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Supervisor:

Prof. Guglielmo Weber

Graduand:

Ana Radovic

2085450

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Abstract

Environmental concerns have been on the rise in recent years, influencing both sustainable home improvements and the growth of green financial solutions. Existing research shows how some of the home improvements, such as solar panels, not only contribute to the environment, but yield significant returns, making them a profitable, tangible investment in sustainability. This thesis aims to investigate motives behind the sustainable behaviour of households, by uncovering whether they come from genuine environmental awareness and growing climate concerns, or if they are primarily driven by an "investors mind-set" seeking for profit in every aspect of their life. Research was conducted using Ordinary Least Squares (OLS) and Instrumental Variable (IV) regressions with household survey data. Analysis showed a positive and significant relationship between owning sustainable securities and sustainable homes, indicating that households who tend to make sustainable investment in tangible assets are more prone to having sustainable securities in their portfolios. Although green preferences and higher education levels play a role, the perception of profitability related to these investments remains a crucial factor in making investment decisions.

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Chapter 1

Introduction

The growing urgency of environmental sustainability has had significant impacts across multiple sectors, particularly influencing personal finance and housing. In recent years, a rising interest in sustainable finance and eco-friendly housing has seen households actively engage in efforts to address climate change through their investment and lifestyle choices. This study aims to understand the motivations driving these sustainable choices, with a focus on whether households are motivated by genuine environmental concerns or by the potential financial returns associated with sustainable investments. Specifically, it examines the intersection between sustainable securities and sustainable housing investments to explore how these two areas interact, and whether sustainable home improvements influence a household's likelihood of holding sustainable financial assets.

The motivation for this research stems from a need to clarify how households perceive and engage in sustainable investments as part of their broader portfolios. Existing literature points to the dual benefits of green investments and sustainable homes, which not only contribute to environmental protection but often yield tangible financial returns. For instance, energy-efficient homes and green financial products have the potential to reduce long-term costs for homeowners and generate positive returns for investors. However, less

is known about how sustainable investment decisions in one area, such as housing, may influence decisions in another, such as securities. This study aims to fill this gap by investigating the connections between sustainable homeownership and green financial investments.

Drawing on data from the Bundesbank Survey on Consumer Expectations (Boddin, 2024), this research uses a robust dataset that provides insights into household financial behaviours, demographic characteristics, and attitudes toward sustainability. Through Ordinary Least Squares (OLS) and Instrumental Variable (IV) regressions, the study analyses how environmental attitudes, financial factors, and demographic variables influence sustainable investment choices. The OLS model identifies key drivers of sustainable investment behaviours, while the IV regression addresses potential endogeneity concerns to better understand the impact of sustainable homeownership on green securities ownership.

This introductory chapter lays the foundation for the study, outlining the research questions and setting the stage for analysis. Chapter 2 reviews relevant literature on environmental sustainability, household investment behaviour, and sustainable finance. This review examines existing findings on how households balance environmental values with financial returns, highlighting both the benefits and challenges associated with sustainable investments. It explores the role of green finance, the increasing importance of sustainable housing as a financially sound choice, and the demographic and behavioural factors that shape sustainable investment decisions. Through this review, the study situates itself within a growing body of research that sees households not only as consumers but as agents of environmental change through their financial and lifestyle decisions.

Chapter 3 then details the data and methodology used in the analysis. The study leverages a comprehensive dataset to capture how households in Germany perceive and engage in sustainable investments. The chapter gives and overview of the source and data pointing to its importance for the research, while also including an in depth description of the

data processing to give a fuller understanding of the changes made to the original dataset. Additionally, the Chapter explains the econometric approach used in the research highlighting the need for using OLS and IV. Moreover, it defines the regression equations used to enhance the understanding of regression tables in the Results Chapter.

Following the methodological framework, Chapter 4 presents and interprets the results, examining the individual and combined effects of environmental concerns, financial conditions, risk perceptions, and demographic variables on sustainable investments. This chapter also tests the hypothesis that sustainable homeownership may encourage investments in sustainable securities, providing a nuanced understanding of how different types of sustainable investments are interconnected.

Chapter 5 offers a broader interpretation of the results, connecting the findings to existing literature and discussing implications for both theory and practice. This discussion contextualizes the results within the broader landscape of sustainable investment research, comparing the study's findings to previous work on green finance and household sustainability. It also addresses how the insights generated by this study could inform policies aimed at increasing sustainable investment participation, suggesting ways to align financial incentives with environmental goals. Lastly this Chapter highlights the opportunities for further research the limitations of the current.

Finally, the study concludes in Chapter 6, where the key findings and broader implications are summarized. This concluding chapter highlights the importance of understanding the multifaceted motivations behind sustainable investment decisions, emphasizing that effective strategies to promote sustainability must consider both environmental and financial perspectives.

Chapter 2

Literature review

Before moving to the research questions and methodology of the research it is important to give a theoretical framework in which analysis is conducted. The literature review aims to give the reader brief insight into the environmental situation and identify the potential solutions. For the purpose of this work the review is only going to focus on solutions that could come from the sector of households by showing how their lifestyle and investment choices can benefit not only the environment, but also their own financial situation and overall well being. The literature review will first give insight into the climate issues, then in subsequent sections it will explain the role of green finance, possibilities and known issues. The following section will then give insight into the importance of sustainable housing and after that an overview of the demographic characteristic of sustainable investors. Lastly the review will cover the relationship between financial investments and sustainable homes through their similarities, sustainability preference, and interconnected economic benefits.

2.1 Households and the environment

The world we live in shapes our way of thinking and behaving. As civilization has grown, so has its impact on the environment, which resulted in mostly negative consequences for the balance of the environment. For a long time, scientists have been warning the public about the negative effects of the modern lifestyle, which the majority continued to ignore, due to no visible changes noticeable for the ordinary person. Today, even ordinary people are starting to notice the consequences ranging from large temperature shifts, mixing of seasons, up to significant decline of air quality. Evidence of human impact on the environment became especially evident during the COVID-19 pandemic, when reduced human activity briefly allowed ecosystems to recover, illustrating the burden human practices place on the natural cycles. "As a global society, we find ourselves at a critical juncture: after decades of fragmented and limited action, we are experiencing a climate emergency " (Moore and Doyon, 2023).

The **?** highlights numerous instances where human activity has been the primary driver of environmental damage, contributing significantly to the ongoing climate crisis, urging a need for a change in peoples behavior. The damage is not isolated to the environment, but spreads to all aspects of peoples lives. According to the report provided by Save the Children International, the irreversible consequences have led to a future in which, even if the current strategic goals were achieved, those born in 2020 would still face much harsher environmental challenges compared to individuals born in 1960 (Ryan et al., 2021). European Environment Agency (2024) discusses the rising economic losses from climate-related events in Europe, emphasizing how weather and climate extremes are already affecting the continent's economy. Southern Europe is expected to face the highest economic burdens due to its susceptibility to droughts and heatwaves, which directly affect agriculture, tourism, and water resources (European Environment Agency, 2024). The impacts of climate change worsens existing inequalities, disproportionately burdening low-income and marginalized communities, who often have the least capacity

to adapt to climate challenges (World Bank, 2010). These are just some of the example that prove the broad and severe consequences of environmental issues which demand action from all levels of society.

In recent years, policymakers have taken greater steps toward addressing the climate crisis, establishing sustainable goals and standards to mitigate environmental damage. The World Bank (2022) estimates that green finance could provide up to 20% of the investment needed to achieve climate-related Sustainable Development Goals(SDGs). The estimation does not seem unrealistic considering the research findings. Namely, recent studies have shown results that support the potential of this policy shift, with individuals being willing to commit to sustainable choices, even at the cost of smaller returns. Contributions toward Environmental, Social, Governance, and Future Generations (ESG+F) goals significantly influence retail investors' decisions, with a positive treatment effect of 1.77 (p ¡ 0.001), showing a strong preference for sustainable investments despite potentially lower returns (Benuzzi et al., 2024). Similarly, environmentally conscious households are reported to prioritize green investments, with many accepting lower expected returns to support environmental objectives (Aron-Dine et al., 2023). Specifically, 42% of households indicated a willingness to forgo interest for a green bank account, and 25% would sacrifice over 1 percentage point in returns (Aron-Dine et al., 2023).

While there is promising evidence that households can support environmental sustainability through financial activities, another critical area where households can make an impact is in the type of dwelling they choose to live in. "The housing sector is considered a low-hanging fruit, which has the potential to improve environmental, social, and financial outcomes significantly for little, if any, additional costs" (Moore and Doyon, 2023). Since every household needs a place to live, the question shifts to whether they are willing to make their homes more eco-friendly. Such sustainable dwellings benefit not only the environment but also offer substantial advantages for residents, which will be explored in more detail in the sections that follow.

The upcoming sections will discuss the two main investment opportunities available to households that recognize the need to act on environmental issues. First the attention will be given to green financial solutions, covering definitions, investment strategies, as well as household behaviors and attitudes toward these options. The following section will highlight the challenges and risks associated with sustainable finance. After that, the importance and wide-ranging benefits of sustainable housing will be presented. This section will be followed by an overview of demographic characteristics of individuals investing in sustainable investments. Finally, the interaction between these two types of investments will be explored, focusing on their synergistic economic effects, environmental benefits, as well as the financial gains they bring to the households who choose to have them as part of their portfolio.

2.2 Finance and the environment

When designing their portfolios individuals make many considerations. As mentioned in the previous section, the rising climate concerns have led to widening of the supply of green financial products. In this section, the reader will be introduced to the definition of sustainable finance and the green financial products which will be the point of the analysis in later chapters of the work.

Over time the roles and the concept of sustainable finance have evolved, from initially integrating sustainability factors, like environmental risks, into investment decisions to prioritizing the allocation of financial resources for advancing a sustainable and climate-neutral economy (Migliorelli, 2021). This has led to different variations of the definition of sustainable finance that come down to the similar descriptions of the role it has to play. The role of sustainable finance is to support sectors and activities which contribute to at least one of the relevant sustainability dimensions (Migliorelli, 2021), but to also address social aspects and questions about the composition and quality of management

at firms in which investments have been or will be made (Deutsche Bundesbank, 2019).

Since the analysis in the later chapters will focus on sustainable securities, it is important to first derive the definitions. For the purpose of this work the sustainable securities will be observed through sustainable stocks and bonds as the most representative. The definition for sustainable securities can be best understood through different sustainable investment strategies for equity investors. The Deutsche Bundesbank (2019) defines six main investment strategies regarding sustainable equity investments:

1. Negative screening – This strategy excludes companies or sectors that do not meet certain ethical or ESG standards.

2. Positive screening – Oppositely from negative screening, investors using this strategy include companies that excel in ESG criteria. This "best-in-class" approach encourages companies across various industries to compete on sustainability performance and supports firms that lead in ESG practices. Another variation to this strategy is the best progress strategy where investors observe which companies had the best progress over an observed period regarding the inclusion of sustainability aspects.

3. Thematic investing – This strategy is characterised by investors picking companies that belong to a particular sector they aim to support, such as solar technology. They profit from positive anticipated market developments in the chosen area.

4. Impact Investing – Investors aim to help solve a social or environmental issue while generating returns at the same time.

5. ESG Integration – Unlike the above strategies, ESG integration strategy evaluates how ESG risks and opportunities affect a company's financial performance. In this the strategy identifies potential long-term risks and balances out financial and ESG considerations.

6. Engagement (Active Ownership) – Some investors use active ownership in order to influence sustainable practices within the company.

Looking at the above strategies, sustainable stock investments may be defined as buying shares in companies that prioritize environmental, social, and governance (ESG) factors in their operations and long-term strategies. In this way investors support businesses that align with sustainable development goals, while staying true to their individual priorities.

Green bonds have gained popularity, particularly since the European Investment Bank issued the first Climate Awareness Bond in 2007, which laid the foundation for the green bond market (Deutsche Bundesbank, 2019). Since then, the market has expanded, especially in Europe, with substantial growth in both issuance and investor interest. The International Capital Market Association (ICMA) (2018) describes them as "any type of bond instrument where the proceeds will be exclusively applied to finance or refinance, in part or in full, new and/or existing eligible green projects and which are aligned with the four core components of the GBP" . The main difference between a traditional and green bond is in the use of the proceeds for an earmarked purpose (Deutsche Bundesbank, 2019). With the aim of increasing transparency and acceptance of green bonds, in 2014 ICMA published the Green Bond Principles (GBP) as voluntary guidelines for issuers, which were further developed in more recent versions. (International Capital Market Association (ICMA), 2018) notes that in order for a bond to be classified as green, it has to align with four core components of the GBP and provides definitions for four basic categories of green bonds:

1. Standard green use of proceeds bonds – This type of bond functions in the same way as a traditional bond, with the main difference being that the funds raised are directed toward environmentally friendly projects. The bond is back by the full credit of the issuer and carries the same credit rating as other bonds from the issuer.

2. Green revenue bond – Unlike the standard green bond, this type of bond is not backed by the issuer's full credit and instead depends on specific revenue streams. The main risk of this bond comes from the projects revenue generation.

3. Green securitised bond - The bond is collateralised by one or more green projects. Revenue generated from those projects is the primary source of repayment for the holder, giving him direct exposure to the success of the green project.

4. Green project bond – The investor has direct exposure to the risk of the projects because the repayment and returns are directly tied to the projects. The issuer may sometimes provide additional financial backing.

While the improvements in terms of labeling of green bonds were followed by propositions of labels for other sustainable bonds and securities, there have also been significant developments in terms of taxonomies, which are responsible for identifying economic sectors or activities which qualify for receiving sustainable financing (Migliorelli, 2021). Both labeling and taxonomies are important contributors, in their own domains, when it comes to eliminating asymmetric information on the green financial market. This is especially important for retail investors who are particularly sensitive to ambiguities when investing. One of the more significant issues that arises from asymmetric information when it comes to green finance is the problem of greenwashing. This problem occurs due to the absence of clear, universal definitions and standards, allowing financial actors to make misleading claims about the sustainability of their products or the environmental practices adopted by their organizations (Delmas and Burbano, 2011). Issuers have noticed the rise in the interest for sustainable products due to the trend shift and aim to gain higher demand by marketing their products as more green then they actually are. Greenwashing poses a significant problem because it directly affects the confidence of investors in such instruments. Households, who on average have limited financial literacy, could be misled into making uninformed decisions, which would result in a decrease in their trust in such investments, leading to a lack of interest. Another related issue is the

absence of uniform taxonomies and disclosure requirements across jurisdictions, creating inconsistencies in labeling green financial products, which not only complicates compliance but also increases the risk of greenwashing, ultimately undermining the credibility of sustainable finance initiatives (IFC, 2023). This disparity could negatively affect the investors, especially retail investors and make way for uncertainty in the market. The second problem that arises in relation to sustainable finance is the disordered adjustment in cost of capital spreads. The capital cost for non-sustainable sector may be directly affected by sustainable finance as the financial flows increasingly favor sustainable industries, which may lead to divesting from traditional investments and cause abrupt pricing disparities between sustainable and non-sustainable sectors. For these and other potential issues arising during the development of green finance, as well as the preservation of trust and interest, the key role will be played by the policymakers.

The sustainable finance market in the EU has grown significantly over recent years, driven by an increasing focus on sustainability across industries and financial sectors. The 2015 Paris Agreement gave a particular boost, highlighting the need to align financial flows with climate goals. This led to the European Commission's Sustainable Finance Action Plan in 2018, which seeks to channel investments toward environmentally sustainable projects through measures like a unified classification system, or taxonomy, for sustainable activities. Despite progress, challenges remain, including a lack of universally accepted definitions and standards for sustainable investment.

Germany has followed the EU's lead by working on its own sustainable finance strategy, with support from various stakeholders. In 2019, the German government established a Sustainable Finance Advisory Council to guide this process, with representatives from finance, academia, industry, and civil society. Initiatives such as the Hub for Sustainable Finance and the Green and Sustainable Finance Cluster Germany have supported sustainable investment in Germany, pushing for unified indicators and transparent reporting standards. These efforts are aimed at integrating sustainability into Germany's financial

market, aligning it with broader EU goals and setting the groundwork for mainstreaming sustainable finance.

2.3 Importance of sustainable housing

When discussing potential areas in which households can contribute to the environment, the dwelling they live in takes significant importance. This section aims to give insight into the role housing plays in improving the environment, but also to show the broader benefits to the residents. Therefore, the following will discuss the environmental, social, economic, but also overall health benefits for households that decide to invest in sustainable home improvements.

Reports show that the residential sector is responsible for 17% of global CO2 emissions in 2019 (International Energy Agency, 2020) and it was projected that the energy demand of the residential sector will increase by around 35% between 2020 and 2050 in the buildings sector (International Energy Agency, 2021), indicating the importance of this sector in the sustainability transition. Additionally, traditional houses negatively affect the environment through their building process through use of materials and generation of waste, which continues during maintenance, and suffer from losses of energy due to inadequate quality (Moore and Doyon, 2023), leading to using more energy than the household actually needs.

Households have the ability to address sustainability challenges through choices they make regarding the design and quality of their homes. These decisions impact not only the environment but also the well-being of residents and broader societal goals. While there are many definitions of sustainable housing, Moore and Doyon (2023) emphasize that a sustainable house is one that achieves minimal or zero carbon impact and, where possible, contributes to initiatives supporting wider sustainability. The benefits of sustainable homes are not only limited to the environment, but offer advantages such as

improving health of residents (Prochorskaite and Maliene, 2013) and economic gains. Through sustainable homes, households can significantly contribute to the environment, as well as improve their own financial situation.

Even if it may not be obvious at first glance, investing in sustainable home improvements in order to get an eco-friends home comes with great utility for the household in the long run. For the purpose of the thesis, more attention will be focused on the economic benefits of having sustainable homes. The affordability of housing is directly affected by its design and quality, in a sense that energy consumption and maintenance costs of poorly build dwellings often make them more expensive in the long run Moore and Doyon (2023). In more serious cases, bad quality housing can contribute to fuel poverty, which refers to a situation where a household cannot afford satisfy their energy consumption needs, or suffer the opportunity costs in other aspects of life in order to afford it (Moore et al., 2017). But even if the household is not at the point of facing fuel poverty, the trait of sustainable housing being energy efficient has proven to have great benefits for the reduction of living costs (Trivess Moore and Horne, 2017). The financial utility of energy efficient homes has also been connected to mortgages. Namely, research conducted by Guin and Korhonen (2020) suggests that households who invested in energy efficient living are less likely to miss payments on their mortgage. Besides the mentioned advantage of sustainable homes in terms of cost reduction, it is important to emphasis the finding regarding value generation for the owner as a profitable investment even after the individual does not have direct use for it. Homes with higher energy efficiency ratings achieved a 3–5% price premium compared to less efficient rated homes, and have potential for faster selling due added value, potential for energy savings and improved comfort perceived by buyers who more and more prefer eco-friendly options (Robert Argento and Brown, 2021).

The facts and findings are just a part of the numerous benefits coming from sustainable homes. Unfortunately, even with the clear evidence of its importance, there is still

resistance in the building industry towards sustainable improvements of dwellings Moore and Doyon (2023). This comes of as strange, considering the increased demand on the housing market when it comes to energy-efficient and eco-friendly housing solutions. While, the issue is being addressed by policymakers, and progress made, there is still a long way to go when it comes to a sustainable transition in terms of housing Moore and Doyon (2023).

2.4 Characteristics of investors

Green investors are shaped by a range of demographic, financial, and social factors, which influence their willingness to participate in sustainable investments. Research indicates that factors such as age, gender, education, income, political orientation, and awareness of climate issues all play significant roles in shaping investment behavior and preferences for sustainable assets. This section focuses on giving an overview of the literature that helped define the characteristics of individuals who are more prone to invest in green.

When it comes to age, younger investors show a notably higher likelihood of holding green assets, particularly green equity. In a study by Aron-Dine et al. (2023), younger households had a significant negative correlation with age (coefficient = -0.007, p ¡ 0.05), indicating a higher propensity for green investments among younger respondents. This trend aligns with findings of Christiansen et al. (2023), where younger adults (ages 18-34) displayed greater participation in ESG (Environmental, Social, and Governance) funds, while older, retired investors (ages 65+) tended toward charitable funds with a preference for non-financial returns. Furthermore, research by Morgan Stanley Institute for Sustainable Investing (2019) found that 95% of Millennials express interest in sustainable investing, which is a 9-point increase since 2017, and 67% engaged in at least one sustainable investing activity. The green values together with the inter-generational wealth transfer to Millennials, gives them potential to have a significant impact on green

investing practices Uzsoki (2020).

Gender also influences green investment behavior, with men showing a slightly higher tendency to engage in green finance. Aron-Dine et al. (2023) found a positive coefficient of 0.137 (p ¡ 0.01) for male respondents answering equity-related questions, suggesting that men might be more inclined toward green equity holdings. In contrast, Christiansen et al. (2023) reported that female-headed households were more likely to participate in socially responsible investing (SRI), demonstrating the varying motivations across gender lines in sustainable finance.

Higher educational attainment is consistently associated with increased participation in green investments. Aron-Dine et al. (2023) noted that college graduates were significantly more likely to invest in green assets, with a coefficient of 0.142 (p ¡ 0.05), indicating that higher education correlates with greater awareness and inclination toward sustainable finance. Similarly, Christiansen et al. (2023) found that individuals with post-high school education were particularly likely to hold ESG and charitable funds with a coefficient of 0.0282 (p ¡ 0.01) for ESG participation. As green investments are often found to be more complex to understand, they demand higher levels of financial literacy, which is often linked to higher education.

Income and wealth also contribute positively to green investment participation. Higher-income households and those with substantial securities holdings were more likely to invest in green assets, as demonstrated by Aron-Dine et al. (2023), who reported a coefficient of 0.029 (p ¡ 0.05) for green asset ownership among wealthier households. However, wealthier individuals tend to allocate a smaller share of their portfolios to green investments (Christiansen et al., 2023). These findings could suggest that while sustainable investments are gaining popularity, they are still ambiguous. Hence, wealthier individuals who are more resilient to risk, could be more likely to consider them and include them as part of their diversification strategy. Conversely, those with more limited investing resources, would be more picky with their investment choices and less likely to

invest in something they do not fully understand, in this case green financial investments.

When it comes to the effect of environmental awareness and concerns on investing decisions, it can be seen how those who are more driven by sustainability increasingly aim to include green investments, even at the expense of lower returns. Retail investors were reported to be more likely to choose sustainable investment options when they included donations tied to ESG+F causes, despite lower expected returns (Benuzzi et al., 2024). Additionally, around 42% of surveyed households were willing to accept lower interest rates on green bank accounts, highlighting the "convenience yield" or non-pecuniary benefits associated with green investments (Aron-Dine et al., 2023). The fact that green investments are gaining more institutional support could lead to an increase in trust and perception of these investments as safe, hence investors depicting them as a safe and socially responsible option that still generates inflows.

2.5 Traditional and sustainable homes in a life-cycle

Sustainable homes function similarly to traditional houses as wealth generators and illiquid assets, yet their unique attributes introduce some distinctions in their role within a household's portfolio. The study by Angelini, V., Bucciol, A., Wakefield, M. and Weber, G. (2020) provides a framework for understanding housing investments in the context of temptation preferences, highlighting how illiquid assets like homes can protect against impulsive consumption and shape life-cycle wealth allocation. In their work Angelini, V., Bucciol, A., Wakefield, M. and Weber, G. (2020)'s illustrate the allocation of liquid and illiquid wealth in a life-cycle model with temptation. This model reveals that individuals accumulate liquid and illiquid assets up to a point, which typically coincides with their first home purchase in their 30s. At this stage, a home serves not only as a residence but also as a safeguard against temptation.

When this logic is extended to sustainable homes, some intriguing differences emerge. As

will be shown in **Figure 3.9.** of this thesis, the peak for investing in sustainable housing shifts to the 50s, compared to the earlier timing of traditional home purchases. This delay can be attributed to several factors. Sustainable homes often require higher initial investments compared to traditional homes. However, they provide increasing value over time through reduced energy costs, higher efficiency, and potential appreciation in resale value. This characteristic aligns with the period of financial stability typically observed in the 50s, enabling households to afford the upfront costs and then harvest the long-term benefits. Moreover, sustainable homes may also play a role in easing the transition to retirement. By reducing ongoing living expenses—such as utility costs—they lower the financial burden on households, potentially substituting for the need to hold larger liquid reserves. This added functionality further differentiates sustainable homes from their traditional counterparts.

Overall, while sustainable homes mirror traditional houses in many ways, their distinct financial and environmental benefits introduce shifts in their life-cycle role. These differences highlight the evolving priorities of households, particularly the interplay between sustainability and financial planning.

2.6 The connection between sustainable homes and financial investments

The previous sections explore how green finance and sustainable homes contribute to the environmental sustainability. However, both types of investments provide additional benefits for the owner. Given the similarities and connections between some of these benefits one could wonder if investing in one type of sustainable asset increase the likelihood of investing in the other? This section aims to help in building the foundation for this question by examining relevant aspects from the literature which derive the connection

between owning sustainable homes and having green financial products in the portfolios. The following sections will first observe both the similarities and connections that arise from the concern for the environment and preference for green practices. Then in the focus will be on the economic synergy of the two investments.

2.6.1 Green Finance and Home Improvement as Part of Sustainable Portfolios

Both sustainable financial products and eco-friendly home improvements should be considered integral parts of a household's sustainable portfolio. This can be validated through facts and research results from previously discussed studies, which prove how these investments are a powerful tool for addressing climate concerns. They can be considered proactive investments because they contribute to the environment, while generating benefits for the owner in terms of income generation, debt constraints mitigation, reduction expenses, and improvements in the quality of life. Both sustainable securities and green home improvements are long-term investments, appealing to environmentally conscious individuals who prioritize lasting impact and recognize the value of such commitments.

Green finance, as indicated by recent policy initiatives from organizations such as the Deutsche Bundesbank (2019) and the International Capital Market Association (ICMA) (2018), has gained significant support. Uzsoki (2020) points out how sustainable finance has shifted from a niche area to a mainstream strategy, with many institutions establishing dedicated ESG teams to support this shift. Similarly, government incentives for sustainable home improvements, like subsidies for solar panel installations, are making eco-friendly housing upgrades more accessible to households.

As seen in the work of Aron-Dine et al. (2023) 25% of households showed willingness to invest in green financial products even at a cost of losing 1% of interest rate on their

returns, and similar confirmation of retail investors preference for green investments was showed in Benuzzi et al. (2024). This finding aligns with the concept of a "greenium," which Aron-Dine et al. (2023) describe as the appeal of green investments despite lower returns due to their non pecuniary benefits, such as supporting climate goals. This "greenium" concept could also apply to sustainable home improvements, where households may accept higher upfront costs to reap the long-term environmental and social benefits.

Higher educated individuals being more likely to hold green investments (Christiansen et al., 2023), which is consistent with the fact that green investments tend to be harder to understand. The logic could be translated to green homes, as both require an understanding of the environmental impact of those investments and the long-term benefits they can provide. Additionally, both Aron-Dine et al. (2023) and Christiansen et al. (2023) showed younger individuals being more interested in green investments. This is also consistent with the findings of Morgan Stanley Institute for Sustainable Investing (2019) regarding the affinity of Millenials thorwards socially responsible and environmentally-friendly investments. Moreover, this tendency among Millennials and younger investors reflects an openness to balancing risk tolerance with value-driven goals. Christiansen et al. (2023) noted that younger and less wealthy investors often allocate a larger portion of their portfolios to socially responsible funds, signaling a long-term commitment to sustainable outcomes even if immediate returns are lower. This is, as Uzsoki (2020), comments an especially important fact because of the wealth transfer to millennials. Lastly, it is important remember that investors' focus on specific ESG elements varies depending on their goals—whether societal impact or financial returns (Benuzzi et al., 2024). This becomes particularly interesting considering the fact that both sustainable home improvements and green finance offer unique advantages for achieving both sustainability and personal financial goals.

By combining green finance and sustainable home improvements, households can create

portfolios that align with both their financial goals and their environmental values, reflecting a comprehensive approach to sustainable living and investment. Additionally, these investments may encourage what could be termed a "behavioural multiplier effect": while engaging in one sustainable area, for example sustainable homes, one can gain a bigger understanding of its importance and become more inclined toward additional eco-friendly actions, such as investing in green finance. This connection can be further explained by the fact that sustainable finance supports green projects, hence an individual living in a green home that can be considered a "green project" could value more such projects and be more likely to support them through future financial decisions. This tendency to reinforce sustainable habits across financial and lifestyle domains makes each type of investment potentially a gateway to the other, promoting a cycle of sustainability that extends beyond financial returns.

2.6.2 Synergistic Economic Benefits

Green finance and sustainable homes share common environmental motivations, but they also present significant economic synergies. These synergies emerge not only from combining the two investment types but also from how one can facilitate the other. This section will focus on connecting them in order to gain a clearer picture of the interaction between the two investments.

Everyday households expenses associated with the dwelling, such as electricity bills, heating, cooling, can be significantly reduced when the home is built to sustainable standards (Trivess Moore and Horne, 2017). By reducing utility costs and helping to cover expenses, sustainable homes free up household resources, which, after covering mandatory expenses, can be redirected toward other investments. Specifically, savings from lower bills or profits from selling excess energy back to the grid can provide the financial flexibility to invest in the broader financial market, including green securities,

aligning with individuals' preferences for sustainable investments. Similarly, households that successfully invest in securities can accumulate wealth, which in turn increases their ability to finance sustainable home improvements.

Previous sections also discussed the potential of increasing the value of a dwelling by incorporating the sustainable improvements. This leads to homes selling or leasing for higher prices and even staying on the market shorter compared to traditional dwellings, that do not possess sustainable home improvements (Robert Argento and Brown, 2021). In this sense, a sustainable home brings revenue to the owner even after he does not live in it. Additionally, the fact that sustainable homes sell better and faster on the market compared to the traditional ones goes hand in hand with the wealth accumulation motives of individuals.

Investing in both green homes and sustainable securities also offers portfolio diversification. While securities, particularly stocks, are typically considered riskier investments, sustainable homes provide a stable, long-term return through the continuous value they generate. The relationship between these investments creates a cycle where successful investments in one area increase the possibility of investing in the other, thereby amplifying overall financial growth. Given these facts, it is reasonable to believe that investing in sustainable home improvements could have positive effect on investing in green securities.

Chapter 3

Data and methodology

The primary aim of this study is to distinguish motives driving green investments and the connection between different types of sustainable investment. In order to do so, a quantitative approach was applied, using household microdata from the Bundesbank Survey on Consumer Expectations (Boddin, 2024).

The data source is representative at the national level, and employs incentivised online surveys with randomly selected households to encourage respondent engagement and ensure high-quality, reliable data. Main interest variables in the Bundesbank Survey on Consumer Expectations (Boddin, 2024) include environmental awareness and green actions importance variables, sustainable financial investments (sustainable securities), tangible sustainable investments(sustainable home improvements), household financial status, and demographic characteristics.

Data and analysis were conducted in STATA, with the two main econometric techniques employed being the Ordinary least squares regression (OLS) and Instrument variable regression (IV). OLS was used in order to identify the key factors influencing investment decisions. The controls used can be classified into 3 groups: environmental concerns and green preferences, financial conditions, and demographics. To address potential

endogeneity, IV was applied, particularly when exploring the interactions between the main investments.

Main research questions this study aims to answer are defined through the following hypothesis:

· Hypothesis 1: Households invest in sustainable financial products and eco-friendly dwellings due to a combination of environmental motivations and perceived financial benefits.

· Hypothesis 2: Higher educational attainment is positively associated with an individual's likelihood to engage in sustainable financial investments and home improvements due to increased climate awareness and financial literacy.

· Hypothesis 3: Households who invest and live in sustainable homes are more likely to invest in sustainable securities.

The subsequent sections will describe in more detail the data source and preparation procedures which lead to the final version of the data-set used for the analysis. Data preparation involved configuring the data-set to suit the research needs, leading to redefining original and generating new variables. In order to make the work and variables more understandable for the reader and ensure replicability, the following chapters provide a detailed description of the processing and cleaning procedures for both data sources.

3.1 Bundesbank Survey on Consumer Expectations

For the purpose of delving deeper into the relationship of sustainable behavior in everyday life and sustainable investing, a second part of the research was done using the data from the Bundesbank Survey on Consumer Expectations (Boddin, 2024). Initially, the idea was to merge several waves in order to include all needed variables, but due to the

insufficient number of observations that resulted from the merge, the analysis was focused on one wave of the survey that contained the most of the needed variables. Selected wave was wave23 from November 2021. survey which contains 6007 observations. The main interest variables from the survey are the two indicator variables showing ownership of sustainable securities and sustainable home improvements alongside the variable defining levels of climate concern, preference for green investments and the opinion on the importance of having sustainable homes in order to combat climate concerns. Additionally, the benefit of using the waves of the Bundesbank Survey on Consumer Expectations (Boddin, 2024) is that every wave contains thorough demographic, income, and wealth data about households which makes it possible for one wave to be sufficient for the analysis, making the whole process easier.

3.2 Processing and variable construction

Initially the intention was to merge multiple waves of the survey in order to create a dataset containing all desired variables. But it was not favorable to merge the data since the number of observations would significantly drop due to inconsistency of participation from same households in each survey wave. For this reason, the decision was made to use wave23, which contained most of the planned variables. The initial number of observations contained in the dataset was 6023 which became 6007 after processing due to dropping 16 observations for which the household size had a non-informative response. In order to make the data easier to analyse and not lose additional observations several variables needed to be adjusted by recoding the "don't know", "no answer" and similar responses or regrouping answers to better fit a particular research need. This section will give a detailed overview of the data processing, while the summary of variable descriptions is given in Table 3.1.

In cases of binary variables or variables that were transformed into binary variables be-

cause of the particular needs of the study both negative and non-informative answers were coded as "0" which represents the absence of characteristic. This was done in order to only highlight the presence of wanted characteristic or action indicated by a particular variable while not losing observations at the same time. Such variables are sustainable home, sustainable securities ownership, being married, preference for sustainable investments, existence of borrowing constraints and homeownership.

For scalar variables, such answers were defined as a natural mid-point or the lowest scalar value depending on the nature of the variable and the rationalization of what such responses could mean in the range of a given scale for each variable. In the case of climate concern variable and the perception of importance of green actions for combating climate issues variables (having a green home/job/transport/politics/products), the "no answer" and "don't know" responses were recoded as the lowest value of concern or perception of importance. Such and similar answers were given value "0" in the case of the number of household children. In generating the professional education level variable, value "1" was assigned to such responses, which means that the individuals who gave such answers were treated as having "no or minimal education". For the variable indicating household income non-informative answers were reassigned to a natural midpoint. Only exception to this rule was the categorical variable indicating the perception of risk of traditional investments compared to sustainable ones, where all non-informative responses were put in the non-informative category with the value "0".

Along with recodes, some variables were generated using existing variables. Here are the following generated variables and the process in which they were generated:

· Binary variable for homeownership (homeowner) was generated using the original categorical variable "homeown" and coding all categories meaning that a person is the owner of a home as "1" and "0" otherwise with the labels "owner" and "renter" respectively.

· Binary variable employed was generated in a similar way using the original variable

"employ" taking all categories indicating that the respondent is employed (range 1 to 4) and coding it as "1" and "0" otherwise.

· Binary variable representing marital status was generated using the original variable "familystatus" and coding the responses representing marriage or partnership as "1" and "0" otherwise.

· After assessing the non-informative values to a natural midpoint, original variable household income was used to generate adjusted household income. This was done by first creating a numerical variable out of the original. Then the numerical variable was divided by the number of household children and then divided by 1000 in order to get more informative regression results.

· Variable female was generated from the original variable gender by taking values "2" which stood for "female" and coding it as "1" and then taking responses under value "1" that stood for "male" and coded it as "0" in the generated variable.

· In order to account for nonlinear effects of age, three additional variables were generated using the original: age divided by 10, age squared divided by 100 and age cubed divided by 1000.

· Professional education variable was created using the existing eduwork variable which defined many detailed categories of work related education. For generating the new variable, individuals with minimal or no formal education (where eduwork equaled 10 or had non-informative values) were recoded as having "No or minimal education." Those engaged in vocational training or apprenticeship (eduwork values of 1, 2, or 3) were grouped under "In training/apprenticeship." Respondents with technical or commercial college education (eduwork values of 4 or 5) were categorized as such, while those with university-level education, including bachelor's, master's, or doctoral degrees (eduwork values of 6, 7, or 8), were assigned to the "University" category. Finally, respondents with other types of education (eduwork equal to 9) were placed in the "Other" category.

· Borrowing constraint variable was constructed using two variables, netwealth_detail_f and netwealth_detail_g which indicate the amount of outstanding loans secured by real estate and the amount of other outstanding loans. The binary borrowing constraint variable takes value "1" if the respondent has either of the loan types, regardless of the amount.

· Risk perception variable indicates the level of risk of a traditional investment compared to a sustainable, it was generated from the risk variable that originaly existed in the dataset. In order to preserve observations, non-informative values were grouped in a category defined as "No answer/Don't know" with a value "0". For simplicity the informative responses were grouped into three categories "Lower", "Similar" and "Higher" compared to five in the original variable.

Table 3.1: Description of variables

Variable name	Description
sustainable securities	Ownership of sustainable securities (=1 if yes, =0 if no).
sustainable home	Ownership of sustainable homes (=1 if yes, =0 if no).
climate concern	Level of concern about climate change.
sustainable inv. pref.	Preference for sustainable investments over traditional.
green home imp.	Importance of green homes for protecting the environment.
green job imp.	Importance of green jobs for protecting the environment.
green politics imp.	Importance of green politics for protecting the environment.
green transport imp.	Importance of green transport for protecting the environment.
green products imp.	Importance of green products for protecting the environment.
hh. income	Total monthly net household income, after taxes and contributions.
adjusted hh. income	Adjusted household income (scaled to account for family size).
borrowing constraint	Borrowing constraints (=1 if yes, =0 if no).
risk perception	Perceived risk of a traditional equity fund, compared to sustainable
age	Age

age/10	Age (divided by 10)
$age^2/100$	Age squared (divided by 100)
$age^3/1000$	Age cube (divided by 1000)
female	Being female (= 1 if female, =0 if male).
married	Being married (=1 if married, =0 if otherwise).
number of children	Number of children under the age of 18 living in the household.
household size	Total number of individuals living in the household
education	Categorical variable indicating professional education levels.
employed	Being employed (=1 if employed, =0 if not employed).
homeowner	Home ownership

3.3 Econometric approach

To analyze the factors influencing sustainable investment decisions, two primary econometric models are employed: the Ordinary Least Squares (OLS) regression and the Instrumental Variables (IV) regression. The OLS regression provides a baseline estimation of the relationships between key variables and sustainable investments, while the IV regression addresses potential endogeneity concerns, especially in examining the effect of sustainable homeownership on sustainable securities investment.

3.3.1 Ordinary Least Squares (OLS) Regression

The OLS model is used to assess the determinants of sustainable investment choices, particularly ownership of sustainable securities and sustainable home improvements. The control variables can be separated into three main groups, environmental, financial and demographic:

· Environmental Controls: These capture individual environmental concerns and attitudes toward sustainable investments. Environmental controls include: climate concern, preference for sustainable investments, importance of having a green home, green politics, green job, green transport and green products.

· Financial Controls: These account for the financial position of individuals, including household income, borrowing constraints and risk perception of traditional, compared to sustainable financial investments.

· Demographic Controls: These control for individual demographic factors, and include: age, gender, marital status, number of children, professional education level, employment status, and homeownership.

The OLS regressions for Sustainable Securities and Sustainable Homeownership are specified as follows:

$$\text{Sustainable Securities}_i = \alpha + \beta_1 \cdot \text{Environmental Controls}_i + \beta_2 \cdot \text{Financial Controls}_i + \beta_3 \cdot \text{Demographic Controls}_i + \epsilon_i \quad (3.1)$$

$$\text{Sustainable Home}_i = \alpha + \beta_1 \cdot \text{Environmental Controls}_i + \beta_2 \cdot \text{Financial Controls}_i + \beta_3 \cdot \text{Demographic Controls}_i + \epsilon_i \quad (3.2)$$

The coefficients from these OLS models provide an initial understanding of how each control variable category, environmental, financial, and demographic, affects sustainable investment decisions and give a foundation for the main research analysis.

3.3.2 Instrumental Variables (IV) Regression

To address endogeneity concerns when assessing the impact of investing in sustainable homes on sustainable securities ownership, an Instrumental Variables (IV) approach is applied. Endogeneity may arise if unobserved factors affect both sustainable home choice and sustainable securities investment, potentially biasing the OLS estimates.

First the OLS version of the regression is performed, with the regression equation being defined as follows:

$$\begin{aligned}\text{Sustainable Securities}_i = \alpha + \beta \cdot \text{Sustainable Home}_i + \delta_1 \cdot \text{Environmental Controls}_i \\ + \delta_2 \cdot \text{Financial Controls}_i + \delta_3 \cdot \text{Demographic Controls}_i + \epsilon_i \quad (3.3)\end{aligned}$$

For the IV regression, green home importance and green job importance are used as instruments for investing in sustainable homes. These variable are chosen as they are likely correlated with the likelihood of having a sustainable home, but less likely to directly affect investment in sustainable securities, aside from its influence through sustainable home choice itself. The IV estimation consists of two stages:

First Stage: The first stage estimates the predicted value of sustainable home investments, using green home and green job importance as instruments, along with the three control groups (environmental, financial, and demographic).

$$\begin{aligned}\text{Sustainable Home}_i = \alpha + \gamma_1 \cdot \text{Green Home Importance}_i + \gamma_2 \cdot \text{Green Job Importance}_i \\ + \delta_1 \cdot \text{Environmental Controls}_i + \delta_2 \cdot \text{Financial Controls}_i + \delta_3 \cdot \text{Demographic Controls}_i + \eta_i \\ (3.4)\end{aligned}$$

Second Stage: The second stage uses the predicted value of sustainable home investments

from the first stage to estimate its effect on sustainable securities investment, controlling again for the three categories of variables.

$$\text{Sustainable Securities}_i = \alpha + \beta \cdot \widehat{\text{Sustainable}}\ \text{Home}_i + \delta_1 \cdot \text{Environmental Controls}_i + \delta_2 \cdot \text{Financial Controls}_i + \delta_3 \cdot \text{Demographic Controls}_i + \epsilon_i \quad (3.5)$$

By comparing the results from the OLS and IV regressions, the causal influence of sustainable home choice on sustainable securities ownership, can better understood, accounting for any potential endogeneity.

3.4 Data overview

In order to gain clearer understanding of the results obtained in subsequent chapters it is important to understand the characteristics of the individuals in the sample. This section focuses on analyzing the sample through summary statistics and graphical representation of the interplay of variables crucial for the study. The main characteristics that will be analysed are participation in green assets and its interplay with gender, education and age.

Table 3.2: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
sustainable securities	6007	0.299	0.458	0	1
sustainable home	6007	0.194	0.395	0	1
climate concern	6007	7.967	2.218	1	10
sustainable investment pref.	6007	1.489	0.5	1	2
green home importance	6007	7.466	2.149	1	10

green car importance	6007	6.622	2.653	1	10
green products importance	6007	7.139	2.243	1	10
green job importance	6007	5.208	2.81	1	10
green politics importance	6007	6.613	2.847	1	10
household income	6007	7.409	2.506	1	13
adjusted household income	6007	2.142	1.119	0.1	11.999
borrowing constraint	6007	0.11	0.313	0	1
risk perception	6007	1.571	0.97	0	3
age	6007	56.795	14.838	16	80
age/10	6007	5.679	1.484	1.6	8
$age^2/100$	6007	34.458	16.095	2.56	64
female	6007	0.409	0.492	0	1
married	6007	0.276	0.447	0	1
household size	6007	2.209	1.055	1	6
number of children	6007	0.318	0.715	0	3
professional education	6007	3.375	1.504	1	7
employed	6003	0.564	0.496	0	1
homeowner	6007	0.277	0.447	0	1

Table 3.2. presents the summary statistics for the sample of 6,007 observations, offering insights into the distribution of key variables related to sustainable investments and demographic characteristics. Approximately 29.9% of participants hold sustainable securities, while around 19.4% have implemented sustainable housing solutions. Environmental concerns are notably high, with climate concern averaging 7.97 out of 10, and the importance of green home scores similarly high at 7.47 out of 10, while green job scores an average importance level. The average adjusted household income is $2,141, with a significant variation reflected by a standard deviation of $1,119. Approximately 11% of participants report borrowing constraints, which could influence investment be-

haviors. Demographic characteristics indicate an average participant age of 56.8 years, with 40.9% identifying as female, 27.6% as married, and an average household size of 2.21 members. Education levels suggest that the sample population generally has at least completed vocational or specialized training, with 56.4% employed and 27.7% owning their home. Overall, these statistics provide a comprehensive overview of the sample, capturing financial behaviors, demographic profiles, and sustainability attitudes relevant to the study.

Table 3.3: Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) sustainable house	1								
(2) sustainable securities	0.091	1							
(3) climate concern	0.071	0.105	1						
(4) sustainable inv. pref.	0.114	0.19	0.331	1					
(5) green home importance	0.18	0.098	0.47	0.303	1				
(6) green car importance	0.105	0.098	0.547	0.349	0.584	1			
(7) green job importance	0.089	0.075	0.352	0.225	0.494	0.474	1		
(8) green politics importance	0.083	0.083	0.479	0.321	0.412	0.496	0.384	1	
(9) greenproducts importance	0.113	0.091	0.466	0.321	0.68	0.617	0.475	0.426	1

Table 3.3. shows the correlation matrix among key variables, highlighting relationships that are central to understanding sustainable investment behaviors. Notably, there is a modest positive correlation (0.091) between sustainable homes and sustainable securities ownership, indicating that households with sustainable homes are somewhat more likely to also hold sustainable financial assets. The strongest correlation (0.470) exists between climate concern and the importance of green homes, suggesting that individuals who prioritize environmental concerns perceive green homes investments as an effective response to climate issues. Other moderate correlations include the relationship between sustain-

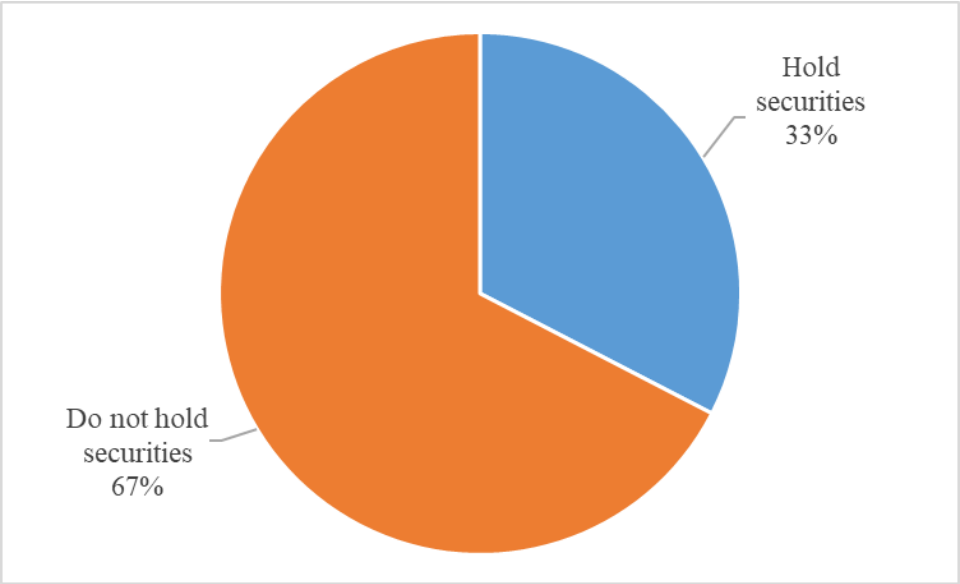

Figure 3.1: Securities holding

able investment preferences and climate concern (0.331). These patterns suggest that individuals concerned about climate issues may prefer sustainable choices across both tangible assets and financial investments, aligning with the study's hypothesis regarding the interconnected nature of sustainability-driven decisions.

The following figures aim to give an overview of the sample in terms of interest variable. By assessing these characteristics and patterns it will be easier to understand and give meaning to the results of the main analysis.

Figure 3.1. to Figure 3.5. show the participation in investments. First Figure 3.1. shows interest in general securities with around 33% of respondents holding securities. This percentage decreases by 10% when the question is asked for specifically holding sustainable securities, represented in Figure 3.2, while it comes down to 17% in case only holding sustainable securities, as showed in Figure 3.3. Attitudes towards sustainable homes are represented in Figure 3.4. and Figure 3.5. While 16% of the respondents have reported having a home with sustainable improvements, 10% does not have sustainable investments other then a sustainable home. These findings indicate a fairly low interest

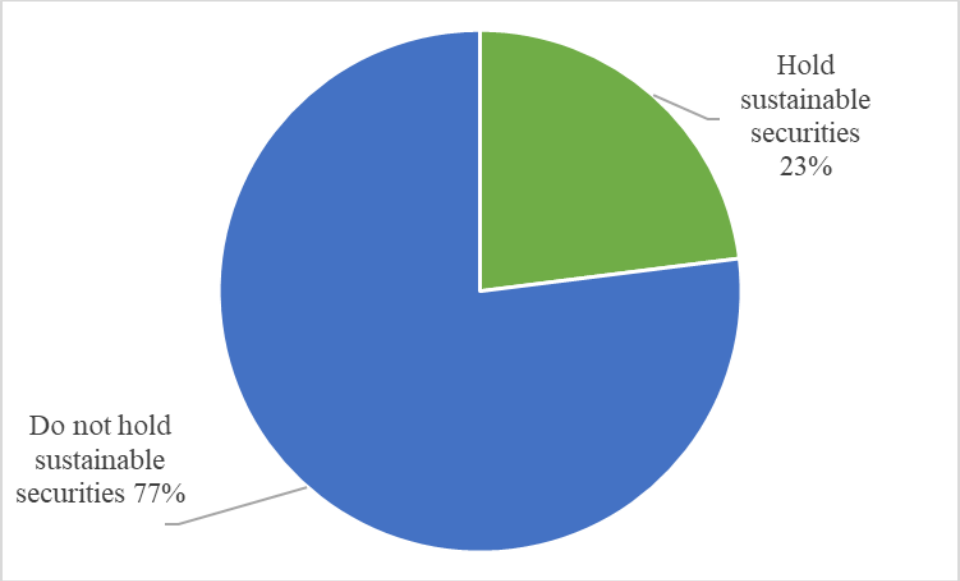

Figure 3.2: Sustainable securities holding

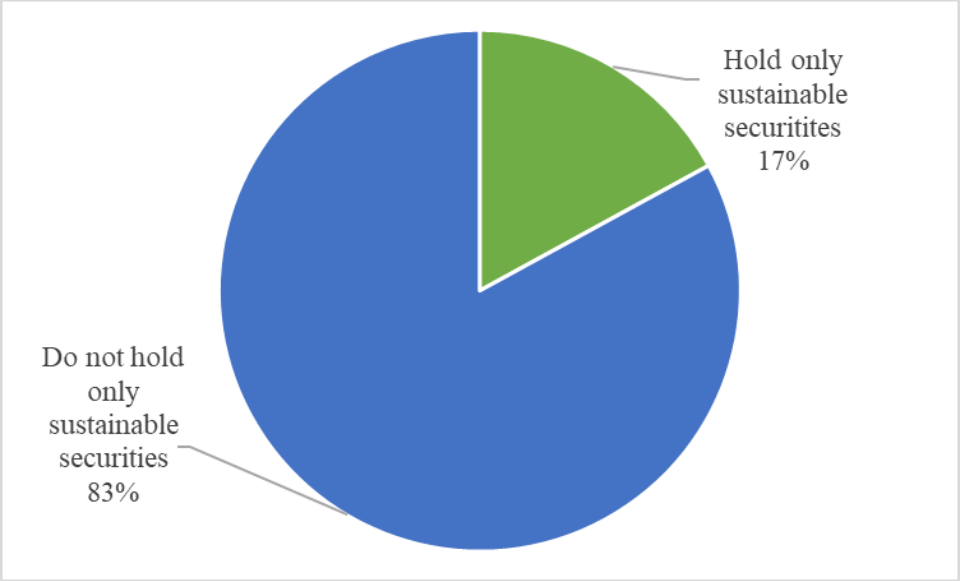

Figure 3.3: Holding only sustainable securities

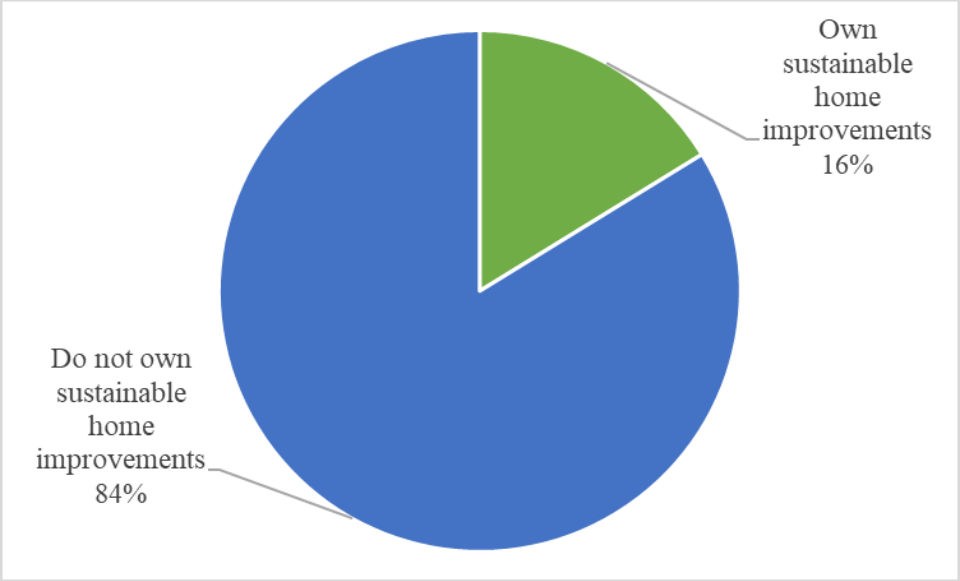

Figure 3.4: Owning sustainable home improvements

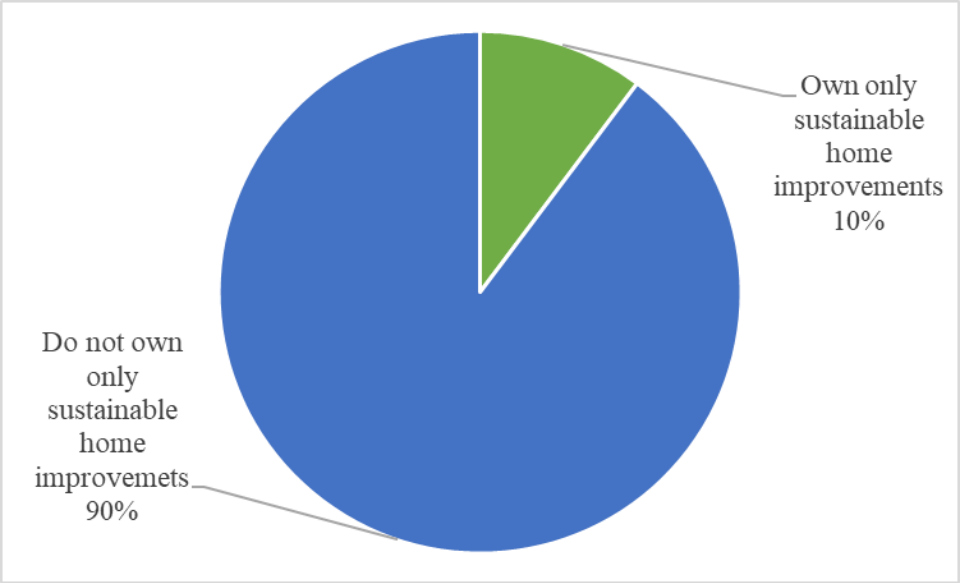

Figure 3.5: Owning only sustainable home improvements

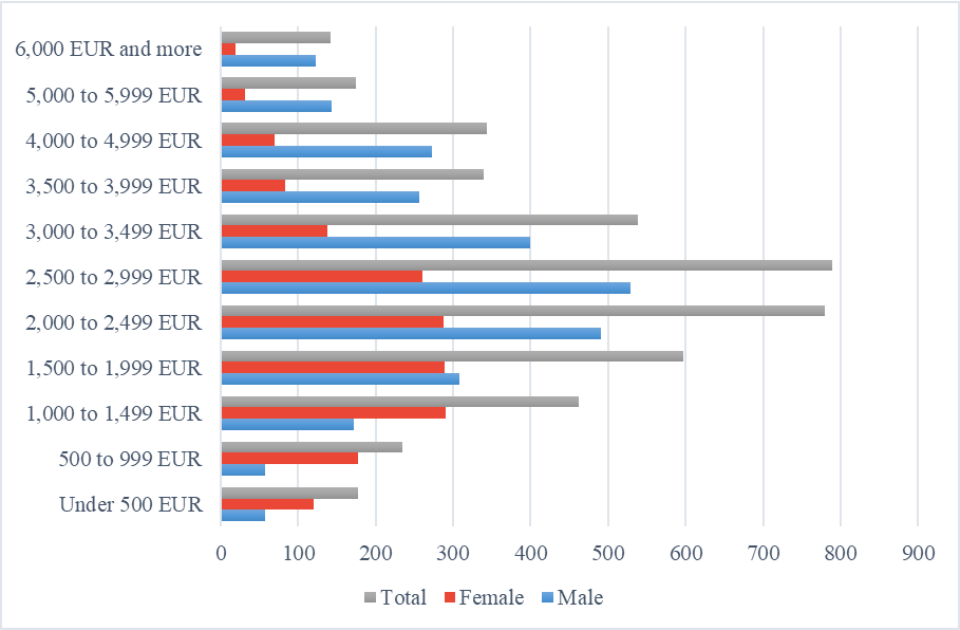

Figure 3.6: Wealth distribution between males and females; Source of data was wave 23 of BSCE Bundesbank

towards sustainable investments inside the sample. Comparing the two investment types, sustainable securities have a significantly higher presence within the sample.

Figure 3.6. categorizes personal income levels, breaking down counts for males and females within each income range, alongside a total for each bracket. The income levels span from "Under 500 EUR" to higher ranges, revealing a potential gender imbalance in income levels. The male and female distributions show variances that may correlate with differing career paths, part-time versus full-time employment, and economic independence across genders. The pattern could indicate that males and females have differing financial capabilities, affecting their ability to engage in investments. For instance, higher individual incomes in males may correspond with greater likelihood to invest or take financial risks. This data is insightful for identifying economic disparities between genders, which in turn might influence financial autonomy and preferences, especially regarding sustainable investments, as income level is a key determinant in financial

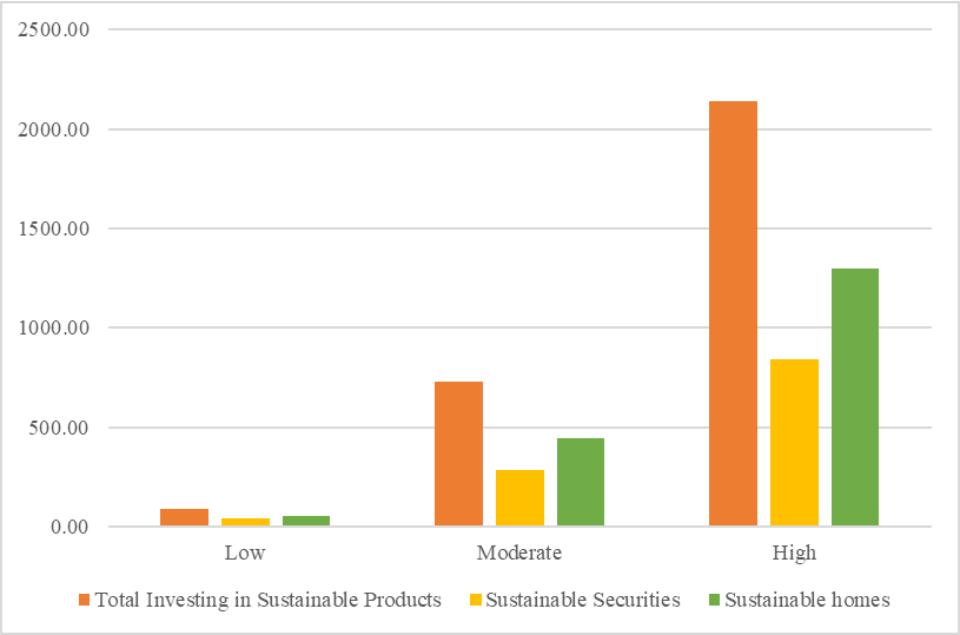

Figure 3.7: How risk perception affects sustainable investments.

decision-making.

Figure 3.7. links levels of environmental concern (categorized as low – from 1 to 3, moderate – from 4 to 7, and high – from 8 to 10) with investment behavior in sustainable investments, specifically sustainable securities and homes. Individuals with higher environmental concern are substantially more likely to invest in both types of sustainable products, with a strong uptick in engagement among those with high concern levels. The data highlights how environmental awareness may drive investment choices, as individuals who prioritize environmental issues tend to align their financial behavior with their values. This finding can support efforts to market sustainable investment products to environmentally conscious demographics. While both investments increase as the level of concern increases, the reaction regarding sustainable homes is much stronger compared to sustainable securities.

Figure 3.8. examines the relationship between educational attainment and types of sustainable investments, categorizing participants by education level. Higher educational

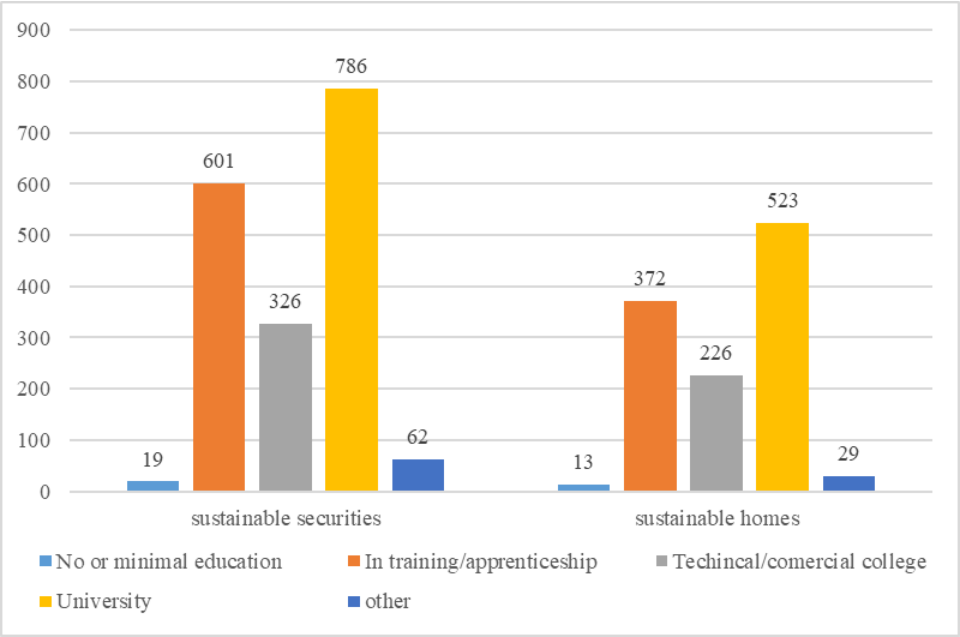

Figure 3.8: How different levels of education affect sustainable investments

levels are associated with greater participation in both types of sustainable investments, particularly sustainable securities. This trend implies that education may raise awareness of or access to sustainable investment products, as higher education often correlates with greater financial literacy and investment confidence. This may suggest targeting educational programs to foster understanding of sustainable finance. Education level significantly influences sustainable investment behavior, positioning education as a key determinant of participation in sustainable finance.

Figure 3.9. illustrates the differences between males and females in investing in sustainable homes across various age groups. This analysis highlights trends in sustainable investments based on age and gender, revealing which demographics show higher engagement. The graph indicates that males generally have higher participation in sustainable home improvements compared to females, with slight differences in the curve's shape. For males, the peak occurs in their late thirties to early forties and remains relatively steady through their late fifties. In contrast, the peak for females is around their fifties,

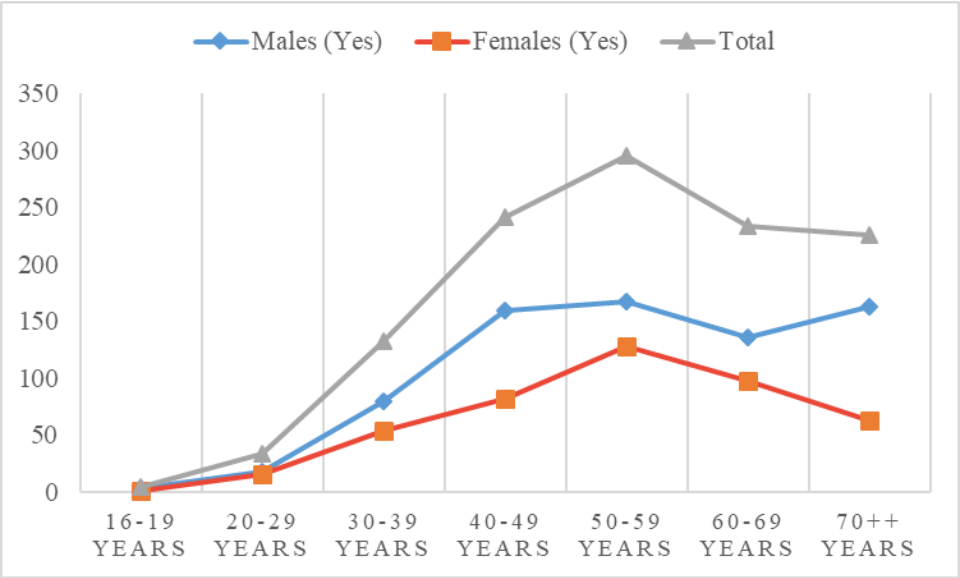

Figure 3.9: How males and females and females invest in sustainable home improvements over their life cycle

after which participation declines. This difference could be attributed to factors such as gender income disparities, as previously discussed, and the tendency for women with children to prioritize family needs over sustainable investments during earlier years.

Figure 3.10. breaks down investment in sustainable securities across age groups, with data separated by gender. Each age group's engagement in sustainable securities is shown, revealing trends in participation across generations and between males and females. Older age groups generally show higher participation rates, suggesting a positive correlation between age and sustainable investment. Age distribution may reflect generational differences in investment priorities or risk tolerance, with older individuals possibly having more financial security to invest. The data could be used to tailor sustainable investment products to appeal to different age groups, considering varying investment capacities and preferences. The insights highlight the role of life stage and financial stability in sustainable investment, suggesting that different age groups respond uniquely to sustainable finance opportunities.

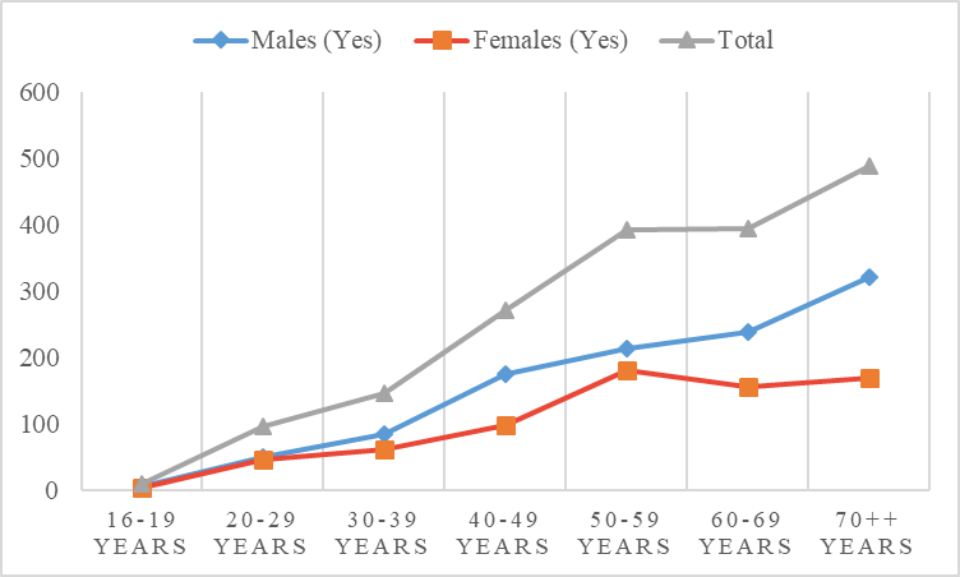

Figure 3.10: How males and females invest in sustainable securities over their life cycle

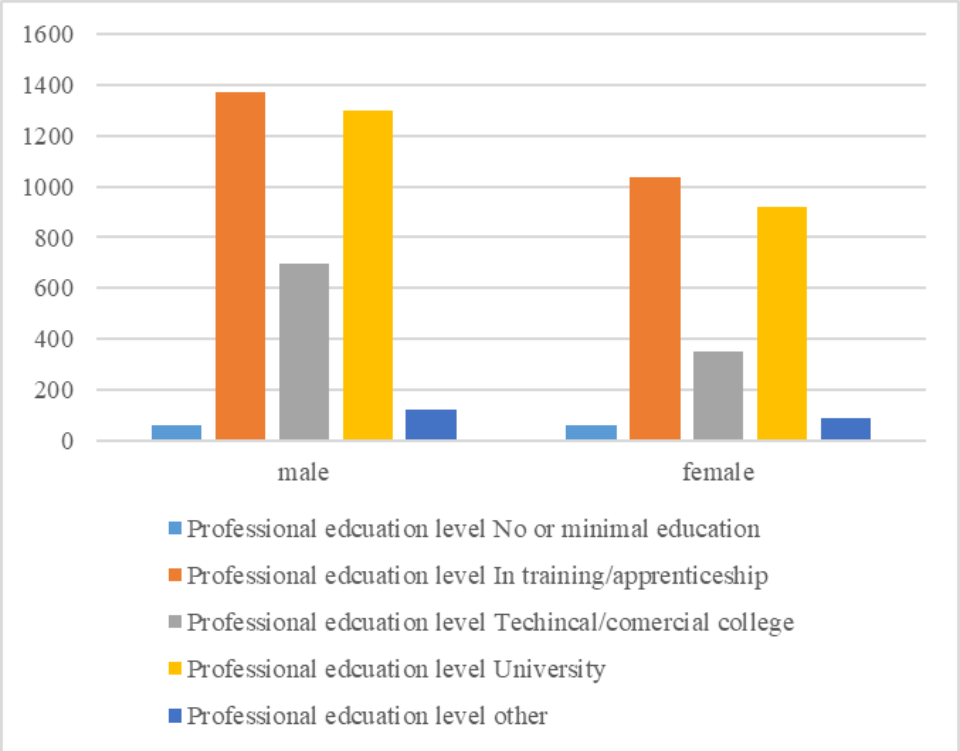

Figure 3.11: Education levels of males and females

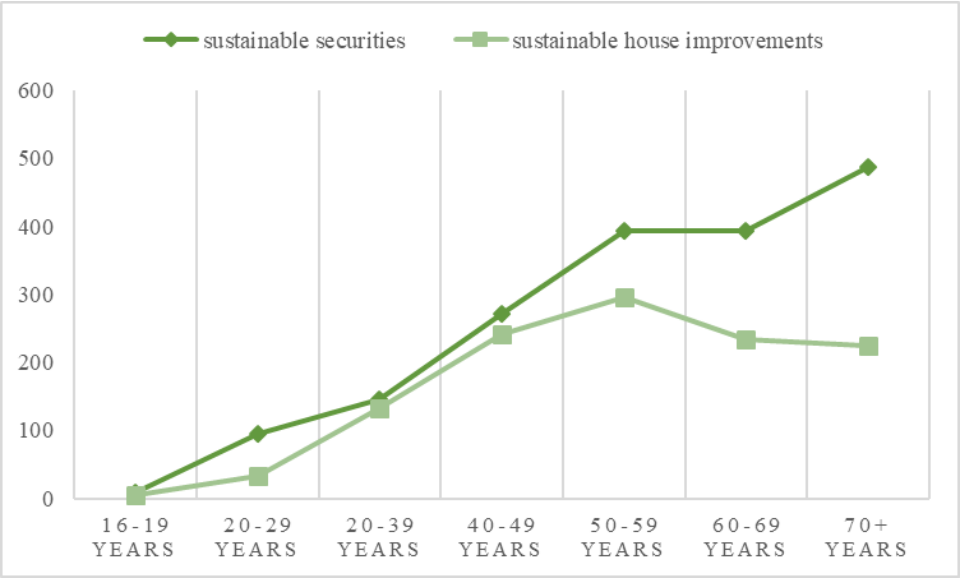

Figure 3.12: Ownership of sustainable investments by age group

Figure 3.12. presents the levels of professional education obtained by males and females in the sample, separately. The data reveals gender-specific patterns in educational attainment, with males and females represented differently across education levels. While the proportions withing a gender seem similar, there is an obvious difference between males and females, with males being significantly more educated. For the purpose of this study, the findings have particular meaning since higher education correlates with greater investment capabilities, potentially leading to differences in sustainable investment behavior by gender.

The final descriptive figure illustrates the investment patterns in green investments across different age groups. Investments in sustainable securities and sustainable homes exhibit similar trends, with their trajectories nearly converging during the age range of 30 to 40. However, beyond this point, the patterns begin to diverge. Participation in sustainable securities continues to rise steadily even in later years, whereas investment in sustainable homes peaks around the age of 50 and then gradually declines. The divergence between investments in sustainable securities and sustainable homes in later years can

be attributed to differences in liquidity, flexibility, and priorities. Sustainable securities are more liquid and easier to manage, appealing to older individuals focused on preserving wealth and generating income as they approach retirement. In contrast, sustainable homes require significant upfront costs and ongoing maintenance, which may deter older age groups who are less likely to invest in new housing. This shift reflects changing priorities, with older individuals favoring financial investments over tangible, long-term commitments like housing.

3.5 Additional explanations for environmental controls

The analysis in the subsequent chapters uses a group of controls defined as environmental controls. Inside that groups is a subgroup of variables that show how important individuals think certain actions are for combating climate related issues. The five actions provided in the data-set are having a green home, using green transport, green politics, having a green job and using green products. For further clarification of the terms, this section will provide a short overview of what is meant by each of the terms.

Green homes represent homes which were created or modified with sustainability in mind. Shortly green homes can be viewed as homes with thermal insulation, which using renewable energy and other smart eco-friendly solutions whit the aim of benefiting the environment.

Green jobs are roles that contribute directly to environmental protection or the sustainable use of resources. These jobs often focus on reducing waste and pollution, conserving energy, or creating sustainable alternatives. Examples include roles in renewable energy (like wind or solar technicians), environmental consulting, green fiance, sustainable agriculture, recycling, eco-friendly manufacturing, and energy-efficient construction. The

green job selection reflects the employers efforts to protect the climate.

Green products are goods and services designed to have a minimal negative impact on the environment. They are often made using sustainable materials, produced with less energy or water, and have a reduced carbon footprint. Green products also refer to buying energy-efficient electrical devices, sustainable clothing or food.

Green politics refers to policies and political movements focused on environmental sustainability, conservation, and climate action. This area of politics advocates for legislation and governance that address issues like climate change, pollution, biodiversity loss, and renewable energy. Green political movements often push for systemic changes to ensure long-term environmental health and are typically represented by political parties or organizations with a strong focus on ecological issues.

Green transport, or sustainable transportation, refers to methods of travel and goods movement that minimize environmental impact. This includes options that produce lower emissions, consume less fuel, or are powered by renewable energy sources. Examples are electric vehicles (EVs), public transportation systems (like trains and buses with low emissions), biking, car-sharing, and walking. Green transport also includes infrastructure that supports these modes, such as electric vehicle charging stations and bike lanes. The goal is to reduce reliance on fossil fuels, decrease pollution, and improve air quality.

Chapter 4

Results

This chapter delves into the factors driving sustainable investment decisions, beginning with an analysis of key influences on sustainable investments, it explores both the motivations and challenges that shape investment in sustainable securities and sustainable home improvements. Using a range of control variables, including environmental attitudes, financial conditions, and demographic characteristics, the chapter provides a comprehensive framework for understanding sustainable behaviour when it comes to financial and everyday investments.

The chapter also examines the relationship between living in a sustainable home and the likelihood of investing in sustainable securities, testing whether a commitment to sustainable practices in one domain encourages sustainable investments in another. Employing advanced econometric techniques, such as Instrumental Variable Regression (IV), this chapter addresses potential biases and ensures robust insights. Together, these analyses contribute to a deeper understanding of the dynamics that promote or hinder sustainable investment.

4.1 What affects sustainable investments

This section explores the primary factors influencing sustainable investments, focusing on the elements that encourage or discourage individuals from investing in sustainable securities. By analyzing various combinations of controls, including environmental, financial, risk perception, and demographic variables, this section provides a comprehensive overview of the key drivers and obstacles in sustainable securities ownership. The findings shed light on the relationship between climate concerns, investment preferences, and the perceived importance of green actions, which collectively shape sustainable investment decisions.

4.1.1 What affects investing in sustainable securities

The first of the two main interest variables to be analysed is the sustainable securities. Table 4.1. presents four variations of the model by including and omitting controls in order to check for consistency. The regressions in all columns were performed using Ordinary Least Squares (OLS) regressions. The controls can be divided into three main groups, environmental, financial and demographic controls. Main differences between the columns arise from changes in the environmental controls. Column 1 of Table 4.1. includes only climate concern as an environmental control, Column 2 includes only the preference for sustainable investments and Column 3 includes both variables. In Column 4, to the regression are added five green action importance variables, which were previously described in the Data and methodology chapter. In order to confirm the stability of the green actions variables, Column 4 was additionally modified by removing sustainable investment preference and climate concern. The results are presented in Column 1 and Column 2 of Table 7.1. in the Appendix.

Table 4.1: What influences investing in sustainable securities

	Method: OLS			
	Dependent variable: **Sustainable securities**			
VARIABLES	(1)	(2)	(3)	(4)
climate concern	0.0178***		0.00918***	0.00634**
	(0.00245)		(0.00255)	(0.00307)
sustainable investment pref.		0.142***	0.130***	0.124***
		(0.0123)	(0.0129)	(0.0133)
green home importance				0.00425
				(0.00363)
green transport importance				-0.00186
				(0.00311)
green products importance				0.000866
				(0.00362)
green job importance				0.00568**
				(0.00251)
green politics importance				-0.000625
				(0.00241)
adjusted household income	0.0276***	0.0267***	0.0268***	0.0276***
	(0.00609)	(0.00597)	(0.00596)	(0.00595)
borrowing constraints	-0.0539***	-0.0621***	-0.0615***	-0.0632***
	(0.0177)	(0.0177)	(0.0177)	(0.0177)
Risk perception				
lower	0.165***	0.145***	0.147***	0.150***
	(0.0163)	(0.0161)	(0.0162)	(0.0162)
similar	0.196***	0.159***	0.159***	0.160***

	(0.0141)	(0.0145)	(0.0145)	(0.0146)
higher	0.221***	0.168***	0.168***	0.168***
	(0.0184)	(0.0193)	(0.0193)	(0.0193)
homeowner	-0.00602	-0.000648	-0.00115	-0.00106
	(0.0169)	(0.0168)	(0.0168)	(0.0168)
age/10	-0.490***	-0.480***	-0.459***	-0.457***
	(0.124)	(0.123)	(0.123)	(0.123)
age2/100	0.0951***	0.0920***	0.0883***	0.0876***
	(0.0247)	(0.0246)	(0.0246)	(0.0246)
age3/1000	-0.00558***	-0.00528***	-0.00509***	-0.00504***
	(0.00155)	(0.00155)	(0.00155)	(0.00155)
female	-0.000246	-0.00595	-0.0101	-0.0125
	(0.0121)	(0.0119)	(0.0120)	(0.0121)
married	0.0413**	0.0386**	0.0379**	0.0375**
	(0.0171)	(0.0170)	(0.0170)	(0.0170)
Number of children				
one child	0.0222	0.0243	0.0252	0.0254
	(0.0223)	(0.0221)	(0.0221)	(0.0221)
two children	0.0260	0.0273	0.0255	0.0246
	(0.0239)	(0.0238)	(0.0238)	(0.0238)
three or more children	-0.0187	-0.0171	-0.0190	-0.0182
	(0.0394)	(0.0388)	(0.0387)	(0.0387)
Professional education				
training/apprenticeship	0.109***	0.114***	0.113***	0.111***
	(0.0361)	(0.0353)	(0.0355)	(0.0355)
technical /commercial college	0.156***	0.156***	0.155***	0.153***
	(0.0380)	(0.0372)	(0.0374)	(0.0374)
university (b, m, phd)	0.173***	0.171***	0.168***	0.169***

	(0.0367)	(0.0359)	(0.0361)	(0.0362)
other	0.131***	0.123***	0.124***	0.121***
	(0.0470)	(0.0460)	(0.0461)	(0.0461)
employed	0.0373**	0.0375**	0.0369**	0.0378**
	(0.0178)	(0.0177)	(0.0177)	(0.0177)
Constant	0.501***	0.451**	0.364**	0.342*
	(0.186)	(0.184)	(0.185)	(0.186)
Observations	6,003	6,003	6,003	6,003
R-squared	0.061	0.075	0.077	0.079

Robust standard errors in parentheses

*** p0.01, ** p0.05, * p0.1

The environmental variables and the different model specifications regarding their inclusion, reveal important patterns. Coefficient of climate concern, even though significant, declines as new environmental controls are introduced to the model, ranging from 0.00634** to 0.0178***. This decrease may suggest that the climate concern is channeled through green preferences. The most distinct drop in the coefficient of climate concern can be observed when comparing Columns 1 and 3 of Table 4.1, which show the isolated effect of climate concern on sustainable securities (Column 1) and the effect of climate concern when sustainable investment preference is added. The climate concern coefficient goes from 0.0178*** in Column 1, to 0.00918*** in Column 3, when preference for sustainable investments is included. This decline could suggest that individual's climate concern affects their investment in sustainable securities only if they believe that sustainable securities could have a significant effect in mitigating climate issues. The coefficient further decreases with the inclusion of additional green controls in Column 4, further confirming the previous statement.

Even though the coefficient of sustainable investment preference decreases in Column 3 compared to Column 2, where it was isolated, the difference is not nearly as drastic as in the case of climate concern. Moreover, the slight changes to the coefficients magnitude can be ignored and it can be viewed as fairly consistent across all models, ranging from 0.124*** to 0.142***. This marginal changes to the coefficient when both climate concern and other green actions variables are included could imply that the personal preference for sustainable investments is a robust, independent predictor of sustainable investment behaviour, largely unaffected by other environmental attitudes. This assumption could lead to a conclusion that individuals with a strong preference for sustainable financial investments actually choose them, reflecting strong alignment between stated preferences and actual investment decisions.

Out of the five importance of green actions variables (such as green home, transport, job, politics, or products), which are introduced in Column 4, only the coefficient for the importance of having a green job shows statistically significant effect on green securities ownership, with the coefficient of 0.00568**. The coefficient can be viewed as consistent across all models regardless of inclusion and exclusion of climate concern and sustainable investment preference variable, as presented in Table 7.1. in the Appendix. Although not high in magnitude as the coefficient of sustainable investment preference, having a green job also seems to contribute to investing in sustainable securities. Building on insights from the literature review, sustainable securities are designed to fund green initiatives. Since green jobs exist in companies operating in sectors that directly contributes to the environment, it is natural to assume that those who think green jobs are important also believe green companies are important. Hence, environmentally conscious investors likely believe they are supporting positive environmental change by providing financial resources to those companies, through for example, purchasing their stocks or bonds.

The effect of the financial situation of the household on security investment can be seen from the adjusted household income and borrowing constraint variables, which are sig-

nificant for all model specifications. The adjusted household income shows a positive effect on investing in sustainable securities, with a consistent coefficient across all models ranging from 0.0267*** to 0.0276***. These results are consistent with the expectations, since households with higher incomes have more financial security and disposable income. In this sense, households with higher income have more resources that could be directed towards financial investments, for example sustainable securities, unlike households who are financial constrained. This could also be viewed from the perspective that wealthier households have more possibilities for diversifying their portfolios, hence it makes them more likely to add sustainable securities to their portfolio. In contrast, borrowing constraints show a negative association with investing in sustainable securities. The coefficient is significant and consistent for all model specifications, ranging from -0.0632*** to -0.0539***. Again, the results go along with expectations, but with the opposite argument, that households facing borrowing limitations likely have reduced capacity or willingness to engage in financial investment, and so sustainable securities, possibly prioritizing immediate financial needs over long-term investment strategies. Both financial variables can be considered important determinants of sustainable security investments.

The variations of risk perception show that as individuals perceive traditional investments as riskier, compared to sustainable, they are increasingly drawn toward sustainable investments. The coefficients across models remains significant and consistent for all three levels of risk perception. Coefficients for "Lower" (when the person believes that traditional investments have a lower risk then sustainable ones) ranges from 0.145*** to 0.165***. In case of "Similar" (when the person believes that traditional investments have a similar level of risk as sustainable ones) the coefficients range from 0.159*** to 0.196***. Lastly, the coefficients of "Higher" (when the person believes that traditional investments have a higher risk then sustainable ones) ranges from 0.168*** to 0.221***. The level of risk of sustainable investments compared to the one of traditional seems to be an important factor for individual's financial decisions. The results suggest that individuals prefer sustainable securities more when they are the less risky alternative. High

risk is usually associated with higher return, while lower risk is associated with lower returns. In this sense it could be said that individuals except safe and stable returns from investing in sustainable securities, rather than higher but riskier returns. Hence, from a portfolio perspective, individuals might depict sustainable securities as safe investments, with long-term, stable returns and ethical values, that balance out the riskier ones. This intuition could be supported by the growing number of policies that work in favor of sustainable financial investments appealing as a safe alternative to the public.

Among demographic factors, age, marital and employment status, as well as the level of professional education seem to be significant predictors of investing in securities. Being married has a consistent positive and statistically significant coefficient across all models, that range from 0.0352** to 0.0387**. The coefficient for employed ranges is also significant and positive for all models, reining from 0.0369** to 0.0378**. Hence employed and highly educated individuals are more likely to invest in sustainable securities, which could be explained in a two ways. First, since financial stability and long-term planning are more common among married and employed individuals, those traits translates into their investment behavior, making them more likely to invest in sustainable securities. Secondly, being married and employed increases the households budget, while at the same time marks a part of an individuals life in which their priorities start shifting towards wealth generation. Strangely, while being married has a positive and significant effect, having children does not seem to have a significant effect. Even if the coefficients are insignificant it is interesting to note how for having more than two children, the coefficient becomes negative. This could be because of the fact that more children a household has the more financial obligations they have, leaving less resources for investing in the financial market.

The age transformations in the model reveal a non-linear relationship between age and sustainable investment interest. The negative coefficient of the linear age term, ranging from -0.490*** to -0.457***, indicates that younger individuals are generally more

inclined toward sustainable securities, possibly due to stronger environmental values which fits the previously described theoretical framework regarding younger investors. This trend moderates with the positive quadratic term, whose coefficient ranges from 0.0876*** to 0.0951***, suggesting a U-shaped pattern where investment interest increases in midlife, likely reflecting greater financial stability. However, for more detailed analysis a cubic term was included. The negative cubic term, ranging from -0.00558*** to -0.00504***, could suggest diminishing interest in later life, as older investors may prioritize safer, more liquid assets. Collectively, these terms depict a relationship, consistent with life-cycle theories, where sustainable investment interest declines with age, rebounds in midlife, and dips again in older age due to shifting financial priorities.

Professional education levels show a significant association with owning sustainable securities. While all levels of professional education have significant effect on owning sustainable securities, it can be noticed how as the level of education increases, so does the magnitude of the coefficient. Specifically, the effect ranges from 0.109*** to 0.114*** for individuals with completed training or apprenticeships, then it increases to the range from 0.153*** to 0.156*** for technical or commercial college graduates. The largest coefficients are obtained in case of university graduates (Bachelor's, Master's, PhD) where the coefficient ranges from 0.168*** to 0.173***. These results are not surprising, since higher education is usually associated with higher financial literacy. Hence highly educated individuals are more prone understanding financial investments and how sustainable finance can benefit the environment. This goes well with the fact that they are reported to have higher engagement in financial markets, compared to less educated individuals. Additionally, individuals with higher levels of education are usually more environmentally aware, which would make them more likely to include sustainability in their decisions. Highly educated individuals also tend to have higher paying jobs which affects the amount of disposable income. Combing all of the characteristics of highly educated, the results obtained become even more reasonable and realistic.

Being female, although negative does not seem to have a significant effect on holding sustainable securities. Usually literature describes female as less interested in financial investments, so even though the sign of the coefficient was expected, it is strange that it is not significant. Similarly, homeownership was assumed to be positive and significant due to the fact that individuals who own the dwelling they live in do not have monthly rent fees, hence less everyday financial obligations. But unlike the gender variable, where at least the sign of the coefficient was consistent with the expectations, homeownership had a negative coefficient, which was opposite of the expectations.

4.1.2 What affects investing in sustainable homes?

This section moves the focus to the second interest variable, living in a sustainable home. Similarly, as in the case of sustainable securities, a set of Ordinary Least Squares regressions were performed in order to determine what influences individuals to choose sustainable homes, over traditional. Table 4.2. presents four variations of the Ordinary Least Squares (OLS) models with the main difference being the specifications in terms of environmental controls. The controls used can again be divided into three main groups, environmental, financial and demographic. Column 1 of Table 4.2. includes only climate concern as an environmental control, Column 2 includes only the green actions importance variables, explained in the Data and methodology chapter, while Column 3 combines both. In the Column 4 of Table 4.2, an additional environmental control is added, preference for sustainable investments. Even though the variable refers to financial investments it is included due to the fact that sustainable preference in one area can be associated with sustainable preferences in other areas.

Table 4.2: What influences sustainable home choices

	Method: OLS			
	Dependent variable: **Sustainable home**			
VARIABLES	(1)	(2)	(3)	(4)
climate concern	0.0120***		-0.00380	-0.00483*
	(0.00216)		(0.00270)	(0.00272)
green home importance		0.0309***	0.0314***	0.0311***
		(0.00309)	(0.00310)	(0.00311)
green transport importance		-0.00190	-0.000990	-0.00168
		(0.00247)	(0.00256)	(0.00256)
green products importance		-0.00402	-0.00371	-0.00427
		(0.00306)	(0.00308)	(0.00308)
green job importance		0.00406*	0.00411*	0.00399*
		(0.00215)	(0.00215)	(0.00215)
green politics importance		0.00358*	0.00425**	0.00339*
		(0.00197)	(0.00203)	(0.00205)
sustainable investment pref.				0.0365***
				(0.0114)
adjusted household income	0.0344***	0.0353***	0.0353***	0.0350***
	(0.00546)	(0.00536)	(0.00536)	(0.00538)
borrowing constraints	0.0810***	0.0749***	0.0744***	0.0728***
	(0.0184)	(0.0181)	(0.0181)	(0.0181)
Risk perception				
lower	0.0420***	0.0411***	0.0408***	0.0360**
	(0.0144)	(0.0142)	(0.0142)	(0.0143)
similar	0.0590***	0.0505***	0.0508***	0.0412***
	(0.0129)	(0.0128)	(0.0128)	(0.0131)

higher	0.0920***	0.0762***	0.0764***	0.0627***
	(0.0165)	(0.0165)	(0.0165)	(0.0170)
age/10	0.0930***	0.0853***	0.0837***	0.0814***
	(0.0231)	(0.0232)	(0.0233)	(0.0233)
age2/100	-0.00872***	-0.00809***	-0.00794***	-0.00764***
	(0.00228)	(0.00229)	(0.00229)	(0.00229)
female	-0.0243**	-0.0357***	-0.0350***	-0.0368***
	(0.0102)	(0.0101)	(0.0101)	(0.0102)
married	-0.0486***	-0.0484***	-0.0482***	-0.0490***
	(0.0130)	(0.0130)	(0.0130)	(0.0130)
Number of children				
one child	0.110***	0.109***	0.109***	0.110***
	(0.0206)	(0.0203)	(0.0203)	(0.0202)
two children	0.146***	0.141***	0.142***	0.142***
	(0.0223)	(0.0219)	(0.0219)	(0.0219)
three or more children	0.247***	0.241***	0.241***	0.242***
	(0.0437)	(0.0428)	(0.0428)	(0.0426)
Professional education				
training/apprenticeship	0.0406	0.0314	0.0312	0.0327
	(0.0300)	(0.0297)	(0.0297)	(0.0297)
technical /commercial college	0.0865***	0.0771**	0.0768**	0.0773**
	(0.0318)	(0.0314)	(0.0315)	(0.0314)
university (b, m, phd)	0.0855***	0.0765**	0.0766**	0.0765**
	(0.0304)	(0.0301)	(0.0301)	(0.0301)
other	0.0114	0.00282	0.00197	0.00117
	(0.0375)	(0.0371)	(0.0372)	(0.0370)
employed	-0.00639	-0.00320	-0.00296	-0.00298
	(0.0151)	(0.0149)	(0.0149)	(0.0149)

homeowner	0.111***	0.109***	0.109***	0.110***
	(0.0138)	(0.0137)	(0.0137)	(0.0137)
Constant	-0.356***	-0.455***	-0.438***	-0.456***
	(0.0629)	(0.0627)	(0.0636)	(0.0636)
Observations	6,003	6,003	6,003	6,003
R-squared	0.067	0.091	0.092	0.093

Robust standard errors in parentheses

*** p0.01, ** p0.05, * p0.1

When examining the environmental controls, five main variables stand out as significant predictors of choosing a sustainable home ownership: climate concern, green home importance, importance of having a green job, importance of green politics and preference for sustainable investments. The remaining two variables, importance of green transport and importance of green products show no significant effect. Similarly, as in the case of sustainable securities, there are interesting changes related to the environmental controls, depending on the combinations used as controls.

Climate concern variable has an unstable coefficient, with fluctuations in both significance and sign depending on the model, ranging from -0.00483* to 0.0120***. This variability suggests that the impact of climate concern may depend on whether other environmental motivations are considered. For instance, Column 1 of Table 4.2, where climate concern is the only environmental control, shows a positive and highly significant effect, potentially reflecting an unfiltered link between general environmental concern and sustainable choices, in this case sustainable homes. However, when the importance of green actions variables group is added in Column 3, climate concern becomes insignificant and even shifts to a negative sign. This could be a potential reason to believe that climate concern is only an important factor in making decisions if the individual believes a certain action is important. When sustainable investment preference is included in Columns 4, climate

concern becomes weakly significant (10% level), further confirming that people's general environmental concern has limited independent influence once specific motivations for sustainable investing are accounted for.

The importance of having a green home is consistently positive and highly significant predictor across all models, with a stable coefficient ranging from 0.0309*** to 0.0314***. Out of the green actions variables it has the highest coefficient, which is natural considering the fact that it represents how important green homes are for the environment. Its stability points to a strong association with sustainable homes. These results, combined with the variability of climate concern, suggest that for climate concern to affect sustainable home ownership, one needs to see a green home as a tangible way to contribute to environmental goals.

Importance of a green job and green politics have smaller, but still significant, positive effects. The coefficients range from 0.00399* to 0.00411* for green job importance, and from 0.00339* to 0.00425** for the importance of green politics. Individuals who see green jobs as important may believe that such a career fosters a life more dedicated to sustainability, where contribution to climate solutions happens directly through work. Hence, they could believe that the commitment to sustainability in the professional life may naturally extend to personal decisions, such as investing in sustainable homes. In the case of green politics, the relationship could come from the fact that political initiatives can enhance the accessibility of sustainable homes through subsidies or incentives for green homeowners. People who see green politics as important likely appreciate its potential to make green projects more accessible. Unlike the direct impact of green home importance, the perception of green job and green politics importance is more indirect, which explains the smaller and less significant coefficients.

Finally, the preference for sustainable investments is included in Column 4 of Table 4.2. It shows a stable, significant, and positive effect with a coefficient of 0.0365***. The strong coefficient emphasizes the previously mentioned conclusion from existing literature on

how preference for sustainability in one area, in this case financial investments, expands to others, like choosing to install sustainable home improvements or buy a sustainable home.

Looking at the financial controls, household income has a consistent effect across all models. The coefficient is positive and significant at all levels for all models ranging from 0.0344*** to 0.0353***. This result was expected due to the fact that sustainable home improvements tend to have costly initial investments, for which higher income is beneficial. Additionally, households with more disposable income are more likely think about improving the dwelling they live in, compared to financially constrained ones. Having borrowing constraints has a positive and significant effect on owning sustainable homes with a coefficient ranging from 0.0728*** to 0.0810***. This effect was also expected because sustainable homes have been proven to generate significant savings through cost reductions, which is beneficial for households with borrowing constraints. Households with borrowing constraints are prone to finding ways in which they could minimize their spending in order to feel less financial pressure from refinancing loans. In this sense sustainable homes could benefit such households, and due to many green orientated policies, acquiring green homes is becoming more financially available to households.

The results reveal a strong link between individuals' perceptions of risk of traditional financial investment, compared to the one in sustainable, and their tendency to invest in sustainable homes. As perceived risk in traditional investments rises, so does the likelihood of investing in sustainable housing. This relationship holds across models, with coefficients remaining significant even as controls are added. For those who see traditional investments as "Lower" risk than sustainable options, the coefficients range from 0.0360** to 0.0420***. When the risks between the two are viewed as "Similar," coefficients increase (0.0412*** to 0.0590***), indicating a rising interest in sustainable housing as a diversification strategy. The highest coefficients (0.0627*** to 0.0920***), occur among those who consider traditional investments "Higher" risk, suggesting these individuals

prefer investing in sustainable homes when they perceive them as a safe investment. Those who see traditional investments as riskier may prefer sustainable homes as both a stable financial investment and a means of supporting environmental sustainability. This trend highlights how risk perceptions can drive a shift toward sustainable investments, providing security while supporting environmental values.

Out of the demographic controls, the only variable that seems to not have effect is the employment, while as expected homeownership has a significant effect on investing in a sustainable home with a coefficient with a negligible change across models from 0.109*** to 0.111***. This was an expected result due to the fact that dwelling owners have more control over the improvements that will be done regarding the dwelling, or if they were the initial builders, the way in which it will be built. Similarly as in the case of sustainable securities, age seems to have a non-linear effect on investing in sustainable securities. The positive coefficient for the linear age term indicates that, initially, age has a positive effect on the likelihood of investing in a sustainable home. However, the negative coefficient of the squared term suggests diminishing interest as age increases, meaning the effect of age becomes smaller and eventually declines at higher age levels. This pattern reflects a concave relationship where middle-aged individuals are the most likely to invest in sustainable homes. This description resembles the graphs presented in Chapter 3, Dana and Methodology, where investing in sustainable homes was presented for different age groups. Moreover, the result was expected since sustainable home improvements require more initial financing and a desire to invest in ones home, which is associated more with older individuals.

Being female and being married both have negative and significant coefficients from -0.0368*** to -0.0243** and from -0.0490*** to -0.0482***. These results come off as strange due to the fact that females tend to be more passionate about the environment, but could be contributed to the fact that females in the sample have been shown to have significantly lower incomes then males. The negative coefficient may be due to different

investment priorities, or decision-making within the household. The unexpected negative effect of marital status was expected to be positive because it marks the moment of settling down and investing in family resources like homes. The negative coefficient may be attributed to the fact that married couples need to agree on major financial decisions, meaning that if one does not particularly care about sustainability, it could lead to discarding the idea of home renovations. Another reason could be the choice of location since married couples often pick locations that are closer to their jobs or school districts, but may not be suitable for sustainable improvements. Conversely, a household with more children is more likely to own a sustainable home. The increase in the coefficient is especially noticeable when moving from having two children, where the coefficient goes from 0.141*** to 0.146***, to having three or more children in which case the coefficient grows to the range from 0.241*** to 0.247***. Since sustainable homes are good for reducing expenses, they can be considered as great investments for larger families with higher utility bills as well as other expenses, which would be easier to cover considering the buffers provided by sustainable housing. Another potential reason behind the strong positive association could be that households with children are more family orientated and potentially have more considerations about the future in which their children will grow up in. Hence, they are more proactive in terms of sustainability and eco-friendly solutions.

Lastly, it can be observed how only the two higher levels of education, college and university, have significant effects on owning a sustainable home. The two categories have almost identical coefficients that are highly significant and positive. The coefficient for having completed a collage ranges from 0.0771** to 0.0865***, while for completed university it ranges from 0.0765** to 0.0855***. This suggests that on average, college and university graduates are more likely to have a sustainable home, compared to less educated individuals. The reasoning behind these results is similar to the one for sustainable securities. Higher educated individuals have higher understanding of the environmental situation and are have higher financial literacy, which can be translated to them better

managing their resources. Sustainable homes combine both factors, one hand one needs to want to contribute to the environment, and the other they have to be able to understand the financial benefits that sustainable homes bring to their owners in the long run.

4.2 How does investing in a sustainable home affect investing in sustainable securities?

This section investigates the relationship between investing in sustainable homes and investments in sustainable securities, testing the hypothesis that individuals who invest in sustainable home improvements are also more likely to invest in sustainable securities. Using an instrumental variable (IV) regression to address potential endogeneity, this analysis assesses whether choosing a sustainable home fosters a broader commitment to sustainable financial investments.

After assessing the relationship of sustainable home ownership and sustainable securities with relevant control variables in Table 4.1. and Table 4.2, the focus moves to what effect owning sustainable homes has on investing in sustainable securities. Column 1 of Table 4.3. explores the relationship between the two variables using OLS and controlling for environmental variables, climate concern and sustainable investment preference, which were significant in the OLS for both owning a sustainable home, Table 4.2, and sustainable securities, Table 4.1. Additionally, the model controls for financial and demographic characteristics.

The OLS coefficient for the effect of sustainable home ownership on investing in sustainable securities is 0.0674*** with a standard error of 0.0160. The positive and statistically significant coefficient indicates that owning a sustainable home is associated with a 0.0674 increase in the likelihood of investing in sustainable securities. However,

there is a concern about the presence of endogeneity. Since both investment types are simultaneously determined, and may be driven by unobservable factors which could bias the OLS coefficient.

In order to address the potential endogeneity, an IV regression is performed, using green home and green job importance as instruments for sustainable home ownership. The intuition behind this choice is as follows: Individuals who are concerned about the climate have different perceptions of which actions are important and effective in improving the state of the environment. In the data-set, there are several variables that asses the perceived importance of certain actions, one of which is the importance of having a green home. If an individual believes having a green home is important, it is reasonable to assume they will try to implement certain installations in their own home in order to make it sustainable. This assumption is confirmed by the results from Column 4 of Table 4.2, which shows that green home importance is a positive and highly significant predictor of owning a sustainable home. However, an individual's belief that having a green home could help improve the state of the environment, does not necessarily affect their financial investments. Even though a person is concerned about the climate and believes green homes are important, they may be skeptical about the impact of sustainable securities in resolving the climate change issues. This may be due to various reasons, one of which is the fact that the majority of the population has low financial literacy, making it more difficult to grasp how sustainable finance could benefit the environment. In that sense, their belief that green homes are important may not have any significant effect on their preference or choices related to sustainable securities. The results provided in Column 2 of Table 1 confirm this, with importance of green homes having insignificant effect of the ownership of sustainable securities. In this way green home importance is a good predictor of the endogenous regressor, owning a sustainable home, while not directly affecting the dependent variable, ownership sustainable securities, making it a good potential instrument. The other potential instrument is green job importance. Having a green job directly affects the lifestyle of an individual which translates into

their sustainable housing choices, which is confirmed with a positive and significant coefficients obtained in Table 4.2. However, even though the regressions in Table 4.1. suggest an existence of a relationship between green job importance and sustainable securities, it can be argued that it is due to the indirect effect through sustainable homes. Namely, preferences for green jobs are unlikely to independently determine knowledge of or access to sustainable financial products. The preference for green jobs reflects the individual's commitment to environmental sustainability, which translates into their lifestyle, hence the choice of sustainable living. Sustainable homes then give the insight into the benefits of sustainability on a tangible investment example, as well as improve the overall financial position of the household. These two facts then translate into the potential for investing in sustainable securities. While the use of green home importance is clear, the potential doubts regarding the use of green job importance will be tackled using adequate econometric tests.

The results of the IV regression for the first and second stage are presented in Columns 2 and 3 of Table 4.3. First-stage confirms the validity of the instruments with a highly significant coefficient of 0.0288*** and a standard error of 0.00269 for green home, and smaller but still significant coefficient for green job with the value of 0.00374* and a standard error of 0.00205. An F-statistic of 70.81 with a p-value of 0.000 indicates that the instruments are strongly correlated with the endogenous regressor (sustainable home), satisfying the relevance condition. This is well above the conventional threshold of 10, suggesting that the instruments are likely valid and effective. The Sargan statistic is 3.219 with a p-value of 0.0728. Since the p-value is well above 0.05, the null hypothesis of valid instruments cannot be rejected at the 5% significance level, which indicates that the instruments are likely valid.

In the second stage (Column 3) the effect of owning a sustainable home on investing in sustainable securities increases and remains significant at all levels, respect to the one in Column 1, where it was obtained with OLS. The coefficient obtained in the second

stage of IV is 0.256*** with a standard deviation of 0.0992. This suggests that the OLS estimate was likely downward biased due to endogeneity, and the IV approach provides a more accurate measure of the causal effect

In order to confirm the need for running the IV regression a Durbin-Wu-Hausman (DWH) using the command in STATA that provides the endogeneity test with the Chi-sq p-value. Under the null hypothesis H_0 of the test, the residuals have no significant effect. If the coefficient is significantly different from zero, the null hypothesis can be rejected, implying that OLS estimates may be biased and that IV should be preferred. Conversely, if the null hypothesis cannot be rejected then the OLS estimates are consistent, suggesting that IV may not be necessary. The endogeneity test statistic provided at the bottom of Table 4.3. is 3.801 with a p-value of 0.0512. With a p-value close to 0.05, it suggests weak evidence of endogeneity. Even if marginal, the test result gives reasonable doubt in the results obtained by OLS, hence treating suggesting that treating sustainable home as endogenous might improve model accuracy.

The results support the idea that the choice of sustainable home has a significant and positive effect on investing in sustainable securities, with the IV regression showing an even stronger effect than the OLS model. This suggests that sustainable behaviors in housing may indeed foster or reflect a broader commitment to sustainable financial investments.

The endogeneity test statistic provided at the bottom of Table 4.3. is 3.466 with a p-value of 0.0627. With a p-value close to 0.05, it suggests weak evidence of endogeneity. It's marginal, indicating that treating sustainable homeownership as endogenous might improve model accuracy.

The results support the idea that sustainable homeownership has a significant and positive effect on investing in sustainable securities, with the IV regression showing an even stronger effect than the OLS model. This suggests that sustainable behaviours in housing may indeed foster or reflect a broader commitment to sustainable financial investments.

Table 4.3: How owning a sustainable home affects investing in sustainable securities

	Dependent Variable		
	(OLS)	(IV)	
		1st stage	2nd stage
	sustainable securities	**sustainable home**	**sustainable securities**
	(1)	(2)	(3)
sustainable home	0.0674***		0.256***
	(0.0160)		(0.0992)
green home importance		0.0288***	
		(0.00268)	
green job importance		0.00374*	
		(0.00205)	
sustainable investment pref.	0.127***	0.0369***	0.116***
	(0.0129)	(0.0112)	(0.0141)
climate concern	0.00897***	-0.00476*	0.00743**
	(0.00254)	(0.00248)	(0.00290)
Risk perception			
lower	0.146***	0.0356**	0.140***
	(0.0161)	(0.0143)	(0.0188)
similar	0.156***	0.0404***	0.148***
	(0.0145)	(0.0131)	(0.0175)
higher	0.164***	0.0619***	0.151***
	(0.0193)	(0.0170)	(0.0216)
adjusted household income	0.0238***	0.0352***	0.0173***
	(0.00601)	(0.00538)	(0.00672)

borrowing constraints	-0.0667***	0.0726***	-0.0813***
	(0.0176)	(0.0181)	(0.0203)
age/10	-0.0682**	0.0773***	-0.0851***
	(0.0290)	(0.0230)	(0.0301)
age2/100	0.00810***	-0.00724***	0.00966***
	(0.00285)	(0.00227)	(0.00295)
female	-0.00757	-0.0371***	-0.00213
	(0.0120)	(0.0101)	(0.0124)
married	0.0389**	-0.0489***	0.0484***
	(0.0170)	(0.0130)	(0.0178)
Number of children			
one child	0.00494	0.110***	-0.0162
	(0.0217)	(0.0202)	(0.0249)
two children	-0.00542	0.142***	-0.0332
	(0.0231)	(0.0219)	(0.0277)
three or more children	-0.0596	0.243***	-0.106**
	(0.0383)	(0.0426)	(0.0486)
Professional education			
training/apprenticeship	0.0860**	0.0325	0.0778*
	(0.0350)	(0.0298)	(0.0425)
technical /commercial college	0.124***	0.0768**	0.108**
	(0.0369)	(0.0315)	(0.0445)
university (b, m, phd)	0.134***	0.0759**	0.118***
	(0.0355)	(0.0302)	(0.0432)
other	0.0988**	0.000275	0.0970*
	(0.0457)	(0.0371)	(0.0518)
homeowner	-0.00523	0.110***	-0.0265
	(0.0169)	(0.0137)	(0.0203)

employed	0.0245	-0.00332	0.0256
	(0.0173)	(0.0150)	(0.0181)
Constant	-0.165**	-0.448***	-0.0906
	(0.0771)	(0.0631)	(0.0892)
Observations	6,003	6,003	6,003
R-squared	0.078	0.093	0.054
F testof excluded instruments	70.81	p-val=0.000	
Sargan statistic	3.219	Chi-sq(1) p-val= 0.0728	
Endogeneity test (sustainable house)	3.801	Chi-sq(1) p-val= 0.0512	

Robust standard errors in parentheses

*** p0.01, ** p0.05, * p0.1

Chapter 5

Discussion

This study provides insights into the determinants and interactions between sustainable housing investments and sustainable securities. The findings reinforce existing literature, showing that while environmental concern plays a significant role in sustainable decision-making, financial motivations are equally influential. This chapter contextualizes these results within the broader field of sustainable finance and discusses their implications for both theory and practice.

The central finding of this research is the positive relationship between sustainable homes and sustainable securities ownership. The study suggests that households investing in sustainable homes are more likely to hold sustainable securities, indicating a broader commitment to environmentally conscious financial behavior. This relationship aligns with findings from Christiansen et al. (2023), which propose that sustainable behavior in one domain can often extend to other areas.

This study also found that higher income levels and financial security positively impact both sustainable homes and securities ownership. Households with higher incomes are more likely to have the resources to invest sustainably, supporting previous research that links economic stability with environmental behavior (e.g., Aron-Dine et al., 2023).

This result emphasizes the need for policy measures that facilitate access to sustainable investment for a broader range of income groups.

While environmental concerns significantly impact sustainable investment decisions, financial motivation remains a critical factor. Although green preferences and climate concerns encourage sustainable investments, the perception of profitability is equally essential, particularly for sustainable securities. This complexity relates to previous research suggesting that environmental impact and financial return are both necessary motivators for a broad segment of investors (Uzsoki, 2020) . Policymakers and financial advisors should thus consider ways to appeal to investors' financial interests while promoting environmental goals.

The results have important practical implications for stakeholders, such as financial advisors, policymakers, and environmental organizations, aiming to promote sustainable investments. The study's finding that sustainable homeownership increases the likelihood of sustainable securities ownership suggests that strategies fostering sustainable behaviors in everyday life may also positively influence financial decisions. For example, public policies could provide tax incentives for both green home improvements and investments in sustainable securities, encouraging households to align their financial and environmental commitments.

This research adds to the growing body of literature on household-level sustainable finance by highlighting the interconnected nature of sustainable housing and securities investments. It contributes to theories on the "spill over effect," where sustainable practices in one area encourage similar behaviors in others. Further research could expand on this by exploring the connection to the time horizon and its influence on sustainable decisions of household.

Chapter 6

Conclusion

In conclusion, this study highlights the complex interplay between environmental concerns, financial motivations, and sustainable investment behaviors. Using a comprehensive dataset and robust econometric methods, the research provides insights into the factors influencing sustainable securities and home improvements, revealing that both values and financial returns play crucial roles in sustainable decision-making. The positive relationship between sustainable homes and sustainable financial investments suggests that a commitment to sustainability in one area may encourage similar choices in another, offering a valuable perspective for promoting integrated sustainability.

By highlighting both the environmental benefits and financial returns of sustainable choices, these investments can appeal to a wider audience, encompassing both environmentally conscious and profit-oriented investors. Further research could explore additional factors influencing sustainable behaviors across different areas, offering an even broader view of the motivations behind green investment choices. In particular it would focus on assessing the role of the time horizon in making decisions related to sustainable investments, both tangible and financial.

As households increasingly prioritize sustainability, understanding these motivations will

be essential to fostering an economy that balances financial growth with environmental responsibility. Unfortunately the damage that has already done to the environment cannot be reversed, meaning the environmental factors are going to continue being a crucial factor in decisions related both to the financial world and the everyday decisions of households.

Chapter 7

Appendix

Table 7.1: Additional model specifications for Table 4.1.

	Method: OLS	
	Dependent variable: Sustainable securities	
VARIABLES	(1)	(2)
climate concern	0.00984***	
	(0.00310)	
sustainable investment pref.		0.127***
		(0.0132)
green home importance	0.00536	0.00510
	(0.00368)	(0.00360)
green car importance	0.000475	-0.000422
	(0.00314)	(0.00301)
green products importance	0.00278	0.00134
	(0.00366)	(0.00362)
green job importance	0.00611**	0.00576**

	(0.00253)	(0.00251)
green politics importance	0.00232	0.000406
	(0.00241)	(0.00236)
adjusted household income	0.0284***	0.0276***
	(0.00605)	(0.00595)
borrowing constraints	-0.0578***	-0.0641***
	(0.0177)	(0.0177)
Risk perception		
lower	0.166***	0.149***
	(0.0163)	(0.0162)
similar	0.193***	0.160***
	(0.0142)	(0.0146)
higher	0.214***	0.167***
	(0.0185)	(0.0193)
homeowner	-0.00490	-0.000613
	(0.0169)	(0.0168)
age/10	-0.478***	-0.463***
	(0.124)	(0.123)
age2/100	0.0925***	0.0887***
	(0.0247)	(0.0246)
age3/1000	-0.00541***	-0.00509***
	(0.00156)	(0.00155)
female	-0.00647	-0.0116
	(0.0122)	(0.0121)
married	0.0404**	0.0378**
	(0.0171)	(0.0170)
Number of children		
one child	0.0239	0.0254

	(0.0223)	(0.0221)
two children	0.0240	0.0249
	(0.0239)	(0.0238)
three or more children	-0.0188	-0.0177
	(0.0394)	(0.0388)
Professional education		
training/apprenticeship	0.107***	0.111***
	(0.0362)	(0.0354)
technical /commercial college	0.153***	0.153***
	(0.0380)	(0.0373)
university (b, m, phd)	0.172***	0.170***
	(0.0368)	(0.0361)
other	0.126***	0.120***
	(0.0470)	(0.0461)
employed	0.0388**	0.0383**
	(0.0178)	(0.0177)
Constant	0.443**	0.374**
	(0.186)	(0.185)
Observations	6,003	6,003
R-squared	0.065	0.078

Robust standard errors in parentheses

*** p0.01, ** p0.05, * p0.1

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