and Gärling (2014), and Riedl and Smeets (2017).

In a cross-country study, Williams (2007) observed that SRI is more influenced by non-financial objectives, in particular social goals, than by financial returns. Bauer and Smeets (2015) similarly found that return expectations are not the primary driver of SRI. This also aligns with the finding of Gutsche et al. (2021), who noted that future intentions to engage in sustainable investing are driven by individual environmental values and ecological political identification. Additionally, Riedl and Smeets (2017) found that social preferences, particularly the tendency to trust others, play an important role in individual sustainable investment decisions. Their finding was confirmed by Gutsche et al. (2023), who found that altruism and trust positively drive sustainable investing. According to them, people are more interested in sustainable investing when they are generally willing to give without expecting a return in receive. They further highlight the motivational role of warm glow, which is the good feeling caused by the act of giving. Warm glow was found to motivate individuals towards sustainable investing in several other studies, such as Dreyer, Sharma and Smith (2023), Gutsche and Ziegler (2019), Gutsche et al. (2019), or Heeb, Kölbel, Paetzold and Zeisberger (2022). These findings of enhanced engagement in sustainable investing further align with the multi-attribute utility function (Ariely, Bracha and Meier, 2009). It suggests that investors consider more than just the risk-return balance, but rather derive direct satisfaction from the socially responsible characteristics of the funds, when they trigger intrinsic motivation like the value of giving per se (Ariely et al., 2009). This trend of personal values driving sustainable investment decisions is supported by further studies such as Nilsson (2008), Nakai, Honda, Nishino and Takeuchi (2018), and Brodback et al. (2019), Gutsche et al. (2019), which all suggest altruistic individuals being more likely to be sustainable investors.

In their study, Giglio et al. (2023) specifically highlighted the role of concerns about climate change. They observed that the highest average portfolio share in ESG funds was among investors motivated primarily by ethical investment considerations and high concerns about climate change. A high concern for climate change was especially observed among younger, female investors, and those from regions with higher support for the Democratic party (Giglio et al., 2023).

When comparing western and non-western countries, Gutsche et al. (2021) found that nonfinancial factors, such as values and personal attitudes, seem to be less significant in non-western countries, indicating cultural and regional differences in sustainable investment behavior.

According to Gutsche et al. (2021) it is plausible to assume that individuals with stronger social preferences might exhibit a higher awareness of sustainable investments, as they might look for ways to express their values and contribute positively to society more actively. It is further reasonable that individuals with strong environmental beliefs are more likely to be aware of sustainable investments as they might belong to communities with similar beliefs and easier access to relevant information. Hence, these individuals might be more willing to proactively seek opportunities for expressing their environmental values (Gutsche et al., 2021). In line with that, Gutsche and Ziegler (2019) and Gutsche et al. (2023) found environmental values so drive sustainable investing.

A contrasting effect was observed by Anderson and Robinson (2022), who found individuals with strong environmental values to exhibit a notable disinterest in financial matters. These households engaged less in financial activities, like stock ownership or pension balance checks. This disinterest in financial matters suggests that high pro-environmental values do not necessarily translate into green financial decision making (Anderson and Robinson, 2022). Further, Gutsche et al. (2019) found a significant negative correlation between a preference for left wing parties and interest in sustainable investing, caused by a strong stock market aversion of left-wing oriented individuals.

In conclusion, most previous research indicates a significant impact of environmental, social and political values on the decision to invest sustainably. These values seem to be a strong motivation for households to engage in sustainable investing. Therefore, the hypothesis addressing the influence of personal values is:

H4: Households with strong environmental, social or political values tend to be more likely to have invested in a sustainable manner compared to households with weaker environmental, social or political values.

4.2.2. Social signaling

A further motivation for sustainable investing seems to be social signaling. Social signaling, refers to showing others that one invests in a sustainable manner as doing so may improve one's own social reputation (Riedl and Smeets, 2017). The motivation behind signaling prosocial or sustainable behavior comes from the desire to be perceived positively by others (Ariely, et al., 2009). Social image is therefore highly dependent on others' perceptions. Improving one's social image derives from the human desire for social approval and respect from others (Ariely et al., 2009). Further, the value of an individual's image increases with the visibility of their prosocial actions, thus enhancing the incentive for such behavior (Ariely et al., 2009). However, this field of research is rather new. Thus, there is just a little number of studies so far.

Especially Riedl and Smeets (2017), being the first to investigate this field of research, have highlighted the role of social signaling in sustainable investment decisions. According to them, some investors choose sustainable investments as an opportunity to signal their commitment to sustainability to others. This phenomenon is characterized by the tendency of such investors to discuss their investment choices with their peers (Riedl and Smeets, 2017). They found social signaling to significantly enhance the likelihood for engaging in sustainable investing. A second study that investigates the influence of social signaling, is the so far often mentioned study from Gutsche et al. (2021). In their study upon the Japanese financial market, they found that social signaling and word-of-mouth learning are among the most significant determinants which influence individual sustainable investment choices. They also observed that individuals who claim to regularly talk about investments tend to be significantly more likely to know about sustainable investments (Gutsche et al., 2021). According to them, social signaling is a key motivation for Japanese retail investors to invest sustainably.

Contrasting the above studies, Gutsche et al. (2023) observed a negative correlation between social signaling and sustainable investing and thus suggested individuals who

often talk about investments to have a negative opinion about sustainable investments. However, they were not able to find a solid explanation for this contradicting finding.

In conclusion, social signaling seems to have a positive effect on sustainable investment decisions. The desire to be perceived by others in a positive way, seem to play a critical role in the decision-making process of sustainable investors. However, the influence of social signaling is a rather new field in research and has therefore been little investigated to date. Thus, definitely more research is needed to see if the previous results can be confirmed by others. Given the so far consistent research, the hypothesis regarding the influence of social signaling is:

H5: Social signaling enhances the likelihood of investing sustainably.

4.2.3. Risk preference

Within the past few years an increasing number of studies has explored the relationship between investors' risk tolerance and their preferences for sustainable investments. But just like the research field regarding social signaling, this is also a rather new field.

As one of the primary reasons for considering ESG factors is to reduce investment risks, investors with lower risk tolerance might care more about environmental and social factors, viewing them as associated with lower risk (CFA, 2020). Aligning with this thought, D`Hondt and his colleagues (2022) identified a strong negative correlation between higher risk tolerance and environmental and social criteria, suggesting that less risk-tolerant investors may favor environmental and social criteria of assets. Conversely, they observed a positive relationship between higher risk tolerance and the governance factor, a finding which indicates that the three ESG criteria are not homogenous (D`Hondt et al., 2022). This calls for further investigation.

An approach that hints on a contrasting relation is provided by Gutsche et al. (2021), as they found a significant positive effect of higher risk tolerance on Japanese households' awareness of sustainable investments (Gutsche et al., 2021). They propose that risk-tolerant individuals might be more willing to accept the risk of limited diversification opportunities, arising from sustainable investment strategies. Additionally, risk-seeking investors are more open to explore new investment opportunities and might thereby increase the likelihood of being aware of sustainable investments (Gutsche et al., 2021).

While the before reviewed studies offer intriguing insights into the relationship between risk tolerance and sustainable investing, it is important to acknowledge that the majority of previous research, including studies by Riedl and Smeets (2017), Delsen and Lehr (2019), Pérez-Gladish, Benson and Faff (2012), Bauer and Smeets (2015) or Gutsche et al. (2023) found no evidence for risk appetite significantly driving sustainable investing.

Since this is a new field of research and studies are limited, more research is needed. In summary, while there are contradicting results, most of the research suggests that risk preferences do not significantly impact engagement in sustainable investing. Hence, the hypothesis regarding the impact of risk preference is:

H6: The risk preference of a German households has no significant impact on the decision to invest sustainably.

4.2.4. Behavior of sustainable investors outside of the financial world

Another factor that may drive households' decision towards sustainable investing might be their behavior outside the financial realm. People, who participate in lots of prosocial and sustainable actions, might be more willing to also invest sustainably, in order to behave consistently. So far there has unfortunately been little research on the link between actual non-financial sustainable behavior and sustainable investing. Thus, this literature review draws on psychological insights into why people adopt sustainable behaviors, the spillover of such behaviors across different areas, and examines characteristics of sustainable investors in their everyday, non-financial activities.

According to the Theory of Planned Behavior, sustainable behavior is driven by personal attitudes towards sustainability, subjective norms, perceived behavioral control and by the perceived importance of a moral action (Ajzen, 1985; Rex, Lobo and Leckie, 2015; Jones, 1991). Further, sustainable behavior arises from recognizing a positive value in such behavior (Mastria, Vezzil and De Cesarei, 2023). Anticipation of positive future emotions or avoidance of negative feelings, along with satisfaction from meeting sustainability expectations, also drive sustainable actions (Mastria et al., 2023).

Given that drivers for sustainable behavior can be similar across various contexts, the question arises of whether engaging in sustainable behavior in one situation could cause sustainable behaviors in another. As the Theory of Consistent Behavior argues that in-

dividuals exhibit consistency in their behavior across different situations and have stable dispositions and qualities, acting sustainably in everyday situations could likely cause engagement in sustainable investing, (Cervone and Shoda, 1991; Weisbuch, Slepian, Clarke, Ambady and Veenstra-VanderWeele, 2010). However, whether sustainable concern and behavior in one area leads to sustainable behavior in another, depends on numerous factors according to previous literature. For example, positive spillovers, where one pro-environmental behavior leads to another, depend on how similar certain actions are perceived. If actions are perceived as similar, positive spillovers are more likely, as observed in studies by Margetts and Kashima (2017) and Thøgersen (2004). Additionally, spillovers depend on efforts and costs that tasks require (Gneezy, Imsa, Brown, Nelson, Norton, 2012; Thøgersen and Crompton, 2009; Truelove, Carrico, Weber, Raimi and Vandenbergh, 2014). Brick, Sherman and Kim (2017) highlighted that acting consistently in a sustainable way also depends on an action's visibility. What may hinder individuals with strong altruistic values to exhibit certain sustainable behaviors are financial incentives (Brunen and Laubach, 2022; Steinhorst, Klöckner and Matthies, 2015; Thøgersen and Crompton, 2009; Xu, Zhang and Ling, 2018). These findings indicate that a spillover of sustainable behavior from one area to another is rather complex. However, if households already participated in climate change actions that are perceived as similar, or require similar resources and are equal in visibility, it can be assumed that they are more likely to also adopt to sustainable investment behavior.

Smeets (2012) found socially responsible investors to engage more often in voluntary work, register more often as organ donors and to also contribute more to charitable causes when compared to their conventional counterparts. However, the extent of their prosocial actions varies across different activities. Specifically, socially responsible investors contribute 68 percent more to charity than conventional investors but are only 21 percent more likely to volunteer (Smeets, 2012). Supporting this finding, Riedl and Smeets (2017) also found socially responsible investors to generally donate more to charity than conventional investors. Further, Gutsche et al. (2019) found that being a member of an environmental organization drives sustainable investing. Moreover, Gutsche (2019) identified a positive correlation between sustainable investing and active involvement in the Christian religion.

Brunen and Laubach (2022) analyzed non-investment-related sustainable behavior of clients from three German robo advisors and set it in relation to their investment deci-

sions. Their research indicates that individuals with sustainable consumption habits are more likely to invest in sustainable portfolios. Supporting this finding, Han and Yoon (2015) along with Palacios-González and Chamorro Mera (2018), did also observe sustainable consumption habits to positively impact the intention to invest sustainably. These findings align with the Theory of Consistent Behavior. However, half of the respondents of Brunen and Laubach`s (2022) study claiming sustainable habits, failed to actually reflect these claims in their actions and did not walk the talk. Only consumers genuinely committed to sustainability are also motivated to invest sustainably, whereas those whose claims are cheap, prioritize personal gain, showing an unwillingness to forgo financial returns in order to contribute to sustainable development (Brunen and Laubach, 2022).

An intriguing approach by Brunen and Laubach (2022) hints at an alternative relationship. With regard to mainstream consumers, they highlight the appearance of moral licensing. Moral licensing is a concept arguing that mainstream consumers may use sustainable investments to compensate their less sustainable consumption (Brunen and Laubach, 2023; Tiefenbeck, Staake, Roth and Sachs, 2013). In line with that, Gutsche et al. (2023) observed individuals who volunteer to be less likely to invest sustainably, suggesting a crowding-out effect from other pro-environmental or pro-social activities, and referenced to the concept of moral licensing. This approach suggests that sustainable behavior in everyday life does not necessarily lead to increased engagement in sustainable investing, contradicting the concept of the Theory of Consistent Behavior.

The relationship between sustainable non-financial behavior and the propensity for sustainable investing needs further refined research due to contrasting findings. Specifically, the contrasting effects of Consistent Behavior Theory and moral licensing call for additional investigation. Considering that most of the reviewed research indicates sustainable investors to often participate in non-financial environmental and social activities, along with the concept of the Theory of Consistent Behavior, the following hypothesis is derived:

H7: Individuals who exhibit a high degree of sustainable behavior in non-financial aspects of their lives are more likely to invest in a sustainable manner.

4.3. Socio demographic factors

4.3.1. Age

Since many years, research on sustainable investing has focused on demographic characteristics, especially on age, and how it relates to preferences for ESG investments. Already in 1991, Rosen and colleagues observed ESG investors to be younger compared to investors of the broader population. In line with that, Riedl and Smeets (2017) as well as Bauer et al. (2021) found older individuals to be less likely to hold SRI funds, indicating a lower preference for sustainable investments among older people. Giglio et al. (2023) further confirm this trend, noting a significantly higher participation in ESG investments among younger investors compared to older ones. Additionally, Bauer and Smeets (2015), found high levels of social identification among younger investors. These findings support the profile of socially responsible investors, outlined by Junkus and Berry (2010) which states socially responsible investors to be younger. Further supported is this trend by Bernow et al. (2017), Gutsche et al. (2019), Gutsche et al. (2023), Giglio et al. (2023), as well as Dorfleitner and Utz (2014), who all reported that sustainable investments are favored by younger individuals. Based on all of these findings; the question about underlying reasons for this demographic trend raises.

Haber et al. (2022) found younger investors to be more willing to support environmental and social issues, even at the cost of giving up a part of retirement savings, compared to older investors. They also found younger individuals to be more concerned about environmental and social issues when compared to older ones. Giglio et al. (2023) confirm this, as they observed that young investors often cite moral reasons as primary motivation for ESG investments. Thus, ethical motivations must be more important to younger investors which may explain the stronger engagement in sustainable investing.

However, Delsen and Lehr (2019) present a contrasting view. They found age to have a positive effect on sustainable investment decisions, indicating that older individuals are more likely to engage in sustainable investing. When looking at their result, it is important to note that their study only included participants aged 40 and above, and has therefore a very limited sample. Similarly, research by D`Hondt et al. (2022) and Rossi et al. (2019) showed older individuals to be more likely to incorporate ESG criteria into their portfolios.

While some researcher observed sustainable investors to be older, the majority of studies found sustainable investors to be younger. This leads to the following hypothesis:

H8: Households with younger members tend to be more likely to invest in a sustainable manner, compared to households with older members.

4.3.2. Gender

When looking at the influence of gender on sustainable investing, previously research presents a very clear trend. To date, many researchers have investigated the relationship between gender and sustainable investment behavior.

Bauer et al. (2021) as well as Gutsche et al. (2023) observed women to be more likely to invest in sustainable funds. Dorfleitner and Utz (2014) confirmed this finding by showing that women tend to have a significantly higher probability of investing in socially responsible mutual funds, compared to men. Consistent with this, Nilsson (2008) found men to tend to invest a smaller proportion of their portfolios in SRI. In line with the mentioned findings, the consensus among several other studies is that well-educated women are more likely to engage in socially responsible investments (e.g. Junkus and Berry, 2010; Rosen et al., 1991; Starr, 2008; Williams, 2007).

Many further studies highlighted that women have stronger social preferences as well as stronger preferences for sustainability which may explains the higher engagement of women towards sustainable investing (e.g. Bolton and Katok 1995; Eckel and Grossman 1998; Güth, Schmidt and Sutter 2007; Croson and Gneezy 2009; Delsen and Lehr, 2019). Giglio et al. (2023) further note that ethical motivations for investments are particularly more important for women than for men. Further, Laroche, Bergeron and Barbado-Forelo (2001) found women to be more environmentally concerned than men.

However, among some recent studies, contrasting findings have emerged. Ridel and Smeets (2017) as well as D`Hondt et al. (2022) and Gutsche et al. (2019) could not find evidence of gender influencing SRI preferences. Aligning to that, Giglio et al. (2023) also found that actual ESG investment behavior is similar across genders. Interestingly, Gutsche et al. (2021) reported women to not only be more uncertain about their future sustainable investments, but also to be less likely to have heard of sustainable investing.

In conclusion, while there is lots of research suggesting a general trend for women to have a stronger preference for sustainable and socially responsible investments, there are some findings that could not confirm this trend. But as the overall majority in research confirms this trend, the hypothesis for the impact of gender on the decision to engage in sustainable investing is:

H9: Compared to men, women tend to be more likely to invest in a sustainable manner.

4.3.3. Education

When looking at the research on the relationship between education and sustainable investing behavior one again finds varying results.

Rosen and his colleagues (1991) reported that ESG investors tend to be better educated compared to other investors from the general population. This finding aligns with Delsen and Lehr (2019), who observed that women exhibit stronger preferences for sustainability when they are higher educated. Bauer and Smeets (2015) further found high levels of social identification among highly educated investors. This aligns with Junkus and Berrys (2010) observation of socially responsible investors being well-educated. This is consistent with evidence from Ridel and Smeets (2017) as well as Rossi et al. (2019), who also indicated individuals with university education to be more likely to invest in SRI funds. Nilsson (2008) observed that individuals without a university degree tend to engage less in SRI. A possible explanation for the trend of higher educated individuals holding more sustainable investments might be the finding of Franzen and Meyer (2010) who found that environmental awareness and environmental concern are positively correlated with the education level, as knowledge is necessary to recognize and understand the complexities of environmental issues.

However, contrasting findings have emerged. D`Hondt et al. (2022) observed that highly educated investors had significantly lower ESG scores in their stock portfolios, compared to less well-educated investors. Hence, highly educated investors are suggested to pay less attention to ESG criteria which convey nonfinancial information when they make investment decisions (D`Hondt et al., 2022). Additionally, Gutsche and Ziegler (2019) found lower education groups to be more likely to have invested in sustainable investment products.

Conversely, Dorfleitner and Utz (2014) as well as Gutsche et al. (2023) could not find any evidence for an influence of education on sustainable investment behavior.

In conclusion, while there is a general trend suggesting that highly educated investors show a preference for ESG investments, some researchers contradictory findings. According to the general trend in research the following hypothesis was derived:

H10: Households with higher educated members tend to be more likely to invest in a sustainable manner.

5. Data set & methodology

5.1. Descriptive analysis of the data set

After the previous research was reviewed and hypotheses got derived, the basis for the empirical testing of these hypotheses gets examined in detail. In order to empirically analyze which German households invest in a sustainable manner, a data set provided by the Deutsche Bundesbank was used. The data set refers to a survey, called “Private Haushalte und ihre Finanzen, Zwischenbefragung 2020”. The survey only includes data from the year 2020 and therefore no panel data. For taking part in the survey, participants had two options: online or via pen and paper. In total, 4,550 German households were asked about their financial situation during the corona crisis. Notably, in this survey participants were also asked about their sustainable behavior.

The following figures provide descriptive information on the uncleaned data set:

Figure F9: Distribution of gender

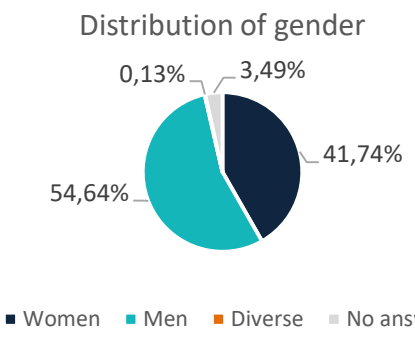
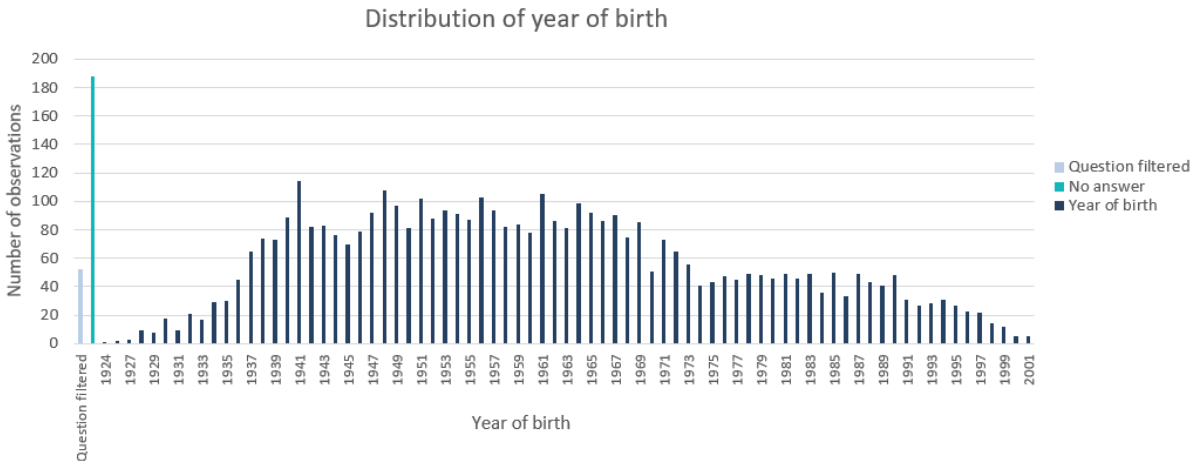


Figure F10: Distribution of age

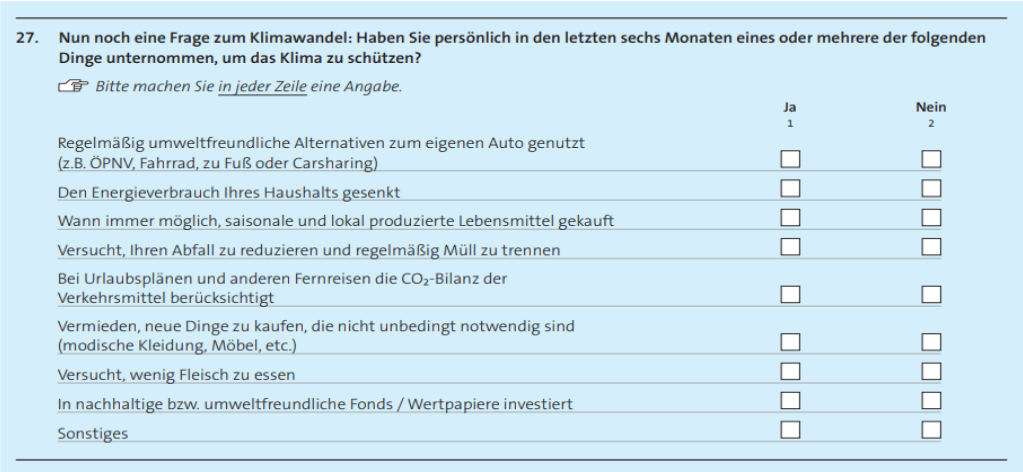


Recording to *figure F9*, more than half of the participants was male, with 54.54 percent in total. 41.74 percent of the sample was female, while only six participants identified as gender diverse. As *figure F10* shows, the majority of the participants was born between 1940 and 1970. Therefore, younger generations are under representative in the sample. Additionally, most of the participants were either employed in full time with N=1,492 or reported to be a retiree or pensioner, with N=1,747[1]. The vast majority reported to be married, making 54.88 percent in total[2]. When analyzing the personal educational level, most participants reported "completed vocational training" with N=1,403, followed by "completed master's degree or diploma" with N=1,392[3]. The average income among the sample lies by 3,327.783€[4]. In summary, the sample predominantly consists of older individuals who possess a high level of education and income, with the majority being either employed full-time or retired. Additionally, most participants were male.

As already mentioned, the survey included a question about sustainable behavior, which is captured by the below figure. When asked, which thigs had be done to protect the climate throughout the past six months, participants had the opportunity to select several response options. One of these response options was "Invested in sustainable and/or environmentally friendly funds/ shares" (Deutsche Bundesbank, p. 8):

[1] See table A2 in the appendix.
[2] See table A3 in the appendix.
[3] See table A1 in the appendix.
[4] See table A6 in the appendix.

Figure F11: Question regarding climate change actions



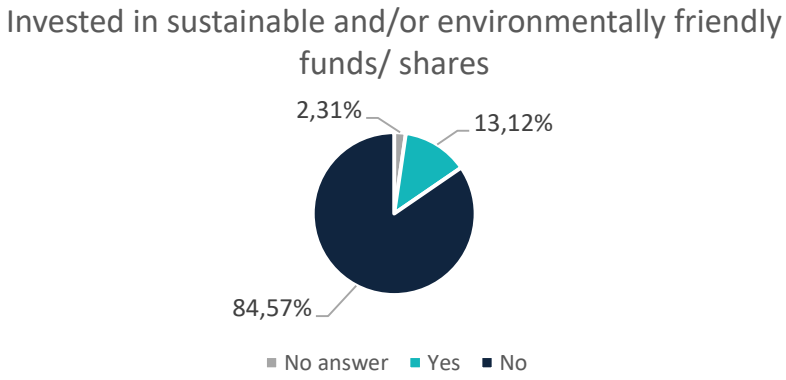
27. **Nun noch eine Frage zum Klimawandel: Haben Sie persönlich in den letzten sechs Monaten eines oder mehrere der folgenden Dinge unternommen, um das Klima zu schützen?**

☞ *Bitte machen Sie in jeder Zeile eine Angabe.*

	Ja 1	Nein 2
Regelmäßig umweltfreundliche Alternativen zum eigenen Auto genutzt (z.B. ÖPNV, Fahrrad, zu Fuß oder Carsharing)	☐	☐
Den Energieverbrauch Ihres Haushalts gesenkt	☐	☐
Wann immer möglich, saisonale und lokal produzierte Lebensmittel gekauft	☐	☐
Versucht, Ihren Abfall zu reduzieren und regelmäßig Müll zu trennen	☐	☐
Bei Urlaubsplänen und anderen Fernreisen die CO_2-Bilanz der Verkehrsmittel berücksichtigt	☐	☐
Vermieden, neue Dinge zu kaufen, die nicht unbedingt notwendig sind (modische Kleidung, Möbel, etc.)	☐	☐
Versucht, wenig Fleisch zu essen	☐	☐
In nachhaltige bzw. umweltfreundliche Fonds / Wertpapiere investiert	☐	☐
Sonstiges	☐	☐

This is the central question, that is from interest for this thesis, as it allows to analyze those households, that stated they have invested sustainably. The answer option "invested in sustainable funds/ shares" therefore is the dependent variable for the regression models. Thus, a closer look must be paid on the descriptive statistics of this question.

Figure F12: Distribution of answer option "invested in a sustainable manner"



Out of the 4,550 households of the survey, 597 households, which equal 13.12 percent, stated that they have invested in sustainable funds or shares within the past six months whereas the vast majority has not invested in sustainable funds or shares (*figure F12*). These 13.12 percent are from high interest as the aim of this thesis is to find out, what characterizes and motivates these households to invest sustainably.

After analyzing the descriptives of the dataset, the next step in the process was to identify several financial, non-financial and demographic factors that could serve as independent variables for the regression.

Financial independent variables captured information about households' savings, income, ownership of assets and their financial stability. Key independent variables were current net income, income changes during the pandemic, future income projections, net wealth, and ownership of special valuables and vehicles. The households' financial stability, was also addressed. Besides that, the total monthly expenditures were also included. Savings were assessed by whether households could save money, though the savings' value was excluded due to missing responses. In addition, financial asset ownership and their estimated values, along with business ownership, were considered. Moreover, homeownership and ownership of other real estate were used. In summary, many variables addressing financial considerations were used. These variables intended to show whether households are wealthy or not. To find out whether financial factors have a significant influence and whether the decision to opt for sustainable investing depends largely on how much money a household has, will help to answer the question of whether sustainable investing is a luxury good.

To investigate whether factors other than financial ones dominate the decision to invest sustainably, multiple demographics were used in the regression. Thus, age, gender, marital status, education and current employment status were considered too. Current employment status, is also referred to as "job" throughout the next sections.

For non-financial independent variables, various personal preferences, values as well as information on actual behavior were included. First, the risk preference of the participants was captured. Also captured was the personal awareness of climate change. In question 27 of the survey, households were asked which of the listed climate change actions they had done within the past six months. Following answer options could be chosen: use an alternative to car, reduce energy consumption, buy local and seasonal products, reduce waste and recycle, consider CO2 emissions when traveling, avoid buying nonessential things, eat little meat. All of these options were used as independent variables. Moreover, the regressions include independent variables on individual characteristics, specifically the importance of others' opinions and personal social status.

To analyze, which of these factors may have a significant influence on a household's decision to invest sustainably, version 12 of the statistic program STATA was used.

5.2. Data cleaning

After identifying the dependent variable and the independent variables, the next step was cleaning the data set. The dependent variable and all of the possible independent variables were analyzed in detail and all observations with missing values, conspicuous values, or values labelled “no answer” got excluded from the sample. Remarkably, the Deutsche Bundesbank data set hardly had any missing values. In this respect, the data set was very clean. Unfortunately, many questions had not been answered. Hence, lots of observations were labelled “no answer” and had to get excluded. Additionally, some observations had the value “96”. These observations were also omitted. In summary, 2,511 observations were left to analyze after the data cleaning.

Because many questions had not been well answered, some variables from interest did not make it into the primary regression. Too many of their observations did not provide any information. For example, “value of homeownership” was not usable, as over 500 observations would have been omitted. As a further example, the current value of vehicles was not used, as over 1,000 households did not answer the question. Initially, it was planned to also include the information on whether or not a household has a financial safety net, meaning an extra source of income. Unfortunately, over 2,700 participants did not answer this question and this variable was also not included in the regression.

As the answer options for some variables were not logically sorted in the data set, it was necessary to re-sort and re-code them. For example, education got sorted in the way from the lowest to the highest educational degree. Thus, lowest value was “no school degree“ and the highest was “Completed Master's degree/Diploma“. This allows for a senseful interpretation of the impact of education on sustainable investing, as an increase by one unit now correlates with the rise in educational level. Further, the variable savings during pandemic, was recoded into a dummy variable by combining two out of three response options into a single option "no, did not save". Unfortunately, for some variables it was not possible to sort or combine answer options in a senseful way. Example are financial losses and income loss during pandemic. It was not possible to combine their answer options or to recode the variables in a senseful way. Hence, these variables could not be integrated into the regression models.

Another point that was considered during the data cleaning process was the problem of outliners that might distort the results. Hence, for metrically scaled variables, attention

was always paid to the range of values. For this purpose, a histogram was used. In cases where outliners were observed and the distribution was skewed, the relevant variable was logarithmized. By logarithmizing of variables, no observations got lost and the variable distribution got smoothed. Thus, these variables could not distort the regression results. Examples for logarithmized variables are value of net income, monthly total expenditures, values of financial assets and net wealth. As logarithmizing resulted in the generation of missing values when the initial value of a variable was zero, these missing values were subsequently recoded back to zero in order to prevent data loss[5].

After cleaning the data set by considering the outlined aspects, the sample's average education level is 3.92 and the median age is 56.8 years[6]. The average income lies by 4,035.876€[7]. Notably, the cleaned sample has a higher proportion of males with 59.18 percent and a lower female proportion of 40.58 percent compared to the uncleaned sample[8]. In summary, this sample is well-educated and consists primarily of wealthy, older and male participants.

5.3. Used regression model

To analyze those households that did invest in sustainable funds or shares, two logistic regressions were run. The logistic regression model was chosen, as the dependent variable "sustainable investing", is a dummy variable that can only take the two values "yes" or "no". Households had the opportunity to select the response option that they have invested in a sustainable way or they could just not to choose this option. Therefore, the answer of all households that did not select this response opportunity, was labelled as "no" and the answer of households that selected this response opportunity was labelled "yes". Using a logistic regression allows to analyze binary outcomes that can take two values, such as "true" and "false" or "yes" and "no" (Edgar and Manz, 2017).

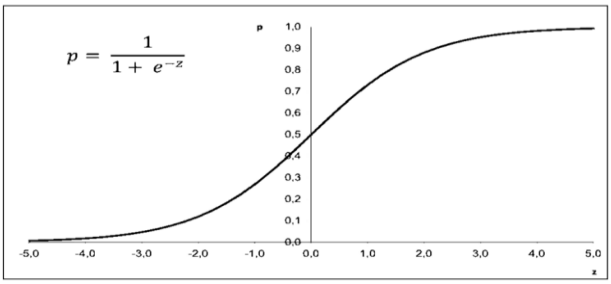
Besides the estimation whether an event will occur or not, a logistic regression can show which of the assessed factors has the strongest association with an outcome and is able to provide measure of the magnitude of the potential influence (Tolles and Meurer,

[5] For an example of a logarithmized variable see figure A7 and A8 of the appendix.
[6] See table A9 of the appendix.
[7] See table A9 of the appendix.
[8] See table A11 of the appendix.

2016). This allows to provide the most dominant characteristics and motives for households to invest sustainably, as this regression model shows which of the independent variables has the strongest influence on the dependent variable. Additionally, the effect size of all independent variables can be compared with each other.

According to Backhaus, Erichson, Gensler and Weiber (2021, p. 293, the equation and the form for the logistic regression model is:

Figure F13: Formula and form of the logistic regression function



"P" represents the probability that the dependent variable equals case zero or case one. In this analysis, case zero would be "not invested sustainable" and case one would be "has invested sustainably". "e" is the base of the natural logarithm and helps to transform the linear combination of the predictors into a probability. Finally, "z" is the linear combination of the independent variables and their corresponding coefficients. *Figure F13* illustrates the form of the logistic regression function which shows the probability for an event's occurrence and does only range between zero and one.

A limitation of the logistic regression model is that its validity depends on the suitability and number of the independent variables (Tolles and Maurer, 2016). If overlapping information is provided by two or more variables, small random variations in the data can heavily and unpredictably influence how much of the association to the dependent variable is attributed to one of these factors (Tolles and Maurer, 2016). In order to prevent a poor fit of the model, the regression was conducted for multiple times. During each iteration, various goodness-of-fit measures, especially R2 that shows the explanatory power, as well as correlations between the variables were monitored. Variables were accordingly recoded, modified, or excluded based on these measurements. The process of validity check will be described in more detail in a later section.

6. Pre-analysis

Before running the logistic regressions, which examine the characteristics of households that invest sustainably, a short pre analysis is conducted. This pre-analysis investigates the impact by the perception of climate change on the engagement in specific climate change actions. For this purpose, cross-tabulations were used, in which a specific climate change action was captured as the dependent variable and perception of the climate change problem as the independent variable. These cross-tabulations refer to question 27 of the survey where participants got asked in which climate change actions they have engaged throughout the past six months. Below are some examples of these cross-tabulations. The remaining cross-tabulations can be found in the appendix[9].

Figure F14: Impact of climate change perception on eating little meat

Tabulation of eat_little_meat perception_of_climate_change

	F26: opinion on political developments-climate change											
F27: eat little meat	Not a problem at all	1	2	3	4	5	6	7	8	9	A very serious problem	Total
Yes	27.59	50.00	32.26	48.94	44.74	46.10	47.71	56.99	59.29	62.55	75.73	65.31
No	72.41	50.00	67.74	51.06	55.26	53.90	52.29	43.01	40.71	37.45	24.27	34.69
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Figure F15: Impact of climate change perception on reducing waste and recycle

Tabulation of reduce_waste_and_recycle perception_of_climate_change

	F26: opinion on political developments-climate change											
F27: reduce waste and recycle	Not a problem at all	1	2	3	4	5	6	7	8	9	A very serious problem	Total
Yes	55.17	77.78	77.42	93.62	94.74	92.20	88.99	89.12	95.93	96.71	97.56	94.90
No	44.83	22.22	22.58	6.38	5.26	7.80	11.01	10.88	4.07	3.29	2.44	5.10
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

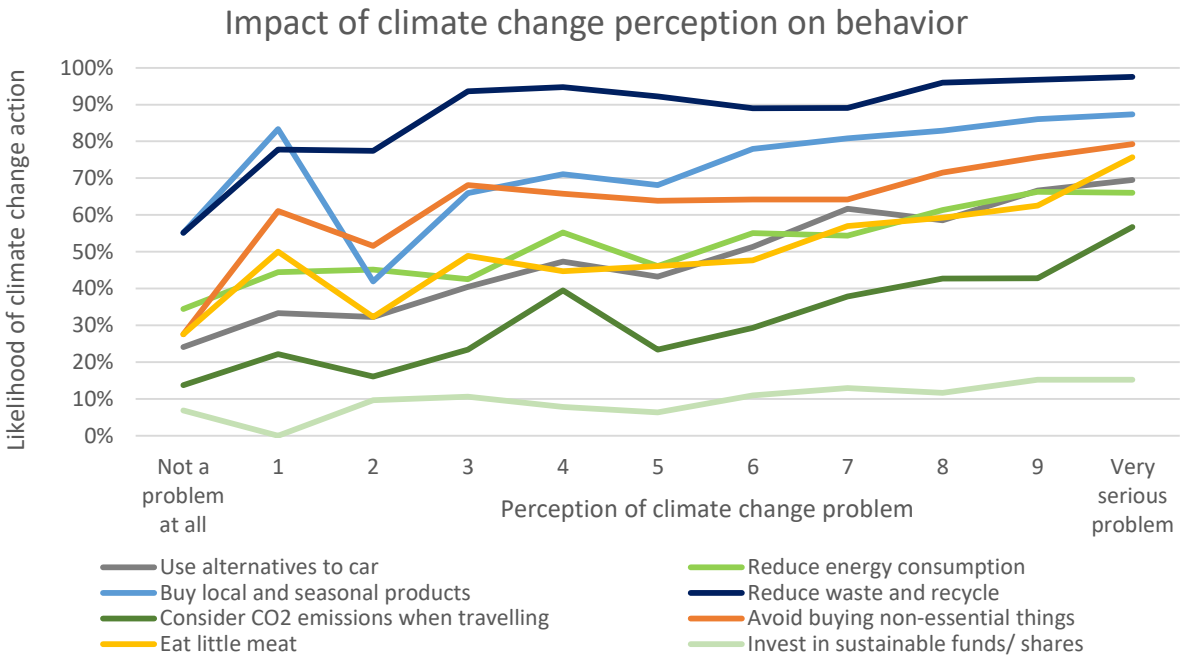
The pre-analysis reveals a positive correlation between the level of concern for climate change and the adoption of environmentally sustainable actions. As concern for climate change increases among German households, there is a tendency to be more likely to use alternatives to cars, reduce energy consumption, minimize buying non-essential things and to decrease meat consumption. For example, out of the participants who reported to be not concerned about climate change, only 27.59 percent reported to eat little meat, while 75.73 percent of the participants who stated they are highly concerned about climate change, reported to eat little meat (*figure F14*). Notable is an outliner for participants, who reported to be slightly concerned about climate change. Here, already

[9] See Table A13 to A17 of the appendix.

50 percent reported to eat little meat.

The chart below shows the impact of climate change perception on all climate change actions, revealing strong differences in the engagement across the different activities.

Figure F16: Impact of climate change perception on all of the climate change actions



According to the chart, very common among German households seems reducing waste and recycling, as already most of the participants with low levels of climate change concern tend to reduce waste and recycle. In addition, about 55 percent tend to buy local products but are not concerned about climate change. Thus, this also seems to be very common. However, for both actions an upwards trend is observed, showing that the likelihood for engagement rises by higher concerns for the climate change problem.

The chart further shows that the more concerned about climate change, the more likely German households are to consider CO2 emissions when traveling. But notably, when compared to most of the other climate change actions, less households engage in this action. Moreover, an increased propensity to invest sustainably is observed among participants with higher levels of concern for climate change. However, the proportion of individuals who did engage in investing sustainably is lower compared to the engage-

ment in all of the other sustainable actions. When reported to be highly concerned about climate change, only 15.2 percent invest sustainably, as illustrated by the beneath table.

Figure F17: impact of climate change perception on sustainable investing

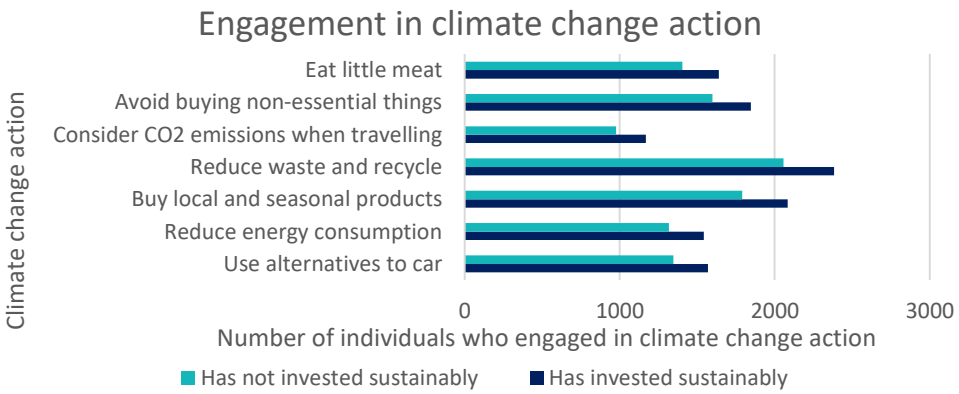
Tabulation of sustainable_investing perception_of_climate_change

F27: climate change action -invest in sustainable fonds / shares	F26: opinion on political developments-climate change											
	Not a problem at all	1	2	3	4	5	6	7	8	9	A very serious problem	Total
Yes	6.90	0.00	9.68	10.64	7.89	6.38	11.01	12.95	11.70	15.23	15.21	13.34
No	93.10	100.00	90.32	89.36	92.11	93.62	88.99	87.05	88.30	84.77	84.79	86.66
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Given these results, the question arises, why the willingness for behaving sustainable in means of investing, differs from the willingness for behaving sustainable in other situations. In the literature review, it was outlined that similar behaviors occur in situations that are perceived as similar, require the same resources and are equally visible (Brick et al., 2017; Gneezy et al., 2012; Thøgersen, 2004). Consequently, sustainable investing might not be perceived as similar to the other actions, as it requires unique resources like financial literacy and considerable amount of capital, resulting in a lower engagement rate. The same reasons might also hold true for the poor engagement in considering CO2 emissions, as traveling is not an everyday situation and implies high cost.

Additionally, the pre-analysis determined how households that invested sustainably differ in their environmentally friendly behavior compared to those that did not. For this purpose, the cleaned dataset was adjusted to retain only the households that invested sustainably and separately, only those that did not invest sustainably. Thereafter, it was investigated how many households in each category undertook climate change actions. The following chart presents the results of this analysis:

Figure F18: Engagement in climate change actions



The chart shows that households who engaged in sustainable investing, participate in each listed climate change action more frequently than those that did not invest sustainably. Hence, it can be assumed that the participation in climate change actions may has a positively significant impact on the propensity for sustainable investing.

7. Regression results

7.1. Regression output

After the dataset was cleaned, the logistic regressions were performed. The output of the primary logistic regression, which includes all of the 2,511 participants from the cleaned sample, is provided by the following figure. The abbreviation "ln" at the end of some independent variables indicates that these variables have been logarithmized. Categorical variables, in specific gender, marital status, and current employment status, were identified for STATA by labelling them with "i." within the regression command.

Table T1: Primary logistic regression

Logistic regression

Sustainable investing	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Current employment status: base Employed part time	1	.	.	.	.	.	
Employed part-time	.795	.249	-0.73	.464	.43	1.47	
Low-paid part-time/ Irregularly employed	.304	.509	-0.71	.477	.011	8.135	
Short-term work	1.879	1.252	0.95	.344	.509	6.935	
On maternity leave	.738	.678	-0.33	.741	.122	4.462	
Unemployed	.217	.26	-1.27	.203	.021	2.282	
In school, university or Unpaid internship	4.792	5.978	1.26	.209	.416	55.259	
Retiree or pensioner	1.586	.489	1.50	.135	.867	2.901	
Early retiree – unfit for work	.171	.187	-1.61	.107	.02	1.462	
Housewife/Houseman	.372	.389	-0.95	.344	.048	2.889	
Other non-working status	1.27	1.073	0.28	.778	.242	6.654	
Age_centered	1.015	.01	1.52	.127	.996	1.034	
Current employment status# c.age_centered: base Employed part time	1	.	.	.	.	.	
Employed part-time	.986	.028	-0.50	.618	.933	1.042	
Low-paid part-time/ Irregularly employed	1.107	.09	1.25	.211	.944	1.299	
Short-term work	.861	.087	-1.47	.141	.706	1.051	
On maternity leave	.954	.037	-1.23	.219	.885	1.028	
Unemployed	.948	.025	-2.02	.043	.901	.998	**
In school, university or Unpaid internship	.949	.043	-1.18	.239	.869	1.036	
Retiree or pensioner	1.016	.018	0.91	.365	.981	1.052	
Early retiree – unfit for work	.992	.033	-0.24	.808	.929	1.059	

Housewife/Houseman	1.085	.074	1.20	.23	.95	1.24	
Other non-working status	.933	.045	-1.45	.147	.849	1.025	
Gender: base Male	1	.	.	.	.	.	
Female	.974	.154	-0.17	.868	.714	1.328	
Diverse	5.443	6.891	1.34	.181	.455	65.087	
Marital status: base Single	1	.	.	.	.	.	
Divorced	.977	.273	-0.08	.934	.564	1.691	
Widowed	1.379	.431	1.03	.303	.748	2.543	
Married/Registered partnership	.887	.178	-0.60	.55	.598	1.316	
Education	.94	.071	-0.82	.415	.811	1.09	
Homeownership	.788	.142	-1.32	.187	.554	1.122	
Ownership of other real estate	.931	.144	-0.47	.642	.688	1.26	
Perception of climate change	1.081	.043	1.94	.053	.999	1.169	*
Risk tolerance	1.13	.038	3.63	0	1.058	1.207	***
Use alternative to car	.942	.137	-0.41	.682	.708	1.253	
Reduce energy consumption	1.436	.209	2.48	.013	1.079	1.911	**
Buy local and seasonal products	1.451	.282	1.92	.055	.992	2.122	*
Reduce waste and recycle	2.811	1.109	2.62	.009	1.297	6.092	***
Consider CO2 emissions	1.892	.273	4.42	0	1.426	2.509	***
Avoid buying non-essential things	.845	.133	-1.07	.284	.621	1.15	
Eat little meat	1.057	.16	0.37	.715	.786	1.421	
Opinion of others	.998	.067	-0.03	.977	.874	1.14	
Importance of social status	1.015	.064	0.24	.811	.898	1.148	
Value net income_ln	.903	.109	-0.85	.398	.712	1.144	
Income during pandemic	1.007	.08	0.08	.933	.862	1.176	
Development future income	1.063	.086	0.75	.453	.906	1.247	
Vehicles ownership	1.077	.232	0.34	.731	.706	1.642	
Valuables ownership	1.579	.244	2.96	.003	1.167	2.138	***
Finances during pandemic	.831	.097	-1.59	.112	.662	1.044	
Savings during pandemic	.815	.129	-1.30	.194	.598	1.11	
Monthly total expenditures_ln	.834	.097	-1.56	.119	.665	1.047	
Total household net wealth_ln	1.045	.035	1.30	.192	.978	1.115	
Ownership of business	.617	.182	-1.64	.101	.347	1.099	
Checking account ownership	.232	.152	-2.22	.026	.064	.841	**
Savings account ownership	.853	.144	-0.94	.346	.612	1.188	
Mutual fund ownership	5.913	.93	11.30	0	4.345	8.047	***
Bonds ownership	2.048	.501	2.93	.003	1.268	3.307	***
Shares ownership	1.605	.252	3.02	.003	1.18	2.182	***
Claim ownership	.711	.199	-1.22	.223	.411	1.23	
Other financial assets ownership	1.358	.22	1.89	.059	.989	1.865	*
Constant	.147	.192	-1.47	.142	.011	1.902	

Mean dependent var	0.133	SD dependent var	0.340
Pseudo r-squared	0.197	Number of obs	2511
Chi-square	333.412	Prob > chi2	0.000
Akaike crit. (AIC)	1699.232	Bayesian crit. (BIC)	2037.281

*** $p<.01$, ** $p<.05$, * $p<.1$

In addition to the above logistic regression, a second one was run. This second logistic regression differs from the first one in the way that it only includes households that own checking accounts, savings accounts, shares and mutual funds. This regression is conducted to investigate which factors have a significant influence on households owning these assets. Initially, it was planned to capture only households that own all of the financial assets listed in the survey. But as the majority of the participants did unfortu-

nately either not answer questions regarding the estimation of their financial assets value or did not own the listed assets, most of the observations had to be omitted from the analysis. Only 55 observations would have remained if only households were kept that own all assets. Thus, value of bonds, claims and other assets could not be captured in the second model. However, households that do not own these specific assets are still part of the sample.

Therefore, this regression is way smaller by including only N=331 observations. Additionally, two independent variables are coded in differently. First, gender was formed into a dummy variable as the six observations for "diverse" got omitted during the data cleaning process, leaving only male and female[10]. Second, job is left with fewer characteristics, as otherwise to many of its observations got omitted because of collinearity[11].

It is further important to note that there is a significant difference in the distribution of the dependent variable between the two samples. Specifically, the average value for sustainable investing in the first and broader sample was 0.133, whereas it increased to 0.278 in the second sample. Thus, a higher proportion of participants engaged in sustainable investing in the second sample compared to the first one[12].

Table T2: Second regression model - households owning certain financial assets

Logistic regression

Sustainable investing	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Current employment status: base: Employed full time	1	.	.	.	.	.	
Employed part-time	.45	.253	-1.42	.156	.149	1.357	
Unemployed	.136	.246	-1.10	.271	.004	4.744	
Retiree or pensioner	1.043	.852	0.05	.959	.21	5.17	
Age_centered	.961	.022	-1.75	.08	.919	1.005	*
Current employment status#age_centered: base Employed full time	1	.	.	.	.	.	
Employed part-time	1.05	.055	0.92	.357	.947	1.164	
Unemployed	1.035	.113	0.31	.756	.835	1.282	
Retiree or pensioner	1.1	.056	1.88	.061	.996	1.216	*
Gender	1.289	.465	0.70	.482	.635	2.614	
Marital status: base: Single	1	.	.	.	.	.	
Divorced	.131	.124	-2.14	.032	.02	.84	**
Widowed	.649	.59	-0.48	.635	.11	3.852	
Married/Registered partnership	1.364	.655	0.65	.518	.532	3.496	

[10] For distribution of gender see table A19 and figure A20 of the appendix.
[11] See Table A21 of the appendix.
[12] See descriptive statistics in table A18 and figure A26 in the appendix.

Education	1.063	.199	0.33	.744	.737	1.533	
Homeownership	.4	.161	-2.27	.023	.181	.881	**
Ownership of other real estate	1.106	.364	0.30	.761	.58	2.107	
Perception of climate change	1.131	.096	1.46	.145	.958	1.335	
Risk tolerance	1.219	.104	2.34	.019	1.032	1.44	**
Use alternative to car	.843	.275	-0.52	.601	.445	1.597	
Reduce energy consumption	.98	.294	-0.07	.946	.544	1.763	
Buy local and seasonal products	.698	.299	-0.84	.401	.301	1.616	
Reduce waste and recycle	9.037	7.795	2.55	.011	1.667	49.004	**
Consider_CO2 emissions	1.064	.334	0.20	.844	.575	1.967	
Avoid buying nonessential things	.73	.241	-0.95	.34	.382	1.394	
Eat little meat	.759	.261	-0.80	.424	.387	1.491	
Opinion of others	.938	.143	-0.42	.674	.696	1.265	
Importance of social status	1.019	.147	0.13	.893	.769	1.352	
Value net income_ln	.612	.186	-1.62	.106	.338	1.11	
Income during pandemic	.967	.182	-0.18	.857	.668	1.398	
Development future income	1.539	.376	1.77	.077	.954	2.484	*
Vehicles ownership	.665	.347	-0.78	.434	.24	1.848	
Valuables ownership	2.238	.733	2.46	.014	1.177	4.254	**
Finances during pandemic	.927	.308	-0.23	.82	.483	1.779	
Savings during pandemic	1.048	.398	0.12	.903	.497	2.206	
Monthly total expenditures_ln	.659	.132	-2.08	.037	.445	.975	**
Total household net wealth_ln	.897	.092	-1.06	.288	.734	1.096	
Ownership of business	.76	.389	-0.54	.592	.278	2.075	
Checking account value_ln	.858	.074	-1.77	.076	.724	1.016	*
Savings account value_ln	.972	.093	-0.29	.768	.806	1.173	
Mutual fund value_ln	1.356	.151	2.73	.006	1.089	1.688	***
Shares value_ln	.993	.097	-0.07	.942	.819	1.203	
Constant	9.188	27.957	0.73	.466	.024	3574.678	

Mean dependent var	0.278	SD dependent var	0.449
Pseudo r-squared	0.168	Number of obs	331
Chi-square	65.567	Prob > chi2	0.005
Akaike crit. (AIC)	405.677	Bayesian crit. (BIC)	557.762

*** $p<.01$, ** $p<.05$, * $p<.1$

Throughout the next sections, the regression results get analyzed and interpreted in detail.

7.2. Wealth factors

7.2.1. Financial performance expectations

In an earlier section, the following hypothesis regarding the influence of financial performance expectations on the decision to invest sustainably, was derived based on previous empirical findings:

H1: Performance expectations regarding a sustainable investment do significantly impact the likelihood of holding sustainable investments among German households, with high expectations enhancing and low expectations decreasing the likelihood.

As the survey did not include any questions regarding respondent's return expectations or diversification, this hypothesis cannot be tested empirically in this thesis. In a former section it has already been worked out that, based on previous findings, return expectations may not be the dominant driver for sustainable investing decisions. While numerous empirical findings indicate a significant impact of return expectations on the decision to invest sustainably, many other studies show that sustainable investors are even willing to accept lower returns in order to invest according to their social values. Consequently, it can be deduced that high return expectations can be outweighed by social values. However, this thesis cannot provide empirical results to either reject or not reject this hypothesis.

A possible approach to nevertheless examine the influence of financial performance expectations would be to merge the dataset of the Deutsche Bundesbank with another dataset of previous research. However, this would go beyond the scope of this thesis.

7.2.2. Financial constraints

Based on previous empirical findings, the following hypothesis regarding the influence of a household's financial constraints on the decision to invest sustainably, was derived:

H2: Wealthier households are not more likely to engage in sustainable investing compared to less wealthy households.

The below figure shows the part of the logistic regression that only includes independent variables addressing the wealth of a household. It already provides the Odds ratios.

Table T3: Impact of wealth factors – primary regression

Logistic regression

Sustainable investing	Coef.	St.Err.	t-value	p-value	[95% Conf	Inter-val]	Sig
Homeownership	.788	.142	-1.32	.187	.554	1.122	
Ownership of other real estate	.931	.144	-0.47	.642	.688	1.26	
Value net income_ln	.903	.109	-0.85	.398	.712	1.144	
Income during pandemic	1.007	.08	0.08	.933	.862	1.176	
Development future income	1.063	.086	0.75	.453	.906	1.247	
Vehicles ownership	1.077	.232	0.34	.731	.706	1.642	

Valuables ownership	1.579	.244	2.96	.003	1.167	2.138	***
Finances during pandemic	.831	.097	-1.59	.112	.662	1.044	
Savings during pandemic	.815	.129	-1.30	.194	.598	1.11	
Monthly total expenditures_ln	.834	.097	-1.56	.119	.665	1.047	
Total household net wealth_ln	1.045	.035	1.30	.192	.978	1.115	
Ownership of business	.617	.182	-1.64	.101	.347	1.099	
Checking account ownership	.232	.152	-2.22	.026	.064	.841	**
Savings account ownership	.853	.144	-0.94	.346	.612	1.188	
Mutual fund ownership	5.913	.93	11.30	0	4.345	8.047	***
Bonds ownership	2.048	.501	2.93	.003	1.268	3.307	***
Shares ownership	1.605	.252	3.02	.003	1.18	2.182	***
Claim ownership	.711	.199	-1.22	.223	.411	1.23	
Other financial assets ownership	1.358	.22	1.89	.059	.989	1.865	*

Mean dependent var	0.133	SD dependent var	0.340
Pseudo r-squared	0.197	Number of obs	2511
Chi-square	333.412	Prob > chi2	0.000
Akaike crit. (AIC)	1699.232	Bayesian crit. (BIC)	2037.281

**** p<.01, ** p<.05, * p<.1*

First, attention is paid to the p-value, that indicates if an independent variable has a significant impact on the dependent variable (Fahrmeir, Heumann, Künstler, Pigeot and Tutz, 2016). The regression shows a significant impact for some of the independent variables. Owning other financial assets has an impact that is significant at the 10 percent level, while having a checking account is significant at the 5 percent level. In addition to that, owing mutual funds, bonds, shares or valuables like art, antiques and valuable jewelry, occur to have an impact that is even significant at the 1 percent level. Interestingly, neither income nor net wealth significantly influence sustainable investing.

After checking the significance of the variables impact, attention is paid to the odds ratios, already provided in *table T3* under the column Coef. "Odds" is an alternative term for “chance”. The odds ratio refers to the predicted chance of belonging to a specific group and can be converted into probabilities via exponentiation (Kohler and Kreuter, 2017). An odds ratio of one indicates that the chance for the event occurring is equivalent between the two groups being compared. An odds ratio greater than one signifies that the odds of the event occurring are higher in the first group relative to the second group. Conversely, an odds ratio less than one implies that the odds of the event occurring are lower in the first group compared to the second group. (Bittmann, 2018). When analyzing a coefficient or odds, a negative sign suggests a negative impact of the independent variable on the dependent variable. Generally, the higher the value, the stronger its effect (Kohler and Kreuter, 2017).

First, the odds ratios for the independent variables having a significant impact on the dependent variable are from special interest. These were variables regarding the ownership of certain financial assets and valuables. As all of these independent variables are dummy variables, an increase by one unit equals the listed valuables or financial assets. Owning a checking account, has an odds ratio of 0.232. As this Odds ratio is smaller than one, it indicates an affiliation to the group of households that did not invest sustainably. Homeownership and owning a savings account also decrease the chance for holding sustainable investments. Compared to that, owning one of the other listed financial assets, has a contrasting effect. Owning other financial assets has an odds ratio of 1.358. Owning valuables increases the chance of investing sustainably by 1.579, owning shares increases the chance by 1.605, owning bonds increases the chance by 2.048 and owning a mutual fund even increases the chance of investing sustainably by 5.913. Therefore, the strongest impact in means of odds ratio and significance on the decision to invest sustainably has the ownership of a mutual fund.

As income and wealth was often discussed in previous research, a closer look to their odds ratios is also paid. An increase of total net income leads to a higher chance of having not invested sustainably as demonstrated by an odds ratio of 0.903, while an increase of total household net wealth by one unit increases the chance of having invested sustainably by 1.045. These effects further are weak, as the odds ratios are close to one. Although most studies have identified a significant effect, no significant effect is found in this thesis for these two variables. However, this aligns with Gutsche et al. (2023).

In order interpret probabilities in a logistic regression, it is necessary to convert the odds ratios into probabilities via exponentiation (Kohler and Kreuter, 2017). For the interpretation of probabilities, the average marginal effects (AME) can be used. AMEs indicate the probability of an observation for belonging to a specific group when all independent variables are set to their mean values (Kohler and Kreuter, 2017). The AMEs for the independent variables capturing information on a household's wealth are presented by the figure below within column "dy/dx".

Table T4: AMEs of wealth factors – primary regression

Average marginal effects Number of obs = 2511
Model VCE : Robust
Expression : Pr(sustainable_investing), predict()

	Delta-method					
	dy/dx	Std.Err.	z	P>z	[95%Conf.	Interval]

Homeownership	-0.023	0.017	-1.320	0.186	-0.056	0.011
Ownership of other real estate	-0.007	0.015	-0.470	0.641	-0.036	0.022
Value net income_ln	-0.010	0.011	-0.850	0.398	-0.032	0.013
Income during pandemic	0.001	0.008	0.080	0.933	-0.014	0.015
Development future income	0.006	0.008	0.750	0.453	-0.009	0.021
Vehicles ownership	0.007	0.020	0.340	0.731	-0.033	0.047
Valuables ownership	0.043	0.015	2.970	0.003	0.015	0.072
Finances during pandemic	-0.018	0.011	-1.590	0.113	-0.039	0.004
Savings during pandemic	-0.019	0.015	-1.300	0.194	-0.049	0.010
Monthly total expenditures_ln	-0.017	0.011	-1.570	0.116	-0.039	0.004
Total household net wealth_ln	0.004	0.003	1.300	0.193	-0.002	0.010
Ownership of business	-0.046	0.028	-1.640	0.100	-0.101	0.009
Checking account ownership	-0.139	0.062	-2.220	0.026	-0.261	-0.016
Savings account ownership	-0.015	0.016	-0.940	0.345	-0.047	0.016
Mutual fund ownership	0.169	0.014	11.920	0.000	0.141	0.197
Bonds ownership	0.068	0.023	2.950	0.003	0.023	0.113
Shares ownership	0.045	0.015	2.990	0.003	0.015	0.074
Claim ownership	-0.032	0.027	-1.220	0.223	-0.084	0.020
Other financial assets ownership	0.029	0.015	1.890	0.059	-0.001	0.059

Note: dy/dx for factor levels is the discrete change from the base level.

When looking at the AMEs, owning a mutual fund has the strongest impact among the wealth factors on sustainable investing. An increase of one unit, meaning owning a mutual fund, leads to an enhanced likelihood of having invested sustainably by 16.9 percentage points. The second strongest effect has the ownership of a checking account with a decrease by 13.9 percentage points. Thus, households owning a checking account are more likely to have not invested sustainably. Owning bonds increases the likelihood of investing sustaianbly by 6.8 percentage points while owning shares does only increases it by 4.5 percent points and owning other financial assets increases it by roughly 3 percentage points. Owning valuables increases the likelihood of having invested sustainably by 4.3 percentage points. In line with previous findings by D´Hondt et al. (2022) or Bauer and Smeets (2015), net income is shown to have a negative impact by decreasing the likelihood of having invested in a sustainable manner by 0.1 percentage points. However, as already mentioned this impact is not significant.

Next, the output of the second, smaller regression gets analyzed. Interestingly, different variables are now significant. As a reminder, this model only considers households that own mutual funds, shares, checking or savings accounts. It does capture the variables addressing the value of financial assets, whereas variables regarding the ownership of financial assets are not included.

Table T5: Second regression model capturing value of financial assets

Logistic regression

Sustainable investing	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Homeownership	.4	.161	-2.27	.023	.181	.881	**
Ownership of other real estate	1.106	.364	0.30	.761	.58	2.107	
Value net income_ln	.612	.186	-1.62	.106	.338	1.11	
Income during pandemic	.967	.182	-0.18	.857	.668	1.398	
Development future income	1.539	.376	1.77	.077	.954	2.484	*
Vehicles ownership	.665	.347	-0.78	.434	.24	1.848	
Valuables ownership	2.238	.733	2.46	.014	1.177	4.254	**
Finances during pandemic	.927	.308	-0.23	.82	.483	1.779	
Savings during pandemic	1.048	.398	0.12	.903	.497	2.206	
Monthly total expenditures_ln	.659	.132	-2.08	.037	.445	.975	**
Total household net wealth_ln	.897	.092	-1.06	.288	.734	1.096	
Ownership of business	.76	.389	-0.54	.592	.278	2.075	
Checking account value_ln	.858	.074	-1.77	.076	.724	1.016	*
Savings account value_ln	.972	.093	-0.29	.768	.806	1.173	
Mutual fund value_ln	1.356	.151	2.73	.006	1.089	1.688	***
Shares value_ln	.993	.097	-0.07	.942	.819	1.203	

Mean dependent var	0.278	SD dependent var	0.449
Pseudo r-squared	0.168	Number of obs	331
Chi-square	65.567	Prob > chi2	0.005
Akaike crit. (AIC)	405.677	Bayesian crit. (BIC)	557.762

*** $p<.01$, ** $p<.05$, * $p<.1$

With 0.168 the second regression provides a lower R squared, indicating a weaker explanatory power compared to the primary model. Notably, the impact of a checking account's value is significant at the 10 percent level, while the impact of a mutual funds value is more substantial, showing significance at the 1 percent level. Ownership of valuables is now significant at the 5 percent level. Surprisingly, different independent variables are now significant, when compared to the primary model. Development of future income is now significant at the 10 percent level, while homeownership and total monthly expenditures are significant at the 5 percent level. Remarkably, homeowners are more likely to have not invested sustainably, as indicated by an odds ratio of 0.4 and an AME of -0.149[13]. Further, an increase in monthly expenditures does also lead to an increased chance of not having invested sustainably. Conversely, an increase in future income increases leads to a categorization as a sustainable investor, according to an odds ratio of 1.539 and an AME of 0.070. An increase in the value of a mutual fund by one unit also associates with having invested sustainably, although the effect, with an

[13] For AMEs see Table A27 of the appendix.

odds ratio of 1.356 and an AME of 0.049, is weaker than that of future income. The strongest positive effect has ownership of valuables with an odds ratio of 2.238 and an AME of 0.131. Lastly, an increase in the value of checking accounts by one unit leads to an increased chance of not having invested sustainably. However, the effects are not as strong as those observed within primary model.

Focusing on a more specific sample, which only includes households that own certain financial assets and including independent variables regarding these assets' values, leads to different wealth factors having significant impacts. However, it must be mentioned that the second sample is considerably smaller with N=331 observations and thus differently composed when compared to the primary sample. While this insight from the second regression is very interesting, more attention is paid to the primary regression as its larger sample size allows for a more applicable generalization to the broader population of German households.

Comparing the median values of the independent variables of both samples reveals that the median values for all discussed variables are higher within the second sample. For instance, the median for homeownership is 0.626 in the first sample and increases to 0.728 in the second sample. Similarly, the median logarithmized income rises from 8,052 in the first sample to 8,45 in the second sample. Thus, households from the second sample appear to be wealthier. In Fact, their not logarithmized median income is over 6.200€[14]. The divergent composition of the two samples, in terms of distributions and means of the independent variables, may partly account for the differing results.

In summary, both regressions include a wide array of variables related to wealth, some of which showed a significant impact, while others showed no significant effect. This makes it challenging to definitively reject hypothesis number two. Thus, the rejection of the hypothesis remains uncertain. However, this thesis offers an initial insight into the relationship between wealth factors and sustainable investment. Furthermore, these findings suggest that owners of certain financial assets appear to differ from the general population, in means of homeownership, income and monthly expenditures.

[14] See table A18 in the appendix.

7.2.3. Financial literacy

Based on the analysis of previous research, the following hypothesis was derived to examine the impact of financial literacy on the decision to invest sustainably:

H3: Households with higher financial knowledge are less likely to have engaged in sustainable investing.

Unfortunately, this hypothesis cannot be tested empirically in this thesis, as the used dataset does not contain any question related to the financial literacy of the participants. It is therefore necessary to rely on existing research findings as this thesis is not able to provide any empirical evidence regarding this hypothesis. In summary, most previous studies suggest that households are more likely to be disinclined towards sustainable investing when they have high financial knowledge.

Likewise for the analysis of performance expectations, it would be a possibility to nevertheless examine the influence of financial literacy in this thesis by merging the dataset with another dataset of previous research. As already mentioned above, this would be a too time-consuming approach and go beyond the scope of this thesis.

7.3. Non-financial Motivations

7.3.1. Social, political and environmental values

As a recap, after analyzing previous research regarding the impact of personal political, social and environmental values, the following hypothesis was derived:

H4: Households with strong environmental, social or political values tend to be more likely to have invested in a sustainable manner compared to households with weaker environmental, social or political values.

This hypothesis can be tested empirically in this thesis, as the data set included a question regarding the perception of the climate change problem. Participants had to rate the seriousness of the climate change issue on a scale from zero to ten, where zero signifies no concern and ten a serious concern. As the following figure shows, most of the participants of the primary sample stated to perceive it as a serious problem. The average value lies by 8.405, indicating the sample was in general very concerned of climate change.

Table T6: Descriptives of perception of climate change

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Perception of climate change	2511	8.405	2.227	0	10

The following figure shows the part of the regression that includes the impact of climate change perception on engaging in sustainable investing.

Table T7: Impact of climate change perception

Logistic regression

Sustainable investing	Coef.	St.Err.	t-value	p-value	[95% Conf	Inter-val]	Sig
Perception of climate change	1.081	.043	1.94	.053	.999	1.169	*

Mean dependent var	0.133	SD dependent var	0.340
Pseudo r-squared	0.197	Number of obs	2511
Chi-square	333.412	Prob > chi2	0.000
Akaike crit. (AIC)	1699.232	Bayesian crit. (BIC)	2037.281

**** p<.01, ** p<.05, * p<.1*

The regression shows, that an increase of the perceived climate change problem by one unit enhances the chance of having invested sustainably by 1.081. As demonstrated by the beneath figure, the AME for the impact of climate change perception lies by 0.007, meaning the likelihood of belonging to the group of households that have invested sustainably increases by 0.7 percentage points if climate change perception increases by one unit. Hence, this effect is weak. Also, if compared to the effect sizes of wealth factors, the impact of climate change perception is much weaker. However, this impact is significant at the 10 percent level (*table T7*).

Table T8: AME of climate change perception:

Average marginal effects Number of obs = 2511
Model VCE : Robust
Expression : Pr(sustainable_investing), predict()

		Delta-method				
	dy/dx	Std.Err.	z	P>z	[95%Conf.	Interval]
Perception of climate change	0.007	0.004	1.950	0.052	-0.000	0.015

Note: dy/dx for factor levels is the discrete change from the base level.

According to the regression result of the primary model, no evidence was found to reject hypothesis number four because the impact of climate change perception is significant at the 10 percent level. Therefore, strong environmental, social or political values

seem to enhance the likelihood for German private households to have invested sustainably. Specifically, a high concern for climate change seems to motivate German private households to engage in sustainable investing.

As the majority of the sample was already highly concerned about climate change, with an average level of 8.405, the result might be distorted. One way to check whether the result may has been distorted by this circumstance is to run the regression again, but to logarithmize the climate change perception variable and thus adjust its distribution.

When looking at the regression result of the second model in the below table, a contrary finding occurs. The second regression shows no significant impact for the perception of the climate change problem on the engagement in sustainable investing. But, like in the primary regression, the odds ratio and the AME indicate a positive impact on sustainable investing, as an increase by one unit leads to a 2.0 percentage points higher likelihood of having invested sustainably[15]. Thus, the effect of climate change perception in the second model appears to be slightly stronger, but not significant when compared to the primary model.

Table T9: Impact of perception of climate change – second regression

Logistic regression

Sustainable investing	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Perception of climate change	1.131	.096	1.46	.145	.958	1.335	

Mean dependent var	0.278	SD dependent var	0.449
Pseudo r-squared	0.168	Number of obs	331
Chi-square	65.567	Prob > chi2	0.005
Akaike crit. (AIC)	405.677	Bayesian crit. (BIC)	557.762

*** *p<.01, ** p<.05, * p<.1*

Remarkably, the median for climate change perception within the sample regarding the second regression is with 8.402 very similar to the median, of the sample of the primary regression, which is 8.405[16]. Therefore, the different results cannot be attributed to a different composition of the sample with regard to attitudes towards the climate change problem. Hence, households that own mutual funds, shares, checking and savings accounts seem to be not influenced by their environmental values when it comes to the

[15] For AMEs see table A27 of the appendix.
[16] See table A24 of the appendix.

decision to invest sustainably. Thus, evidence was found to reject the hypothesis when applying it to households that own the named financial assets.

7.3.2. Social signaling

Based on the findings of Riedl and Smeets (2017) and Gutsche et al. (2021), who all observed a significant positive influence of social signaling on engaging in sustainable investing, the following hypothesis was derived:

H5: Social signaling enhances the likelihood of investing sustainably.

When analyzing the impact of social signaling, it is important to note that its measurement is challenging, particularly identifying factors that can accurately quantify it (Riedl and Smeets, 2017). In previous studies, social signaling was always measured by the tendency of talking to others about investments. Even Riedl and Smeets (2017) noted that their proxy "talking about investment" may not be a pure measure of social signaling. Unfortunately, the Deutsche Bundesbank survey did not include any question that addresses a participant's tendency towards talking about their investments to others. Consequently, the act of social signaling itself could not be directly measured and the impact of social signaling cannot be analyzed in the manner of the previous studies.

To gain an insight into how the intent for signaling sustainable investing affects actual sustainable investing, proxies for the purpose of social signaling got derived. According to Riedl and Smeets (2017), the purpose of social signaling is to improve one's social reputation. Their explanation aligns with the concept of image motivation, which refers to an individual's propensity to be driven by others' perceptions, thus underlining the desire to be liked and respected by others (Ariely et al., 2009). The survey included questions on the importance of one's social status and other people's opinions, which may serve as proxies to capture this purpose of social signaling, as importance of social status and other's opinion reflect people's desire to be recognized and respected within a community (Anderson, Hildreth and Howland, 2015; Ariely et al., 2009). Thus, they do both directly relate to motivations for creating a certain image to the social environment. Given the link to image motivation, both factors were used as proxies to capture enhancing social reputation, which is the aim of social signaling. The regression results for both variables are captured by the table beneath.

Table T10: Impact of social status and opinion of others – primary regression

Logistic regression

Sustainable investing	Coef.	St.Err.	t-value	p-value	[95% Conf	Inter-val]	Sig
Opinion of others	.998	.067	-0.03	.977	.874	1.14	
Importance of social status	1.015	.064	0.24	.811	.898	1.148	

Mean dependent var	0.133	SD dependent var	0.340
Pseudo r-squared	0.197	Number of obs	2511
Chi-square	333.412	Prob > chi2	0.000
Akaike crit. (AIC)	1699.232	Bayesian crit. (BIC)	2037.281

*** *p<.01, ** p<.05, * p<.1*

Table T11: AMEs for importance of social status and opinion of others – primary model

Average marginal effects Number of obs = 2511
Model VCE : Robust
Expression : Pr(sustainable_investing), predict()

	Delta-method					
	dy/dx	Std.Err.	z	P>z	[95%Conf.	Interval]
Opinion of others	-0.000	0.006	-0.030	0.977	-0.013	0.012
Importance of social status	0.001	0.006	0.240	0.811	-0.010	0.013

Note: dy/dx for factor levels is the discrete change from the base level.

Based on the odds ratios, which are very close to one and the low AMEs, the impact of both variables is very weak. This indicates that the two groups of sustainable investors and non-sustainable investors do not differ greatly from another in means of importance of their social status and others opinion. Additionally, the impact for none of the two proxies is significant.

Just like the primary regression model, the second model does not show any significant impact for one of the two variables on sustainable investing. While the effects are similar in direction, they are slightly stronger[17]. Thus, households owning the listed assets seem to not differ from the broader sample in means of enhancing the social image.

As no significant impact was found, the desire to improve one's social image, consequently tends to have no impact on the decision to invest sustainably.

It is important to note that the act of social signaling itself, and therefore the corresponding hypothesis, could not be directly tested by this thesis. Instead, the intention

[17] See table A27 of the appendix.

behind it was inferred through proxies such as "opinion of others" and "importance of social status". However, it remains uncertain whether these two variables adequately capture the true intent of social signaling. Moreover, no study could be identified, that has yet explored how the aim of social signaling, impacts sustainable investing. Consequently, the variables used cannot be directly compared to existing research. Nevertheless, an insight into the relationship between the intention of enhancing one's social image and investing sustainably, is provided.

7.3.3. Risk preference

As previous research shows a clear trend of risk preferences not significantly impacting engagement in sustainable investing, the following hypothesis was derived:

H6: The risk preference of a German households has no significant impact on the decision to invest sustainably.

It was possible to test this hypothesis empirically, as the survey of the Deutsche Bundesbank did include a question that addressed the respondents risk tolerance. The regression results are captured by the table beneath.

Table T12: Impact of risk tolerance – primary regression

Logistic regression

Sustainable investing	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Risk tolerance	1.13	.038	3.63	0	1.058	1.207	***

Mean dependent var	0.133	SD dependent var	0.340
Pseudo r-squared	0.197	Number of obs	2511
Chi-square	333.412	Prob > chi2	0.000
Akaike crit. (AIC)	1699.232	Bayesian crit. (BIC)	2037.281

*** *p<.01*, ** *p<.05*, * *p<.1*

The impact of risk tolerance is highly significant as the model shows significance at the 1 percent level. When looking at the odds ratio, an increase in risk tolerance by one unit results in a 1.13 higher chance of having invested sustainably. As the odds ratio does not differ strongly from the value of one, the groups of sustainable investing households and not sustainable investing households seem to not differ heavily from another in terms of risk preference. The AME (*table T13*) also indicates that the effect of this im-

pact is not that strong, as an increase of risk tolerance by one unit only leads to a 1.2 percentage points higher likelihood of having invested sustainably.

Table T13: AMEs of risk tolerance – primary regression

Average marginal effects Number of obs = 2511
Model VCE : Robust
Expression : Pr(sustainable_investing), predict()

	Delta-method					
	dy/dx	Std.Err.	z	P>z	[95%Conf.	Interval]
Risk tolerance	0.012	0.003	3.650	0.000	0.005	0.018

Note: dy/dx for factor levels is the discrete change from the base level.

In comparison to the impact of climate change perception, this impact is equally strong, but from higher significance, as the odds ratio for climate change perception was 1.081, but only significant at the 10 percent level.

Like the primary regression, the second regression model does also show a significant impact for an individual's risk tolerance on the decision to invest sustainably. But the impact is only significant at the 5 percent level. The effect is similar in direction, but stronger when comparing the AMEs, which is 0.032 in the second regression[18].

Based on these regression results, evidence was found to reject hypothesis six, as risk tolerance shows a highly significant impact on sustainable investing. Thus, it can be assumed that higher levels of risk tolerance do increase the likelihood for German private households to invest sustainably.

7.3.4. Behavior of sustainable investors outside the financial world

The hypothesis regarding the impact of non-financial sustainable behavior is:

H7: Individuals who exhibit a high degree of sustainable behavior in non-financial aspects of their lives are more likely to invest in a sustainable manner.

Below, the regression analysis results are presented, capturing the impact of climate change actions on sustainable investing.

Table T14:Impact of climate change actions – primary regression

[18] See Table A27 of the appendix for list of AMEs to the second regression.

Logistic regression

Sustainable investing	Coef.	St.Err.	t-value	p-value	[95% Conf	Inter-val]	Sig
Use alternative to car	.942	.137	-0.41	.682	.708	1.253	
Reduce energy consumption	1.436	.209	2.48	.013	1.079	1.911	**
Buy local and seasonal products	1.451	.282	1.92	.055	.992	2.122	*
Reduce waste and recycle	2.811	1.109	2.62	.009	1.297	6.092	***
Consider CO2 emissions	1.892	.273	4.42	0	1.426	2.509	***
Avoid buying non-essential things	.845	.133	-1.07	.284	.621	1.15	
Eat little meat	1.057	.16	0.37	.715	.786	1.421	

Mean dependent var	0.133	SD dependent var	0.340
Pseudo r-squared	0.197	Number of obs	2511
Chi-square	333.412	Prob > chi2	0.000
Akaike crit. (AIC)	1699.232	Bayesian crit. (BIC)	2037.281

*** *p<.01*, ** *p<.05*, * *p<.1*

At first, it is necessary to note that all of the independent variables regarding climate change actions are dummy variables, meaning an increase of one unit means having engaged in the particular action. Interestingly, for four climate changes actions the impact on sustainable investing occurs significant. Buying local and seasonal products is significant at the 10 percent level, while reducing energy consumption is significant at the 5 percent level. An even stronger significant impact has reducing waste and recycle as well as considering CO2 emissions as they are significant at the 1 percent level.

When looking at the effect size, climate change actions have on sustainable investing, reducing waste and recycle has the strongest effect among the climate change actions with a 2.811 higher chance and a 9.8 percentage points higher likelihood of belonging to the group of sustainable investors by an increase of one unit. The second strongest effect has the consideration of CO2 emissions with a 1.892 higher chance and a 6.1 percentage points higher likelihood, followed by buying local and seasonal products and reducing energy consumption, with both a higher chance of around 1.4 for having invested sustainably. The two groups of sustainable retail investors and non-sustainable retail investors seem to be very similar when it comes to how much meat they eat, as eating little meat shows an odds ratio of 1.057 which is not that different from one and an AME of 0.005 (*table T14, T15*). Notably, two climate change actions have a negative impact. Avoiding buying non-essential thigs as well as using alternatives to car provide odds ratios below one and are therefore indicating an affiliation to the group of not sustainably investing households. Also, when looking at the AMEs it can be observed that their impact is negative in means of likelihood.

Table T15: AMEs of climate change actions – primary regression

Average marginal effects Number of obs = 2511
Model VCE : Robust
Expression : Pr(sustainable_investing), predict()

	Delta-method					
	dy/dx	Std.Err.	z	P>z	[95%Conf.	Interval]
Use alternative to car	-0.006	0.014	-0.410	0.682	-0.033	0.021
Reduce energy consumption	0.034	0.014	2.480	0.013	0.007	0.061
Buy local and seasonal products	0.035	0.018	1.920	0.055	-0.001	0.072
Reduce waste and recycle	0.098	0.037	2.620	0.009	0.025	0.172
Consider CO2 emissions	0.061	0.014	4.430	0.000	0.034	0.087
Avoid buying non-essential things	-0.016	0.015	-1.070	0.283	-0.045	0.013
Eat little meat	0.005	0.014	0.370	0.715	-0.023	0.033

Note: dy/dx for factor levels is the discrete change from the base level.

When compared to the odds ratios of risk tolerance (1.13) and climate change perception (1.081), climate change actions have a stronger average effect on sustainable investing, demonstrated by an average odds ratio of 1.49.

Surprisingly, when comparing the regression results of the primary model to those of the second model, some differences emerge. While the primary regression showed four climate change actions to have a significant impact on sustainable investing, the second model does only show significance for reducing waste and recycle. Like in the primary model, this influence is significant at the 5 percent level. But with an odds ratio of 9.037 and an AME of 0.358, the effect is way stronger[19]. When looking at the direction of the effect, buying local and seasonal things as well as eating little meat and reducing energy consumption, do now indicate a higher chance of having of not invested sustainable, whereas the direction was the other way around in the primary model.

Table T16: Impact of climate change actions – second regression

Logistic regression

Sustainable investing	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Use alternative to car	.843	.275	-0.52	.601	.445	1.597	
Reduce energy consumption	.98	.294	-0.07	.946	.544	1.763	
Buy local and seasonal products	.698	.299	-0.84	.401	.301	1.616	
Reduce waste and recycle	9.037	7.795	2.55	.011	1.667	49.004	**
Consider_CO2 emissions	1.064	.334	0.20	.844	.575	1.967	
Avoid buying nonessential things	.73	.241	-0.95	.34	.382	1.394	
Eat little meat	.759	.261	-0.80	.424	.387	1.491	

[19] For AMEs see table A27 of the appendix.

Mean dependent var	0.278	SD dependent var	0.449
Pseudo r-squared	0.168	Number of obs	331
Chi-square	65.567	Prob > chi2	0.005
Akaike crit. (AIC)	405.677	Bayesian crit. (BIC)	557.762

*** p<.01, ** p<.05, * p<.1

Overall, participants of the second sample showed fewer engagement to climate change actions, with the exception of eating less meat[20]. For example, a notable difference is observed in the consideration of CO2 emissions: 53.44 percent of respondents in the primary sample answered "no", compared to 58.01 percent in the smaller sample. This variation in the distribution of the samples may partially explain the differing results.

As the primary regression revealed a significant impact of most climate change actions on sustainable investing engagement, and the second model showed significance for one such action, no empirical evidence was found to reject hypothesis six. Hence, it can be assumed that if German households show engagement in non-financial sustainable actions, they are more likely to also invest in a sustainable manner.

7.4. Demographics

Based on the analysis of existing research, the following hypotheses addressing the impact of demographic factors on the engagement in sustainable investment were derived:

H8: Households with younger members tend to be more likely to invest in a sustainable manner, compared to households with older members.

H9: Compared to men, women tend to be more likely to invest in a sustainable manner.

H10: Households with higher educated members tend to be more likely to invest in a sustainable manner.

All of these hypotheses got tested empirically. The figure below captures the regression results regarding the impact of demographics on the decision to invest sustainably.

[20] See descriptives statistics in table A18 and table A25 in the appendix.

Table T17: Impact of demographics – primary regression

Logistic regression

Sustainable investing	Coef.	St.Err.	t-value	p-value	[95% Conf	Inter-val]	Sig
Current employment status: base Em-ployed part time	1	.	.	.	.	.	
Employed part-time	.795	.249	-0.73	.464	.43	1.47	
Low-paid part-time/ Irregularly employed	.304	.509	-0.71	.477	.011	8.135	
Short-term work	1.879	1.252	0.95	.344	.509	6.935	
On maternity leave	.738	.678	-0.33	.741	.122	4.462	
Unemployed	.217	.26	-1.27	.203	.021	2.282	
In school, university or Unpaid internship	4.792	5.978	1.26	.209	.416	55.259	
Retiree or pensioner	1.586	.489	1.50	.135	.867	2.901	
Early retiree – unfit for work	.171	.187	-1.61	.107	.02	1.462	
Housewife/Houseman	.372	.389	-0.95	.344	.048	2.889	
Other non-working status	1.27	1.073	0.28	.778	.242	6.654	
Age_centered	1.015	.01	1.52	.127	.996	1.034	
Current employment status# c.age_centered: base Employed part time	1	.	.	.	.	.	
Employed part-time	.986	.028	-0.50	.618	.933	1.042	
Low-paid part-time/ Irregularly employed	1.107	.09	1.25	.211	.944	1.299	
Short-term work	.861	.087	-1.47	.141	.706	1.051	
On maternity leave	.954	.037	-1.23	.219	.885	1.028	
Unemployed	.948	.025	-2.02	.043	.901	.998	**
In school, university or Unpaid internship	.949	.043	-1.18	.239	.869	1.036	
Retiree or pensioner	1.016	.018	0.91	.365	.981	1.052	
Early retiree – unfit for work	.992	.033	-0.24	.808	.929	1.059	
Housewife/Houseman	1.085	.074	1.20	.23	.95	1.24	
Other non-working status	.933	.045	-1.45	.147	.849	1.025	
Gender: base Male	1	.	.	.	.	.	
Female	.974	.154	-0.17	.868	.714	1.328	
Diverse	5.443	6.891	1.34	.181	.455	65.087	
Marital status: base Single	1	.	.	.	.	.	
Divorced	.977	.273	-0.08	.934	.564	1.691	
Widowed	1.379	.431	1.03	.303	.748	2.543	
Married/Registered partnership	.887	.178	-0.60	.55	.598	1.316	
Education	.94	.071	-0.82	.415	.811	1.09	

Mean dependent var	0.133	SD dependent var	0.340
Pseudo r-squared	0.197	Number of obs	2511
Chi-square	333.412	Prob > chi2	0.000
Akaike crit. (AIC)	1699.232	Bayesian crit. (BIC)	2037.281

*** *p<.01, ** p<.05, * p<.1*

At first, it is necessary to note, that the variables current employment status, gender, marital status as well as education are all factor variables. Therefore, the odds ratios and AMEs for these variables are only interpretable in relation to the base value.

Overall, the odds ratios for the demographics do all appear to be close to one. Thus, households that do not invest sustainably and those that do invest sustainably, do not greatly differ from another in terms of demographics. For example, an increase of age by one unit increases the chance for having invested sustainably by only 1.015. When

looking at its AME (*table T18*), it is again observable, that the effect of age on sustainable investing appears to be weak as the likelihood of having invested sustainably does only increase by 0.2 percentage points if age increases. In contrast to age, a higher educational level has a negative impact on sustainable investing. An increase of the personal educational level by one unit results in a higher chance of having not invested sustainably as the odds ratio is 0.94. This impact is also very weak, as the AME shows a decrease of only 0.6 percentage points. The odds ratios for gender are only interpretable in relation to the male gender. With an odds ratio of 5.443 diverse participants seem to greatly differ from men in means of sustainable investing, while women do not seem to differ from men. The differing result for diverse people may be due to the fact that very few participants identified as diverse. Only six people identified as diverse, leading diverse people to be under representative in the sample. When looking at the AMEs for the demographics in *table T18*, they show no notably strong effect of the independent variables on sustainable investing.

Notably is the interaction effect that was assumed between age and employment status. This interaction effect is statistically significant at the 5 percent level for the job category of "unemployed". Consequently, participants that where not employed at the time of answering the survey appear to significantly differ from those with different employment statuses regarding whether they have previously engaged in sustainable investing.

Table T18: AMEs of the demographics – primary regression

Average marginal effects Number of obs = 2511
Model VCE : Robust
Expression : Pr(sustainable_investing), predict()

		Delta-method				
	dy/dx	Std.Err.	z	P>z	[95%Conf.	Interval]
Current employment status						
Employed part-time	-0.022	0.027	-0.790	0.427	-0.075	0.032
Low paid part time	-0.025	0.062	-0.410	0.681	-0.147	0.096
Short-term work	0.162	0.136	1.190	0.235	-0.105	0.429
On maternity leave	-0.020	0.088	-0.230	0.816	-0.192	0.151
Unemployed	-0.090	0.050	-1.810	0.070	-0.187	0.007
In school/university/unpaid internship	0.220	0.221	1.000	0.318	-0.212	0.653
Retiree or pensioner	0.055	0.040	1.350	0.176	-0.024	0.134
Early retiree – unfit for work	-0.104	0.033	-3.120	0.002	-0.169	-0.039
Housewife/Houseman	-0.031	0.054	-0.570	0.570	-0.136	0.075
Other non-working status	0.045	0.087	0.520	0.605	-0.125	0.215
Age_centered	0.002	0.001	2.020	0.044	0.000	0.003
Gender: base: Male						

Female	-0.002	0.015	-0.170	0.868	-0.032	0.027
Diverse	0.231	0.217	1.060	0.287	-0.195	0.657
Marital status						
Divorced	-0.002	0.027	-0.080	0.934	-0.055	0.051
Widowed	0.034	0.034	1.000	0.317	-0.033	0.101
Married/Registered partnership	-0.011	0.019	-0.590	0.556	-0.049	0.027
Education	-0.006	0.007	-0.810	0.416	-0.020	0.008

Note: dy/dx for factor levels is the discrete change from the base level.

Below are the regression results of the second model presented (*table T19*). Notably, the second regression shows a significant impact for age at the 10 percent level, which contrasts the finding of the primary regression. Remarkably, also the direction of the effect is different, by indicating a higher chance of having not invested sustainably when age increases by one unit as the odds ratio is 0.961 and the AME only -0.001[21]. Thus, this specific group of German households seems to differ from the broader population in means of age when it comes to sustainable investing. In line with the primary model, no significant impact was found for education, gender or any other demographic factor. Again, surprising is that the effect direction for education is now also different to the primary regression by indicating a belonging to the group of sustainable investing households with an odds ratio of 1.063. Additionally, divorced individuals invest less sustainably than individuals who are single and. Moreover, the interaction effect shows significance for the group of retirees and pensioners. However, it must be noted here that job has been regrouped[22].

Table T19: Impact of demographics - second regression

Logistic regression

Sustainable investing	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Current employment status: base: Employed full time	1	.	.	.	.	.	
Employed part-time	.45	.253	-1.42	.156	.149	1.357	
Unemployed	.136	.246	-1.10	.271	.004	4.744	
Retiree or pensioner	1.043	.852	0.05	.959	.21	5.17	
Age_centered	.961	.022	-1.75	.08	.919	1.005	*
Current employment status#age_centered: base Employed full time	1	.	.	.	.	.	
Employed part-time	1.05	.055	0.92	.357	.947	1.164	
Unemployed	1.035	.113	0.31	.756	.835	1.282	

[21] For AMEs see table A27 of the appendix.
[22] See table A21 of the appendix for the new distribution of job.

Retiree or pensioner	1.1	.056	1.88	.061	.996	1.216	*
Gender	1.289	.465	0.70	.482	.635	2.614	
Marital status: base: Single	1	.	.	.	.	.	
Divorced	.131	.124	-2.14	.032	.02	.84	**
Widowed	.649	.59	-0.48	.635	.11	3.852	
Married/Registered partnership	1.364	.655	0.65	.518	.532	3.496	
Education	1.063	.199	0.33	.744	.737	1.533	

Mean dependent var	0.278	SD dependent var	0.449
Pseudo r-squared	0.168	Number of obs	331
Chi-square	65.567	Prob > chi2	0.005
Akaike crit. (AIC)	405.677	Bayesian crit. (BIC)	557.762

**** p<.01, ** p<.05, * p<.1*

It was further examined whether there is a difference in the participants age between the two samples. The sample regarding the second regression has an average birth year of 1964.112, leading to an average age of 55.9 years and thus to a younger sample compared to the primary sample. In the primary sample the average age is 56.8 years[23].

However, in contrast to most of the previous research, the regressions show no significant impact for the demographic related variables. The only exception is the second regression which shows significance for age. This calls for additional investigation and a further iteration of the survey, incorporating a larger number of participants.

Consequently, evidence was found to reject all of the hypotheses regarding the influence of demographics when it comes to the broader sample. According to this thesis´s empirical analysis, the engagement for sustainable investment among German private households is not significantly influenced by any demographic factors. Only households that own mutual funds, shares, checking and savings accounts seem to be influenced by age, as the likelihood of investing sustainably decreases if age increases.

8. Discussion

In summary, most hypotheses were tested empirically. However, due to the absence of questions that address participants' financial literacy or their investment performance expectations, the referring hypotheses could not be tested. Moreover, the act of social signaling itself, meaning how frequently individuals discuss their investments with

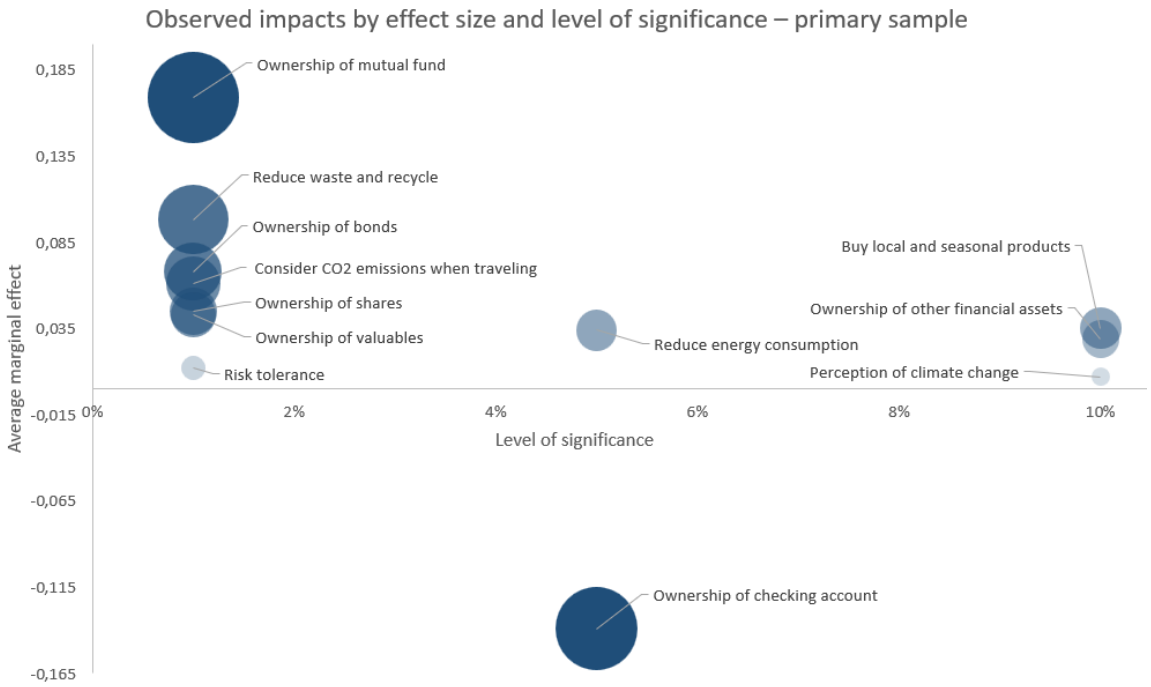
[23] For median of age see table A18 in the appendix.

peers, could not be directly tested, as a corresponding question is missing. Nevertheless, an attempt was made to examine the relationship between the intention behind social signaling and sustainable investing. Therefore, “importance of social status” and “importance of others opinion” were used as proxies to capture this intent. In result, no significant impact was observed for the two proxies. Further, none of the impacts was strong in means of effect size. If these proxies do accurately capture the purpose for social signaling remains uncertain, as no paper could be found that employed these variables in such manner before. The remaining hypotheses could all be tested, as variables similar to those used in existing research were available in the dataset. Due to a huge number of wealth factors considered as independent variables and the varying results within this group, the decision regarding the rejection of the wealth factors hypothesis remains open. However, the analysis provides interesting initial insights into the relationship between wealth factors and sustainable investing.

The results of the primary regression are captured by the beneath chart. Significant effects were observed for various independent variables. While risk tolerance only shows a weakly positive effect, its effect is significant at the 1 percent level. This finding contradicts most previous studies, who did not find a significant impact (e.g. Bauer and Smeets, 2015; Riedl and Smeets, 2017). Perception of climate change shows also a weakly positive effect and is significant at the 10 percent level. This finding aligns with most previous studies, like the one of Giglio et al. (2023). Further, ownership of most financial assets shows significant impacts at the 1 percent level, except for checking accounts, which is significant at the 5 percent level and other financial assets, remaining significant at the 10 percent level. These impacts do further vary strongly in means of effect size, as demonstrated by the below chart. In addition to that, owning valuables, like art or jewelry, has a moderately strong positive effect that is highly significant. Next, a significant impact is observed for nearly all variables addressing participation in climate change actions, with significance levels ranging from 1 percent to 10 percent and AMEs ranging from 0.034 to 0.098. Age and education do both show very weak effects, with age having a weakly positive tendency. Thus, older individuals may be slightly more inclined towards sustainable investing, which is contrary to most research (e.g. Giglio et al, 2023; Haber et al., 2022). Education shows a weak negative effect, implying higher educated households to be less likely to invest sustainably, also contrasting most of previous studies, (e.g. Rossi et al., 2019). No notable difference is ob-

served between men and women, which again stands in contrast to most studies that imply women to be more likely to engage in sustainable investing (e.g. Bauer et al., 2021; Junkus and Berry, 2010). Remarkably, none of the impacts caused by demographics is significant, which deviates from most previous findings, like Bauer et al. (2021) or Bernow et al. (2017). Among the significant impacts, mutual fund ownership had the strongest effect, demonstrated by an AME of 0.169, followed by ownership of checking account -0.139 and reducing waste and recycling with an AME of 0.098. Perception of climate change had the weakest significant effect, having an AME of 0.007.

Figure F19: Results of the primary regression

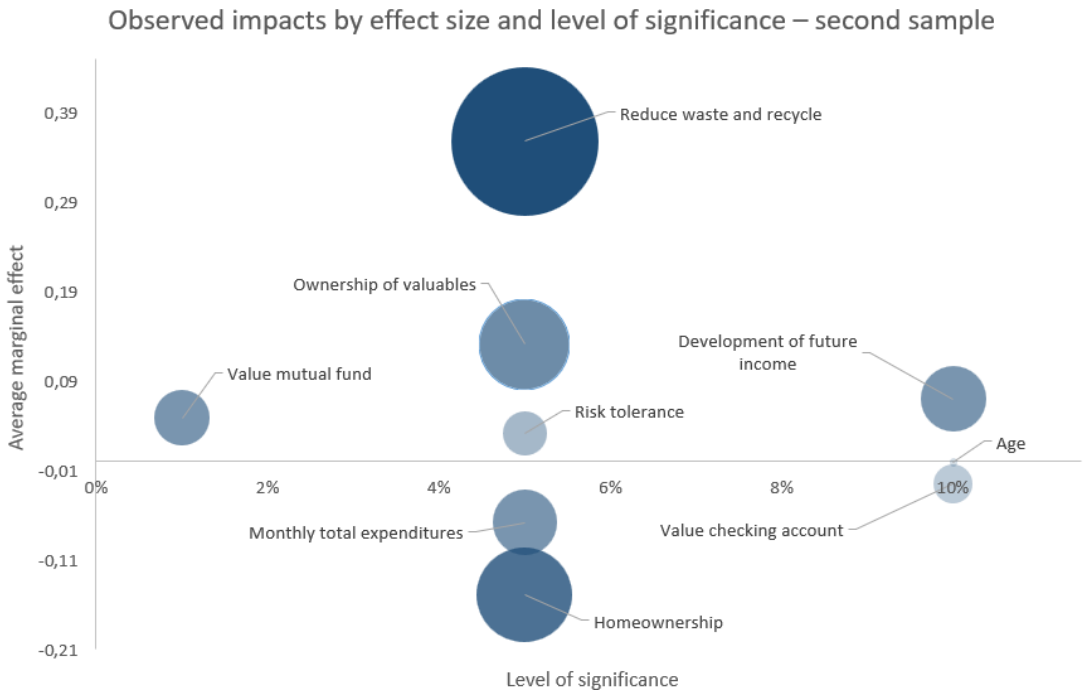


According to the findings of this thesis, households that engage in various sustainable activities and those that own certain financial assets or valuables are more likely to invest sustainably. An explanation for the significantly positive effect of most climate change actions, may lie in the Theory of Consistent Behavior, which suggests a specific behavior in one area can extend to other areas (Cervone and Shoda, 1991). Thus, individuals intrinsically motivated towards general sustainable behavior are more likely to invest sustainably (Brunen and Laubach, 2022). What hints at sustainable investments being a luxury good is the positive correlation with ownership of valuables, thus aligning with the conclusion of Döttling and Kim (2021). With respect to the impact result-

ing from the ownership of certain financial assets, to date no study could be identified that examines this relationship. A possible explanation for the negative effect of having a checking account on sustainable investing may be a preference for saving rather than investing. It also appears that households owning mutual funds and shares, may be more familiar with sustainable investing, as those without these assets are generally less involved in any form of investment, including sustainable ones. In addition, the decision to invest sustainably happens to be influenced by risk tolerance and the perception of climate change. Households more concerned about climate change and with a higher risk appetite are more likely to invest sustainably. Individuals with a higher risk tolerance may be more inclined to accept the diversification limitations caused by sustainable investment strategies and might be more open to exploring new investment opportunities, thereby enhancing their awareness of sustainable investment options (Gutsche et al., 2021). Additionally, individuals with strong environmental and social values tend to be more aware of sustainable investments, driven by a strong desire to align their financial decisions with their ethical beliefs and to contribute positively to society via active engagement (Gutsche et al., 2021).

While the primary regression includes a broad sample, the second regression includes a more specific one, comprising only households that own checking and savings accounts, shares, and mutual funds. As asset ownership already plays a crucial role in the broader sample, identifying key factors affecting these specific households is very interesting. When comparing the results of the primary regression with those of the second one, differences emerge. As illustrated by the below chart, the second regression shows significantly negative impacts for age, homeownership, value of checking account and monthly expenditures, with homeownership having the strongest effect. A positive development of future income has a weakly positive significant impact. Like in the primary regression, a significantly positive effect of risk tolerance and reducing waste occurs.

Figure F20: Results of the second regression



While the impact of reducing waste and recycle is weaker when compared to the primary regression, it happens to be the strongest effect among the significant impacts of the second regression. In contrast to the primary sample, no significant impact was found for the other variables addressing climate change actions. Also contrasting the results of the primary model, homeownership has a strong negative impact. The impact of risk tolerance is with an AME of 0.032 equally in effect size, when compared to the primary regression. Further, the value of checking accounts and mutual funds significantly impact sustainable investing, the former having a weakly negative impact and the latter a positive one.

According to the results of both regressions, financial as well as nonfinancial factors drive German households' sustainable investment behavior. This aligns with finding of various studies (e.g. Beal et al., 2005; Gutsche et al., 2023). Further, for households owning the listed assets, wealth factors and age are more dominant drivers, whereas perception of climate change appears to be not as relevant for this specific group.

However, comparing the two models is complicated by several factors. Fist, the sample sizes are very different and second, some variables are coded differently. Moreover, some variables show great differences in their mean values, such as age, which has a significant lower mean in the second sample.

9. Goodness of fit of the used models

The following section briefly examines the goodness of the used regression models fit. At first, the number of observations is evaluated. In total, the primary regression model includes N=2,511 observations. A sample of a logistic regression should include at least N=100 observations (Bittmann, 2018). Hence, with respect to the size of the sample, the primary model performs well. The second regression includes fewer observations, with N = 331, which are still enough. But given its smaller sample size, the second regression model might be underpowered. An underpowered model can reduce the chance of detecting the true effect and may produce effects with inflated sizes. Additionally, the risk of false positives is higher in underpowered models (Fraley and Vazire, 2014).

Second, R square, which reflects the explanatory power of the regression, is examined in more detail. In principle, the higher the R square, the better (Kohler and Kreuter, 2017). In this analysis, the model's fit was assessed by McFadden's R squared. Regression models with McFadden's R squared ranging from 0.2 to 0.4 are considered to be well fitted (Urban, 1993). The obtained R squared value of the primary model is 0.197 and therefore just below the threshold of being classified as a good fit. Compared to that, the R squared value for the second model is even lower with 0.168.

To check weather unimportant variables are included in the regression model or if important variables are missing, a simple method is running the link test (Bittmann, 2018). Here, the variables of interest are "_hat" and "_hatsq". While "_hat" should exhibit a significant result with a p-value less than 0.05, "_hatsq" should show no significance. As the _hat value remains significant while the _hatsq value is not significant this suggests a good fit of the model[24]. In contrast to that, the link test shows that the _hatsq value for the second regression is 0.014 and therefore significant at the 5 percent level[25]. Thus, according to the link test the primary regression has a better fit.

Another way to test the goodness of the underlying model is to check pearson chi squared by running the Hosmer-Lemeshow test. The test indicates a good fit of the model if the chi squared value is not significant (Kohler and Kreuter, 2017). For the main regression, the Hosmer-Lemeshow test shows a non-significant chi squared with a

[24] See table A28 in the appendix.
[25] See table A31 in the appendix.

value of 0.7190, indicating a good fit of the model[26]. In line with that, the test does also show a non-significant chi squared of 0.4191 for the second model[27].

Additionally, interaction effects can influence the goodness of a regression model. An interaction is assumed if it is suspected that two variables interact, meaning the impact of one variable changes, depending on the levels of another variable (Rosnow and Rosenthal, 1989). In the conducted regression model, an interaction effect between age and job was assumed due to strong correlation between these variables. In order to make the interaction effect interpretable and to prevent any observations from being omitted, the age variable was centered by subtracting the average age from each observation. Incorporating the interaction effect led to an improved model fit, as evidenced by the outcome of the link test. Before incorporating this interaction effect, the _hat value was significant, but the _hatsq value too. Since the variable job is categorical, the interaction effects can only be interpreted in reference to the base, the interaction between age and job category "employed full time". Notably, the interaction between age and job category "unemployed" was significant in the first model. This suggests that unemployed participants behave differently in terms of sustainable investing. Contrasting that, the second regression shows a significance for the interaction between age and being a retiree.

To verify the percentage of observations that have been correctly classified into their respective groups by the model, classification tables can be used (Kohler and Kreuter, 2017). For the primary logistic regression, a total of 87.06 percent of the observations were correctly classified by the model, which is a good result (Kohler and Kreuter, 2017)[28]. Compared to that, the second model only classified 74.32 percent correctly[29].

Next, attention is paid to the Akaike information criterion (AIC), which serves to compare different models with each other. Generally, the model showing the lower AIC is considered as better suited (Bittmann, 2018). The first regression model has an AIC of 1,699,232 while the second model shows an AIC of 405,677. Due to its lower AIC, the second model performs better, while the first model may be overfitted. A model is overfitted, if it includes more variables than necessary, which may distort the results (Hawkins, 2004). Here, overfitting may be caused by including too many independent varia-

[26] See table A29 of the appendix
[27] See table A32 of the appendix for the detailed results.
[28] See table A30 of the appendix.
[29] See table A33 of the appendix.

bles, particularly wealth factors. However, prior testing to monitor changes in the significance of individual variables and R squared when removing some wealth factors did not show substantial differences. Consequently, all variables retained in the model.

Furthermore, both models were tested for multicollinearity. To detect multicollinearity, the variance inflation factor (VIF) can be used (Daoud, 2017). For the first model, the average VIF is 14.02, whereas it is 26.14 for the second model. In both models, the variables value of net income and monthly total expenditures show notably high values of over 100 for VIF[30]. Thus, the results from both models could be distorted due to the high values for multicollinearity. In general, a VIF above 10 is considered problematically (Allison, 2012; Midi, Sarkar and Rana, 2010; Senaviratna and Cooray, 2019).

As the used models were logits, a probit version was run for each model to check the results consistency[31]. The respective probit versions show similar R squared and AIC values. Also, the same variables happen to be significant. Only exceptions are ownership of business, which is significant at the 10 percent level in the first model and the variable value net income, which is significant at the 10 percent level in the probit version for the second sample. Notably, the impact for both variables is negative.

Overall, the primary regression model outperforms the second regression model in nearly all tests. Hence, especially with regard to the larger sample size, it is preferred over the second model in terms of model fit. The only advantage of the second model is a better AIC value.

10. Conclusion and limitations

Throughout the past years, awareness and interest in sustainable investing have significantly increased, as evidenced by the substantial growth in sustainable investment volumes held by retail investors both globally and in Germany (e.g. FNG, 2023; GSIA, 2023). Despite this trend of growing awareness of sustainable investing, confusion remains about the reliability of various ESG ratings and what sustainable investing really entails. Given the heterogenous use of terms and definitions, as well as the multiple forms sustainable investing can take, it is no surprise that many investors remain uncer-

[30] See table A34 and A25 of the appendix.
[31] For regression output of the two probit versions see Table A37 and A38 of the appendix.

tain about investing sustainably (Brunen and Laubach, 2022; Gutsche and Zwergel, 2020; Wins and Zwergel, 2016; Bundesverband Deutscher Banken, 2023).

Considering this development, the aim of this thesis was to explore the participation in sustainable investing among German households and to understand the motivations behind their sustainable investment decisions. To achieve this, a detailed review of previous research was conducted and hypotheses were derived based on previous findings. In recent years, an increasing number of studies explored characteristics of sustainable retail investors and their motivations. However, there undoubtedly is a need for further research, as empirical findings regarding certain factors, such as income and wealth, remain contradicting. Furthermore, as research areas like social signaling are relatively new, previous studies are rare to find. To address this research gap, the thesis derived proxies to capture the aim behind social signaling in order to get an initial insight into the relation between this intent and engagement in sustainable investing. To date, no previous research papers regarding the use of these specific proxies could be identified. The biggest research gap lies in understanding how participation in non-financial sustainable actions affects the willingness to engage in sustainable investing. Hence, insights into the sustainable non-financial behavior of sustainable investing German households were provided. The thesis reveals them to be more actively engaged in climate change actions, like reducing meat consumption and energy use, when compared to non-sustainable investors, highlighting the need for further research.

In order to test the derived hypotheses empirically, a dataset of a survey from 2020, provided by the Deutsche Bundesbank, was analyzed. Therefore, two separate regression models were conducted. While the primary model included 2,511 observations and captured a broader view on German private households, the second model focused specifically on households that own certain financial assets, such as mutual funds, checking accounts, shares and savings accounts and included 331 observations.

Starting with the results of the primary regression model analysis, significant impacts for risk tolerance and perception of the climate change problem were identified. Additionally, significant impacts were observed for almost all climate change actions, as well as for ownership of valuables and financial assets. Except for checking account ownership, all of the mentioned independent variables had a significantly positive effect on sustainable investing, with mutual fund ownership having the strongest impact.

Compared to that, in the second regression, significant impacts of age, homeownership, future income, and monthly expenditures on sustainable investing were found. Except for future income, which had a positive effect, all other mentioned variables showed significant negative effects on sustainable investing. Similar to the primary regression, a significant positive effect of risk tolerance, ownership of valuables and reducing waste was observed. However, no significant impact was detected for further variables related to climate change actions. In addition, value of checking account and mutual fund significantly influenced sustainable investing, the former having a negative, and the latter a positive effect.

However, the comparability of the results from the two regression models is limited due to several factors. First, the composition of the samples differs. Second, the models include distinct variables, and some variables are even coded differently. Lastly, the models differ in terms of goodness of fit.

While the survey provided intriguing data, allowing to investigate private households' engagement in sustainable investing, the dataset and survey methodology exhibited certain limitations. The first point to note is the sample´s size and its distribution. Aiming to represent the whole German population, a sample of only 4,550 participants may be considered too small depending on the diversity of this population. In addition to that, the average age of the participants was notably high with 56.8 years. This could cause a bias and thus limit the applicability of the findings to the general population, as it may skew results towards the perspectives and behaviors of older individuals.

What further restricts the surveys scope is the limited way of asking about engagement in sustainable investing and the absence of a definition for sustainable investing. Moreover, participants were only asked whether or not they have engaged in sustainable investing within the last six months. Prior investment behaviors or future intentions, were unfortunately not considered. This six-months-focus oversees potential future trends in sustainable investing and fails to capture the complete previous sustainable investment behavior. A further shortfall in the survey design is the lack of depth in questioning. In particular, there were no questions regarding participants motivations for sustainable investing, their financial literacy, or their understanding of what sustainable investing really is. Additionally, it was not asked what they may expect from sustainable investments in terms of returns. This shortfall in depth of questioning leads to a gap in under-

standing driving forces behind sustainable investment decisions, the competence of individuals in making financial decisions, and their expectations regarding returns. Another limitation of the data set is the lack of given answers. Many questions have not been answered well. Hence, some variables could not be included in the regression models. Thus, the sample of the second regression remains rather small.

Acknowledging these limitations, the surveys design and execution limitations hinder a broader understanding. Nevertheless, the survey provides valuable and interesting insights on sustainable investing among German households. Future surveys could benefit from a more inclusive sample, a broader temporal scope, and a more comprehensive set of questions. These improvements would enable a more detailed analysis of sustainable investing and enhance the applicability to the wider population.

As the survey only includes German private households, the results of this analysis cannot be generalized to the broader investor population worldwide. The focus on German households may offer valuable insights into the tendencies and attitudes within this specific demographic, but applying these results to a wider, more diverse population of investors around the world may be rather difficult.

Exploring the factors that drive German households to engage in sustainable investing, this thesis comes to the conclusion, that sustainable investing is not merely a question of money, but it is rather influenced by multiple factors. Whether a household tends to invest sustainably is determined by a combination of financial factors, non-financial motives like risk awareness or environmental values, and demographics. Interestingly, the decision to invest sustainably also appears to be influenced by the extent of participation in other sustainable actions unrelated to the financial realm. Thus, policy makers should highlight different facets of sustainable investments to engage various investors driven by different motivations. (Gutsche et al. 2023).

So, is there is specific stereotype of a German household that is most likely to invest sustainably? Given the results of this thesis, households with strong environmental values, those with a willingness to take risks, those who already engage in sustainable behaviors, and those with access to various financial assets and valuables happen to be very likely to invest sustainably. Thus, there is a rather heterogeneous group of households than a specific stereotype.

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Appendix

Figure A1: Distribution of the educational level – uncleaned data set

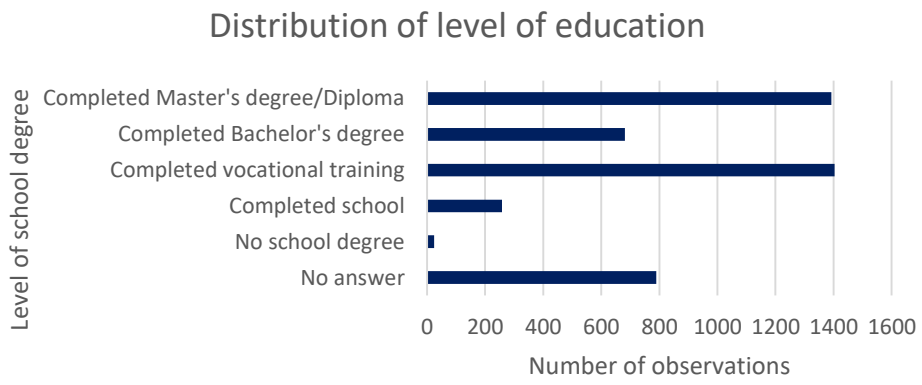

Figure A2: Distribution of current employment status - uncleaned data set

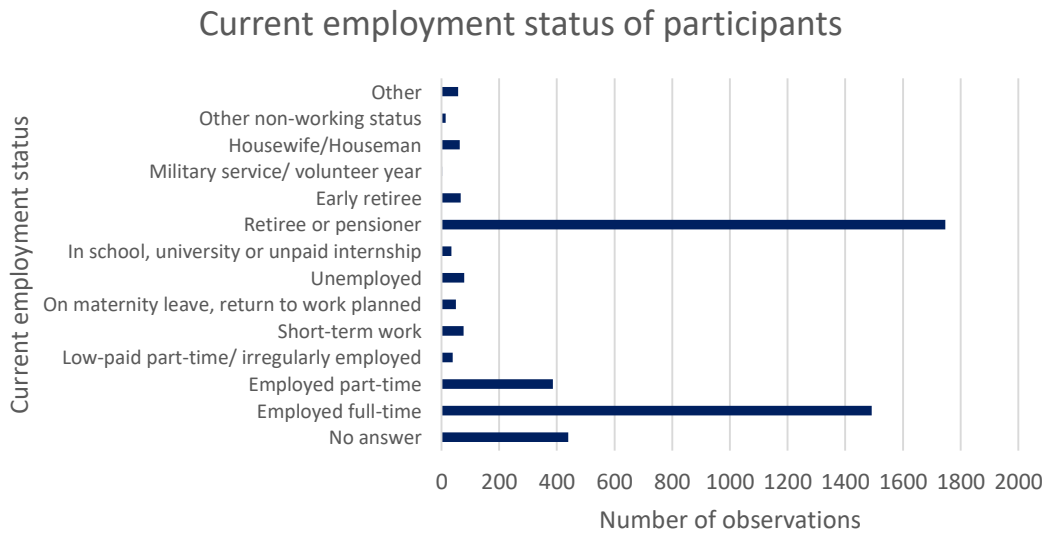

Figure A3: Marital status of the participants – uncleaned data set

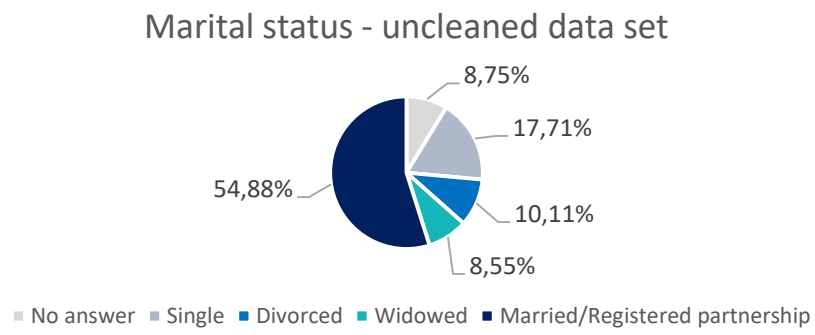

Table A4: Descriptives to question on sustainable investing – uncleaned data set

Tabulation of sustainable_investing

F27:climate change action - invest in sustainable fonds / shares	Freq.	Percent	Cum.
No answer	105	2.31	2.31
Yes	597	13.12	15.43
No	3848	84.57	100.00
Total	4550	100.00	

Table A5: Mean value of sustainable investing – uncleaned data set

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Sustainable_investing	4550	1.776	.671	-2	2

Table A6: Descriptives – uncleaned data set

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Finances during pandemic	4550	3.543	3.209	-2	96
Savings during pandemic	4550	1.725	4.048	-2	96
Income during pandemic	4550	3.853	2.59	-2	96
Development of future income	4550	3.836	2.161	-2	96
Value net income	4550	3327.783	5773.133	-2	250000
Monthly total expenditures	4550	1199.167	1288.923	-2	45000
Homeownership	4550	1.353	.598	-2	2
Ownership of other real estate	4550	1.653	.612	-2	2
Perception of climate change	4550	8.153	2.662	-2	10
Use alternative to car	4550	1.3	.683	-2	2
Reduce energy consumption	4550	1.294	.667	-2	2
Buy local and seasonal products	4550	1.111	.55	-2	2
Reduce waste and recycle	4550	1.013	.395	-2	2
Consider CO2 emissions when traveling	4550	1.408	.798	-2	2
Avoid buying non-essential things	4550	1.199	.58	-2	2
Eat little meat	4550	1.29	.629	-2	2
Sustainable investing	4550	1.776	.671	-2	2
Risk tolerance	4550	4.208	2.272	-2	10
Importance of opinion of others	4550	2.583	1.23	-2	5
Importance of social status	4550	2.913	3.058	-2	96
Total household net wealth	4550	390827.9	2331780.6	-400000	1.500e+08
Vehicles ownership	4550	1.124	.511	-2	2
Valuables ownership	4550	1.598	.939	-2	2
Checking account ownership	4550	.931	.516	-2	2
Checking account value	4550	12832.807	38371.561	-3	950000
Savings account ownership	4550	1.13	.837	-2	2
Savings account value	4550	28058.475	73873.911	-2	1200000
Mutual fund ownership	4550	1.447	.99	-2	2
Mutual fund value	4550	17060.277	80948.317	-2	2700000
Bonds ownership	4550	1.609	1.129	-2	2
Bonds value	4550	2853.713	32538.822	-2	1300000

Shares ownership	4550	1.476	1.037	-2	2
Shares value	4550	20081.255	146141.41	-2	4000000
Claims ownership	4550	1.627	1.084	-2	2
Claims value	4550	3689.919	52872.875	-2	2000000
Other financial assets ownership	4550	1.494	1.136	-2	2
Other financial assets value	4550	6595.349	88943.113	-2	4000000
Ownership of business	4550	1.839	.674	-2	2
Gender	4550	1.39	2.931	-3	96
Age (year of birth)	4550	1857.08	439.1	-3	2001
Marital status	4550	2.752	3.618	-3	96
Education	4550	11.902	28.218	-3	96
Current employment status	4550	20.382	140.301	-3	5813

Figures A7 and A8: Example for logarithmized variable - estimation of monthly net income:

Figure A7: Not logarithmized variable estimation of monthly net income

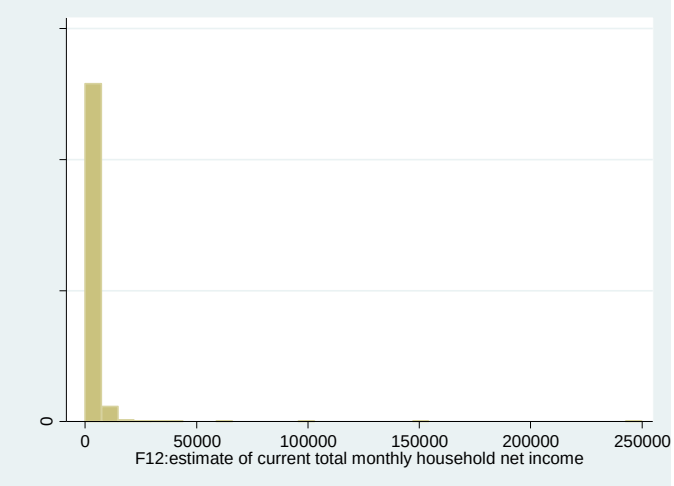

Figure A8: Logarithmized variable estimation of monthly net income

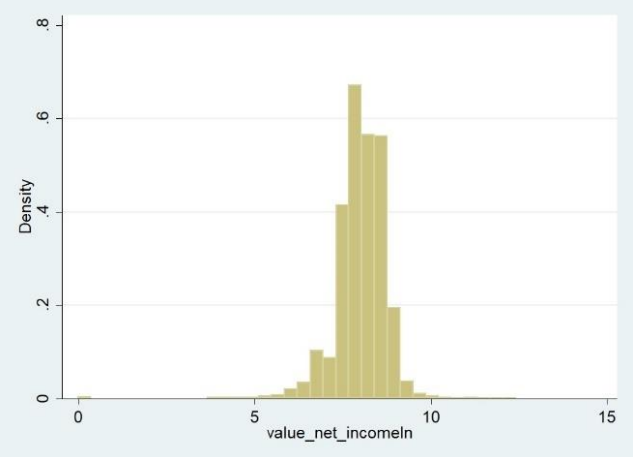

Table A9: Descriptive statistics of the cleaned data set – sample for the primary regression model

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Finances during pandemic	2511	3.548	.716	1	4
Savings during pandemic	2511	1.386	.487	1	2
Income during pandemic	2511	3.851	.941	1	7
Development future income	2511	3.876	.831	1	7
Value net income	2511	4035.876	6882.877	0	250000
Monthly total expenditures	2511	1335.408	1541.862	0	45000
Homeownership	2511	.626	.484	0	1
Ownership of other real estate	2511	.292	.455	0	1
Perception of climate change	2511	8.405	2.227	0	10
Use alternative to~ ca	2511	.625	.484	0	1
Reduce energy consumption	2511	.614	.487	0	1
Buy local and seasonal things	2511	.83	.376	0	1
Reduce waste and recycle	2511	.949	.22	0	1
Consider CO2 emissions	2511	.466	.499	0	1
Avoid buying nonessential things	2511	.736	.441	0	1
Eat little meat	2511	.653	.476	0	1
Sustainable investing	2511	.133	.34	0	1
Risk tolerance	2511	4.364	2.122	0	10
Opinion of others	2511	2.729	1.089	1	5
Importance of social status	2511	2.829	1.143	1	5
Total household net wealth	2511	420183.04	758884.13	-400000	11000000
Vehicles ownership	2511	.855	.352	0	1
Valuables ownership	2511	.206	.404	0	1
Checking account ownership	2511	.991	.095	0	1
Savings account ownership	2511	.752	.432	0	1
Mutual fund ownership	2511	.347	.476	0	1
Bonds ownership	2511	.047	.211	0	1
Shares ownership	2511	.293	.455	0	1
Claim ownership	2511	.067	.251	0	1
Other financial assets ownership	2511	.179	.384	0	1
Ownership of business	2511	.057	.232	0	1
Gender	2511	1.411	.497	1	3
Age	2511	1963.166	16.272	1924	2001
Marital status	2511	3.098	1.24	1	4
Job	2511	4.171	3.389	1	12
Education	2511	3.924	1.001	1	5
Value net income_ln	2511	8.052	.702	0	12.429
Monthly total expenditures_ln	2511	6.947	.715	0	10.714
Total household net wealth_ln	2511	11.248	3.152	0	16.213
Age_centered	2511	0	16.272	-39.166	37.834

Figure A10: Distribution of gender – primary sample

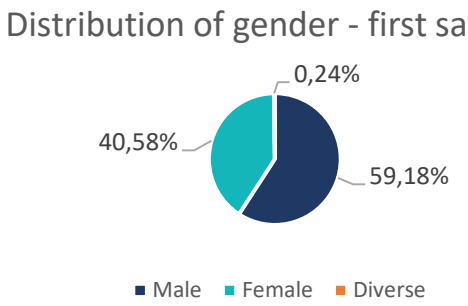

Table A11: Tabulation of gender – primary sample

Tabulation of gender

gender	Freq.	Percent	Cum.
Male	1486	59.18	59.18
Female	1019	40.58	99.76
Diverse	6	0.24	100.00
Total	2511	100.00	

Figure A12: Distribution of age – primary sample

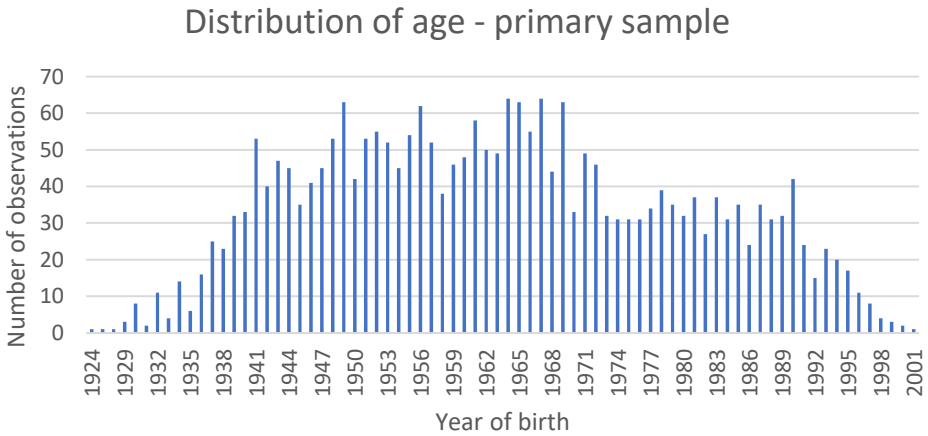

Table A13: Impact of climate change perception on using alternatives to car

Tabulation of use_alternative_to_car perception_of_climate_change

	F26: opinion on political developments-climate change											
F27: climate change action -alternatives to car	Not a problem at all	1	2	3	4	5	6	7	8	9	A very serious problem	Total
No	75.86	66.67	67.74	59.57	52.63	56.74	48.62	38.34	41.48	33.33	30.50	37.48
Yes	24.14	33.33	32.26	40.43	47.37	43.26	51.38	61.66	58.52	66.67	69.50	62.52
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table A14: Impact of climate change perception on buying local and seasonal products

Tabulation of buy_local_and_seasonal_products perception_of_climate_change

	F26:opinion on political developments-climate change											
F27:climate change action -buy local and seasonal products	Not a problem at all	1	2	3	4	5	6	7	8	9	A very serious problem	Total
No	44.83	16.67	58.06	34.04	28.95	31.91	22.02	19.17	17.05	13.99	12.61	17.05
Yes	55.17	83.33	41.94	65.96	71.05	68.09	77.98	80.83	82.95	86.01	87.39	82.95
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table A15: Impact of climate change perception on considering CO2 emissions when traveling

Tabulation of consider_CO2_emissions perception_of_climate_change

	F26:opinion on political developments-climate change											
F27:climate change action -consider CO2-emissions when travelling	Not a problem at all	1	2	3	4	5	6	7	8	9	A very serious problem	Total
No	86.21	77.78	83.87	76.60	60.53	76.60	70.64	62.18	57.25	57.20	43.26	53.44
Yes	13.79	22.22	16.13	23.40	39.47	23.40	29.36	37.82	42.75	42.80	56.74	46.56
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table A16: Impact of climate change perception on reducing energy consumption

Tabulation of reduce_energy_consumption perception_of_climate_change

	F26:opinion on political developments-climate change											
F27:climate change action -reduce energy consumption of the household	Not a problem at all	1	2	3	4	5	6	7	8	9	A very serious problem	Total
No	65.52	55.56	54.84	57.45	44.74	53.90	44.95	45.60	38.68	33.74	33.96	38.55
Yes	34.48	44.44	45.16	42.55	55.26	46.10	55.05	54.40	61.32	66.26	66.04	61.45
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table A17: Impact of climate change perception on avoiding to buy nonessential things

Tabulation of avoid_buying_nonessential_things perception_of_climate_change

	F26:opinion on political developments-climate change											
F27:climate change action -avoid buying non-essential things	Not a problem at all	1	2	3	4	5	6	7	8	9	A very serious problem	Total
No	72.41	38.89	48.39	31.91	34.21	36.17	35.78	35.75	28.50	24.28	20.72	26.44
Yes	27.59	61.11	51.61	68.09	65.79	63.83	64.22	64.25	71.50	75.72	79.28	73.56
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table A18: Descriptive statistic of the sample regarding the second regression

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Finances during pandemic	331	3.737	.505	2	4
Savings during pandemic	331	1.202	.402	1	2
Income during pandemic	331	4.003	.879	1	7
Development future income	331	3.94	.728	1	6
Value net income	331	6264.29	11173.238	400	150000
Monthly total expenditures	331	1813.716	2662.281	0	45000
Homeownership	331	.728	.446	0	1
Ownership of other real estate	331	.39	.488	0	1
Perception of climate change	331	8.402	2.192	0	10
Use alternative to car	331	.628	.484	0	1
Reduce energy consumption	331	.505	.501	0	1
Buy local and seasonal things	331	.834	.373	0	1
Reduce waste and recycle	331	.931	.255	0	1
Consider CO2 emissions	331	.42	.494	0	1
Avoid buying nonessential things	331	.683	.466	0	1
Eat little meat	331	.674	.47	0	1
Sustainable investing	331	.278	.449	0	1
Risk tolerance	331	4.767	1.855	0	9
Opinion of others	331	2.873	1.025	1	5
Importance of social status	331	2.87	1.092	1	5
Total household net wealth	331	769487.92	1075274.5	-200000	11000000
Vehicles ownership	331	.918	.274	0	1
Valuables ownership	331	.332	.472	0	1
Checking account ownership	331	1	0	1	1
Checking account value	331	23797.1	47829.479	0	500000
Savings account ownership	331	1	0	1	1
Savings account value	331	74688.64	118350.19	0	1000000
Mutual fund ownership	331	1	0	1	1
Mutual fund value	331	71914.964	157411.03	0	2000000
Bonds ownership	331	.151	.359	0	1
Shares ownership	331	1	0	1	1
Shares value	331	66238.912	246660.16	0	3000000
Claim ownership	331	.103	.304	0	1
Other financial assets ownership	331	.369	.483	0	1
Ownership of business	331	.082	.274	0	1
Gender	331	1.269	.444	1	2
Age	331	1964.112	15.076	1929	1998
Marital status	331	3.311	1.184	1	4
Job	331	3.429	3.18	1	8
Education	331	4.278	.878	2	5
Value net income_ln	331	8.45	.616	5.991	11.918
Monthly total expenditures_ln	331	7.203	.81	0	10.714
Total household net wealth_ln	331	12.781	1.874	0	16.213
Checking account value_ln	331	8.906	1.744	0	13.122
Savings account value_ln	331	10.272	1.664	0	13.816
Mutual fund value_ln	331	10.07	1.706	0	14.509
Shares value_ln	331	9.567	1.889	0	14.914
Age_centered	331	-.032	15.076	-35.144	33.856

Table A19: Tabulation of gender – second

Tabulation of gender

gender	Freq.	Percent	Cum.
Male	242	73.11	73.11
Female	89	26.89	100.00
Total	331	100.00	

Figure A20: Distribution of gender – second sample

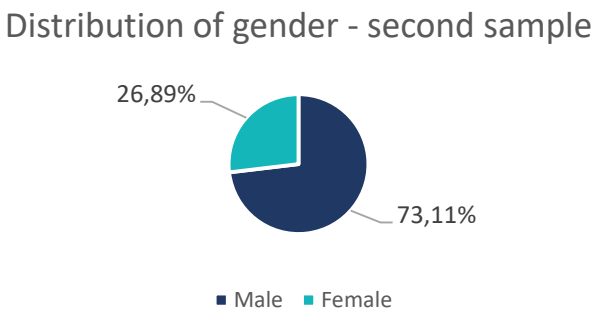

Table A21: New distribution of variable job – sample for the second regression

Tabulation of job

current employment status	Freq.	Percent	Cum.
Employed, also apprenticeship, full-time	177	53.47	53.47
Employed part-time	43	12.99	66.47
Unemployed	8	2.42	68.88
Retiree or pensioner	103	31.12	100.00
Total	331	100.00	

Figure A22: Distribution of current employment status – second sample

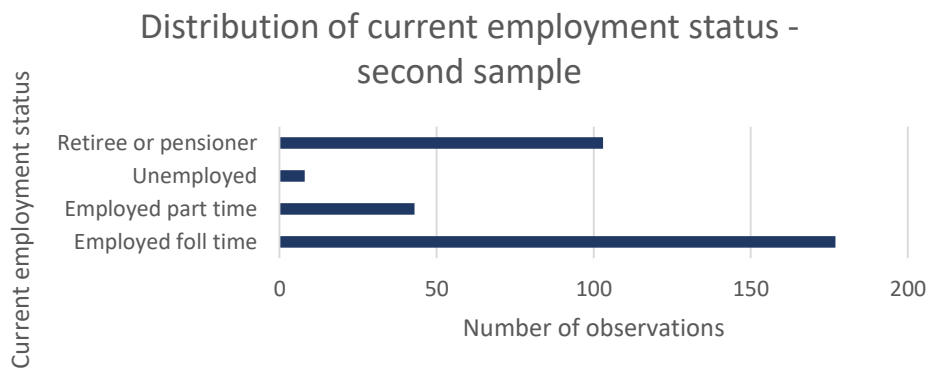

Table A23: Tabulation and summary of perception of climate change second sample

Tabulation of perception_of_climate_change

F26: opinion on political developments-climate change	Freq.	Percent	Cum.
Not a problem at all	3	0.91	0.91
1	3	0.91	1.81
2	6	1.81	3.63
3	6	1.81	5.44
4	4	1.21	6.65
5	9	2.72	9.37
6	22	6.65	16.01
7	25	7.55	23.56
8	57	17.22	40.79
9	36	10.88	51.66
A very serious problem	160	48.34	100.00
Total	331	100.00	

Table A24: Mean value of perception of climate change – second sample

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
perception of climate change	331	8.402	2.192	0	10

Figure A25: Engagement in climate change actions – first sample vs second sample

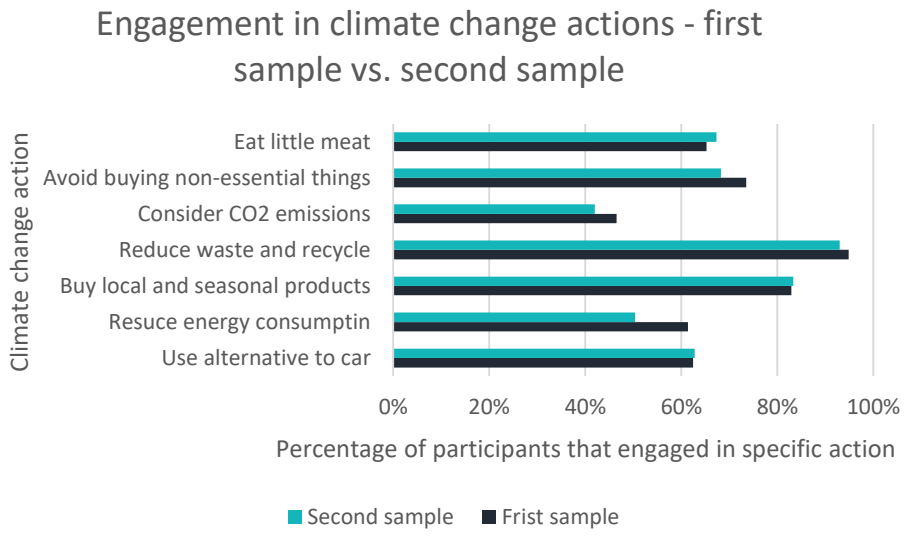

Figure A26: Engagement in sustainable investing – primary sample vs second sample

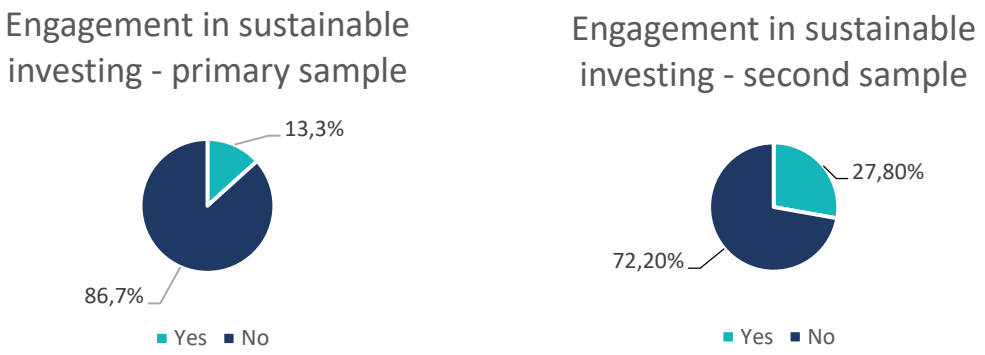

Table A27: AMEs – second regression model

Average marginal effects Number of obs = 331
Model VCE : OIM
Expression : Pr(sustainable_investing), predict()

	Delta-method					
	dy/dx	Std.Err.	z	P>z	[95%Conf.	Interval]
Current employment status: base: Employed full time						
Employed part time	-0.144	0.089	-1.620	0.105	-0.317	0.030
Unemployed	-0.285	0.155	-1.840	0.066	-0.589	0.019
Retiree or pensioner	-0.004	0.137	-0.030	0.977	-0.273	0.265
Age_centered	-0.001	0.003	-0.270	0.789	-0.007	0.005
Gender	0.041	0.059	0.700	0.481	-0.074	0.156
Marital status						
Divorced	-0.203	0.075	-2.700	0.007	-0.351	-0.056
Widowed	-0.062	0.125	-0.500	0.618	-0.307	0.183
Married/ Registered partnership	0.051	0.076	0.670	0.502	-0.098	0.200
Education	0.010	0.030	0.330	0.744	-0.050	0.069
Homeownership	-0.149	0.064	-2.330	0.020	-0.274	-0.024
Ownership of other real estate	0.016	0.053	0.300	0.760	-0.089	0.121
Perception of climate change	0.020	0.014	1.470	0.141	-0.007	0.047
Risk tolerance	0.032	0.013	2.400	0.016	0.006	0.059
Use alternative to car	-0.028	0.053	-0.520	0.600	-0.131	0.076
Reduce energy consumption	-0.003	0.049	-0.070	0.946	-0.099	0.092
Buy local and seasonal products	-0.059	0.069	-0.840	0.399	-0.195	0.077
Reduce waste and recycle	0.358	0.136	2.630	0.008	0.091	0.624
Consider CO2 emissions	0.010	0.051	0.200	0.844	-0.090	0.110
Avoid buying nonessential things	-0.051	0.053	-0.960	0.338	-0.156	0.053
Eat little meat	-0.045	0.056	-0.800	0.422	-0.154	0.065
Opinion of others	-0.010	0.025	-0.420	0.674	-0.059	0.038
Importance of social status	0.003	0.023	0.130	0.893	-0.043	0.049
Value net income_ln	-0.080	0.049	-1.640	0.102	-0.175	0.016
Income during pandemic	-0.006	0.031	-0.180	0.857	-0.065	0.054
Development future income	0.070	0.039	1.790	0.073	-0.006	0.147
Vehicles ownership	-0.066	0.084	-0.780	0.433	-0.232	0.099
Valuables ownership	0.131	0.052	2.530	0.011	0.030	0.232

Finances during pandemic	-0.012	0.054	-0.230	0.820	-0.118	0.094
Savings during pandemic	0.008	0.062	0.120	0.903	-0.114	0.129
Monthly total expenditures_ln	-0.068	0.032	-2.130	0.033	-0.130	-0.005
Total household net wealth_ln	-0.018	0.017	-1.070	0.285	-0.050	0.015
Ownership of business	-0.045	0.083	-0.540	0.591	-0.208	0.118
Checking account value_ln	-0.025	0.014	-1.810	0.071	-0.052	0.002
Savings account value_ln	-0.005	0.016	-0.290	0.768	-0.035	0.026
Mutual fund value_ln	0.049	0.017	2.830	0.005	0.015	0.084
Shares value_ln	-0.001	0.016	-0.070	0.942	-0.032	0.030

Note: dy/dx for factor levels is the discrete change from the base level.

Table A28: Link test – primary regression

Iteration 0: log likelihood = -986.37988
Iteration 1: log likelihood = -837.19832
Iteration 2: log likelihood = -795.93007
Iteration 3: log likelihood = -790.94774
Iteration 4: log likelihood = -790.92286
Iteration 5: log likelihood = -790.92286

Logistic regression Number of obs = 2511
LR chi2(2) = 390.91
Prob > chi2 = 0.0000
Log likelihood = -790.92286 Pseudo R2 = 0.1982

sustaina-ble_investing	Coef.	Std.Err.	z	P>z	[95%Conf.	Interval]
_hat	0.844	0.142	5.940	0.000	0.565	1.123
_hatsq	-0.049	0.042	-1.180	0.239	-0.131	0.033
_cons	-0.063	0.118	-0.540	0.590	-0.294	0.167

Figure A29: Goodness of fit test – primary sample

Logistic model for sustainable_investing, goodness-of-fit test

number of observations = 2511
number of covariate patterns = 2511
Pearson chi2(2453) = 2411.95
Prob > chi2 = 0.7190

Table A30: Goodness of classification – primary regression

Logistic model for sustainable_investing

Classified	True D	~D	Total
+	48	38	86
-	287	2138	2425
Total	335	2176	2511

Classified + if predicted Pr(D) >= .5
True D defined as sustainable_investing != 0

Sensitivity	Pr(+| D)	14.33%
Specificity	Pr(-|~D)	98.25%
Positive predictive value	Pr(D| +)	55.81%
Negative predictive value	Pr(~D| -)	88.16%
False + rate for true ~D	Pr(+|~D)	1.75%
False - rate for true D	Pr(-| D)	85.67%
False + rate for classified +	Pr(~D| +)	44.19%
False - rate for classified -	Pr(D| -)	11.84%
Correctly classified		87.06%

Table A31: Link test – second sample

Iteration 0: log likelihood = -195.62184
Iteration 1: log likelihood = -165.98429
Iteration 2: log likelihood = -160.38965
Iteration 3: log likelihood = -159.26806
Iteration 4: log likelihood = -159.25408
Iteration 5: log likelihood = -159.25407
Logistic regression Number of obs = 331
LR chi2(2) = 72.74
Prob > chi2 = 0.0000
Log likelihood = -159.25407 Pseudo R2 = 0.1859

sustaina-ble_investing	Coef.	Std.Err.	z	P>z	[95%Conf.	Interval]
_hat	0.600	0.202	2.980	0.003	0.205	0.996
_hatsq	-0.318	0.130	-2.450	0.014	-0.572	-0.064
_cons	0.122	0.182	0.670	0.503	-0.234	0.478

Table A32: Goodness of fit test – second sample

Logistic model for sustainable_investing, goodness-of-fit test

number of observations = 331
number of covariate patterns = 331
Pearson chi2(291) = 295.28
Prob > chi2 = 0.4191

Table A33: Goodness of classification – second sample

```
Logistic model for sustainable_investing
```

Classified	True D	True ~D	Total
+	26	19	45
-	66	220	286
Total	92	239	331

```
Classified + if predicted Pr(D) >= .5
True D defined as sustainable_investing != 0
```

Sensitivity	Pr(+| D)	28.26%
Specificity	Pr(-|~D)	92.05%
Positive predictive value	Pr(D| +)	57.78%
Negative predictive value	Pr(~D| -)	76.92%
False + rate for true ~D	Pr(+|~D)	7.95%
False - rate for true D	Pr(-| D)	71.74%
False + rate for classified +	Pr(~D| +)	42.22%
False - rate for classified -	Pr(D| -)	23.08%
Correctly classified		74.32%

Table A34: Multicollinearity – first sample

Variable	VIF	1/VIF
Current employment status		
Employed part time	2.18	0.458756
Low-paid part-time/ irregularly employed	1.27	0.787737
Short-term work	1.83	0.546399
On maternity leave	5.00	0.199966
Unemployed	1.33	0.752037
In school, university or unpaid internship	11.15	0.089722
Retiree or pensioner	8.80	0.113588
Early retiree – unfit for work	1.22	0.816545
Housewife/ Houseman	1.10	0.908532
Other non-working status	1.06	0.946366
Age_centered	6.18	0.161902
Current employment status# c.age_centered		
Employed part time	1.89	0.530398
Low-paid part-time/ irregularly employed	1.24	0.803890
Short-term work	1.83	0.547591
On maternity leave	5.00	0.199974
Unemployed	1.29	0.777653
In school, university or unpaid internship	11.17	0.089508
Retiree or pensioner	10.34	0.096716
Early retiree – unfit for work	1.17	0.853040
Housewife/ Houseman	1.05	0.948418
Other non-working status	1.06	0.941504
Gender		
Female	2.34	0.427526

Diverse	1.05	0.951911
Marital status		
Divorced	1.85	0.539873
Widowed	1.87	0.534361
Married/ Registered partnership	6.71	0.149141
Education	21.35	0.046842
Homeownership	4.42	0.226155
Ownership of other real estate	1.69	0.590400
Perception of climate change	18.85	0.053045
Risk tolerance	5.81	0.172007
Use alternative to car	3.03	0.329786
Reduce energy consumption	2.85	0.350742
Buy local and seasonal products	6.86	0.145769
Reduce waste and recycle	22.00	0.045448
Consider CO2 emissions	2.20	0.453608
Avoid buying nonessential things	4.38	0.228331
Eat little meat	3.35	0.298220
Opinion of others	8.63	0.115841
Importance of social status	8.04	0.124329
Value net income_ln	210.14	0.004759
Income during pandemic	24.84	0.040259
Development future income	26.19	0.038189
Vehicles ownership	8.66	0.115436
Valuables ownership	1.41	0.710326
Finances during pandemic	42.23	0.023680
Savings during pandemic	10.71	0.093338
Monthly total expenditures_ln	144.10	0.006939
Total household net wealth_ln	26.53	0.037698
Ownership of business	1.17	0.852388
Ownership of business	86.67	0.011538
Savings account ownership	86.67	0.210342
Mutual fund ownership	1.89	0.530159
Bonds ownership	1.16	0.860773
Shares ownership	1.86	0.537345
Claim ownership	1.14	0.880234
Other financials ownership	1.36	0.733061
Mean VIF	14.02	

Table A35: Multicollinearity – second sample

Variable	VIF	1/VIF
Current employment status		
Employed part-time	2.13	0.469311
Unemployed	2.05	0.487416
Retiree or pensioner	9.96	0.100450
Age_centered	5.95	0.167928
Current employment status##age_centered		
Employed part-time	1.71	0.583963
Unemployed	1.99	0.502972
Retiree or pensioner	12.32	0.081145
Gender	13.49	0.074153
Marital status		
Divorced	1.67	0.600176
Widowed	1.72	0.579991

Married/ Registered partnership	9.47	0.105565
Education	36.06	0.027733
Homeownership	6.33	0.157958
Ownership of other real estate	2.23	0.449227
Perception of climate change	22.78	0.043897
Risk tolerance	9.52	0.105071
Use alternative to car	3.54	0.282388
Reduce energy consumption	2.36	0.423700
Buy local and seasonal products	7.77	0.128694
Reduce waste and recycle	18.27	0.054730
Consider CO2 emissions	2.26	0.443208
Avoid buying nonessential things	4.07	0.245747
Eat little meat	4.03	0.248118
Opinion of others	11.38	0.087895
Importance social status	10.85	0.092154
Value net income_ln	232.83	0.004295
Income during pandemic	29.87	0.033473
Development future income	40.91	0.024446
Vehicles ownership	13.78	0.072566
Valuables ownership	1.88	0.530530
Finances during pandemic	80.88	0.012364
Savings during pandemic	11.97	0.083523
Monthly total expenditures_ln	114.64	0.008723
Total household net wealth_ln	97.28	0.010280
Ownership business	1.27	0.785079
Checking account value_ln	34.46	0.029018
Savings account value_ln	56.01	0.017853
Mutual fund value_ln	54.11	0.018480
Shares value_ln	45.64	0.021909
Mean VIF |	26.14	

Table A36: Section of the correlation of the correlation between all variables (before age was centered)

\|
Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) sustainable_in~g	1.000									
(2) job	0.039	1.000								
(3) age	-0.021	-0.698	1.000							
(4) gender	0.037	0.000	0.121	1.000						
(5) marital_status	0.021	0.213	-0.388	-0.148	1.000					
(6) education	-0.058	-0.099	0.016	-0.176	0.074	1.000				
(7) homeownership	0.001	0.099	-0.257	-0.121	0.426	0.064	1.000			
(8) ownership_of_o~a	-0.034	0.022	-0.103	-0.100	0.179	0.142	0.246	1.000		
(9) perception_of_~e	-0.074	0.039	-0.050	0.104	0.038	0.086	0.076	0.001	1.000	
(10) risk_tolerance	-0.110	-0.087	0.071	-0.164	-0.029	0.092	-0.031	0.071	0.001	1.000

Table A37: Probit version of the primary regression

Probit regression

Sustainable investing	Coef.	St.Err.	t-value	p-value	[95% Conf	Inter-val]	Sig
Current employment status: base Employed part time	0	.	.	.	.	.	
Employed part-time	-.135	.165	-0.82	.414	-.458	.189	
Low-paid part-time/ Irregularly employed	-.493	.702	-0.70	.483	-1.868	.882	
Short-term work	.386	.33	1.17	.241	-.26	1.032	
On maternity leave	-.244	.493	-0.50	.62	-1.21	.722	
Unemployed	-.672	.528	-1.27	.203	-1.707	.362	
In school, university or Unpaid internship	.797	.788	1.01	.312	-.748	2.341	
Retiree or pensioner	.223	.167	1.33	.183	-.105	.55	
Early retiree – unfit for work	-.947	.494	-1.92	.055	-1.916	.022	*
Housewife/Houseman	-.382	.503	-0.76	.448	-1.368	.605	
Other non-working status	.092	.455	0.20	.839	-.8	.985	
Age_centered	.008	.005	1.60	.11	-.002	.018	
Current employment status# c.age_centered: base Employed part time	0	.	.	.	.	.	
Employed part-time	-.007	.014	-0.50	.617	-.033	.02	
Low-paid part-time/ Irregularly employed	.048	.039	1.23	.22	-.029	.125	
Short-term work	-.068	.037	-1.83	.067	-.14	.005	*
On maternity leave	-.025	.022	-1.14	.253	-.067	.018	
Unemployed	-.03	.014	-2.19	.029	-.056	-.003	**
In school, university or Unpaid internship	-.028	.028	-1.02	.306	-.082	.026	
Retiree or pensioner	.007	.01	0.67	.5	-.013	.026	
Early retiree – unfit for work	-.005	.017	-0.27	.783	-.038	.029	
Housewife/Houseman	.034	.032	1.06	.289	-.029	.096	
Other non-working status	-.033	.029	-1.16	.244	-.09	.023	
Gender: base Male	0	.	.	.	.	.	
Female	-.003	.084	-0.04	.97	-.167	.161	
Diverse	.929	.667	1.39	.164	-.379	2.236	
Marital status: base Single	0	.	.	.	.	.	
Divorced	.029	.148	0.20	.844	-.26	.319	
Widowed	.181	.168	1.07	.283	-.149	.51	
Married/Registered partnership	-.053	.11	-0.48	.629	-.268	.162	
Education	-.041	.04	-1.01	.311	-.119	.038	
Homeownership	-.141	.095	-1.49	.136	-.328	.045	
Ownership of other real estate	-.035	.082	-0.43	.67	-.197	.126	
Perception of climate change	.036	.021	1.76	.078	-.004	.077	*
Risk tolerance	.068	.018	3.78	0	.032	.103	***
Use alternative to car	-.027	.077	-0.35	.729	-.178	.124	
Reduce energy consumption	.205	.078	2.62	.009	.052	.359	***
Buy local and seasonal products	.217	.105	2.07	.039	.011	.422	**
Reduce waste and recycle	.565	.215	2.63	.009	.143	.987	***
Consider CO2 emissions	.359	.076	4.70	0	.209	.508	***
Avoid buying non-essential things	-.087	.085	-1.02	.308	-.255	.08	
Eat little meat	.034	.08	0.43	.669	-.123	.191	
Opinion of others	.01	.036	0.28	.781	-.06	.08	
Importance of social status	.001	.033	0.02	.983	-.064	.065	
Value net income_ln	-.052	.065	-0.79	.427	-.179	.076	
Income during pandemic	.002	.042	0.04	.971	-.081	.084	
Development future income	.034	.045	0.76	.447	-.054	.122	
Vehicles ownership	.035	.114	0.30	.761	-.189	.258	

Valuables ownership	.252	.084	3.00	.003	.087	.416	***
Finances during pandemic	-.101	.062	-1.62	.104	-.223	.021	
Savings during pandemic	-.105	.083	-1.26	.208	-.268	.058	
Monthly total expenditures_ln	-.081	.061	-1.32	.188	-.201	.039	
Total household net wealth_ln	.025	.017	1.47	.143	-.008	.059	
Ownership of business	-.275	.158	-1.74	.082	-.584	.034	*
Checking account ownership	-.819	.351	-2.34	.019	-1.506	-.132	**
Savings account ownership	-.077	.089	-0.86	.392	-.252	.099	
Mutual fund ownership	.953	.08	11.94	0	.797	1.11	***
Bonds ownership	.416	.139	2.98	.003	.143	.689	***
Shares ownership	.29	.085	3.43	.001	.124	.456	***
Claim ownership	-.196	.147	-1.34	.18	-.484	.091	
Other financial assets ownership	.178	.088	2.01	.044	.005	.35	**
Constant	-1.245	.703	-1.77	.077	-2.623	.133	*

Mean dependent var	0.133	SD dependent var	0.340
Pseudo r-squared	0.199	Number of obs	2511
Chi-square	355.859	Prob > chi2	0.000
Akaike crit. (AIC)	1696.821	Bayesian crit. (BIC)	2034.870

*** $p<.01$, ** $p<.05$, * $p<.1$

Table A38: Probit version of the second regression

Probit regression

Sustainable investing	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Current employment status: base: Employed full time	0	.	.	.	.	.	
Employed part-time	-.479	.336	-1.43	.154	-1.137	.179	
Unemployed	-1.231	.569	-2.16	.03	-2.345	-.116	**
Retiree or pensioner	.021	.411	0.05	.96	-.784	.825	
Age_centered	-.023	.013	-1.77	.076	-.049	.002	*
Current employment status#age_centered: base Employed full time	0	.	.	.	.	.	
Employed part-time	.027	.032	0.85	.398	-.036	.091	
Unemployed	.024	.039	0.61	.539	-.052	.1	
Retiree or pensioner	.057	.025	2.31	.021	.009	.106	**
Gender	.15	.21	0.72	.474	-.261	.561	
Marital status: base: Single	0	.	.	.	.	.	
Divorced	-1.236	.464	-2.67	.008	-2.145	-.328	***
Widowed	-.236	.534	-0.44	.658	-1.282	.81	
Married/Registered partnership	.159	.289	0.55	.582	-.407	.725	
Education	.04	.109	0.36	.715	-.173	.252	
Homeownership	-.529	.235	-2.25	.024	-.989	-.069	**
Ownership of other real estate	.056	.19	0.30	.767	-.316	.429	
Perception of climate change	.072	.044	1.63	.104	-.015	.159	
Risk tolerance	.116	.048	2.41	.016	.022	.21	**
Use alternative to car	-.114	.186	-0.62	.537	-.478	.249	
Reduce energy consumption	-.001	.17	-0.00	.997	-.334	.333	
Buy local and seasonal products	-.222	.251	-0.88	.377	-.714	.27	
Reduce waste and recycle	1.336	.408	3.28	.001	.537	2.135	***

Consider_CO2 emissions	.025	.176	0.14	.886	-.32	.371	
Avoid buying nonessential things	-.199	.189	-1.05	.292	-.57	.172	
Eat little meat	-.177	.184	-0.97	.334	-.537	.183	
Opinion of others	-.036	.083	-0.43	.664	-.199	.127	
Importance of social status	.02	.082	0.25	.806	-.141	.182	
Value net income_ln	-.293	.172	-1.70	.089	-.631	.045	*
Income during pandemic	-.023	.106	-0.21	.831	-.229	.184	
Development future income	.252	.134	1.88	.06	-.011	.514	*
Vehicles ownership	-.243	.322	-0.76	.45	-.874	.388	
Valuables ownership	.479	.189	2.54	.011	.11	.849	**
Finances during pandemic	-.045	.187	-0.24	.809	-.411	.321	
Savings during pandemic	.035	.213	0.16	.87	-.383	.453	
Monthly total expenditures_ln	-.25	.109	-2.29	.022	-.464	-.036	**
Total household net wealth_ln	-.061	.058	-1.06	.29	-.174	.052	
Ownership of business	-.171	.306	-0.56	.577	-.771	.429	
Checking account value_ln	-.091	.047	-1.93	.053	-.184	.001	*
Savings account value_ln	-.018	.052	-0.34	.73	-.12	.084	
Mutual fund value_ln	.183	.061	3.02	.003	.064	.301	***
Shares value_ln	-.006	.054	-0.11	.913	-.113	.101	
Constant	1.315	1.615	0.81	.415	-1.85	4.48	

Mean dependent var	0.278	SD dependent var	0.449
Pseudo r-squared	0.172	Number of obs	331
Chi-square	70.359	Prob > chi2	0.002
Akaike crit. (AIC)	404.030	Bayesian crit. (BIC)	556.115

**** p<.01, ** p<.05, * p<.1*

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