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The Relation between Green Preferences and Risk Preferences

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ABSTRACT

A lot of research is focused on sustainability and ESG investing nowadays. This thesis adds to this line of research by investigating the relation between green preferences and risk preferences. It researches this with survey data from the Dutch Household Survey, focusing on the green investments reported by the participating households. More specifically the stated ownership of green investments and the portion of funds invested in green investments are taken into account. It is found that more risk-seeking investors invest a smaller portion of their funds in green mutual funds, a risk-bearing investment. While this finding is robustly, the same relation is not robustly found for investing in green savings accounts. Next to this we found that highly educated people have stronger green preferences and investors with a higher gross income are less drawn to investing in green funds.

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I. Introduction

Nowadays, the news is filled with articles regarding climate change, biodiversity and it's preservation and the green transition. In these global affairs, every actor has to get his part and find out what he can do in resolving these issues. A large actor is for example the big oil companies like Shell and ExxonMobil. They got record profits over the last year, but have growing attention on them on how they improve on the problems in the world (Hensen (2023)).

Next to this, the financial markets can have a large influence on the transition. This can for example be done by the fact of taking ESG-criteria into account when investing. When taking ESG-criteria into account this may lead to lower shareholder value, whilst stakeholders are considered in their investment decision. In the USA there currently is a debate whether pension funds are allowed to take ESG-criteria into account when selecting their investments. (Beunderman (2023)).

This American debate boils down to a major question for investment funds and each investor in general, namely which factors do you take into account when selecting your investments. In the past, the two main components in this process where the return and the risk, put together in the mean-variance framework. This leads to the maximization of shareholder value. If a third factor, ESG-performance, is added to this existing mean-variance framework, maximizing shareholder value is not solely the objective. The concerns of stakeholders are then also accounted for in the portfolio selection. This might have a large influence on the composition of portfolios.

However, what are the drivers for investors to select stocks with high ESG-criteria? Several researchers have tried to find answers for the reasons investors select SRI assets. Riedl and Smeets (2017) and Bauer et al. (2021) both found that people invest in SRI assets out of social preferences. This motivation may thus be separated from the motivation to diversify your assets across different investments. This is what Duchêne et al. (2022) studied. They tried to find if people accept different returns or risk levels for a higher ESG-rated asset. They found that investors are willing to give up a part of their maximum returns, but are unwilling to get involved in a higher level of risk. Evidently, there is another side to an investment, the environmental and social component, creating a third dimension to it. A lot of research has been done in trying to indicate this exact new dimension and its determinants.

This leads us to question whether risk averse or risk seeking investors are more drawn to investing in ESG assets. Research in this direction is more scarce. The research that has been done on this effect is mostly from the macro-level to the level of the firm or the investment fund/manager. An example on the individual level is the research by Riedl and Smeets (2017) studying the relation between risk preference and ESG preference within socially responsible investors as a side effect in their research. They found a positive relation, meaning that a more risk seeking investor is more likely to invest in SRI-funds and puts in a larger portion of funds as well. However, research on the level of the individual investor is still scarce and more specifically individual experimental results and results from surveys.

To try and find if a risk-averse investor has another view upon SRI investments, this leads to the following research question:

What is the relation between green preferences and risk preferences?

To research this relation we are going to make use of the Dutch Household Survey (DHS) distributed yearly by the Dutch National Bank (DNB) amongst a representative panel of the Dutch households. This survey is composed of different sets of questions, which also include questions about people's assets and their risk preferences.

There are two different classes of assets being analyzed in this thesis, a risk-free asset: savings accounts and green savings accounts, and a risk-bearing asset: mutual funds and green mutual funds. To analyze the green preference firstly a set of regressions is run on the fact whether the respondent owned a green asset, presenting a preference for ESG and specifically the environmental part. Secondly, a set of regressions is run on the percentage of funds invested in that certain asset in the green kind of it. A separate risk measure is created from six different risk elicitation questions. The overall ESG-preference cannot be analyzed, because the DHS specifically asks their subjects for green investments.

A robust significant result is found on the portion of funds invested in green mutual funds. This is a negative relationship, indicating that a more risk-seeking investor invests a smaller portion of his funds invested in mutual fund in green mutual funds. The opposite is then also implied, a more risk-averse investor invests a larger percentage of funds in green mutual funds.

The remainder of this thesis is organized as follows. Section II gives a literature review, after which section III and IV go into the used methods and data. Section V provides the results following from this research, which are discussed in section VI. Section VII gives the conclusion and provides some implications of this research.

II. Literature Review

Economists have always been busy with figuring out the optimal way to allocate one's assets. This led to the development of the mean-variance framework, which lies at the core of contemporary investment decisions. This framework boils down to the tradeoff between return (represented by the mean) and risk (represented by the variance). When acting according to the framework an investor selects his portfolio in such a way that is on the efficient frontier, meaning that for a preset return the variance is minimized and vice versa (Markowitz and Todd (2000)).

As economics developed, lots of deviations from this framework were found. Alongside this development the world is also constantly changing, for example with a growing conscience of the environment and social aspects of society. With this growing awareness additional measures were developed, such as ESG ratings. An ESG-rating tries to measure how a company performs with respect to environmental, social, and governmental aspects. SRI (socially responsible investing) is a concept derived from this and consists of either individual investors or investment funds focusing on ESG. For the remainder, these two concepts (ESG and SRI) are used interchangeably, unless specified otherwise.

II.I ESG Preferences and Risk.

One way to focus on ESG is to invest in mutual funds focused on socially responsible investing (SRI) or ESG-performance. Carlsson Hauff and Nilsson (2022) experimentally tested investors' perception of both the financial and the sustainable performance of ESG-profiled mutual funds. The three most used strategies by mutual funds to construct their portfolios are exclusion (selection based on excluding low rated ESG-stocks), inclusion (selection based on including high rated ESG-stocks) and engagement (also named shareholder activism strategy). The authors find that investors perceive the inclusion strategy to be of higher quality, even more so when this is performed inside the mutual fund and is not outsourced to another party. However, individual investors seem to base their overall validation of the mutual fund mostly on the perceived financial performance, and not on the sustainable performance. This implies that investors would most likely focus on the financials of the assets which score high on ESG-performance.

Nonetheless Riedl & Smeets (2017) experimentally found otherwise. With a survey they found that the decision for investing in a SRI fund is mostly driven by social preferences of the individual investor. These social preferences even lead SRI investors to expect and accept lower financial returns. Bauer et al. (2021) confirm this finding with a survey amongst pension fund members, whom they asked whether they would prefer their money to be invested in sustainable funds. Most of them did not expect that the returns would be lower when investing in those funds, but the ones that did expect lower returns still preferred investing in sustainable funds, because of their social preferences.

Many other researchers have tried to explain the effect of pro-social behaviour on ESG-investing. Nilsson (2008) found that two significant reasons people invest in SRI-funds are (1) perceived consumer effectiveness, meaning that people who believe that their investment in such a fund will help in solving the issues, and (2) that pro-social attitudes concerning the addressed issues in the SRI-fund influence the decisions to invest.

The impact one can create with his investments also received more interest in more recent literature. This is called impact investing: focusing on both the profit one may achieve by investing but also adding social value, or impact. In this line Barber et al. (2021) found that investors are willing to sacrifice a part of their financial returns for the impact of their investments. These are so-called nonpecuniary benefits of investing.

Pedersen et al. (2021) investigated how ESG affects investor's preferences. These findings led to the creation of an ESG-efficient frontier, where the presence of ESG-preference is added to the 'classic' mean-variance framework. In this model they included heterogeneity in the function of ESG-information. Some investors may use ESG-information as a source for making a well-considered investment choice, whereas others use it to form ESG-preferences. This first use implies that more information is included by looking it a stock's ESG information which may give a more complete picture (see e.g. Cornell (2021) and Giese et al. (2019)). They test their theory for an ESG-efficient frontier by using proxies for each of the ESG-criteria. The carbon intensity (the amount of carbon dioxide a company produces) is used as a indicator for E performance, the sin stock indicator is used as a measure for S. As a proxy for G they used the aggressiveness of the company's accounting choices. From this they created a new model combining the trade-off between risk, returns and ESG and are among the first to do so. From this they also created an adjusted CAPM model, controlling for ESG.

Bonnefon et al. (2022) divides the previously discussed two ESG incorporation methods into value-alignment (Pedersen et al. (2021)) and impact-seeking investing (Barber et al. (2021)). In this paper they try to elicit which of these two views forms investor's preferences. They experimentally tested this by presenting subjects with a list of companies differentiating in the amount of money they donate to charity, from which subjects could decide how much they are willing to pay for each asset. They conclude that the ESG preferences do not align with impact seekingness, but with value alignment.

Duchêne et al. (2022) conducted an experiment around ESG-preferences in an investment environment. In this experiment subjects had to elicit their investment preferences when confronted with assets differing on expected return, risk, and environmental impact. They found that investors are willing to accept lower returns for a higher environmental impact. However, they do not take on higher risk for a higher environmental impact.

According to the previously mentioned literature investors mainly select SRI funds based on their social preferences and are willing to accept lower returns, but not higher risk. One may ask if these concerns are necessary based on the performance of SRI funds in the market. Ferriani and Natoli (2021) found that the stocks with low ESG risk performed better during the Covid-19 crisis. This same effect was already found by Nofsinger and Varma (2014) who analyzed SRI fund outperformance during crisis periods. They found that during normal (non-crisis) times conventional funds realize higher returns. However, in periods of crisis the SRI funds outperform the conventional funds. This opposite movement is even stimulated more when the fund manager uses positive screening. This asymmetric return may be another reason for investors to engage themselves in SRI funds. However, Bansal et al. (2021) found the exact opposite, they namely found that SRI funds outperform the conventional in good economic times, and underperform in bad economic times

such as a recession. Friede et al. (2015) find, based on 2200 individual studies, that ESG-investing pays off.

H1: The willingness to take risks does not increase green preferences.

II.II. Measuring ESG-preferences.

An overall measurement for an investor's ESG-preference is hard to find as ESG includes many different aspects. It of course consists out of three different domains, environmental, social and governmental, which each can be divided into several components. This is why researchers often tend to find proxies in one of the first two domains and tend to explain the overall preference with this proxy. This is often not done with governmental aspects as these are even more difficult to proxy.

Rossi et al. (2019) try to find preference for SRI products within Dutch households. To elicit this preference they asked subjects to state whether they own any SRI-products and next to this ask them several questions about hypothetical choices for SRI-products, they find that the subjects do not need a little nudge to invest in SRI-products, but are prepared to pay a price for these products. The stated ownership of green products will also be used as a measure of green preference in this thesis.

This measure is also used as a dependent variable by Riedl and Smeets (2017), whose research is already described shortly earlier in this section. Next to this they also use the percentage of funds invested in SRI-funds as a dependent variable. This is calculated by dividing the holdings in SRI equity by the total holding in equity. Such a portion of funds invested in an asset will also be used in this thesis.

Next to our main hypothesis, we will also research the effect of some demographic variables on green preferences. These variables are gender, age, education level and the income level. It is often found that females are more risk-averse and display more pro-social behaviour. This leads them to invest a larger portion of their funds in SRI products, as found by Nilsson (2008). Bauer et al. (2021) also found that women have stronger ESG preferences.

H2: Females have stronger green preferences.

Riedl and Smeets (2017) found that people of younger age are more likely to hold SRI funds. This sound logical, as young people are often more interested in creating a more sustainable economy. Next to this Bauer et al (2021) also find that younger people have stronger ESG-preferences. However, Rossi et al. (2019) display that the holder of a SRI-fund is in general quite old. This might have to do with the fact that older people have more funds available to use for investing purposes, though it is still expected that ESG-preferences, and thus also green preferences, are stronger amongst young people.

H3: People of young age have stronger green preferences.

Highly educated people tend to invest more in SRI funds, because they have a greater awareness for the topology. Riedl and Smeets (2017) there is an increased chance of holding a SRI fund when the investor holds a university degree. This same effect is found by Rossi et al. (2019).

H4: Highly educated investors have stronger green preferences.

Bauer et al. (2021) found that investors with a higher income are less drawn to opt for incorporating four SDG's in the strategy, which signals that investors with a higher income have weaker ESG-preferences, and thus green preferences.

H5: Investors with a higher income have weaker green preferences.

II.III. Risk preferences

Risk preferences lay at the foundations of financial economics. Financial decision making is mainly about the trade-off of risks and returns. This forms the reason why researchers have come up with a lot of different methods to measure individual risk preferences. Charness et al. (2013) provide a non-exhaustive overview of some of these different methods. The most of those methods experimentally try to find investors' risk preferences by letting them choose between some sort of risky asset and a risk-free asset with for example the method by Holt and Laury (2002). In this experiment a choice between two gambles is presented, one in which to payoff does not differ that much (e.g. $2 and $1.60) and a gamble with a bigger difference (e.g. $3.85 and $0.10). This choice is presented ten times, but with different probability for each of the payoffs in the pairs. Another well-known method is the Balloon Analogue Risk Task (BART) in which subjects can pump more air into the balloon for a higher payoff until it pops, then the subjects receives zero.

Another method to find out investors' risk preferences is to simply ask for their risk preferences. This may be done by the following question: Are you generally a person who is willing to take risks or do you try to avoid taking risks? This answer can be answered by giving a score from 0 to 10, in which 0 means 'not at all willing to take risks' and 10 means 'very willing to take risks'. This question seems simple at a first glance compared to the experimental methods described above.

The validity of this question is proven by Dohmen et al. (2011). They did this by comparing this question to an experiment in which subjects to choose between a safe option and a lottery. In this experiment the safe options kept increasing, until the subject reached a switching point from the lottery to the safe option. From this switching point the level of risk-averseness could be deducted after which this was regressed on the earlier mentioned survey-question. They found that the general risk attitude question is a good predictor for the actual behavior in the lottery. Next to this they also found that females are for example more risk averse, as are older people compared to younger people. Lastly, they found that the general question seems to give a good interpretation of people's risk preferences across different domains.

Lastly, Pedroni et al. (2017) researched consistency between different risk measures. In the ideal situation one would reply to all risk measures in the same manner. However, people tend to be inconsistent in these answers and switch between different sets of questions or experimental methods. They, thus, concluded that to get a more accurate measure for general risk preferences one should combine different risk measures. Even more so when you use different self-reported risk preferences, a combination of these will result in a quite accurate measure for risk preferences.

In this thesis a combination of six survey question will be used, with this combining the findings by Dohmen et al. (2011) and Pedroni et al. (2017) to get to a reliable risk measure. The next section explains more about this variable and the other variables used in this thesis, which is followed by a section presenting some summary statistics.

III. Methodology

To test the relation between ESG preferences and risk preferences I am going to make use of the DNB Household Survey yearly distributed by Centerdata since 1993. In this survey a panel of 1500 households is asked for their income and expenditures behaviour. This survey consists of six main question sets: General Information on the Household; Household and Work; Accommodation and Mortgages; Health and Income; Assets and Liabilities and lastly, Economic and Psychological Concepts. This data is going to be analyzed using R Studio.

From this large dataset the questions of interest to answering the research question are going to be used. The questions are selected based on their suitability for investigating this relationship. As a start the most important sociodemographic variables are taken from the survey, including gender, age, educational level, number of children, financial knowledge and gross income.

In the survey there are different questions about the investment behaviour into different kinds of assets of the questioned subjects. From this list of assets the investments in mutual funds and the investment in savings and/or deposit accounts are considered in this thesis. These two are chosen, because the parts of these investments for green causes are also questioned in the survey and thus known. Next to this a mutual fund can be seen as a risky investment, whereas putting your money aside in a savings account can be considered risk-free.[1]

In this section these variables are introduced, as are the methods used to analyze these variables. In the next section, the summary statistics will be presented.

Green preferences.

The fact that the subjects are also asked to state whether they invest for green causes, creates the option to determine their green preferences.[2] The first way to do this is looking at the variable if the subject invested in green investments. These variables are named GREENINV1 and GREENSAV1. If the subjects answered ‘yes’ to this question this implies that he/she has some preference for investments which strive towards a green goal. The two variables with regard to mutual fund investments and savings account are analyzed separately, because of the difference between the two different investments. One is a risk bearing investment, whereas the other can be seen as risk free.

The fact that a respondent answered yes to this question implies that next to deciding to invest his funds in either a risk free or risky asset, the respondent also thought about the goal where to these funds should go, e.g., green causes. The fact that he chose for this already says a lot about his preferences regarding green causes. Too many observations were included in GREENINV1 and GREENSAV1 in DHS dataset. To get reliable results this had to be corrected for, which led to the corrected coefficients for these two, named GRINV for GREENINV1 and GRSAV for GREENSAV1. The manner in which this is corrected can be found in Appendix C.

[1] When referring the data or variables, this is all based on the codebooks belonging to each year of the DHS survey. These can be downloaded freely on the internet: dhsdata.nl.

[2] This is the information given to respondents about the definition of green investments: ‘Green investments are investments in funds that participate in projects for environmental protection. Such investments are subject to a special exemption on the capital gains tax. In addition, green investments give entitlement to an additional tax rebate.’

Next to this a ratio can be calculated from the stated size of the investments in either a green mutual fund or savings account. This ratio would then state the investor's actual preference for green investments over 'traditional' investments. To do this the variables GREENINV3/GREENSAV3 and GREENINV2/GREENSAV2 are used. The last mentioned question in 2022 was: 'How much was the total value of your green investments/savings or deposit accounts on 31st December 2021?'. If subjects were unable to answer this question they could state the size in preset categories. These two variables were then merged together.[3]

A separate ratio is calculated for both investments in mutual funds and for investments in savings account. The one for mutual funds is named MFPREF and for savings accounts SAVPREF. To do this the following formula is used:

$$MFPREF_{i,t} = \frac{GREENINV_{i,t}}{MFINV_{i,t}} \qquad (1)$$

$$SAVPREF_{i,t} = \frac{GREENSAV_{i,t}}{TOTSAV_{i,t}} \qquad (2)$$

The ratio per category of investments is used, because otherwise the image will get troubled by the size of the total of assets. The ratios following from formula 1 and 2 will thus represent the portion of the respective asset invested for green causes. 1 will thus mean the whole investment in that asset is used for green causes and 0 nothing at all.

Risk preferences.

Lastly a measure for risk preferences has to be found in the DHS data. As concluded from the paper by Dohmen et al. (2011), asking people to rate their risk preference from 1 to 10 is a very good indicator for their risk preferences. Such a variable is included in the DHS (PREF2).[4] This question asks for how willing you are to take risks in general. Next to this there is also a set of six questions (S1 – S6) asking more specific into people's willingness to take risks regarding their investing behaviour. These questions present different statements to which respondents can reply on a 7-point Likert scale, in which 1 means totally disagree and 7 totally agree. The statements can be found in table 1.

According to Pedroni et al. (2017) one should combine these answers into one variable to get a better measure for the subject's risk preferences. The value given does not always correspond to the same risk preference as can been derived from table 1. To still be able to create an overall risk measure, the first three questions will be recoded in such a way that 1 will present the most risk averse score. After doing this, all six questions will have an equal risk level for the corresponding value. The six different risk measures can then be combined into one risk measure. To create this overall measure for risk preferences the following formula is used:

$$R_{i,t} = \frac{S1_{i,t} + S2_{i,t} + S4_{i,t} + S3_{i,t} + S5_{i,t} + S6_{i,t}}{6} \qquad (3)$$

[3] To merge these two the method suggested by the DHS is used, which is to take the middle value of the range and use that value to merge with GROENBEL2/GROENSPA2, which is used when available.

[4] Question is only included from 2021 on.

Table 1: Risk elicitation questions.

The given introduction in the DHS is: The following statements concern saving and taking risks.
Please indicate for each statement to what extent you agree or disagree.
Please indicate on a scale from 1 to 7 to what extent you agree with the statement.
1 means 'totally disagree'.
7 means 'totally agree'.

$S1_{i,t}$	I think it is more important to have safe investments and guaranteed returns, than to take a risk to have a chance to get the highest possible returns.	7 is risk-averse
$S2_{i,t}$	I do not invest in shares, because I find this too risky.	7 is risk-averse
$S3_{i,t}$	I want to be certain that my investments are safe.	7 is risk-averse
$S4_{i,t}$	If I think an investment will be profitable, I am prepared to borrow money to make this investment.	1 is risk-averse
$S5_{i,t}$	If I want to improve my financial position, I should take financial risks.	1 is risk-averse
$S6_{i,t}$	I am prepared to take the risk to lose money, when there is also a chance to gain money.	1 is risk-averse

Using formula (1) a person who gave the most risk-averse answers to all the statements will get a score of 6, whereas the most risk seeking individuals would get a score of 42. By dividing this score by the total number of questions taken into account the score will be brought back to the 7-point Likert scale, converting it into a more suitable variable for interpretation. The score 1 will thus be the most risk-averse, whereas 7 is the most risk-seeking.

Regressions

The data will be analyzed using a set of different regression analyses. The first set of regressions will be run with the question whether a subject invested in green assets (GRINV and GRSAV) as the dependent variable. The second set will be run with the portion of funds invested in the green variant (MFPREF and SAVPREF) This will be done using an OLS regression. A logistic regression will be run as well as the dependent variable in this regression is binary, but these will be placed in Appendix B. This leads to the following regression formulas:

$$Y_{i,t} = \beta_0 + \beta_1 R_{i,t} + \varepsilon_{i,t} \quad (4)$$

$$Y_{i,t} = \beta_0 + \beta_1 R_{i,t} + +\beta_7 year_t + \varepsilon_{i,t} \quad (5)$$

$$Y_{i,t} = \beta_0 + \beta_1 R_{i,t} + \beta_2 gender_i + \beta_3 age_{i,t} + \beta_4 income_{i,t} + \beta_5 educmed_{i,t} + \beta_6 EducHigh_{i,t} + \varepsilon_{i,t} \quad (6)$$

$$Y_{i,t} = \beta_0 + \beta_1 R_{i,t} + \beta_2 gender_i + \beta_3 age_{i,t} + \beta_4 income_{i,t} + \beta_5 educmed_{i,t} + \beta_6 educhigh_{i,t} + \beta_7 year_t + \varepsilon_{i,t} \quad (7)$$

These four regressions will be performed on the four main variables of interest. Firstly, these variables will be regressed on GRINV and GRSAV and after that on MFPREF and SAVPREF. These four different dependent variables are placed in the position of $Y_{i,t}$, giving a total of sixteen regressions. Formula 4 presents a regression with only the risk measure ($R_{i,t}$) as an independent variable. In formula 5 dummies for the different analyzed years are added, with 2017 as a reference year. In formula 6 the control variables have been added, and in formula 7 the previously described years are added to that regression as well. To correct for clustering on an individual level, clustered standard errors on an individual level are used in each of the regressions.

The results of these previously described regressions are shown in section V. Firstly, the summary statistics are presented in section IV, also including the filters placed on the data to run each of the described regressions in formulas 4 through 7.

IV. Data

In this section summary statistics of the variables of interest can be found. The results presented here are compiled for the whole dataset, which combines the years from 2017 to 2022. It is important to keep in mind that this also means that includes double observations (=N) from year to year per individual. However, when analyzing the data this is corrected for by clustering the standard errors on an individual level. The total panel includes 30,445 observations.

In this section some summary statistics of the DHS dataset can be found. In total there are 5077 respondents (N=5077) in 2022. In table 2 the sociodemographic statistics of the respondents in 2022 are presented.

Table 2: Sociodemographic statistics in 2022

Gender equals 1 if the respondent is female. The three education levels are dummies ordered by the ordering used by CBS (=Dutch Statistics Bureau). When financial knowledge is low respondents answered 1 and when high 4. Gross income is upon a yearly basis before taxes and other costs, such as social insurances. The presented values in this table are based on the findings from the DHS survey in 2022

	Mean	St. Dev.	Min.	Max.	N
Gender	0.51	0.49	0.00	1.00	5077
Age	45.34	22.92	0.00	97.00	5077
Educ. Level: High Educ	0.30	0.46	0.00	1.00	1538
Educ. Level: Medium Educ	0.30	0.46	0.00	1.00	1493
Educ. Level: Low Educ	0.40	0.49	0.00	1.00	2044
Children in household	1.03	1.19	0.00	6.00	5077
Fin. knowledge	2.29	0.76	1.00	4.00	2717
Gross yearly income (€)	33,260.65	28,648.66	0.00	229,246.00	1971

The DSH tries to assemble a panel representative for the Dutch population, which is quite well done looking at the statistics. Around half of the respondents are female, all ages are represented. Financial knowledge (measured on a scale from 1 to 4) is in the middle of the possible answers, and the mean gross yearly income is quite on average for the Dutch population.

Educational levels are divided based on the division provided by the Dutch Statistics Bureau (CBS). In this division a university degree and a HBO (higher vocational studies) degree are highly educated individuals. The middle level consists of people with a MBO (secondary vocational education) degree, or a high school diploma of a HAVO (higher general continued education) or VWO (pre-university education) level. The rest of the degrees/diplomas are placed in the low education level. The distribution between these categories is almost equal.

Table 3 presents some descriptive data statistics of variables of importance to this thesis. To present this data some filters a put in place already. These filters leave

out not available (NA) answers, because subjects simply did not answer these questions. When analyzing GRINV and MFPREF the data is filtered on subjects who answered question GRINV, ones who did not answer that question are left out of the analysis.[5] When analyzing GRSAV and SAVPREF this filter is based on answering GRSAV. The number of not available answers can be found be substracting the number of observations of that variable from the total of 30,445 observations in the dataset. For the variables MFPREF and SAVPREF more observations disappear, because for people without green investments (GRINV or GRSAV is 0) the ratio from formulas 2 and 3 cannot be calculated. The filters are also put in place for analyzing purposes, to prevent too much noise entering the dataset.

Table 3: Descriptive data statistics

All information provided in this table is derived from the whole panel dataset (all 6 years). Mutual fund owners (BZ12) equals 1 if the respondent is an owner of a mutual fund. GREENINV1 and GRINV equal 1 when the respondent is an owner of a green mutual fund. Savings account owner (BZ03) equals 1 if the respondent owns a savings account. GREENSAV 1 and GRSAV equal 1 if the respondent owns a green savings account. MF value, GRINV value, SA value and GS value are presented in absolute numbers of the given value.

	Mean	St. Dev.	Min.	Max.	N
Mutual fund owners (1=yes)	0.126	0.316	0.000	1.000	15,231
MF value	5,409.260	36,647.200	0.000	1,039,500.0	15,231
GREENINV1 (1=yes)	0.063	0.242	0.000	1.000	5,763
GRINV[6]	0.205	0.404	0.000	1.000	1,761
GRINV value	24,855.000	91,106.800	0.000	1,500,000.0	294
MFPREF	1.184	8.455	0.000	136.364	260
MFPREF (filter)	0.416	0.340	0.000	1.000	223
Savings account owner (1=yes)	0.774	0.418	0.000	1.000	15,231
SA value	22,556.900	60,027.700	0.000	3,100,000.0	15,231
GREENSAV1 (1=yes)	0.039	0.193	0.000	1.000	13,542
GRSAV[6]	0.045	0.206	0.000	1.000	11,816
GS value	17,621.700	25,635.600	0.000	175,000.0	474
SAVPREF	7.203	62.935	0.000	1,000.000	446
SAVPREF (filter)	0.426	0.370	0.000	1.000	374

Table 3 presents summary statistics for the measures of green preferences for the six analyzed years combined. This total data set consists of 1,715 mutual fund owners, of which 363 are green mutual fund owners. This boils down to a yearly

[5] According to the codebooks belonging to the DHS.
[6] See appendix C for the manner in which this variable is created.

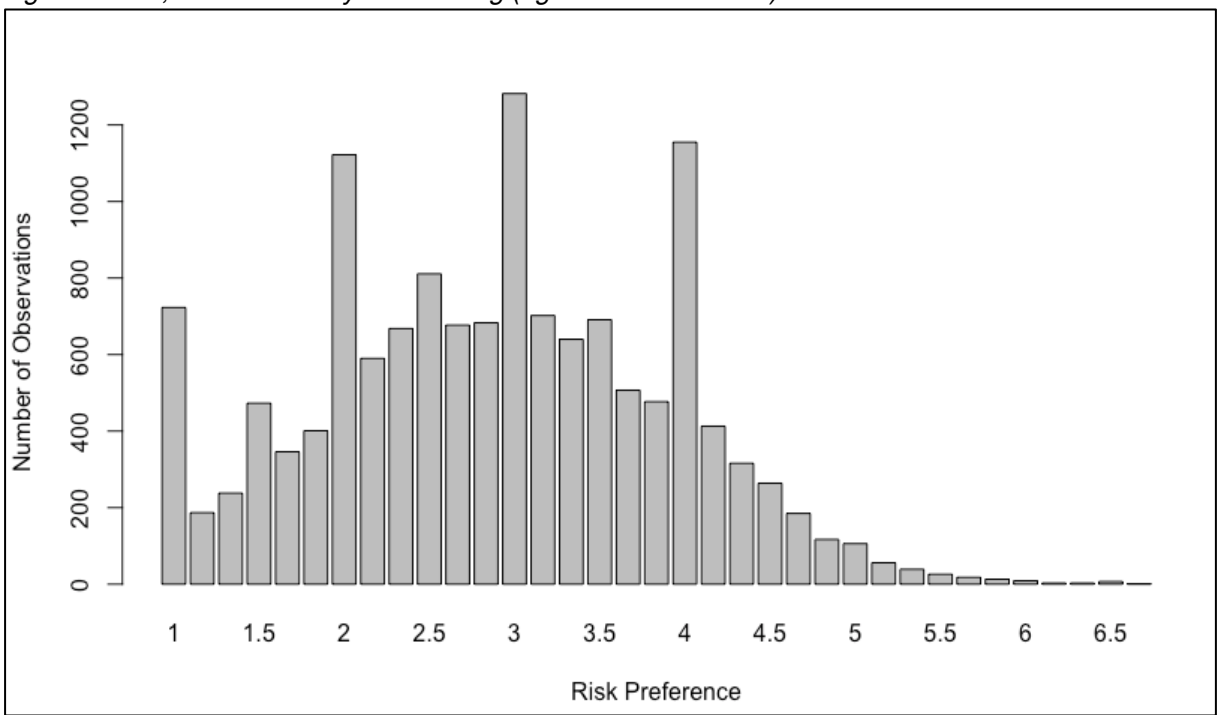
average of 286 mutual fund owners and 60 green mutual fund owners per year. Over the six years there are 11,789 savings account holders, of which 528 have green savings accounts. On a yearly average this is 1,965 savings account holders and 88 green savings account holders.[7]

In table 3 can be seen that the maximum values of MFPREF and SAVPREF exceed 1.00. This should not be possible as the maximum value of your green mutual funds (or green savings accounts) cannot be larger as the total value of your green mutual funds. These thus have to be filtered out of the data to be able to analyse those variables. These are the variables presented as MFPREF (filter) and SAVPREF (filter). As can be seen 37 observations are filtered out for MFPREF and 72 for SAVPREF.

Figure 1 shows the distribution of values for the used risk measurement combined for all six years. What can be seen is that score 3 has the highest count on a scale from 1 to seven. This means that most subjects are moderately risk-averse. Next to this can be seen that the density of the graph lies at the lowest scores, which means that most of the subjects are risk averse. Lastly, it seems that subjects anchor their values to a whole value, as there are clear spikes visible for the round numbers.

Figure 1: Risk measure

Graph of the number of observations for each score on the risk measurement variable ($R_{i,t}$). When an individual scores 1, he is extremely risk averse (left side of the chart). When an individual scores 7, the highest score, he is extremely risk seeking (right side of the chart).



In the next section the results will be presented based on the previously introduced variables and the regressions composed in the previous section.

[7] These values are provided by R.

V. Results

In this section the results from the proposed regressions in section III are presented. In some cases results are in Appendix B, because they are not in depth discussed in this section. In those cases this will be pointed out.

V.I. GRINV and GRSAV Regression analyses.

As pointed out in section III the main variable of interest is a binary variable (GRINV and GRSAV). The methods used to analyze these variables are several Ordinary Least Squares (OLS) regressions, because they are much more suited for clear and understandable interpretation. When the dependent variable is binary one possible correct method to analyze this data is a logistic regression, but to interpret these results one should work with marginal effects or odds ratios. However, when the signs of the coefficients (negative or positive) and the according significance are comparable it is possible to interpret the OLS regression instead of the logistic regression, as concluded by Pohlman and Leitner (2003). Our results can be interpreted with an OLS regression because we are looking to classify the coefficient's effect on the dependent variable.

When comparing the logistic regressions to the OLS regressions presented hereafter, one notices that the signs of the coefficients and the significance are comparable. The OLS regressions will thus be presented in this section. The logistic regressions can be found in appendix B.

Prior to presenting and discussing the analyses on GRINV and GRSAV, a glance will be thrown at the traditional reason for investing in mutual funds, which lies in line with the mean-variance framework. You either want to hedge your risk or you are looking for getting a return on your money. It is expected that as risk appetite increases, investors are more eager to invest in mutual funds and less in their savings accounts. A risk-averse individual of course is more drawn toward putting his funds in a savings account. To test whether this relation can be found within the used data a regression of BZ12 (do you invest in mutual funds?) and BZ03 (do you have one or more savings accounts?) on risk can be seen in table 4.

The effect of risk on BZ12 is significant and positive. When the level of risk preferences increases by 1, the chance gets 8 percentage point larger that you will invest in a mutual fund. This is in line with the classic finance literature saying that as your risk preferences becomes higher (are more risk loving) you want to invest in more risky assets, like a mutual fund. This is also found for BZ03, which has a negative significant relation with risk. This means that as your risk appetite increases chances become smaller of you holding a savings account. As this can be seen as a risk-free asset, you will want to invest less of your funds in this when you become more risk loving. The opposite is also true you want to hold more of your assets in a savings account when you are risk-averse.

Table 5 gives the results for the regressions given in formulas 4,5,6 and 7 for GRINV. The variable risk-seeking ($R_{i,t}$) is the main independent variable of interest in this thesis. It is composed as described in formula 3, which means that the higher $R_{i,t}$ becomes the more risk-seeking or risk-loving the investor is. If it has value one the respondent is extremely risk averse.

Table 4: OLS Regressions on BZ12 and BZ03

*All six regressions are OLS regressions. These regressions have been run on BZ12 (= whether a subject invested in mutual funds (1=yes and 0=no)), and BZ03 (=whether a subject holds a saving account (1=yes and 0=no)). To prevent clustering on an individual level, standard errors clustered on personal id's are presented. These standard errors can be found in the parentheses. The demographic variables and the years are the same as mentioned in table 5, but are in these regressions just used as a control variable. Note: *p<0.1; **p<0.05; ***p<0.01.*

	BZ12 (1)	BZ12 (2)	BZ12 (3)	BZ03 (1)	BZ03 (2)	BZ03 (3)
	Beta (β)	Beta (β)	Beta (β)	Beta (β)	Beta (β)	Beta (β)
Risk-Seeking	0.080*** (0.005)	0.084*** (0.006)	0.084*** (0.006)	-0.018*** (0.006)	-0.029*** (0.006)	-0.029*** (0.006)
Demographic variables	NO	YES	YES	NO	YES	YES
Years	NO	NO	YES	NO	NO	YES
R2	0.062	0.128	0.128	0.002	0.038	0.038
F-statistic	810.300 (0.000)	241.600 0.000)	131.800 (0.000)	25.860 (0.000)	65.650 (0.000)	35.94 (0.000)
N	12299	9903	9903	12299	9903	9903

The effect of risk preferences on GRINV is negative in the first regression and positive in the two regressions in which control variables have been added. In regression 1 this would mean that as risk preferences increase by one the chance that GRINV is one would decrease by 0.4 percentage point. For regression 2 and 3 the chances would increase by 0.6 and 0.5 respectively. However, all these results are insignificant. This means that a relation cannot be deduced from the data analyzed in this regression.

The dataset used in this case is filtered on GRINV, the variable created as described in appendix C, which leaves out a lot respondents who do not own mutual fund investments and/or green investments. In the case where these observations were still included these three variables were highly significant and pointed in the positive direction. This regression can be found in appendix B (table B3). This can be due to the fact that there are more observations included in that analysis.

Next to this no significant effects have been found on the effect of age and gender on the fact whether the investor holds green mutual funds. There is however a significant effect of having a high education. When an investor has a high education the probability that he will hold green mutual funds increases by 10 percentage points. This thus means that higher educated individuals are more drawn to investing in green mutual funds. This is in line with the findings of Riedl and Smeets (2017) and Rossi et al. (2019). Next to this gross income has a negative significant effect of 0.1 percentage point on GRINV. This means that as income increase by a thousand euros the chance that the investor holds green mutual funds decreases by 0.1 percent, in line with the results of Bauer et al. (2021).

A closer look will now be taken at the regressions on GRSAV. Risk preference has a positive effect on GRSAV in all four regressions, from 0.2 in the first regression to 0.3 in the other two. This means that as an investors is more willing to take on risks, the probability increases that he will put his money in a green savings account. However, these results are insignificant, so no relation can be derived from this.

A significant positive effect of age on GRSAV is found. This means that as people get one year older the chance of them saving their money in a green savings account increases by 0.01 percentage point, in line with Riedl and Smeets (2017) and Bauer et al (2021), but contrasting Rossi et al. (2019). Next to this a really small significant negative effect of an increase in income is found on the probability of saving in a green savings account, in line with Bauer et al (2021). Lastly a significant positive effect of high education on GRSAV is found. This means that higher educated people are 3.5 percentage point more likely to save in a green savings account, also in line with Riedl and Smeets (2017) and Rossi et al. (2019). No significant effects of adding the analyzed years to the regression are found.

Lastly, in the first and second regression of table 5 and 6 the F-tests are insignificant, which means that the presented values cannot be given any meaning. The third and fourth regression, including the control variables, do have a significant F-test, which means that the model fits better with the included variables than without, although the R-squared of the models is quite low.

No significant effects of risk on GRINV and GRSAV have been found in the regressions displayed in table 5, which might be due to the filters placed on the dataset. Only the observations conditional on having either a mutual fund or a savings account are displayed. This means that only if you have a mutual fund account, your answer to GREENINV1 is considered. The fact that others who do not own a mutual fund account, also do not hold a green mutual fund is not taken into account.

There are several reasons for this. First of all, this is not meant to happen according to the codebooks belonging to the DHS. When this would be the case the data would be biased towards not having green mutual funds. There would then of course be much more participants who do not own a green mutual fund compared to those who do.

The second reason is of even greater importance for the analysis done in this thesis. As we are trying to see if there is an effect of risk preferences on green preferences, we should isolate these effects as much as possible. The composition of the risk measure has been described in section III. For eliciting the green preferences, one should take several things into account. Firstly, subjects are asked whether they invest in green mutual funds. This thus consists of two parts, the green part and the mutual fund part. We want to investigate the relation between the green part and risk and not the relation with the mutual fund part.

When you do not invest in mutual funds you also cannot invest in green mutual funds. The subjects not investing in mutual funds are not of interest to our research, we only want to look at the respondents already investing in mutual funds. The relation between risk appetite and investing in a mutual fund or savings account can be seen in table 4, as discussed earlier.

In the analysis shown in table 5 there are thus only subjects included already investing in mutual funds. For this reason, the relation described in table 4 is for a large part not taken into account, as every subject in the analysis already holds mutual funds. This leads to the fact that the subjects owning green mutual funds do this out of some sort of green or social preferences and not purely out of hedging their risks or finding higher returns.

Table 5: OLS Regressions on GRINV

*All four regressions are OLS regressions, as specified earlier. To prevent clustering on an individual level, standard errors clustered on personal id's are presented. These standard errors can be found in the parentheses. Note: *p<0.1; **p<0.05; ***p<0.01.*

	GRINV (1)	GRINV (2)	GRINV (3)	GRINV (4)
	Beta (β)	Beta (β)	Beta (β)	Beta (β)
Risk-seeking	-0.004 (0.014)	-0.005 (0.014)	0.006 (0.016)	0.005 (0.016)
Gender			0.046 (0.042)	0.046 (0.042)
Age			0.000 (0.001)	0.000 (0.001)
Education (ref: low)				
Medium			0.007 (0.052)	0.006 (0.052)
High			0.101** (0.047)	0.102** (0.047)
Gross income (x10,000)			-0.009** (0.004)	-0.009** (0.004)
Year (ref:2017)				
2018		-0.011 (0.027)		-0.040 (0.027)
2019		-0.043 (0.029)		-0.064** (0.031)
2020		-0.022 (0.030)		-0.030 (0.032)
2021		-0.004 (0.032)		-0.015 (0.034)
2022		0.007 (0.033)		-0.012 (0.034)
Constant	0.219*** (0.055)	0.233*** (0.0560	0.077 (0.145)	0.104 (0.144)
R2	0.000	0.002	0.018	0.021
F-statistic	0.158 (0.691)	0.4743 (0.828)	4.238 (0.000)	2.656 (0.002)
N	1561	1561	1373	1373

Table 6: OLS Regressions on GRSAV

*All four regressions are OLS regressions, as specified earlier. To prevent clustering on an individual level, standard errors clustered on personal id's are presented. These standard errors can be found in the parentheses. Note: *p<0.1; **p<0.05; ***p<0.01.*

	GRSAV (1)	GRSAV (2)	GRSAV (3)	GRSAV (4)
	Beta (β)	Beta (β)	Beta (β)	Beta (β)
Risk-seeking	0.002 (0.003)	0.002 (0.003)	0.003 (0.003)	0.003 (0.003)
Gender			0.011 (0.008)	0.011 (0.008)
Age			0.001** (0.000)	0.001** (0.000)
Education (ref: low)				
Medium			0.003 (0.009)	0.003 (0.009)
High			0.035*** (0.010)	0.035*** (0.010)
Gross income (x10,000)			-0.003** (0.001)	-0.003** (0.001)
Year (ref:2017)				
2018		0.003 (0.006)		-0.002 (0.006)
2019		0.005 (0.006)		0.000 (0.007)
2020		-0.007 (0.006)		-0.008 (0.007)
2021		-0.001 (0.007)		-0.001 (0.007)
2022		0.000 (0.006)		-0.001 (0.007)
Constant	0.039*** (0.009)	0.039*** (0.010)	-0.018 (0.024)	-0.016 (0.024)
R2	0.000	0.000	0.008	0.008
F-statistic	0.7431 (0.389)	0.669 (0.675)	10.260 (0.000)	5.743 (0.000)
N	9882	9882	8109	8109

V.II. MFPREF and SAVPREF Regression analyses.

Secondly, we will look into the relation between risk and the portion of funds invested in the green variant. This portion is calculated according to the formulated ratios in formulas 1 and 2. The dependent variables used in the regressions are MFPREF and SAVPREF filtered on values larger than 1, as explained in the previous section used in the regression formulas presented in formula 4,5,6 and 7. These analyses give some insight into the relation between the relative size of the investment compared to the investors' risk preference. The results from these analyses can be found in table 7 and 8.

In all four regressions on MFPREF, risk ($R_{i,t}$) is negative and strongly significant. In regression 1 the effect of an increase of 1 in risk appetite, meaning that the investor becomes more risk seeking, has an effect of -7.5 percentage point. In regression 2 and 3 this effect is -12 percentage point. This implies that a more risk loving/seeking investor invests less of his funds in green mutual funds. The portion of funds invested is thus larger in 'conventional' mutual funds. The opposite is then also true. A more risk averse individual invests a bigger portion of his investments in mutual funds in green mutual funds. This contrasts with the findings by Riedl and Smeets (2017), who found as a side effect a small positive effect of risk appetite on the percentage of funds invested in SRI funds.

The age of the investor has a significant effect on MFPREF. As an investor gets older the portion of funds invested in green mutual funds decreases by 0.8 percentage point, which is in line with Riedl and Smeets (2017) and Bauer et al. (2022). The other control variables gender, education and income all have a negative effect on the portion of funds invested in green mutual funds. However, these three variables have insignificant effects. Next to this, adding dummies of the analyzed years to the regression did not have a significant effect. The F-tests for the models are significant except for model 2 in table 7. Next to this, the R-squared statistics of models 3 and 4 are comparable to the ones presented in Riedl and Smeets (2017).

In the regressions on SAVPREF a negative relation with risk preference is found. This is only significant in the first regression and not in the other two in which control variables have been added. In regression 1 risk appetite has an effect of 6 percentage point on SAVPREF, as risk appetite increases. This means that as the subjects' risk appetite grows larger the invest a smaller part of their funds invested in savings accounts in green savings accounts. When they are more risk-averse they thus invest a large portion of their funds in savings accounts in green savings accounts. The F-statistics for the models on SAVPREF are all significant, still the R-squared statistics are quite low.

The effect of gross income on SAVPREF is negative and significant. This means that as your income increases the portion of funds invested in green savings accounts decreases, in line with the findings by Bauer et al. (2021). The effects of the other demographic control variables are insignificant. The control of adding the analyzed years to the regression does not have a significant effect on SAVPREF.

Lastly, we will compare these found results with the proposed hypotheses.

Hypothesis 1 stated the following: the willingness to take risks does not increase green preferences. In the regressions presented in table 5 we did not find a relation between risk appetite and green preferences. In the regressions in table 6 we

found that as risk appetite increases investors hold a smaller portion of their invested funds in a certain asset in the green variant of that fund. These results thus confirm hypothesis 1.

We found no proof for hypothesis 2: females have stronger green preferences, because all these results are insignificant.

We did not find conclusive proof for hypothesis 3: people of young age have stronger green preferences. In the regressions on GREENSAV we found a positive effect, however in the regressions on MFPREF we found a negative effect. This means that we can neither refute nor confirm this hypothesis.

We found a positive significant effect for hypothesis 4: highly educated investors have stronger green preferences in the regressions on GRINV and GRSAV. This means that we can confirm this hypothesis, because highly educated investors are more likely to invest in green funds.

We found proof for hypothesis 5: Investors with a higher income have weaker green preferences. In the regressions on GRINV, GRSAV and SAVPREF we found a significant negative effect. We could confirm hypothesis 5, however the effects were quite small.

Table 7: OLS Regressions on MFPREF

*All four regressions are OLS regressions, as specified earlier. To prevent clustering on an individual level, standard errors clustered on personal id's are presented. These standard errors can be found in the parentheses. Note: *p<0.1; **p<0.05; ***p<0.01.*

	MFPREF (1)	MFPREF (2)	MFPREF (3)	MFPREF (4)
	Beta (β)	Beta (β)	Beta (β)	Beta (β)
Risk-seeking	-0.075** (0.032)	-0.072** (0.033)	-0.120*** (0.038)	-0.117*** (0.040)
Gender			-0.065 (0.042)	-0.063 (0.042)
Age			-0.008*** (0.002)	-0.008*** (0.002)
Education (ref: low)				
Medium			-0.187 (0.145)	-0.190 (0.149)
High			-0.200 (0.139)	-0.206 (0.141)
Gross income (x10,000)			-0.008 (0.010)	-0.009 (0.010)
Year (ref:2017)				
2018		0.021 (0.083)		-0.003 (0.072)
2019		0.066 (0.091)		0.052 (0.086)
2020		0.021 (0.084)		0.090 (0.080)
2021		-0.034 (0.078)		0.000 (0.079)
2022		-0.056 (0.077)		-0.009 (0.071)
Constant	0.667*** (0.123)	0.659*** (0.145)	1.621*** (0.305)	1.597*** (0.326)
R2	0.040	0.054	0.183	0.196
F-statistic	8.208 (0.005)	1.834 (0.094)	6.218 (0.000)	3.591 (0.000)
N	199	199	174	174

Table 8: OLS Regressions on SAVPREF

*All four regressions are OLS regressions, as specified earlier. To prevent clustering on an individual level, standard errors clustered on personal id's are presented. These standard errors can be found in the parentheses. Note: *p<0.1; **p<0.05; ***p<0.01.*

	SAVPREF (1)	SAVPREF (2)	SAVPREF (3)	SAVPREF (4)
	Beta (β)	Beta (β)	Beta (β)	Beta (β)
Risk-seeking	-0.060*** (0.022)	-0.058*** (0.022)	-0.044 (0.028)	-0.044 (0.028)
Gender			0.035 (0.060)	0.037 (0.060)
Age			-0.001 (0.002)	-0.001 (0.002)
Education (ref: low)				
Medium			-0.091 (0.111)	-0.096 (0.112)
High			-0.047 (0.106)	-0.050 (0.106)
Gross income (x10,000)			-0.022** (0.010)	-0.021** (0.010)
Year (ref:2017)				
2018		0.045 (0.069)		0.072 (0.075)
2019		0.050 (0.072)		0.039 (0.074)
2020		0.003 (0.070)		0.018 (0.072)
2021		-0.067 (0.069)		-0.012 (0.074)
2022		0.016 (0.084)		0.021 (0.068)
Constant	0.613*** (0.072)	0.602*** (0.084)	0.706*** (0.227)	0.684*** (0.228)
R2	0.026	0.037	0.067	0.071
F-statistic	8.875 (0.003)	2.106 (0.052)	3.322 (0.004)	1.923 (0.037)
N	337	337	286	286

VI. DISCUSSION

In the regressions on GRINV and GRSAV (table 5) the relation between risk appetite and green preferences was insignificant. Regressing risk on MFPREF and SAVPREF (table 6) we found that an increasing risk appetite leads to a smaller portion of the total of funds invested in green mutual funds or savings accounts.

ESG Measurement.
The ESG-preferences or more strictly speaking green preferences of the respondents were measured in two different ways. The first one according to the dummy question (GRINV and GRSAV), which only states whether one invests in green assets. This of course explains a part of one's green preferences, as they already invest in a certain asset and on top of this decide to invest in a green mutual fund or savings account. The second set of variables (MFPREF and SAVPREF) builds on this by determining the portion of invested funds devoted to the green assets. This explains something about the relative size of the investments in green assets. By using these four variables as the dependent variables we try to explain green investing preferences.

Duchene et al. (2022) find the green preference by providing the option to invest in a neutral, green or brown asset, which is more or less comparable to the method used in this research, but we take an empirical approach.

These green preferences are for this research however implied by investing in green assets, and are not separately investigated in an experimental way. Riedl and Smeets (2017) elicited social preferences with a trust game in which two players are endowed with 50 dollars. The first mover has to decide how much to give to the second mover, which amount is then tripled for the second mover. After that the second mover has to decide how much to send back to the first mover. The second mover has to decide how much to send back, before the received amount is known to him. In this way they try to elicit intrinsic social preferences. Riedl and Smeets (2017) also elicit the percentage of funds held in SRI-funds.

Bauer et al. (2021) combine social preferences with voting behaviour, which is accordingly a good proxy for social preferences as well as green preferences. Next to this they ask subjects whether they want 3 SDG's (social development goals) included in a pension funds investing policy, or want to increase that to 4 SDG's. Lastly, they ask subjects: 'how willing are you to give to good causes without expecting anything in return', rated on a 10-point Likert scale.

However, these methods were not available to us, because they are not included in the DHS data. When they were included, you could asses a person's general green/social/ESG preferences and include this extra information in the regression. This would reveal more information behind the reasons for investing in green assets. These reasons could be others than green preferences.

Bauer et al. (2021) listed three possible reasons for investing in green assets. A first possibility could be that people invest in green assets, because they expect them to financially outperform conventional assets. On the other side, one could choose to invest in a green asset as a hedge in his portfolio. Thirdly, the choice can be made based on your social preferences. This would lead investors to still make the investments in green assets, even though they might expect negative financial repercussions. Riedl and Smeets (2017) add to this that social signaling could also

play a role in deciding to invest in green assets. People would in this case invest in these assets, because it creates a positive social image or increases their reputation. Lastly, it could of course also be a random choice to invest in green assets.

Others who researched the relation between risk and ESG-preferences however focused on other aspects. They often focus on the perceived riskiness of an SRI/ESG-asset. They investigate the relationship between the perceived riskiness and the pro-social preferences. In this way Duchene et al. (2022) find that investors are not willing to bear increased risk.

Riedl and Smeets (2017) investigated the portion of funds invest in SRI-funds as well. They found that a more risk-seeking investor has a larger portion of funds invested in SRI-funds.

For future research, the reasons why people invest in green/ESG assets could also be added to the research. Next to this the effect of ESG assets instead of solely green assets can be looked into.

Other assets.

In this study only green investments in mutual funds and savings accounts have been analyzed. However, in the DHS subjects are also asked for their investments in bonds, shares, cryptocurrencies and options. For these assets there is no inquiry into the green motives in these assets, although a wide range of green options for these assets exists as well, especially for bonds and shares.

It would be of added value to ask for green motives in these assets as well, this would give a lot of extra information. It is however already known in which shares the respondents invested, so an ESG-rating could be rewarded to each share. However, when this is analyzed, the problem exists that you do not know the motive for investing in these assets as discussed earlier, so you cannot draw conclusion from this data.

Risk elicitation puzzle.

As discussed in section II, Pedroni et al. (2017) found that people do not reply to risk elicitation tasks in a consistent manner. They called this inconsistency ‘the risk elicitation puzzle’. This same inconsistency is found by Frey et al. (2017), who state that only half of the variance is stable. Next to this they find that a risk measure is quite stable over time.

To prevent to get an unreliable risk measure they suggest using a combination of different risk measures. In this thesis a combined measure of different self-reported risk preference measures (table 1) is used. However, experimental measures of risk, such as the BART or the Holt-Laury task are not used, because this data was not available to us. The risk measure is however used over six years of data, which makes it a stronger measure in our regression analyses.

In the main regressions presented in the previous section the general risk measure composed according to formula 3 has been used. However, this is composed out of six different questions each trying to inquire one’s risk appetite in a slightly different way. To test the robustness of this measure, a regression of the six components separately on the four main variables of interest can be found in table 9.

Table 9: OLS Regressions with S1 – S6

*All four regressions are OLS regressions. The main dependent variables. Instead of using the weighted risk measure as formulated in formula 3, the independent components of this measure have been used. The questions belonging to the independent variables can be found in table 1***. To prevent clustering on an individual level, standard errors clustered on personal id's are presented. These standard errors can be found in the parentheses. The demographic variables and the years are the same as mentioned in table 4***, but are in these regressions just used as a control variable. Note: *p<0.1; **p<0.05; ***p<0.01.*

	GRINV (1)	MFPREF (2)	GRSAV (3)	SAVPREF (1)
	Beta (β)	Beta (β)	Beta (β)	Beta (β)
$S1_{i,t}$	-0.017 (0.012)	0.017 (0.024)	0.001 (0.001)	-0.024 (0.019)
$S2_{i,t}$	0.016* (0.009)	0.053** (0.022)	-0.004** (0002)	0.008 (0.013)
$S3_{i,t}$ SPAAR4	0.006 (0.012)	-0.005 (0.019)	0.003 (0.002)	-0.006 (0.023)
$S4_{i,t}$ SPAAR3	-0.005 (0.008)	-0.036** (0.017)	-0.000 (0.002)	-0.006 (0.016)
$S5_{i,t}$ SPAAR5	-0.005 (0.011)	0.018 (0.018)	-0.002 (0.002)	-0.006 (0.017)
$S6_{i,t}$ SPAAR6	0.015 (0.011)	-0.021 (0.027)	0.004 (0.002)	-0.036* (0.022)
Demographic variables	YES	YES	YES	YES
Years	NO	NO	NO	NO
Adj. R2	0.018	0.177	0.008	0.068
N	1,373	174	8,109	286

These are the original variables, so not the transformed ones described in section 2. As can be seen in table 9 some of these separate variables are significant.

Especially, $S2_{i,t}$[8] has a significant effect on GRINV and GRSAV, whereas the overall risk measure ($R_{i,t}$) did not. The relationship found with $S2_{i,t}$ is that the subjects are more likely to invest in green mutual funds as they become more risk averse and invest less in green savings accounts becoming more risk averse. This is in line with the results found in table 7, that investors invest a smaller portion of the funds in mutual funds in green mutual fund as their risk appetite increases.

Next to this a significant relation is found between $S2_{i,t}$, $S4_{i,t}$[9] and MFPREF. However, these results are both in line with the results found in table 7, as they both indicate that as you become more risk-seeking you will invest a smaller portion in green mutual funds. Lastly, $S6_{i,t}$[10] has a negative significant effect on SAVPREF.

[8] To improve readability, the question belonging to $S2_{i,t}$ is: 'I do not invest in shares, because I find this too risky'.

[9] To improve readability, the question belonging to $S4_{i,t}$ is: 'If I think an investment will be profitable, I am prepared to borrow money to make this investment'.

[10] $S6_{i,t}$: 'I am prepared to take the risk to lose money, when there is also a chance to gain money'.

This implies that as you become more risk-seeking you will invest a smaller portion of funds in savings accounts in green savings accounts.

From the regressions in table 9 we learn that the regressions performed on MFPREF (table 7) hold with two of the separate risk elicitation questions. Next to this a significant effect is found between $S2_{i,t}$, and GRINV and GRSAV.

In future research a variety of risk measures could be used to get a more precise and reliable measure once combined. In composing this measure you could combine self-reported risk measures and experimental measures, preferably measured over different years. According to Pedroni et al. (2017) and Frey et al. (2017) this would render the most reliable measure.

Financial knowledge.

As a robustness check a difference has been made between people with low financial knowledge and people with high financial knowledge. The subjects placed in the high knowledge group considered their financial knowledge as either knowledgeable or very knowledgeable. This group is hereafter named 'financial professionals'.

From a broader stream of literature follows that financial professionals are more risk-seeking than students, for example this follows from the research conducted by Bottasso et al. (2022). They also found that the risk appetite of the professional is comparable to that of the general population. Duchêne et al. (2022) found next to this that a professional investor invests significantly more in green assets than the market traders. This gives enough reason to test and see if splitting the previously used panel in two groups, based on their financial knowledge, leads to different results.

These results can be found in table 10. It can be seen that the found effects on MFPREF are robust in both the low knowledge group and the high knowledge group. We also found a significant effect on SAVPREF in the low knowledge group, with adding the demographic variables, which was not found before. This might be due to the fact that not much financial knowledge is needed to open a green savings account, whereas investors with more knowledge might prefer investing in a green mutual fund. All three effects are negative which means that as the person becomes more risk-seeking, he invests a smaller portion of his funds in the green variant of the asset.

Miscellaneous.

Lastly, as we used panel data in OLS regressions, we tested whether using fixed and random effects models changed the variables. These two models have been fit on all four main variables of interest. These models can be found in Appendix B (table B4). The significant results on MFPREF were robust to these different models.

Next to this, some mistakes or problems exist within the DHS dataset. For example some of the green mutual fund owner observations disappear when you set BZ12 equal to one. This should however not be possible, because when you own a green mutual fund, you should also own a mutual fund in general.

Table 10: OLS Regressions with financial knowledge groups

*All regressions are OLS regressions. These regressions differ from the previous because the subjects have been divided in two subgroups based on their financial knowledge. To prevent clustering on an individual level, standard errors clustered on personal id's are presented. These standard errors can be found in the parentheses. The demographic variables and the years are the same as mentioned in table 4***, but are in these regressions just used as a control variable. Note: *p<0.1; **p<0.05; ***p<0.01.*

	Low Knowledge		**High Knowledge**	
	GRINV (1)	GRSAV (2)	GRINV (3)	GRSAV (4)
	Beta (β)	Beta (β)	Beta (β)	Beta (β)
Risk-Seeking	0.012 (0.025)	0.001 (0.004)	0.005 (0.020)	0.006 (0.004)
Demographic variables	YES	YES	YES	YES
Years	NO	NO	NO	NO
R2	0.012	0.009	0.037	0.008
F-statistic	1.406 (0.210)	7.220 (0.000)	4.561 (0.000)	4.349 (0.000)
N	658	5006	715	3103
	Low Knowledge		**High Knowledge**	
	MFPREF (5)	SAVPREF (6)	MFPREF (7)	SAVPREF (8)
	Beta (β)	Beta (β)	Beta (β)	Beta (β)
Risk-Seeking	-0.096** (0.044)	-0.076** (0.032)	-0.144*** (0.044)	0.013 (0.040)
Demographic variables	YES	YES	YES	YES
Years	NO	NO	NO	NO
R2	0.162	0.121	0.246	0.044
F-statistic	2.474 (0.031)	3.606 (0.002)	4.516 (0.001)	0.879 (0.512)
N	84	164	90	122

VII. CONCLUSION & IMPLICATIONS

In this section we will conclude this thesis followed by some implications from the findings in this thesis.

It was found that there is no relationship between a person's risk preference and the ownership of either a green mutual fund or a green savings account. However, we did find that there exists a negative relationship between risk appetite and the portion of funds invested in green mutual funds or savings accounts relative to the total amount. This implies that as an investor is more risk-seeking he will invest a smaller portion of his funds in the green category of that asset. This finding is deemed robust for the size of green mutual funds compared to the total. This result is in line with hypothesis 1, however this is the only one of the four main variables that is.

Next to this, we looked into different sociodemographic variables. It was found that higher educated people have stronger green preferences, in the way that they are more likely to own green assets. This confirms hypothesis 4. Hypothesis 5 was proven, because negative effects were found of income on the different green preference variables. Hypothesis 2 cannot be proven or disproven, because no significant results were found for gender. Significant effects were found for the effect of age, but these were contradictory, in some cases these were positive, in others negative. There thus is no conclusive proof for hypothesis 3.

We found that an investors' risk appetite has an influence on the portion of funds he invests in green assets. To comply with the preferences of a participant in a investment or a pension fund, this also has some implications for the fund manager. As the European Union has a line of imposing more and more policy around sustainability upon both the financial industry and large public companies as a part of their Sustainable Finance Action Plan (SFAP). Regulation for these large companies comes mostly down to reporting obligations in their annual reports (Teijgeler (2022)).[11] On behalf of the financial industry the Taxonomy Regulation and the Sustainable Finance Disclosure Regulation (SFDR), have the biggest impact. The first one sets out a framework to qualify an investment as environmentally sustainable. The SFDR attempts to let for example pension funds, but also financial advisors and asset managers, integrate ESG-considerations into their investment strategy and report those considerations to the public (Roelofsen (2020)).

Next to this an addition to the existing MiFID II directive obliges asset managers to ask their participants/clients for their sustainable preferences.[12] Bauer et al. (2021) found that most participants in pension funds would like them to put (at least a part of) their funds in sustainable assets. Following this, they state that future methods should be established to integrate these sustainable/green preferences into the investment policy of the fund. This then has to be added to the existing policy focusing on hedging risks and maximizing returns. In this new framework the combination between the size of green investments and risk preferences also has to be made, improving the existing portfolios from 2D to 3D quality.

[11] This legislation for example includes: the Corporate Sustainability Reporting Directive (CSRD) and the Corporate Sustainability Due Diligence Directive (CSDDD).
[12] Delegated Regulation (EU) 2017/565.

VIII. Bibliography

Bansal, R., Wu, D., & Yaron, A. (2022). Socially responsible investing in good and bad times. *The Review of Financial Studies*, *35*(4), 2067-2099.

Barber, B. M., Morse, A., & Yasuda, A. (2021). Impact investing. *Journal of Financial Economics*, *139*(1), 162-185.

Bauer, R., Ruof, T., & Smeets, P. (2021). Get real! Individuals prefer more sustainable investments. *The Review of Financial Studies*, *34*(8), 3976-4043.

Beunderman, M. (4-3-2023). De Amerikaanse cultuuroorlog over het 'woke' beleggen gaat over het wezen van het kapitalisme. *NRC, (https://www.nrc.nl/nieuws/2023/03/04/de-amerikaanse-cultuuroorlog-over-woke-beleggen-gaat-over-het-wezen-van-het-kapitalisme-a4158615).*

Bonnefon, J. F., Landier, A., Sastry, P. R., & Thesmar, D. (2022). *The moral preferences of investors: Experimental evidence* (No. w29647). National Bureau of Economic Research.

Bottasso, A., S. Duchêne, E. Guerci, N. Hanaki, & C. N. Noussair (2022). Higher order risk attitudes of financial experts. Journal of Behavioral and Experimental Finance 34, 100658.

Carlsson Hauff, J. & Nilsson, J. (2022). Is ESG mutual fund quality in the eye of the beholder? An experimental study of investor responses to ESG fund strategies. *Business Strategy and The Environment,* 1-14.

Charness, G., Gneezy, U., & Imas, A. (2013). Experimental methods: Eliciting risk preferences. *Journal of economic behavior & organization*, *87*, 43-51.

Cornell, B. (2021). ESG preferences, risk and return. *European Financial Management*, *27*(1), 12-19.

Dohmen, T., Falk, A., Huffman, D. & Sunde, U. (2011). Individual risk attitudes: measurement, determinants and behavioral consequences. *Journal of the European Economic Association, 9* (3), 522–550.

Duchêne, S., Nguyen-Huu, A., Dubois, D., & Willinger, M. (2022). Risk-return trade-offs in the context of environmental impact: a lab-in-the-field experiment with finance professionals. *Working Paper: Available at: https://shs.hal.science/hal-03883121/*

Ferriana, F. & Natoli, F. (2021). ESG risks in times of Covid-19. *Applied Economics Letters*, 28(18), 1537-1541.

Frey, R., Pedroni, A., Mata, R., Rieskamp, J., & Hertwig, R. (2017). Risk preference shares the psychometric structure of major psychological traits. *Science advances*, *3*(10), e1701381.

Friede, G., Busch, T. & Bassen, A (2015) ESG and financial performance: aggregated evidence from more than 2000 empirical studies, Journal of Sustainable Finance & Investment, 5(4), 210-233.

Giese, G., Lee, L. E., Melas, D., Nagy, Z., & Nishikawa, L. (2019). Foundations of ESG investing: How ESG affects equity valuation, risk, and performance. *The Journal of Portfolio Management*, *45*(5), 69-83.

Hensen, C. (3-2-2023). Shell gaat na recordwinsten de energietransitie niet leiden, wijst naar consument. *NRC, (https://www.nrc.nl/nieuws/2023/02/03/shell-gaat-na-recordwinsten-de-energietransitie-niet-leiden-wijst-naar-consument-a4156148).*

Holt, C.A., Laury, S.K. (2002). Risk aversion and incentive effects. *American Economic Review 92* (5), 1644–1655.

Markowitz, H. M., & Todd, G. P. (2000). *Mean-variance analysis in portfolio choice and capital markets* (Vol. 66). John Wiley & Sons.

Nilsson, J. (2008). Investment with a Conscience: Examining the Impact of Pro-Social Attitudes and Perceived Financial Performance on Socially Responsible Investment Behavior. *Journal of Business Ethics*, 83, 307–325.

Nofsinger, J. & Varma, A. (2014). Socially responsible funds and market crises. *Journal of Banking & Finance,* 48, 180-193.

Pedersen, L. H., Fitzgibbons, S., & Pomorski, L. (2021). Responsible investing: The ESG-efficient frontier. *Journal of Financial Economics*, *142*(2), 572-597.

Pedroni, A., Frey, R., Bruhin, A., Dutilh, G., Hertwig, R., & Rieskamp, J. (2017). The risk elicitation puzzle. *Nature Human Behaviour*, *1*(11), 803-809.

Pohlman, J. T., & Leitner, D. W. (2003). A comparison of ordinary least squares and logistic regression, (https://kb.osu.edu/handle/1811/23983).

Riedl, A., & Smeets, P. (2017). Why do investors hold socially responsible mutual funds?. *The Journal of Finance*, *72*(6), 2505-2550.

Roelofsen, E.P. (2020). Wat is de mogelijke impact van de aankomende Europese duurzaamheidswetgeving op Pensioenfondsen? *Tijdschrift voor Financieel Recht*, *6*, 259-266.

Rossi, M., Sansone, D., Van Soest, A., & Torricelli, C. (2019). Household preferences for socially responsible investments. *Journal of Banking & Finance*, *105*, 107-120.

Teijgeler, E.J. (2022). ESG & M&A: Waarom ESG-kwesties de blijvende aandacht verdienen. *Tijdschrift Ondernemingsrechtpraktijk*, *7*, 26-34.

IX. Appendix A: Original DHS survey questions

Questions used from the DNB Household Survey (Survey 2022 (most recent version)).

General Information
GEBJAAR/BIRTHYEAR
Year of birth of the respondent
any answer
.....

GESLACHT/GENDER
Sex of the respondent
1 male
.....
2 female
.....

OPLMET/EDUCATIONLEVEL
Highest level of education completed
1 (Voortgezet) speciaal onderwijs / (continued) special education
.....
2 Kleuter-, lager- of basisonderwijs / kindergarten/primary education
.....
3 Voorbereidend middelbaar beroepsonderwijs (VMBO) / pre-vocational education
……..
4 HAVO/VWO / pre-university education
.....
5 MBO of het leerlingwezen / senior vocational training or training through apprentice system
.....
6 HBO (eerste of tweede fase) / vocational colleges
.....
7 Wetenschappelijk onderwijs WO / university education
.....
8 Did not have education (yet)
.....
9 other sort of education/training
.....

IJ181 thru IJ183
Could you then indicate the **net income** over 2020 which you received?
Please give your answer in whole euros.
Net income in euros
.....
-9 don’t know
.....

KUNDE?FINKNOWLEDGE
How knowledgeable do you consider yourself with respect to financial matters?
1 not knowledgeable.....
2 more or less knowledgeable.....
3 knowledgeable……
4 very knowledgeable .....

Investment Behaviour
BZ03
Did you, on 31st December 2021, have one or more savings or deposit accounts?
1 yes.....
0 no.....

SPA3/TOTSAV
What was the total balance of your savings or deposit accounts on 31st December 2021? Type **-99** if you don't know the answer.
amount .....
-9 don't know .....

SPA4
Into which of the categories did the total balance of your savings go?
1 less than 50 Euro .....
2 between 50 Euro and 250 Euro.....
3 between 250 Euro and 500 Euro .....
4 between 500 Euro and 750 Euro .....
5 between 750 Euro and 1,000 Euro.....
6 between 1,000 Euro and 2,500 Euro .....
7 between 2,500 Euro and 5,000 Euro .....
8 between 5,000 Euro and 7,500 Euro .....
9 between 7,500 Euro and 10,000 Euro.....
10 between 10,000 Euro and 11,500 Euro.....
11 between 11,500 Euro and 14,000 Euro.....
12 between 14,000 Euro and 17,000 Euro.....
13 between 17,000 Euro and 20,000 Euro.....
14 between 20,000 Euro and 25,000 Euro.....
15 25,000 Euro or more .....
-9 don't know .....

BZ12
Did you, on 31st December 2021, have investments with mutual funds?
Do **not** include investments in growth funds, investments (shares, bonds) in companies, or 'insured saving' (i.e. saving through a life-insurance) here.
1 yes .....
0 no .....

BEL3/MFINV
How much was the total value of your investments with mutual funds on 31st December 2021? Please give your answer in whole euros.
Type **-99** if you don't know the answer.
Answer.....
-9 don't know.....

BEL5
Into which of the categories did the total value of your investments go?
1 less than 500 Euro .....
2 between 500 Euro and 1,500 Euro .....
3 between 1,500 Euro and 2,500 Euro.....
4 between 2,500 Euro and 5,000 Euro .....
5 between 5,000 Euro and 7,500 Euro.....
6 between 7,500 Euro and 10,000 Euro.....
7 between 10,000 Euro and 12,000 Euro.....
8 between 12,000 Euro and 15,000 Euro.....
9 between 15,000 Euro and 20,000 Euro.....
10 between 20,000 Euro and 25,000 Euro.....
11 between 25,000 Euro and 50,000 Euro.....
12 between 50,000 Euro and 75,000 Euro……
13 between 75,000 Euro and 100,000 Euro.....
14 100,000 Euro or more.....
-9 don't know .....

BEL7A1 thru BEL7A5
In what kind of mutual fund do you invest?
1 shares-fund.....
2 bonds-fund .....
3 deposit- and liquidity fund.....
4 real estate-fund.....
5 mix-fund……
6 hedge fund……
-9 don't know ..... [13]

[13] In the survey several questions were asked about investments in bonds, shares, cryptocurrencies and options. For now I did not include these in my data, because these specific questions about these assets were not followed by the question whether a certain part is invested in green investments, which is the main focus of this thesis. However, later on these can be included.

ESG-Preferences / Green investments

GROENBEL1/GREENINV1

Green investments are investments in funds that participate in projects for environmental protection. Such investments are subject to a special exemption on the capital gains tax. In addition, green investments give entitlement to an additional tax rebate.

Were green investments part of your investments in mutual funds?

1 yes.....

2 no.....

GROENBEL2/GREENINV2

How much was the total value of your green investments on 31st December 2021? Please give your answer in whole euros.

Type **-99** if you don't know the answer.

Answer

.....

-9 don't know

.....

GROENBEL3/GREENINV3

Into which of the categories did the total value of your green investments go on 31st December 2021?

1 less than 500 Euro .....

2 between 500 Euro and 1,500 Euro .....

3 between 1,500 Euro and 2,500 Euro.....

4 between 2,500 Euro and 5,000 Euro .....

5 between 5,000 Euro and 7,500 Euro.....

6 between 7,500 Euro and 10,000 Euro.....

7 between 10,000 Euro and 12,000 Euro.....

8 between 12,000 Euro and 15,000 Euro.....

9 between 15,000 Euro and 20,000 Euro.....

10 between 20,000 Euro and 25,000 Euro.....

11 between 25,000 Euro and 50,000 Euro.....

12 between 50,000 Euro and 75,000 Euro……

13 between 75,000 Euro and 100,000 Euro.....

14 100,000 Euro or more.....

-9 don't know .....

GROENSPA1/GREENSAV1
Several banks in the Netherlands offer **green** savings products. Banks then offer products in which the money is invested in **green** (sustainable) projects (with or without tax benefit).
Were **green** savings or deposit accounts part of your savings or deposit accounts on 31st December 2021?
Do not include investments in mutual funds here. These have already been reported.
1 yes.....
2 no.....

GROENSPA2/GREENSAV2
How much was the total value of your green savings or deposit accounts on 31st December 2021? Please give your answer in whole euros.
Type **-99** if you don't know the answer.
Answer .....
-9 don't know .....

GROENSPA3/GREENSAV3
Into which of the categories did the total value of your green savings or deposit accounts go on 31st December 2021?
1 less than 500 Euro .....
2 between 500 Euro and 1,500 Euro .....
3 between 1,500 Euro and 2,500 Euro.....
4 between 2,500 Euro and 5,000 Euro .....
5 between 5,000 Euro and 7,500 Euro.....
6 between 7,500 Euro and 10,000 Euro.....
7 between 10,000 Euro and 12,000 Euro.....
8 between 12,000 Euro and 15,000 Euro.....
9 between 15,000 Euro and 20,000 Euro.....
10 between 20,000 Euro and 25,000 Euro.....
11 between 25,000 Euro and 50,000 Euro.....
12 between 50,000 Euro and 75,000 Euro……
13 between 75,000 Euro and 100,000 Euro.....
14 100,000 Euro or more.....
-9 don't know .....

Risk Preferences

The following statements concern saving and taking risks. Please indicate for each statement to what extent you agree or disagree.
Please indicate on a scale from 1 to 7 to what extent you agree with the statement.
1 means '**totally disagree'**
7 means '**totally agree'**

SPAAR1
I think it is more important to have safe investments and guaranteed returns, than to take a risk to have a chance to get the highest possible returns.
.....
SPAAR2
I do not invest in shares, because I find this too risky
.....
SPAAR3
If I think an investment will be profitable, I am prepared to borrow money to make this investment
.....
SPAAR4
I want to be certain that my investments are safe
.....
SPAAR5
If I want to improve my financial position, I should take financial risks
.....
SPAAR6
I am prepared to take the risk to lose money, when there is also a chance to gain money
.....

BESCHRYF
How would you describe the risks that you have taken with investments over the past few years? If you haven't made any investments, choose 'not applicable'.
1 I have taken no risk at all.....
2 I have taken small risks every now and then .....
3 I have taken some risks .....
4 I have sometimes taken great risks .....
5 I have often taken great risks .....
-7 not applicable ……
-9 don't know .....

PREF2
Are you generally a person who is willing to take risks or do you try to avoid taking risks?
0 means **'not at all willing to take risks'**
10 means **'very willing to take risks'**
.....

X. Appendix B: Additional results/tables

Table B1: Logistic regressions on GRINV

*All three regressions are logistic regressions, as specified earlier. To prevent clustering on an individual level, standard errors clustered on personal id's are presented. These standard errors can be found in the parentheses. For interpretation purposes each regressions has a second column included which shows e^{β}, also called the odds ratio. Note: *p<0.1; **p<0.05; ***p<0.01*

	GRINV (1)		GRINV (2)		GRINV (3)	
	Beta (β)	Exp beta	Beta (β)	Exp beta	Beta (β)	Exp beta
Risk-seeking	-0.026 (0.088)	0.975	0.037 (0.106)	1.038	0.032 (0.106)	1.033
Gender			0.284 (0.256)	1.329	0.285 (0.255)	1.329
Age			0.002 (0.008)	1.002	0.002 (0.008)	1.002
Education (ref: low)						
Medium			0.053 (0.415)	1.054	0.045 (0.416)	1.046
High			0.684* (0.354)	1.982	0.690* (0.354)	1.994
Gross income (x1000)			-0.006* (0.003)	0.994	-0.006* (0.003)	0.994
Year (ref:2017)						
2018					-0.255 (0.171)	0.775
2019					-0.427*** (0.209)	0.653
2020					-0.189 (0.200)	0.828
2021					-0.094 (0.209)	0.910
2022					-0.078 (0.207)	0.925
Constant	-1.272*** (0.332)		-2.205** (0.948)		-2.032** (0.944)	
Pseudo R2	0.000		0.019		0.022	
N	1561		1373		1373	

Table B2: Logistic regressions on GRSAV

*All three regressions are logistic regressions, as specified earlier. To prevent clustering on an individual level, robust standard errors were used, clustered on personal id's. These standard errors can be found in the parentheses. For interpretation purposes each regression has a second column included which shows e^{β}, also called the odds ratio. Note: *p<0.1; **p<0.05; ***p<0.01*

	GRSAV (1)		GRSAV (2)		GRSAV (3)	
	Beta (β)	Exp beta	Beta (β)	Exp beta	Beta (β)	Exp beta
Risk-seeking	0.042 (0.069)	1.043	0.080 (0.077)	1.083	0.081 (0.077)	1.084
Gender			0.267 (0.181)	1.306	0.271 (0.182)	1.312
Age			0.013** (0.005)	1.013	0.013** (0.005)	1.013
Education (ref: low)						
Medium			0.060 (0.266)	1.062	0.059 (0.266)	1.060
High			0.820*** (0.239)	2.272	0.820*** (0.239)	2.271
Gross income (x1000)			-0.007* (0.003)	0.993	-0.007** (0.003)	0.993
Year (ref:2017)						
2018					-0.044 (0.153)	0.957
2019					0.008 (0.157)	1.008
2020					-0.202 (0.173)	0.817
2021					-0.024 (0.173)	0.976
2022					-0.028 (0.170)	0.972
Constant	-3.207*** (0.214)		-4.593*** (0.608)		-4.563*** (0.611)	
Pseudo R2	0.000		0.021		0.021	
N	9882		8109		8109	

Table B3: OLS Regressions on GREENINV1 and GREENSAV1

*All three regressions are OLS regressions, as specified earlier. To prevent clustering on an individual level, standard errors clustered on personal id's are presented. These standard errors can be found in the parentheses. Note: *p<0.1; **p<0.05; ***p<0.01*

	GREEN INV1 (1)	GREEN INV1 (2)	GREEN INV1 (3)	GREEN SAV1 (1)	GREEN SAV1 (2)	GREEN SAV1 (3)
	Beta (β)	Beta (β)	Beta (β)	Beta (β)	Beta (β)	Beta (β)
Risk-seeking	0.030*** (0.005)	0.030*** (0.005)	0.015*** (0.005)	0.001 (0.003)	0.002 (0.003)	0.002 (0.003)
gender		0.010 (0.013)	0.007 (0.013)		0.010 (0.007)	0.009 (0.007)
age		0.001*** (0.0004)	0.001* (0.0004)		0.0005** (0.0002)	0.0004** (0.0002)
Education (ref: low)						
medium		0.019 (0.014)	0.010 (0.013)		0.004 (0.008)	0.004 (0.008)
High		0.072*** (0.015)	0.049*** (0.014)		0.035*** (0.009)	0.034*** (0.009)
Gross income (x1000)		0.0001 (0.0002)	-0.0002 (0.0002)		-0.0002** (0.0001)	-0.0002** (0.0001)
Year (ref:2017)						
2018			-0.005 (0.004)			-0.001 (0.005)
2019			0.111*** (0.023)			0.0004 (0.006)
2020			0.144*** (0.024)			-0.0001 (0.006)
2021			0.143*** (0.024)			0.006 (0.007)
2022			0.152*** (0.025)			0.005 (0.007)
Constant	-0.026** (0.012)	-0.158*** (0.042)	-0.077** (0.039)	0.035*** (0.008)	-0.015 (0.022)	-0.015 (0.022)
Log.like.						
N						

Table B4: Robustness with fixed effects and random effects

*As a robustness check, because panel data has been used, the main analyses have been redone using fixed effects and random effects. To prevent clustering on an individual level, standard errors clustered on personal id's are presented. These standard errors can be found in the parentheses. The demographic variables and the years are the same as mentioned in table 4***, but are in these regressions just used as a control variable. Note: *p<0.1; **p<0.05; ***p<0.01.*

	GRINV		**GRSAV**	
	FE (1)	RE (2)	FE (3)	RE (4)
	Beta (β)	Beta (β)	Beta (β)	Beta (β)
Risk-Seeking	0.008 (0.016)	0.000 (0.012)	0.001 (0.003)	0.001 (0.003)
Demographic variables	YES	YES	YES	YES
Years	NO	NO	NO	NO
R2	0.002	0.017	0.001	0.004
F-statistic (FE) Chi-sq (RE)	0.272 (0.928)	7.909 (0.245)	0.556 (0.734)	27.491 (0.000)
N	1373	1373	8109	8109
Balance	480x6	480x6	2606x6	2606x6
	MFPREF		**SAVPREF**	
	FE (5)	RE (6)	FE (7)	RE (8)
	Beta (β)	Beta (β)	Beta (β)	Beta (β)
Risk-Seeking	-0.121*** (0.042)	-0.131*** (0.030)	-0.064 (0.042)	-0.058** (0.025)
Demographic variables	YES	YES	YES	YES
Years	NO	NO	NO	NO
R2	0.123	0.269	0.035	0.055
F-statistic (FE) Chi-sq (RE)	4.308 (0.007)	34.445 (0.000)	1.428 (0.238)	14.588 (0.024)
N	174	174	286	286
Balance	79x6	79x6	165x6	165x6

XI. Appendix C: Data

Table C1: number of observations

Observations of GREENINV1, bz12, GREENSAV1 and bz03

	value	2017	2018	2019	2020	2021	2022
GREENINV1	0	2299	2072	235	261	268	267
	1	59	51	53	64	66	68
BZ12 (MF owner)	0	2100	1900	2467	2487	2334	2228
	1	258	223	288	325	306	315
GREENSAV1	0	2278	2046	2649	2114	1993	1936
	1	80	77	106	88	88	87
BZ03 (SA owner)	0	497	467	629	610	639	605
	1	1861	1656	2126	2202	2001	1938

As can be seen in table C1, GREENINV1 takes on the value of 0 more often in 2017 and 2018 then in the other analyzed years. This is because it is given the value of zero every time when a subject answered BZ12, instead of NA as in done in the years after that and what should be done according to the codebook belonging to the survey.
This has to be corrected for, because otherwise too much zeroes will be taken into account analyzing GREENINV1, which will produce a distorted effect in the regression analysis. This is done in the following manner. The variable GRINV will be given the value zero when BZ12 is 1, after that GRINV will get the value 1, when GREENINV1 is 1. In this manner the filing of a zero where this should have been a NA is corrected for, leaving us with a correct variable according to the codebook belonging to the DHS.

The same problem exists with the variable for savings accounts, GREENSAV1. This is corrected in the same manner as described above. The correct variable for GREENSAV1 will be named GRSAV.