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On the relationship between green preferences and returns

A study of environmental nonpecuniary preferences using survey evidence

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Thesis Summary

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Authors	Cornelia Frick, Ella Klynning
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Key words	Green investing, Behavioural finance, Capital asset pricing model, Investor preference, Nonpecuniary preference
Purpose	Our aim is to find quantitative data on the trade-off relationship between nonpecuniary environmental preference and return.
Methodology	An economic experimental survey is used to allocate nonpecuniary preferences and further analysed as input variables of an extension of CAPM.
Theoretical Perspectives	The theoretical foundation of this study lays within an extension of the CAPM, aspiring to show that observed trends in the financial market have an impact on cost of capital.
Empirical foundation	We use a sample of 161 economics students and financial controllers to measure the allocation of green nonpecuniary preferences.
Conclusions	The linear relationship between environmental performance of an asset and return is displayed through the slope: -0.368. Despite negative relationship, the results show that in 44.6 % of cases, a nonpecuniary preference for the environment is present. The aggregated return, exchanged for a higher environmental score, enumerates to 1.19 percentage points.

Abstract

The care for the environment in investment situations is rising among different groups of investors, due to social and psychological factors. Existing studies on nonpecuniary preferences for the environment are focused on measuring the proportion of individuals with green agendas, whereas we focus on measuring also magnitudes, i.e. how much future wealth are people actually prepared to give up for making a greener investment? Inspired by behavioural finance, we have derived an economic experimental survey to allocate nonpecuniary preferences and thus, the input variables of an extension of CAPM. Using the extension of CAPM that includes environmental preferences and further develop the traditional CAPM assumptions per the addition of the variables *e,* a_1 and a_2, we find the linear relationship between green performance of an asset and return. The linear relationship between environmental performance of an asset and return is displayed through the slope: -0.368. Despite the negative relationship, the results show that in 44.6 % of cases, a nonpecuniary preference for the environment is present. The aggregated return, exchanged for a higher environmental score, enumerates to 1.19 percentage points. Our main contribution is that this is the first study to translate survey responses into exactly how the cost of capital for a company is related to its environmental performance.

Keywords: *Green investing, Behavioural finance, Capital asset pricing model, Investor preference, Nonpecuniary preference*

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1. Introduction

The environment, climate change in particular, is an unavoidable economic discussion. Scarcity of natural resources and rising carbon levels suggest that current market patterns need to be adjusted (Rockström, 2009). Trends and regulations in the financial market seem to correspond to this suggestion (OECD, 2019). According to OECD (2019), green finance, and subsequently its demand, is vital to save the climate. Green finance broadly refers to investments in companies or projects with a focus on operating with low carbon emission and clean technology (Inderst *et al.,* 2012). In 2019, 16 % of global individual investors chose investments with a green agenda, a number that has been steadily increasing during the past years (Schroders, 2019; USSIF, 2019). If green investing is used as a tool to show care for the environment, it can be argued that nonpecuniary preferences for sustainability must exist.

The current literature uses two main approaches to gauge the effect of environmental preferences. One approach is to find the implied preferences by looking at prices in financial markets. The other approach uses surveys to directly ask investors about preferences. The major drawback with looking at market prices is that, currently, the lack of a common and transparent framework for measuring "greenness" means that investors' preferences are obfuscated due to the lack of information. Because of this, we use a survey based method which completely overcomes the transparency problem. Existing surveys have focused on measuring only the proportion of individuals with green preferences, whereas we will focus on measuring also magnitudes, i.e. how much future wealth people are actually prepared to give up for making a greener investment. Our main contribution is that we are the first study to translate our survey responses into exactly how the cost of capital for a company is related to its environmental performance. We accomplish this using the asset pricing model, CAPM with a twist, of Baker *et al.* (2018).

The use of CAPM with a twist is suitable for this study, since theories of fully homogenous market portfolio preferences are not applicable when assuming different groups have different

preferences. To capture and properly analyse the aforementioned preferences of green, it is relevant to find quantitative data on the subject. Inspired by behavioural finance, we have derived an economic experimental survey to allocate nonpecuniary preferences and thus, the input variables of CAPM with a twist. The purpose of this study is, firstly, to detect if there are nonpecuniary preferences for the environment, and secondly, to find and identify the fraction of people having this additional green preference. Additionally, when future wealth is being put against environmental damage, we attempt to quantify to what degree trade-off return is given up for such a preference. This is done by finding and analysing the input variables, a_1, a_2 and e (further explained in sections 2.2.3, 3.2.1 and 3.2.2), to the CAPM with a twist, in order to describe the linear relationship between the environmental performance of a firm and cost of capital. We therefore derive a suitable scale for the scoring variable *e,* and find the allocation of a_1 and a_2 through an experimental survey.

2. Literature Review and Theoretical Framework

2.1 Green investing

2.1.1 What is green investing?

The financial market is of great importance with regards to climate issues. To reach a low carbon emission economy, as determined by the Paris Agreement, industrial investors and companies must take green actions (OECD, 2019). This can be accomplished through environmental efforts within CSR (corporate social responsibility) programmes. The phenomena of green investing can come to change existing consumption and production patterns and thus reduce carbon dioxide in the atmosphere. The potentials and mechanisms of implementing greener regulations in the investment sector can be a powerful tool for policymakers in the battle against climate change (Bachelet *et al.*, 2019).

Multiple definitions and ways of measurement are used to define the greenness of an asset. On behalf of OECD, Inderst *et al.* (2012) state that green investments differ from traditional investments through actively acting on reducing climate change. For investors, the definition of what is included in the concept of green investing is somewhat diffuse. A general definition is given by Inderst *et al.* (2012), where "green investments refer broadly to low carbon and climate resilient investments made in companies, projects and financial instruments that operate primarily in the renewable energy, clean technology, environmental technology or sustainability related markets as well as those investments that are climate change specific". Green investments can be interpreted in terms of absolute and in terms of relative. Absolute terms refer to whether a technology or a good is considered green. Relative terms refer to whether one company has a lower emission of carbon than another (Inderst *et al.*, 2012).

2.1.2 Scoring sustainability

Environmental, social and governance factors, abbreviated ESG, are commonly mentioned in sustainable investing. ESG is used as a measurement of how sustainable a company, an asset or a fund is (MSCI Inc, 2019). The most common rating is that of Morningstar and their partner Sustainalytics, a third-party research firm. Morningstar's rating assesses the ESG characteristics of a fund's underlying holdings (Morningstar, 2019). On a 5-tier scale, assets with low ESG-risk are awarded five globes and assets with high ESG-risk are assigned one globe, putting an asset awarded three globes in the middle of the scale (Morningstar 2019).

Rating the environmental performance of an asset solely, beyond the ESG spectre, is a complex task. Since no standard definition of a company's environmental sustainability exists, ESG ratings and scores often differ from provider to provider (Hale, 2017). The Morningstar scoring scale of ESG is widely accepted among individual as well as institutional investors. This study focuses on the environmental aspect alone and incorporates elements of the Morningstar ESG scale into our interpretation of an environmental scoring, since this scale is readily applicable in our study.

2.1.3 The environmental investing trend

An increasing proportion of Swedes believe that climate change is one of society's biggest problems, were especially women and the younger generation have expressed concern (Rönnerstrand, 2019). Sustainable investing is perceived to be a growing trend among both individual and institutional investors. A 2017 survey, including 1 000 individual investors, showed that sustainable investing, with a focus on social and environmental factors, has developed into a widespread practice (Morgan Stanley, 2017). The United Nations has issued Principles for Responsible Investing (PRI) leading to a large number of institutional investors becoming involved in transforming their investment practices (Hummels, 2012). The PRI have since 2006 gained support from more than 1 800 signatories who voluntarily commit to the six principles of PRI, the first being to incorporate ESG issues in investment decisions and analysis (MSCI Inc, 2019).

Furthermore, the Morgan Stanley (2017) report concludes that interest in sustainable investing is increasing among individual active investors. In their research, 75 % of 1 000 U.S. individual investors expressed interest in sustainable investing. The survey respondents, the millennials in particular, believe that they can influence issues they care about through investment decisions. Compared to the entire investor population, millennials are twice as likely to express interest in investing in companies targeting social or environmental goals. Women, as well, are more likely to express interest in investments holding a conscious approach. According to the survey, however, only about 50 % of investors who express interest in investing sustainably actually do so (Morgan Stanley, 2017). Although the majority of asset growth in the sustainable segment predominantly has come from institutional investors in the past, evidence suggests that individual investors are increasing their investments in the sustainable category (Hale, 2017). According to an extensive survey of over 25 000 investors across 32 locations globally, 16 % of individual investors actively invest sustainably (Schroders, 2019).

Moreover, according to Morgan Stanley (2017), people's prejudice of green investing suggest a belief among investors that there is a trade-off between financial gain and sustainability. Between 2015 and 2017, the conception that there is a trade-off increased from 8 % to 18 % among millennials. By those who actively invest with a green agenda, the perception of a trade-off is more common. This suggests that a nonpecuniary preference for the environment exists.

The Forum for Sustainable and Responsible Investment (2019) concludes in their report on SRI (sustainable, responsible, and impact) investment trends during 2018, that the number of U.S. assets distinguished by a SRI strategy management increased by 38 % over a two-year period, from early 2016 to early 2018. Interestingly, the report covers money managers and institutional investors discreetly and also differentiates the ESG aspects independently. Regarding money managers, the ESG criteria displaying the largest amount of growth was climate change, with an increase of 110 % from 2016 to 2018. Among the ESG factors, institutional investors did not consider the environment to be the most important criteria but did, nevertheless, show concern for climate change with an increase of 28 % (USSIF, 2019).

The increase of interest in green investing began in 2004 through 2010. It was in part thwarted by the financial crisis of 2009 but has since then regained momentum, largely because of support from the public sector. During the financial crisis, green investing declined globally as a result of uncertainty about future demand, reduced liquidity and less favourable financial conditions. In Europe however, governmental interventions such as "feed-in-tariffs" remained more common than in other regions, proving to impact green investing in a positive way (Eyraud *et al.*, 2011).

Although there is no clear or definitive definition of what green investing is and, also, that there is a growing perception that there exists a negative trade-off between return and sustainability (Morgan Stanley, 2017), the literature shows that there since at least 2004 is a clearly growing trend towards increased green investing among both individual and institutional investors (Eyraud *et al.*, 2011; Hale, 2017; Schroders, 2019; USSIF, 2019). It is possible that the strength

of this trend varies between different markets, different investors, different genders and different age groups. However, the trend exists and whether or not this has had, or will have, an impact on traditional investment modelling has not yet been fully elucidated. Previous research leaves an information gap with regards to the magnitude of future wealth an investor is willing to give up for a greener investment and, to some extent, the fraction of people willing to make this trade-off. This study attempts to give some perspective on whether nonpecuniary preferences are present and, if so, to what extent, using survey evidence.

2.1.4 The cost of being climate friendly

With the growing environmental awareness and climate threat, various regulations are imposed on the industry, leading to transformation towards obtaining increasingly sustainable procedures for production. To reach a high score in ESG, a company's environmentally unfriendly actions must be compensated for, which comes at a cost. Thus, there is an expenditure for a firm to change the current methods of production (Industrin Ekonomiska Råd, 2018).

Chava (2014), Sharfman and Fernando (2008) suggest that high environmental performance of a firm can lower the cost of equity, and equivalently, expected return. This can be due to the impact of environmentally conscious investors and the fact that sustainable approaches are becoming higher in demand. Chava (2014) explains how investors might see environmentally sustainable approaches of a firm as an indicator of low future risk. Similarly, investments obtaining negative environmental approaches can be seen as high future risk, requiring a higher cost of equity. Sharfman and Fernando (2008) suggest that improved environmental risk management is correlated to a lower cost of capital through the effect on the cost of equity, among other factors. Additionally, Chava (2014), Sharfman and Fernando (2008) observes that negative environmental actions of a firm, although not yet regulated (such as greenhouse gas emissions), can through the environmentally conscious investor have an impact on the cost of equity and capital. This concept agrees with the model of CAPM with a twist and its implications which we will further examine.

2.2 CAPM

2.2.1 The logic of CAPM

CAPM (capital asset pricing model) is the theoretical model mainly used when evaluating prices and returns of an asset not yet traded in a marketplace. In essence, CAPM implies that a portfolio risk decreases with the diversity of the portfolio. CAPM describes the relationship between a risky diverse asset and a riskless asset under a certain level of risk (Lintner, 1965; Sharpe, 1964). The traditional relationship of CAPM, called the Security Market Line (SML) is as follows:

$$r_i = r_f + (r_m - r_f)\beta_i$$

Where r_i is expected return, r_f is the risk free asset, r_m is market return and β_i explains the asset return's sensitivity to the market return. Excluding the risk free rate from the formula, the CAPM can be described as follows:

$$r_i = r_m\beta_i$$

The CAPM assumes that the market is efficient and that the expectations of investors are homogeneous. Additionally, all agents are assumed to be rational mean variance investors. This implies that everyone should invest in the diverse market portfolio (Markowitz, 1959; Merton, 1969; Sharpe, 1964). If one or many stocks are excluded from the market portfolio without any loss in risk adjusted return, at least one of the CAPM assumptions must be wrong.

2.2.2 Criticism of CAPM

Fama and French (2007) study how pricing of assets is potentially affected by individual biases and tastes, given a firm's behaviour is exogenous. The authors point out several flaws within the CAPM. In particular, Fama and French (2007) state that traditional assumptions of asset pricing, where assets are chosen solely based on anticipated return and investors completely agree on

probability and risk, are unrealistic. Furthermore, the authors provide a framework where they investigate how asset prices can be affected when investors are misinformed or have a certain taste in assets or consumer goods. A commonly used example of a certain taste of assets is socially responsible investments. The paper concludes that anticipated returns are incorrect when investors exhibit biases or when information anomalies are present in the market. In other words, the CAPM assumption regarding mean variance preferences does not hold (Fama and French, 2007).

2.2.3 CAPM with a twist

As an extension of the theory by Fama and French (2007) of CAPM being insufficient in explaining market biases, Baker *et al.* (2018) presents a further developed version of the CAPM theory. Here, price and return are determined in the context of a clientele with nonpecuniary preferences. Baker *et al.* (2018) examine how ownership patterns and ownership concentration can be analysed when green nonpecuniary preferences are present in a market. Baker *et al.* (2018) derive their asset pricing model from the assumption that there are two groups of investors with the same risk aversion and homogeneous expectations for risk and return. Group 1 are mean variance maximisers whereas Group 2, in addition to being mean variance maximisers, also care about an asset's environmental score, denoted by *e*. In the model, Group 2 gains extra utility from a positive environmental score and, concurrently, loses extra utility from a negative environmental score. The mean value of *e* is put to zero.

To derive the ownership concentration, Baker *et al.* (2018) stipulate that Group 1's capital comes from a_1 individuals and Group 2's capital comes from a_2 individuals. Each individual holds a capital of \$1. This is expressed in the following formula where *w* is weight allocation:

$$\frac{a_1}{a_1+a_2}w_1 + \frac{a_2}{a_1+a_2}w_2 = w_m$$

By assuming $a_2 = 0$, the portfolio weight allocation for Group 1 can be calculated as follows:

$$w_1 = \frac{1}{\gamma}\Sigma^{-1} r = w_m$$

Where γ is a common risk aversion parameter, Σ is common risk, r is return and w_m is the market weight. This leads Baker *et al.* (2018) to the traditional CAPM formula since the formula above can be used to calculate expected returns for the entire market, allowing the inverse of γ ($\frac{1}{\gamma}$) to be substituted by the market Sharpe ratio ($\frac{r_m}{\sigma_m^2}$):

$$r = \frac{r_m}{\sigma_m^2}\Sigma w_m = \beta r_m$$

This is, in essence, equal to the original CAPM formula without a risk free rate both result in:

$$r_i = r_m \beta_i$$

Similarly, the weight allocation for Group 2 is:

$$w_2 = \frac{1}{\gamma}\Sigma^{-1}(r + e)$$

Where e, as earlier mentioned, is the environmental score of an asset. Adding Group 2 to the traditional CAPM leads Baker *et al.* (2018) to a new version of the CAPM, denoted the CAPM with a twist:

$$r = \frac{r_m}{\sigma_m^2}\Sigma w_m = \beta r_m - \frac{a_2}{a_1 + a_2} e$$

In this version of the CAPM, the environmental, nonpecuniary preference of a_2 is accounted for, as well as an environmental score for the capital asset in question. As such, the CAPM with a twist describes how the cost of capital for a company is related to its environmental performance through the slope: $\frac{a_2}{a_1 + a_2}$. Finding realistic estimates of a_1 and a_2 can give insights to the proportion of investors with, and investors without a nonpecuniary preference for the

environment. Hereby, it is possible to examine to what degree an individual is willing to trade money on behalf of the climate. Hence, the purpose is to find the proportion and concentration of individuals of a_1 and a_2 in a trade-off situation to analyse nonpecuniary preferences for the environment.

2.3 Behavioural Finance

The differences and similarities between behavioural finance and experimental economics have been discussed by Loewenstein (1999). He states that the two subcategories are, although not identical, very similar. Within this study, behavioural finance and experimental economics are regarded as one discipline.

Studies in psychology suggest that people tend to be irrational when making financial decisions (Muradoglu and Harvey, 2012). Wang *et al.* (2010) describe how the methodology of behavioural finance represents an interdisciplinary science where financial research is combined with psychological and sociological elements, such as preferences for the environment. The authors state that basic assumptions made in financial models are sometimes insufficient to fully explain market anomalies and social behaviour (Wang *et al.*, 2010). By analysing behavioural financial literature, Zahera *et al.* (2018), review that behavioural finance facilitates the study of investors in a stock market. The biases and dimensions of an investor's decisions can therefore be more deeply observed by studying behaviour than through traditional economic surveys.

3. Methodology

3.1 Previous methods

Previous research for studying individual's nonpecuniary preferences in the financial market has been primarily focused on existing data of green attitudes. Reports have emphasised individuals' existing preferences of investments through asking questions about investment habits and requirements. These studies are good estimates of what people consider to be important when

they invest. Previous reports capture to what degree individuals are interested in having a sustainable financial behaviour (Morgan Stanley, 2017; Schroders, 2019; USSIF, 2019). The reports, however, are unable to describe how people might change their behaviour when investing sustainably is being put in a trade-off situation with future wealth. Additionally, the reports do not process if nonpecuniary preferences for the environment exist in the financial market.

Other theoretical methods have been developed to describe environmental and other preferences in a financial setting (Baker *et al.,* 2018; Fama and French, 2007). We find, however, no attempts to refine and quantify input data to these models. The lack of quantitative input data leaves information about the magnitude of future wealth an investor is willing to give up for a greener investment and, to a degree, the fraction of people willing to make this trade-off, to be wanting. Trough quantifiable survey evidence, this study attempts to shed light on whether nonpecuniary preferences are present and, if so, to what extent. Our main contribution is that we are the first study to translate our survey responses into exactly how the cost of capital for a company is related to its environmental performance.

3.2 Finding variables in CAPM with a twist

3.2.1 Scoring range and the variable e

In order to apply survey results to the CAPM with a twist, we created a scale for environmental performance. To find a suitable scoring system measuring an environmental investment in, we combined the variable *e* (Baker *et al.*, 2018) and Morningstar's ESG globe rating system (Hale, 2017). From these starting points, we constructed an environmental range from -2 to 2 displayed to subjects in our experiment. When measuring individual preferences of environmental performance, we attempt to incorporate the concept of subjective relativism (Inderst *et al.* 2012). In brief, this concept proclaims the fact that what is true to one person is not necessarily true to another. We therefore derived the measure from being better or worse from the average peer performance in absolute terms, assuming that this approach is easier to interpret and evaluate for

the individual investor. For example, some perceive electric cars as environmentally friendly since they run by electricity instead of fossil fuels, whereas others perceive electric cars as a strain on the environment because of the effect the production of the batteries has on climate change. This clearly exemplifies the need for a subjective environmental scoring system.

The original variable *e,* retrieved from Baker *et al.* (2018), describes $e = 0$ as the average score of environmental performance. Moreover, a positive value of *e* generates lower returns and *vice versa*, a negative value generates higher return, as implied by Chava (2014), Sharfman and Fernando (2008). Morningstar's globe rating system retrieves values of 1 to *5* globes (Hale, 2017). The average score of an asset compared to its peers is put to *3* globes and is in our system translated into the value 0. Similarly, 1*,* 2*,* 4, and 5 globes are in our system translated into -2, -1, 1 and 2 respectively, displayed in the survey. Thus, we constructed our own interpretation of the variable *e* in order to apply a suitable input to CAPM with a twist.

3.2.2. The variables a_1 *and* a_2

In the CAPM with a twist, a person with a nonpecuniary preference for the environment is denoted by a_2. This variable is explained as subjects choosing a positive environmental score in our survey. To find evidence for environmental nonpecuniary preferences, and moreover, to find the input ratio $\frac{a_2}{a_1+a_2}$, our seven investment scenarios (question 6 to 12 in appendix) were studied separately. The result of a subject's separate choices of assets A, B, C and D corresponds to the values of *e*: -2, -1, 1 and 2. This enables us to summarise the numbers of chosen assets A, B, C and D, giving us the allocated weights for each question. Furthermore, since the assets A and B both have an *e* score below the average 0, their resulting weights are together determined to be the value of a_1 for each question. Similarly, the assets C and D both have an *e* score above the average 0, therefore their resulting weights are together determined to be the value of a_2 in each question. The aggregated preference of *e* in total is retrieved using the same method of summarising total answers of A, B, C and D respectively, and finding the corresponding aggregated value of a_1 and a_2.

3.3 Subjects of experimental survey

In total, 141 economic students at Lund University and 20 individuals, having a similar educational background within the business world, participated in our experiment. The subjects of economic students were chosen since they possess knowledge within financial terminology and theory. To stretch the range of age, gender and experience, we reached out to the business industry. These subjects were targeted by requesting employees at IKEA in Älmhult and digital requests to people using LinkedIn. The people requested to partake in the experiment from LinkedIn were randomly selected financial employees of SEB, Nordea, Danske Bank, Deutsche Bank and Google. The subjects of students and the subjects of financial controllers from the business world are considered to have similar understanding of the investment options they were exposed to in the survey. By gathering as many respondents as possible, as dictated by time and resources, the subject pool is not balanced with regards to gender and age.

The point of testing individuals who are currently studying or have studied economics in the past is to minimise the irrationality of subjects, as implied by the conventional CAPM. The CAPM with a twist by Baker *et al.* (2018) is, as outlined above, derived from two groups. The subjects of both groups are initially mean variance maximisers but the subjects of the Group 2 have an additional nonpecuniary environmental preference. Testing individuals with knowledge of economic theory might increase the chances of subjects acting rational (apart from possible nonpecuniary green preferences) since we have trust in this target group to make theoretically informed decisions. We postulate that all participants in our survey are mean variance maximisers, but also that there are differences with regard to nonpecuniary environmental preferences within the sample. The additional nonpecuniary environmental preference is therefore what is left to test for. Hence, the test group of student and financial controllers is a suitable sample for our study.

3.4 Design of survey

3.4.1 Experimental setting

The subjectivity of one's environmental preference is difficult to capture. Due to relative subjectivism when measuring environmental utility, a suitable method of behavioural finance containing experimental elements is used. Behavioural finance is commonly studied in an experimental setting (Hogarth, 2005). We have derived an economic experiment of the decision making of an individual that is divided into two parts, as suggested by Hogarth (2005). The first section puts the subject's decision making in an abstract setting where they spontaneously have to choose the most suitable option. The data is in the second part analysed through economic theory. To obtain a decision making as spontaneous as possible, as dictated by behavioural finance, the subjects did not receive information regarding the purpose of the experiment before entering, nor did they know what they were tested for.

Our study is based on perfect transparency and incorporates both absolute and relative terms when measuring climate preference (Inderst *et al.,* 2012). Absolute terms are used to gain objectiveness and transparency, giving subjects absolute choices of environmental score. Relative terms are used to capture personal preferences of greenness. Our method contains a relative scale of environmental impact that can be subjectively interpreted by the test group. The experiment does not exemplify any of the choices that can be made which gives the subjects interpretational freedom of what the specific choice translates to, in reality. In other words, it is up to the subject to trade personal concern of climate change for money, or *vice versa*.

Studying market behaviour in this type of experimental setting, rather than using solely financial methodology, gives us the ability to experiment with the variables in CAPM with a twist. Hence, we quantify green preferences in a theory that actually treat such variables. The method is believed to be a reliable indicator of how individuals may act in scenarios where they have to choose between higher return and subjective environmental concern, as is in agreement with

CAPM with a twist. Thus, we find if, and to what extent, nonpecuniary preferences exist and our results can act as input variables to the CAPM with a twist.

3.4.2 Trade-off scenarios

The survey provides the subject with nine scenarios. In each scenario, four alternatives are presented and the subjects have to make an individual decision of which alternative they prefer. The entirety of the survey is mainly divided into four parts.

1) The first part focuses on people's preference for return in general. Four alternatives of assets, with different returns but equal risk, are presented, with returns ranging from 10 % to 6 %. The returns are theoretically constructed percentages, based on the average expected return of a long-term investment in Sweden (Ekonomifokus, n.d). This part is intended to enable an evaluation of the subjects. Logically, everyone should choose asset A, since the environmental aspect is yet to be introduced and equal risk stands. If subjects choose any other asset, B, C or D, their further answers might not be as reliable as those of the subjects choosing asset A, as they show a weak initial preference for return. Example is given below:

Asset:	A	B	C	D
Return:	10 %	9 %	7 %	6 %

2) The second part of the experimental survey provides the subjects with information about environmental scoring. This scoring range was based on the variable *e* (Baker *et al*., 2018) and Morningstar's sustainable rating system (Hale, 2017). The environmental score of the survey consists of the following values: -2, -1, 1 and 2.

The subjects were presented with the following explanation:

> -2 = in comparison to similar investments this asset the most negative impact on the climate.
> -1 = in comparison to similar investments this asset has an impact more negative than average on the climate.
> 0 = in comparison to similar investments this asset has the same impact on the climate as average.
> 1 = in comparison to similar investments this asset has an impact more positive than average on the climate.
> 2 = in comparison to similar investments this asset the most positive impact on the climate.

The subjects were not given the option to select an asset with an average environmental score, 0, making subjects unable to take a neutral stand for the environment. If a neutral option was exposed to the subjects, finding additional environmental preferences in behaviour could not have been done without difficulty.

From an environmental aspect, the negative scores are 1 and 2 scores below average of mutual investments (denoted by -2 and -1). Similarly, the positive scores are 1 and 2 scores above average of mutual investments (denoted by 1 and 2). Example is given below:

Asset:	A	B	C	D
Environmental score:	-2	-1	1	2

3) The third part of the experimental survey combines the first and the second part, explained above. In this part, subjects have to make a decision on what option they prefer when return is being traded for environmental score. Example is given below:

Asset:	A	B	C	D
Return:	10 %	9 %	7 %	6 %
Environmental score:	-2	-1	1	2

4) The fourth and main part of this experimental survey is an extension of part three. Again, subjects have to make a decision on what option they prefer when return is being traded for environmental score. In extension to this, the alternatives are put into the context of saving 1 000 SEK per month for 20 years (for future pension). The amount of 1 000 SEK is retrieved from SEB's (2019) general recommendations of individual pension savings. Presented as "final value" is this hypothetical monthly saving and the corresponding yearly return of the asset. The inclusion of the final value is an effort to put the returns into perspective, enabling respondents to make informed decisions. Traditional financial theory, however, would predict equal responses from part three and the first question of part four, since the change is solely in the framing of the question. The table for this part of the survey contains an additional row showing the final value retrieved after saving 1 000 SEK per month for 20 years with a specific return. Example is given below:

Asset:	A	B	C	D
Return in %:	10 %	9 %	7 %	6 %
Final value:	756 030 SEK	669 174 SEK	526 382 SEK	467 913 SEK
Environmental score:	-2	-1	1	2

This scenario is repeated for a total of six times. However, new percentages of return and final values are provided to the subject in each scenario. In all scenarios, asset A has the highest return and the lowest environmental score, and asset D has the lowest return and highest environmental score. The different percentages of return are varying in range and level in all scenarios. We have determined the range and level of return in the different scenarios on what data we find interesting to analyse. To be able to analyse the results of CAPM with a twist, the majority of the investment choices follow a linear scale differing in percentage points and level. We are also interested in testing if extreme differences can explain the existence of nonpecuniary green preferences, which is why we in question 10 have obtained a nonlinear approach. Furthermore,

in order to obtain spontaneous answers, subjects were unable to go back to change their previous answers. All questions of the survey can be further observed in the appendix.

3.4.3 Environmental tendencies

To enable a deeper analysis of the environmental tendencies of the subjects, five additional questions were included. The first of which asks if the subjects have actively invested green in the past, allowing for analysis of present and past investment behaviour, from an environmental point of view, to be conducted. The second of the additional questions require the subjects to estimate the level of return they are willing to give up for environmental investments. This enables a comparison between the estimates of the subjects and the actual amount they gave up in the previous trade-off scenarios of the survey. The third question is a further inquiry in money given up for the environment, as subjects are questioned about donations to environmental organisations. This question additionally acts as a possible explanation as to why a subject might choose assets with a negative environmental score in the trade-off scenarios, since it allows the subject to prove their possible concern for the environment, monetarily, in a non-investment setting.

The fourth question investigates whether the subjects consider green investing to be an adequate approach when attempting to affect the climate. In combination with the trade-off scenario results, this question can shed light on why some subjects made choices that allocated them in Group 1, assuming they did not consider green investing to be adequate as a way of affecting the environment. The fifth question asks whether or not the subjects consider themselves to be environmentally friendly in their everyday life. This provides information on the overall environmental tendency of a subject. The environmental tendencies are analysed through a regression, further explained in section 3.6.

3.5 Statistical power

Statistical power is a tool used to calculate the number of respondents needed for an experiment. With enough power, i.e. respondents, it is possible to avoid type II errors: to assume no

difference when in reality there is one. The higher the statistical power, the fewer type II errors can be expected. Statistical power is expressed as follows: $power = Pr(reject\ H_0 \mid H_1\ is\ true)$ (Kraemer and Blasey, 2016). To avoid type II errors, statistical power of 0.95 is applied in this study when possible.

3.6 Regression

To find if the environmental tendencies can explain the greenness of the subject's investment choices, we perform a regression. The questions 1 (gender) and 2 (age), and the questions explained in section 3.4.3; 13 (green investment history), 15 (charity donations), 16 (if sustainable investing is a good way to affect the environment) and 17 (green lifestyle in general) might explain the likelihood of a subject being an a_2 investor. Therefore, we run the regression on the above-mentioned variables as the explaining variables and putting to what degree a subject was likely to choose answers of a_2 as the dependent variable. The variable woman and "green answers" in the questions were put to 1 and other options, put to 0. This degree of a_2 is retrieved by the number of times the separate individual chose the assets C or D, divided by the total number of analysed scenarios, 6. This generates an average a_2 value between 0 and 1, putting those who solely chose the assets A and B, which we denote a_1, to 0. Explaining the nonpecuniary greenness of investment decisions will then be the following:

$$y_i = \beta_0 + \beta_1 \times gender + \beta_2 \times age + \beta_3 \times investing\ green + \beta_4 \times donate + \beta_5 \times good + \beta_6 \times green\ lifestyle$$

3.7 Delimitation

The survey of this study is partly based on experimental finance. However, due to time constraints, an approach completely aligned with behavioural finance methodology is not achieved. Our study is done in a computer-based survey containing both experimental and empirical elements. As a result, we have not been fully able to control the physical experimental setting in which the subjects responded to the survey. Additionally, due to lack of resources, the experiment did not, to the full extent, include real monetary incentives. If subjects were to gain actual monetary compensation, corresponding to the choices made of *e* and return, a result more

accurate to a real life situation might be closer at hand (Kamenica, 2012). However, we tried to balance the lack of monetary compensation by introducing subjects to a price, given participation with honest attitudes in the experiment, they could be randomly selected in a lottery, winning two cinema tickets.

Furthermore, this study focuses on the environmental aspect alone, where an ESG inspired score is used as an estimate of an investor's interest in environmental investing. The use of ESG is motivated by its wide exertion and acceptance among both individual as well as institutional investors.

Moreover, in this study, a negative average environmental score allocates a subject to a_1 and a positive average environmental score allocates a subject to a_2. This corresponds to subjects choosing mostly assets A and B being allocated to a_1 and subjects choosing mostly assets C and D being allocated to a_2. It can be argued, however, that subjects choosing mostly assets B, C and D should be allocated to a_2 since all of these choices mean some return has been traded for a higher environmental score. This approach, however, was not opted for in this study, since it can be argued that an honest preference for the environment is shown through choosing a positive environmental score consistently enough for the average to result in a positive value.

Finally, in this study, we perform statistical power tests on our data. In some cases, although not all, we found our statistical power to be lacking. This implies that the number of respondents, in some questions, is insufficient. A continuation of this study, with more resources and more time, would surely retrieve interesting results that can be verified with statistical power.

4. Results and analysis

4.1 Respondents

4.1.1 Response rate

The survey was distributed to different groups to enable a broader span of ages and genders among the respondents. Apart from being translated, all groups received an identical survey. In total, three groups were approached and responses were received from all groups. As shown in *figure 1,* the highest response rate was observed among students at the economic bachelor programme, and the lowest was observed among students at the master's programme. In total, 161 responses were retrieved and 230 subjects were approached.

This study is at some risk of a sampling error, since we are unable to calculate if those who actually took the survey were more likely to invest sustainably, or *vice versa*. The survey was, however, only possible to take on a computer. This is relevant as, at least among students and master students, the dropout statistic could be completely random, since those who did not take the survey could be students who failed to bring their laptop to class that day.

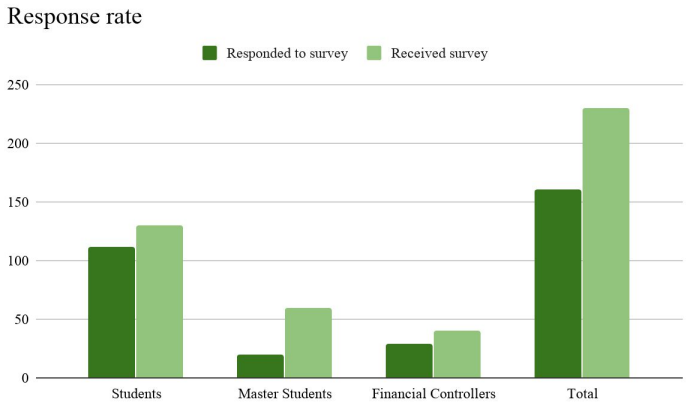


Figure 1

In *figure 2,* the response rates are shown as percentages.

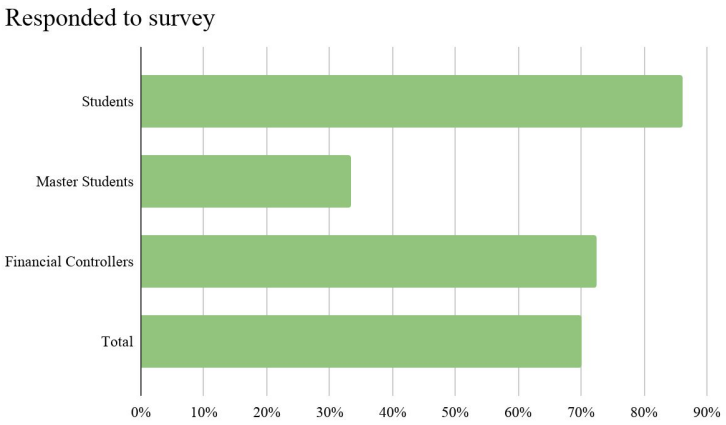


Figure 2

4.1.2 Respondent information

General information about the subjects was gathered in the initial section of the survey. The subjects were given the alternatives of male, female, and other, when requested to state their gender. A majority of respondents stated their gender as male, as shown in *figure 3*. As per design, the ages of respondents vary. The concentration of respondents of the ages 19 to 29, visible in *figure 4*, can be explained by the fact that the majority of subjects approached were students at Lund University, and thereby generally younger.

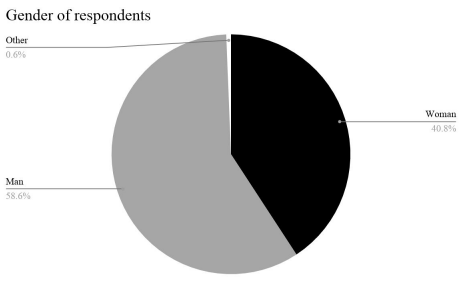


Figure 3, Survey question 1

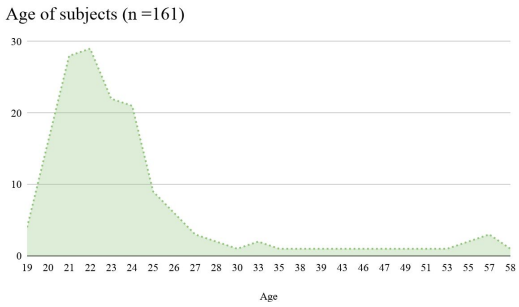


Figure 4, Survey question 2

4.2 Data from the experiment

4.2.1 Survey part 1

In the first part of the survey, the subjects were asked to choose one out of four assets solely based on information about the returns of the assets. As expected, a majority of respondents chose asset A with a return of 10 %, instead of assets B, C or D, with returns of 9 %, 7 % and 6 % respectively. This enables us to confirm that a majority of respondents are homogenous in their preference for maximum return. The aggregated results are presented in *figure 5*.

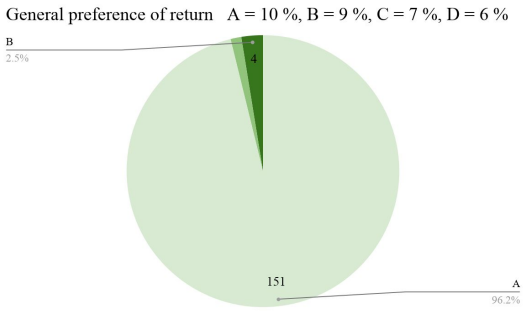


Figure 5, Survey question 3

4.2.2 Survey part 2

To gain a perception of environmental preferences in a non-trade-off situation, the subjects were asked to choose one out of four assets solely based on information about the environmental scores of the assets. A majority of subjects chose asset D, the asset with the highest (the best) environmental score, as shown in *figure 6*. A considerable share of respondents did, however, choose one of the other three assets, A, B or C. This implies that approximately one quarter of respondents are unwilling to invest in green assets, although no other factors could be either to gain or to lose. Subjects choosing assets A, B or C in this scenario show no environmental preference, indicating that the allocation of a_1 should be greater than 25 %.

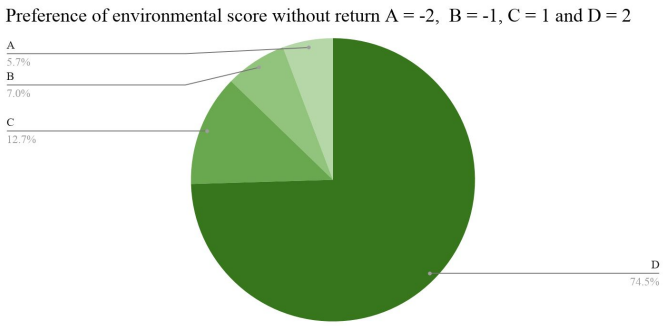


Figure 6, Survey question 5

In an extension of part two, subjects were asked if they understood the meaning and implications of the environmental score. The subjects who answered negatively were excluded from all trade-off scenario questions, resulting in a new total of $n = 158$.

4.2.3 Survey part 3 and 4

4.2.3.1 Survey part 3 - Initial allocation of a_1 and a_2

When subjects were asked to choose one out of four assets based on information on environmental score and return, with the latter ranging from 10 % to 6 %, a majority choose asset C or D. The allocation, shown in *figure 7,* resulted in $a_1 = 70$ and $a_2 = 88$, giving a ratio of $\frac{a_2}{a_1+a_2} = 0.557$. This implies that there is a tendency among subjects to prioritise environmental score above return. However, when a hypothetical final value of the investments is displayed (see appendix), the outcome is changed, to $a_1 = 100$ and $a_2 = 58$, giving a ratio of $\frac{a_2}{a_1+a_2} = 0.367$, despite the fact that the percentages of return remain the same. This was found through analysis and comparison of the question in part three of the survey, and the first question of the fourth part of the survey, displayed in *figure 7* and *8* (survey questions 6 and 7). Survey question 7 offered the exact same alternatives as the question prior, only with the addition of the final values of the assets. Our results show a significance regarding difference with $p < 0.05$ and a statistical power of 0.95.

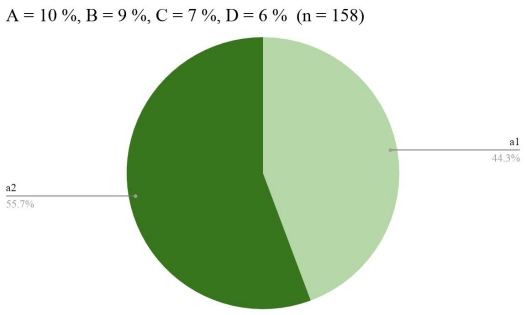


Figure 7, Survey question 6

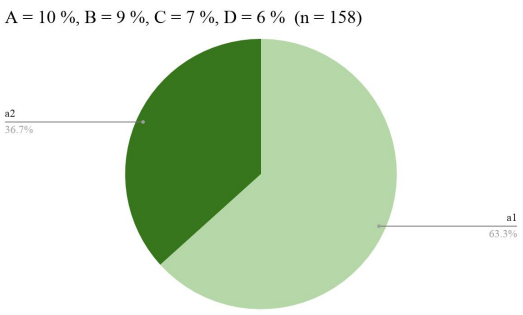


Figure 8, Survey question 7

Based on this result, the question from part three (survey question 6) was completely excluded when analysis on part four was performed. Had there not been a significant difference, the question from part three could have served as an addition to part four. The different outcomes do, however, imply that the inclusion of the final value enables the subjects to make an informed decision and thereby give more truthful responses to the trade-off scenarios. In reality, however, individual investors are not presented with a final value. Although it is possible for the individual investor to calculate this value, it is not offered as standard investment information. Because of this, the layout of question 6 is more similar to an investment situation in reality. Considering the evidence, shown in *figure 7* and *8*, it is possible that the inclusion of a final value, although generating informed and truthful answers, leads to an underestimation of a_2.

4.2.3.2 Survey part 4 - allocation of a_1 and a_2 continuation

The first question of this part of the survey, question 7, is discussed in section 4.2.3.1. The second question displays considerably lower returns, 4 % to 1 %, but do, however, still show a tendency amongst subjects to choose assets with a negative environmental score, shown in *figure 9*. In this scenario, $a_1 = 84$ and $a_2 = 74$ giving a ratio of $\frac{a_2}{a_1+a_2} = 0.468$.

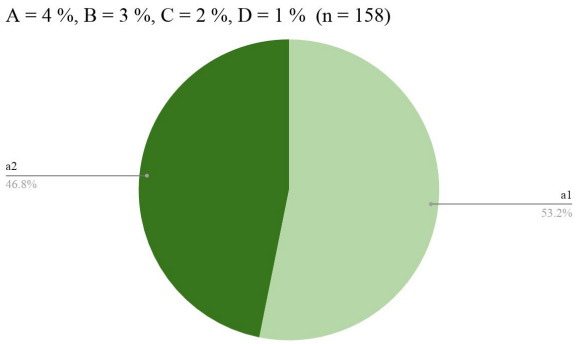


Figure 9, Survey question 8

When presented with rather small differences in return, 0.5 percentage points, in the range of 9 % to 7.5 %, a majority of subjects chose asset C or D and consequently positive environmental scores. As illustrated in *figure 10*, a majority of subjects gave up some return for the environment, giving $a_1 = 62$ and $a_2 = 92$ and a ratio $\frac{a_2}{a_1+a_2} = 0.608$. Perhaps, subjects are more willing to make the trade-off because of the small differences in return, 0.5 percentage points, as they can give up very little to obtain an environmentally friendly asset.

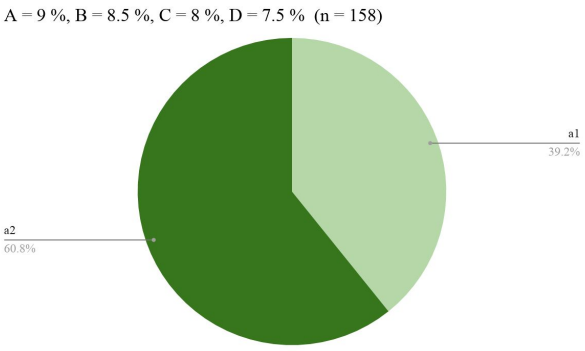


Figure 10, Survey question 9

In question 10, presented in *figure 11,* the differences in returns are relatively large and nonlinear in data, with corresponding values of 14 %, 9 %, 8 % and 3 %. Subjects tendency for high-return assets, with a negative environmental scoring, can be observed through 74 % of respondents choosing asset A or B, resulting in $a_1 = 117$ and $a_2 = 41$ and the lowest ratio observed of

$\frac{a_2}{a_1+a_2} = 0.259$. This can be due to the fact that the price of e (what one has to give up in order to choose a more environmentally friendly asset) was in this question very high in comparison to our other survey questions. A quarter of respondents were, however, allocated to a_2. Taking a closer look at the data, we find that 99 respondents chose asset A and 37 respondents chose asset D, meaning 37 subjects were willing to give up more than 500 000 SEK. Among these 37 respondents, the nonpecuniary preference seems to be strong.

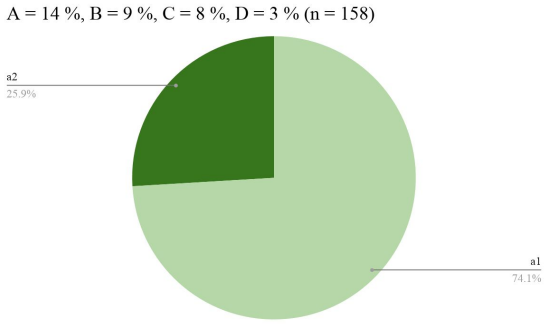


Figure 11, Survey question 10

With relatively high returns and differences of 1 percentage point, ranging from 15 % to 12 %, a majority of 57 % of respondents chose asset A or B. This result generated $a_1 = 90$ and $a_2 = 68$ and a ratio $\frac{a_2}{a_1+a_2} = 0.430$, illustrated in *figure 12*. Looking at *figure 9* as well as *figure 12*, the results suggest that, when the level of return is high, subjects tend to prioritise future wealth prior to environmental sustainability.

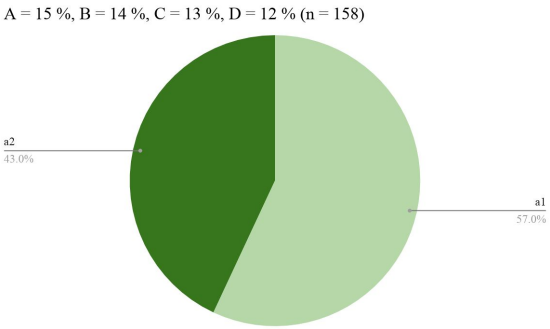


Figure 12, Survey question 11

Interestingly enough, the trend of choosing monetary wealth drastically changed when we in question 12 lowered the level of return and lessened the difference, only being 0.5 percentage points, ranging from 2 % to 0 %. In this scenario, a majority gave up some return for the environment generating $a_1 = 76$ and $a_2 = 86$ and a ratio $\frac{a_2}{a_1+a_2} = 0.544$. The slight majority is displayed in *figure 13.* As discussed in connection to *figure 12,* the tendency seems to be that with higher rates of returns, the weaker the preference for environmental sustainability. Based on the results shown in *figure 13*, the opposite seems to be true as well, since the relatively low returns resulted in a majority prioritising a positive environmental score above higher return. It is possible, however, that the connection is stronger to the cost of *e,* in this case, as well as that shown in *figure 10*, equal to 0.5 percentage points.

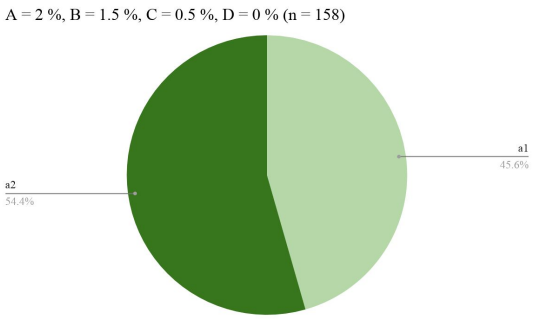


Figure 13, Survey question 12

In four out of seven scenarios, a majority of subjects chose asset A or B. Disregarding question 6, an even larger share of questions was predominantly characterised by choices allocating a subject to a_1. However, in many of the scenarios, the allocation of a_2 was a rather large minority, in many cases above 40 %, implying nonpecuniary preferences exist to a certain degree.

4.2.3.3 Overall allocation of a_1 and a_2

Out of 948 investment scenarios in total (question 7 to 12), the most commonly chosen preference of environmental score, *e*, was the score of 1 (asset C) with 33.9 %. Asset C was

explained to perform better in an environmental aspect than the average of similar investments. However, the second most chosen *e* was the score of -2 (asset A) with 31.3 %. The investment with this score was explained to be the worst for the environment. Moreover, the investment with a score performing below average from an environmental perspective, -1 (asset B), was chosen 24.1 % of the time. The least chosen asset, with 10.8 %, was the asset with the environmental score of 2 (asset D), which was explained to be the best for the environment. The allocation of total *e* preferences is shown in *figure 14*. The aggregated results of preferable *e*'s, show that people tend to choose assets with a negative environmental scoring when it is being traded for return. Investments with scores greater than 0 (C and D) were in total chosen 44.6 % of the time ($a_2 = 423$) and investments with scores less than 0 (A and B) were in total chosen 55.4 % ($a_1 = 525$) of the time, as implied by *figure 15*. This gives us the ratio $\frac{a_2}{a_1+a_2} = 0.446$, which is the same as the total share of people choosing assets C and D. As predicted through analysis of question 5, see commentary on *figure 6*, the allocation of a_1 exceeds 25 %.

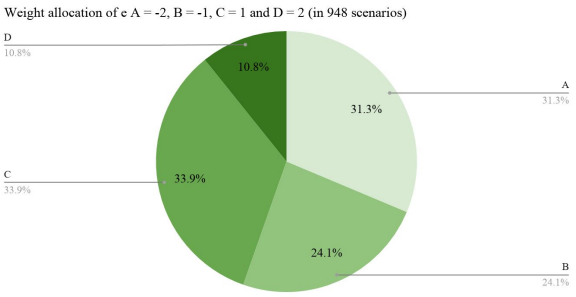


Figure 14

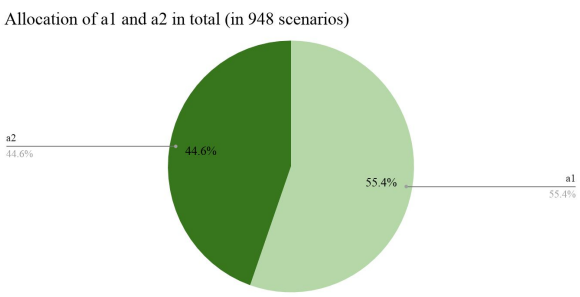


Figure 15

According to Eyraud *et al.* (2011), green investing declined during the financial crisis of 2009 due to uncertainty about future demand, reduced liquidity and less favourable financial conditions. The rather large allocation of a_2 in this study could imply a sense of the opposite among the respondents, i.e. certainty about future demand, increased liquidity and more favourable financial conditions. Perhaps, the environmental preference of a subject is stronger when these aspects are present.

4.2.4 Further survey data

Regarding subjects' prior sustainable investing, 48.1 % claim not to have done so. Close to a third, 29.7 %, of subjects claim to have invested sustainably in the past and 22.2 % claim to never have actively invested. These results are presented in *figure 16.* Although the purpose of this study is not to detect general investment habits, the result of this question is to some extent comparable and exceeds the 16 % of global individual investors who claim to invest sustainably (Schroders, 2019). More interestingly, a majority of our subjects are students who, presumably, are less active investors than the global individual investor. This implies our target group is more environmentally friendly than the global investor and that might be due to the fact that investors in different countries have different approaches to sustainable investing.

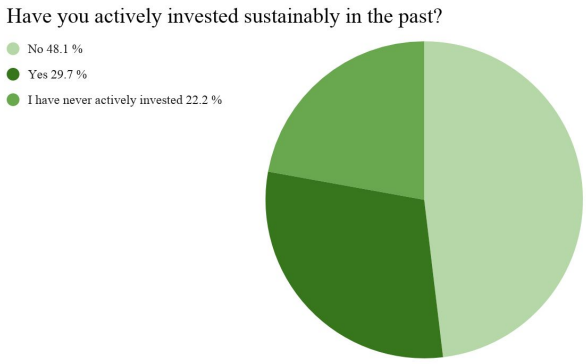
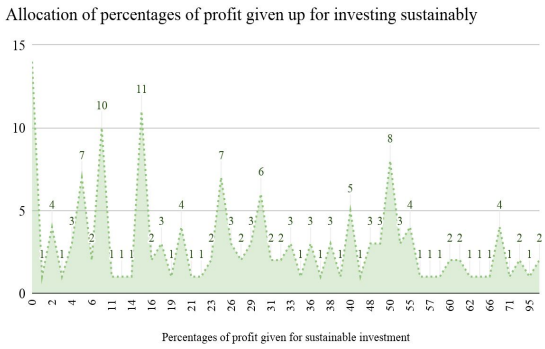


Figure 16, Survey question 13

The of subjects estimated percentage of return given up for environmental investments displayed an average of 31 %, based on data collected in survey question 14 (see *figure 17*). Furthermore, a majority of respondents have not donated to an environmental organisation. As shown in *figure 18,* about a third of respondents have expressed concern for the environment through donations.



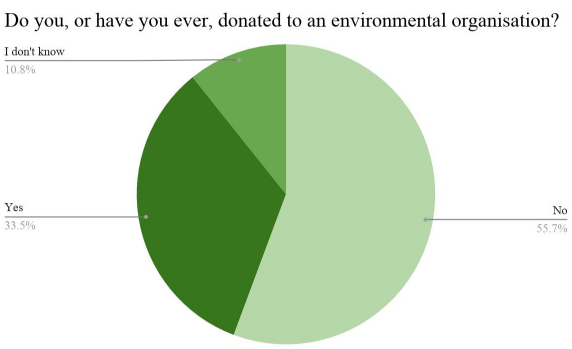


Figure 17, Survey question 14

Figure 18, Survey question 15

As shown in *figure 19*, a majority, 84 %, of subjects consider sustainable investing to be a good way to affect the climate. Interestingly, this percentage exceeds that of the average of subjects who, in our survey, invested in assets with a positive environmental score, as in the allocation of $a_2 = 44.6\ \%$.

Figure 20 displays how those who suggest sustainable investing is a good way to affect the climate actually acted in our survey. In total, 44.4 % of subjects who consider sustainable investing to be effective, chose to invest with a green nonpecuniary agenda, and thus trade return for *e*. Although question 16 does not directly ask if the subject has a specific interest in investing green, it is interesting to observe to what extent people act on their beliefs. Previous studies show that 50 % of those who express interest in investing sustainably actually do so (Morgan Stanley, 2017). Our study shows that, although not by much, less than 50 % of subjects who express that green finance is a good action to affect the environment, do choose corresponding choices in investments.

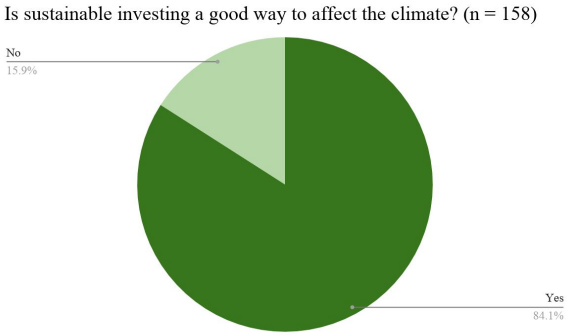


Figure 19, Survey question 16

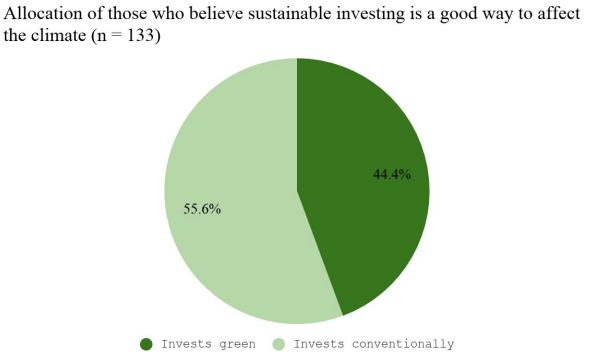


Figure 20

Close to 90 % of respondents consider themselves to be environmentally friendly in their everyday life, implying a majority of subjects do act on their concerns for the climate. According to *figure 21*, about 8 % of respondents do, however, not aspire to be environmentally friendly through commonplace actions. This evidence suggests that environmental awareness is common.

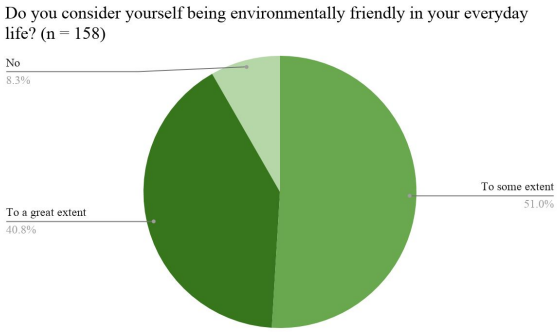


Figure 21, Survey question 17

4.3 Statistical results

4.3.1 Introductory information

To find if, and to what extent, environmental tendencies and background variables could explain the subject's degree of giving up money for the environment, we ran a regression with the six explaining variables as follows:

$$y_i = \beta_0 + \beta_1 \times gender + \beta_2 \times age + \beta_3 \times investing\ green + \beta_4 \times donate + \beta_5 \times good + \beta_6 \times green\ lifestyle$$

The outcome can specifically be observed in *table 1.*

4.3.2 Gender and age

Observing the results of the regression, one result, gender, stands out. The p-value of gender is significantly low, explaining that the female subjects are 0.227 more nonpecuniary green in their investment choices than male subjects. The number 0.227 refers to the increase in average a_2 value if being woman. Furthermore, age is also significantly low and retrieves a low standard error (SE), explaining that one extra year of age, generates 0.006 more to the subject's average a_2 value. The result of age is not equivalent to what the literature on environmental financial preferences suggests. Morgan Stanley (2017) and Rönnerstand (2019), conclude that younger people are more concerned and willing to invest sustainably. Our results suggest the opposite. In other words, the older the subject, the more environmentally conscious when investing.

Overall, the average environmental score chosen by subjects, ranging from -2 to 2, resulted in -0.30. Comparing the different categories of subjects, the evidence from the regression suggests that women care more about environmental scoring than men, which we found interesting in particular. Through further analysis of female subjects' (in total 64) answers, we found that their environmental score mean resulted in $\overline{e_f} = 0.2370$, meaning $\overline{e_f} > 0$ for female respondents. In comparison, the mean amongst our 93 male respondents resulted in $\overline{e_m} = -0.6685$ meaning $\overline{e_m} < 0$. The difference in choice is significant with $p < 0.05$ and obtain a statistical power of 0.95. This indicates that women have stronger nonpecuniary preferences for the environment than men.

In the regression, we also found it particularly interesting that the higher the age of the subject, the higher the likelihood to have nonpecuniary preferences for the environment. Rönnerstrand (2019) suggests that people under 30 are more concerned about the environment, which

contradicts our results. To further analyse the age coefficient, we divided subjects into groups of over and under 30. Subjects in the age group "over 30" displayed an environmental score mean of $\overline{e_o} = 0.4907$, meaning $\overline{e_o} > 0$. The mean of the subjects of the age group "under 30" resulted in $\overline{e_u} = -0.4119$, meaning $\overline{e_u} < 0$ for subjects of the ages 29 and under. The results indicate that individuals of the ages 30 and older are more likely to choose assets with a positive environmental score, $e > 0$, in a trade-off situation than individuals younger than 30. The evidence is significant since $p < 0.05$. Statistical power was, however, not obtained as not enough subjects of the age group "over 30" were present in the survey.

Although not provable in this study, it is possible that subjects with a larger personal wealth are more likely to invest sustainably since, in this study, a trade-off between return and environmental score has to be made. The majority of the subjects were students (who are generally younger) with, presumably, a smaller personal wealth than working individuals. It is possible that the opinion of these students is that sustainable investing is a good way to affect the climate, but they feel unable to make the trade while in possession of a small wealth. The older and fewer subjects of the survey, financial controllers, presumably have a larger wealth and could therefore be more likely to invest sustainably. Additionally, this connection would explain the distortion commented on in connection to *figure 19*, where the percentage of subjects of the opinion that green investing is a good way to affect the climate, is exceeded by that of subjects who were allocated to a_2.

4.3.3 Prior green investing

Moreover, in *table 1*, the subjects' investment history being green did not seem to explain their willingness to invest environmentally in this survey, since the *p-value* > *0.05*. However, to gain statistical power of 0.95 for this linkage, the sample groups of prior green investing and no prior green investing would have required at least 173 subjects each, to produce a result free from type II errors. Interestingly, previous studies show that there is an increasing number of those who actively invest with a green agenda, and concurrently, expect there to be a trade-off for return. The conception of a trade-off among millennials, which is a corresponding target group to ours,

reaches 18 % (Morgan Stanley, 2017). Despite our survey results of 29.7 % respondents displaying a history of investing green, this share seems to not correspond to a nonpecuniary preference, opposing the study by Morgan Stanley (2017). Our result on this variable might, however, err, since we did not ask whether the subjects have the perception that green investing is a trade-off deal with the environment or not. However, since the majority of subjects are millennials it can be argued that the conception of a trade-off is present among at least some of our subjects.

4.3.4 Environmental donations

As familiar did 33.5 % of subjects answer that they have on one or more occasions donated money to an environmental organisation. The purpose of this question is to observe if individuals tending to be a_1, and concurrently expressing care for the environment in survey questions 5 (see *figure 6*) and 17 (see *figure 21*) might compensate for their care for the environment by taking other actions, such as donating money to an environmental organisation. According to the evidence, this was not the case. The other way around, however, the linkage was found to be significant. An affirmative answer to question 15, regarding donations, increases the subject's average a_2 value with 0.116, and is a significant result in this survey with a *p-value < 0.05,* see *table 1*. Thus, having donated money to an environmental organisation increases the likelihood of being an individual denoted by a_2. However, to retrieve statistical power of 0.95 for this linkage, the sample groups of donating and not donating would have required at least 99 subjects each. Although not validated by statistical power, this finding is interesting. The evidence suggests that individuals with a nonpecuniary preference for the environment, tend to act on, and allocate their wealth to other environmentally beneficial aspects. Perhaps, having a nonpecuniary preference for the environment is linked to an overall environmentally conscious personality.

4.3.5 Effect on the climate of investing green

The subjects were asked whether or not they believe investing green is a good way to affect the climate, with 84.1 % answering affirmatively. In the regression, the value of average a_2 is explained to increase with 0.215 if answering yes to this question. This result is significant

among our subjects with a *p-value* < *0.05*, see *table 1*. However, to retrieve a statistical power of 0.95 the sample of each answer requires a size of 39 respondents each. The correspondent samples in our survey are 134 and 25.

4.3.6 Green lifestyle

Among subjects, 40.8 % answered that they to a great extent considered themselves being environmentally friendly in their everyday life. With an affirmative answer, this explanatory variable increases the average value of a_2 with 0.108, being statistically significant in this experiment with $p < 0.05$, see *table 1*. However, to obtain a statistical power of 0.95 of this question, the sample of answering "to a great extent" and sample of answering any of the other options, requires a size of 68 respondents each. The correspondent samples are in our survey 98 and 60. These findings further validate the idea that the nonpecuniary preference for the environment that a subject demonstrated through their choices in the trade-off scenarios could be linked to an overall environmentally conscious personality. The results suggest that individuals who donate to, or have donated to, an environmental organisation, as well as individuals who consider themselves to be environmentally friendly to a great extent, are more likely to invest in assets with a positive environmental score, despite the trade-off. The pattern is unfolding as a general tendency for green actions, in as well as out of a financial setting.

	Coeff	*SE*	*t stat*	*P*	*Lower 95%*	*Upper 95%*	*Lower 95%*	*Upper 95%*
Intercept	-0.091	0.091	-0.997	0.320	-0.271	0.089	-0.271	0.089
Gender	0.227	0.053	4.293	3.13336E-05	0.123	0.331	0.123	0.331
Age	0.006	0.003	2.085	0.039	0.000	0.012	0.000	0.012
Invest_green	0.049	0.056	0.871	0.385	-0.061	0.159	-0.061	0.159
Donate?	0.116	0.055	2.091	0.038	0.006	0.225	0.006	0.225
Good?	0.215	0.069	3.121	0.002	0.079	0.351	0.079	0.351
Green_life	0.108	0.055	1.980	0.049	0.000	0.216	0.000	0.216

Table 1

4.4 Results of CAPM with a twist

To find input to the CAPM with a twist formula: $r = \beta r_m - \frac{a_2}{a_1+a_2}e$, a hypothetical market return was derived from the survey scenarios, generating $r_m = 7.6\ \%$. This value could, however, be considered unimportant since it only explains the level of intercept, and we are interested in finding the slope of the SML. In the survey, we assume a common risk for all investments which gives us equal values of β. Since no risk is present, β is put to 1. The level of *e* is already set to the values of -2, -1, 1 and 2, which means that $\frac{a_2}{a_1+a_2}$ is a function of *e*. In CAPM with a twist, the product of $\frac{a_2}{a_1+a_2} * e$ should be relatively stable, since the ratio of $\frac{a_2}{a_1+a_2}$ increases as *e* decreases, and *vice versa*.

When choosing an environmentally preferable *e* in the survey, the investor pays a price, consisting of return percentage points, see *table 2*. To be able to calculate the cost of equity, we derived the price of *e* in our survey questions separately, enabling us to calculate new values for $\frac{a_2}{a_1+a_2}$. For each scenario in the survey, the initial values of $\frac{a_2}{a_1+a_2}$ were: *Q7 = 0.367, Q8 = 0.468, Q9 = 0.608, Q11 = 0.430, Q12 = 0.544.* For question 7, 8 and 11, we put the price of *e* to 1*,* since one unit of *e* corresponds to 1 percentage point of return. For question 9 and 12, we put the price of *e* to 0.5*,* since one unit of *e* corresponds to 0.5 percentage points of return. The calculation for the price of *e* in question 10 is not applicable since this question has a nonlinear range of returns. Furthermore, we adjusted the ratio of $\frac{a_2}{a_1+a_2}$ for each question by multiplying it with its price of *e,* giving us an accurate ratio of: *Q7 = 0.367, Q8 = 0.468, Q9 = 0.304, Q11 = 0.430, Q12 = 0.272.* Thereafter, we calculated the average of these ratios resulting in 0.3682. The new ratios are somewhat similar, indicating that the survey answers were only contradictious to a small extent, and subjects have stable preferences for *e.* The data can be further observed in *table 2.*

When $e = 1$, the adjusted ratio of $\frac{a_2}{a_1 + a_2}$, for each question, could thereafter be put into our formula: $r = \beta r_m - \frac{a_2}{a_1 + a_2} e$, generating the correspondent expected return for each question, shown in *table 2*.

Q	Price of e	a2/all	Price of e x a2/all	E(r)CAPM twist with e=1
Q7	1	0.367	0.367	7.233
Q8	1	0.468	0.468	7.132
Q9	0.5	0.608	0.304	7.296
Q10	-	-	-	-
Q11	1	0.430	0.430	7.170
Q12	0.5	0.544	0.272	7.328
rm	**7,6**		**Average: 0.3682**	

Table 2

All input variables were from this retrieved in order to analyse the different returns as a function of *e* in our model, $r = \beta r_m - \frac{a_2}{a_1 + a_2} e$:

$\beta = 1$

$r_m = 0.076$

$\frac{a_2}{a_1 + a_2} = 0.3682$ (the average of the adjusted ratio, being the slope of the function)

$e = -2, -1, 0, 1$ and 2.

Given this input, the SML function is as follows: $r = -0.3682e + 8.705$ and furthermore the following returns can be observed: $r_{-2} = 8.32\ \%$, $r_{-1} = 7.97\ \%$, $r_1 = 7.23\ \%$ and $r_2 = 6.68\ \%$, see *table 3*. *Figure 22* shows the linear relationship between environmental score *e* and return *r*. This relationship models how the cost of capital for a company is related to its environmental

performance. As familiar, our function retrieves a slope of -0.3682, explaining that every unit of *e* is traded for -0.3682 percentage points of return, based on our data.

e	SML	SML with a twist
-2	7.6%	8.34%
-1	7.6%	7.97%
0	7.6%	7.60%
1	7.6%	7.23%
2	7.6%	6.86%

Table 3

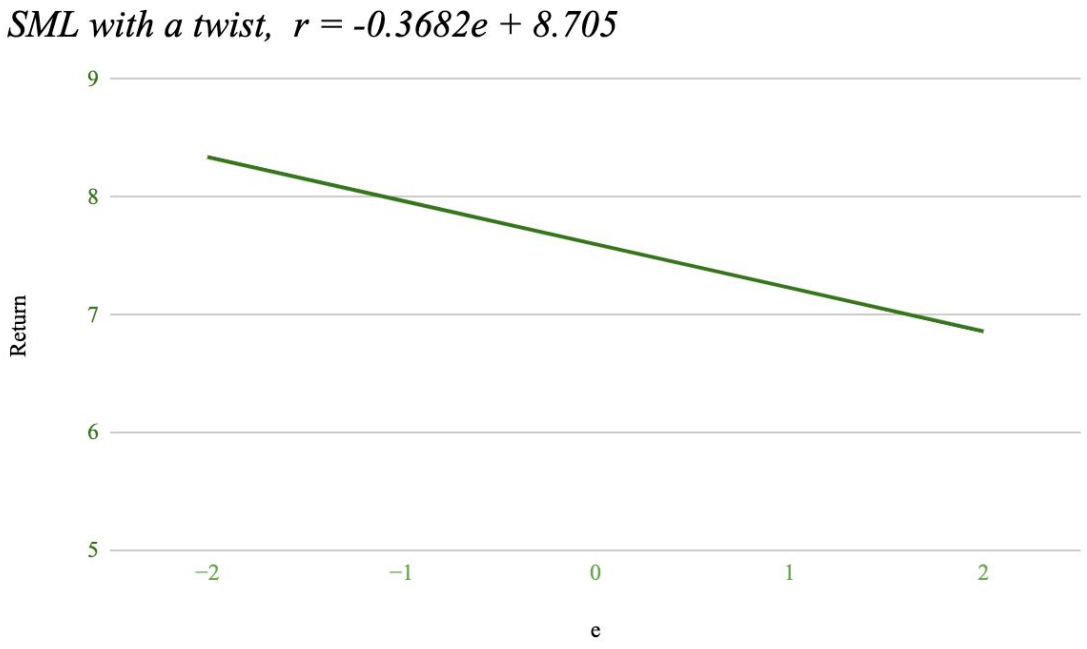


Figure 22

Using our results from CAPM with a twist, $r_{-2} = 8.32$ %, $r_{-1} = 7.97$ %, $r_1 = 7.23$ % and $r_2 = 6.68$ %, we are able to calculate the average percentage that subjects actually gave up for the environment, through their choices of assets in the survey. By taking the difference of the means for r_{-2} and r_{-1} (8.145) and for r_1 and r_2 (6.955), enumerating to 1.19 percentage

points, and dividing this by the highest mean, $\frac{8.145-6.955}{8.145}$, the given-up percentage results in 15 %. Interestingly, in question 17 of the survey, the subjects were asked to fill in a fixed percentage of a possible profit from gained return, on how much they estimated they were willing to give up for investing environmentally friendly. The average answer resulted in 31 %. This implies that subjects overestimate how much of their profit they are willing to trade for investing sustainably. Again, this suggests that putting real life scenarios of pension savings into the main part of the survey, generated a more honest result without overestimations of one's environmental friendliness.

Viewed from a firm's perspective, the CAPM with a twist suggests lower returns, thus, lower cost of equity, when associated with a good environmental score. Results from our data show a slope of -0.3682, implying that for every unit of *e* a company advance in environmental performance, they will lower their cost of equity with -0.3682 percentage points.

Baker et al. (2018) derive the cost of equity in CAPM a twist by being determined by the market weights of environmental assets with the corresponding demand for such assets. The cost of equity is thus determined by the demand for a preferable *e* by the equation $\frac{a_2}{a_1+a_2}e$. The literature, presented by Chava (2014), Sharfman and Fernando (2008), suggests that it is, in fact, the demand for sustainable investments that affects a firm's cost of equity when it is associated with a certain environmental performance.

The impact of the demand side is further argued in favour of, as investors perception of future risk being associated with its environmental score, can affect a firm's cost of equity as well (Chava, 2014; Sharfman and Fernando 2008). Through subjective relativism, the subjects of this survey were given the interpretational freedom to evaluate their personal importance of *e.* It can therefore be argued that investors having the perception of future risk being associated with a certain level of *e,* take into consideration regulated environmentally unfavourable actions, (through for instance the PRI and the Paris Agreement) as well as unregulated environmentally unfavourable actions. The results of the allocation of a_1 and a_2, particularly the fact that a_2 is

rather large, implies that the effects of the environmental investing trend are substantial. Perhaps, they are substantial enough for there to be a considerable change in the number of environmentally conscious companies through incorporation of CSR. Investors who invest sustainably presumably also disaffiliate with environmentally unfavourable actions of a firm. With enough investors of this opinion, firms could see benefits in becoming sustainable, i.e. lower cost of equity. In this way, the phenomena of green investing can actually come to change existing consumption and production patterns and thus reduce carbon dioxide in the atmosphere. Perhaps, an environmental focus is the best way for a limited company to generate profit, if that is where the investors' preferences lay.

5. Conclusion

Our main contribution is that we are the first study to translate our survey responses into exactly how the cost of capital for a company is related to its environmental performance. Analysing CAPM with a twist with quantitative data enabled us to find the existence and magnitude of nonpecuniary environmental preferences. The linear relationship between the environmental performance of an asset and return is displayed through the slope: -0.3682. Even though a negative slope insinuates a trade-off deal with future wealth, we observe a demand for green investing. Our results show that in 44.6 % of cases, a nonpecuniary preference for the environment is present. The aggregated return, exchanged for a higher environmental score, enumerates to 1.19 percentage points.

Unsurprisingly, when in non-trade-off scenarios, subjects show a great preference for return and likewise, for the environment. When in trade-off scenarios, the nonpecuniary preference for the environment varies depending on the level of return and the cost of *e*. We found that small differences in rate and low levels of return generated a stronger nonpecuniary preference. Likewise, greater differences in rate and high levels of return generated weaker nonpecuniary preferences. The results suggest that the magnitude of the trade-off affects the likelihood of investing sustainably.

Furthermore, we prove that women express, to a significant extent, a stronger nonpecuniary preference for green investments than men, as suggested by previous studies. Perhaps more interestingly, our results regarding age contradict that of previous studies. Based on our data, subjects 30 years old and over, are more likely to invest in environmentally sustainable assets. The regression results additionally show a linkage between a green nonpecuniary preference in investment scenarios, and an overall environmentally conscious personality. An environmentally conscious personality, in this study, regards to the variables: green charity donations, the belief that green investing is a good way to affect the climate and whether they consider themselves to have an environmentally friendly lifestyle to a great extent. These results are validated through statistical significance.

A considerable difference in trade-off results occurred when presenting the subject with a hypothetical outcome from invested money. This motivates us to believe that the methodology, an experimental survey, used to quantify the results of CAPM with a twist acts as an honest indicator. In comparison with previous literature, the target group of this study seem to be more environmentally conscious than the average global investor. By this, it can be suggested that other interesting results, among other target groups, are left to be found.

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Appendices

Appendix. Allocation of answers

	A	**B**	**C**	**D**	**All**
6	28	42	64	24	158
7	49	51	45	13	158
8	40	44	55	19	158
9	36	26	73	23	158
10	99	18	37	4	158
11	46	44	47	21	158
12	27	45	64	22	158
Total	325	268	385	126	1104
	A	**B**	**C**	**D**	**All**
6	17.7%	26.6%	40.5%	15.2%	100%
7	31.0%	32.3%	28.5%	8.2%	100%
8	25.5%	27.4%	35.0%	12.1%	100%
9	22.8%	16.5%	46.2%	14.6%	100%
10	62.7%	11.4%	23.4%	2.5%	100%
11	29.1%	27.8%	29.7%	13.3%	100%
12	17.2%	28.0%	40.8%	14.0%	100%
Total	29.4%	24.3%	34.9%	11.4%	100%
		a1		**a2**	
		55.2%		**44.8%**	100%

Appendix. Survey in full

* 1. Gender?

- ◯ Man
- ◯ Woman
- ◯ Other

2. Age?

* 3.

There are four assets, A, B, C and D.

All assets are subjected to the same amount of risk but have different returns.

Asset:	A	B	C	D
Return rate:	10 %	9 %	7 %	6 %

	A	B	C	D
Which asset would you rather invest in?	◯	◯	◯	◯

4. Environmental sustainability is measured on a scale from -2 to 2 with an average of 0. The value of -2 indicates that the investment has the most negative impact on the climate. The value of 2 indicates that the investment has the most positive impact on the climate.

-2 = in comparison to similar investments this asset the most negative impact on the climate.

-1 = in comparison to similar investments this asset has an impact more negative than average on the climate.

0 = in comparison to similar investments this asset has the same impact on the climate as average.

1 = in comparison to similar investments this asset has an impact more positive than average on the climate.

2 = in comparison to similar investments this asset the most positive impact on the climate.

	Yes	No
Do you understand the information above?	○	○

* 5.

There are four assets, A, B, C and D. All assets are subjected to the same amount of risk and the same level of return but received different environmental scores.

Asset:	A	B	C	D
Environmental impact:	-2	-1	1	2
Clarification:	Worst environmental impact	Environmental impact more negative than average	Environmental impact more positive than average	Best environmental impact

	A	B	C	D
Which asset would you rather invest in?	○	○	○	○

* 6.

There are four assets, A, B, C and D. All assets are subjected to the same amount of risk but different levels of return and received different environmental scores.

Asset:	A	B	C	D
Return rate:	10 %	9 %	7 %	6 %
Environmental impact:	-2	-1	1	2

	A	B	C	D
Which asset would you rather invest in?	○	○	○	○

7.

There are four assets, A, B, C and D. All assets are subjected to the same amount of risk but different levels of return and received different environmental scores.

Assume that you save 1 000 kr per month for 20 years in a pension fund.

Asset:	A	B	C	D
Return rate:	10 %	9 %	7 %	6 %
Final value:	756 030 kr	669 174 kr	526 382 kr	467 913 kr
Environmental impact:	-2	-1	1	2

	A	B	C	D
Which asset would you rather invest in?	○	○	○	○

8.

There are four assets, A, B, C and D. All assets are subjected to the same amount of risk but different levels of return and received different environmental scores.

Assume that you save 1 000 kr per month for 20 years in a pension fund.

Asset:	A	B	C	D
Return rate:	4 %	3 %	2 %	1 %
Final value:	371 630 kr	332 118 kr	297 400 kr	266 870 kr
Environmental impact:	-2	-1	1	2

	A	B	C	D
Which asset would you rather invest in?	○	○	○	○

9.

There are four assets, A, B, C and D. All assets are subjected to the same amount of risk but different levels of return and received different environmental scores.

Assume that you save 1 000 kr per month for 20 years in a pension fund.

Aseet:	A	B	C	D
Return rate:	9 %	8,5 %	8 %	7,5 %
Final value:	669 174 kr	606 919 kr	593 076 kr	540 534 kr
Environmental impact:	-2	-1	1	2

	A	B	C	D
Which asset would you rather invest in?	○	○	○	○

10.

There are four assets, A, B, C and D. All assets are subjected to the same amount of risk but different levels of return and received different environmental scores.

Assume that you save 1 000 kr per month for 20 years in a pension fund. What asset would you rather invest in?

Asset:	A	B	C	D
Return rate:	14 %	9 %	8 %	3 %
Final value:	1 173 474 kr	669 174 kr	593 076 kr	332 118 kr
Environmental impact:	-2	-1	1	2

	A	B	C	D
Which asset would you rather invest in?	○	○	○	○

11.

There are four assets, A, B, C and D. All assets are subjected to the same amount of risk but different levels of return and received different environmental scores.

Assume that you save 1 000 kr per month for 20 years in a pension fund.

Asset:	A	B	C	D
Return rate:	15 %	14 %	13 %	12 %
Final value:	1 327 073 kr	1 173 474 kr	1 038 485 kr	919 857 kr
Environmental impact:	-2	-1	1	2

	A	B	C	D
Which asset would you rather invest in?	○	○	○	○

12.

There are four assets, A, B, C and D. All assets are subjected to the same amount of risk but different levels of return and received different environmental scores.

Assume that you save 1 000 kr per month for 20 years in a pension fund.

Asset:	A	B	C	D
Return rate:	2 %	1,5 %	0,5 %	0 %
Final value:	297 400 kr	281 644 kr	253 009 kr	240 000 kr
Environmental impact:	-2	-1	1	2

	A	B	C	D
Which asset would you rather invest in?	○	○	○	○

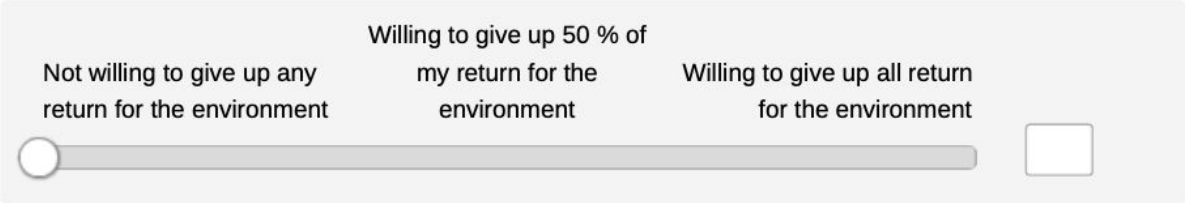
13. Do you, or have you ever, actively invested in environmentally sustainable assets?

- ○ Yes
- ○ No
- ○ I have never actively invested.

14. If you save 1 000 kr a month for 20 years it will generate a final value of
240 000 kr. If you invest your savings you can additionally retrieve return to your 240 000 kr.

Example: 8 % in return rate will generate 350 000 kr.
Final value of 8 % in return rate: 240 000 + 350 000 = 590 000

What **percentage %** of a future wealth in terms of return (in example 350 000 kr) would you be willing to give up in exchange for green investing?



15. Do you, or have you ever, donated money to an environmental organization?

- Yes
- No
- I don't know

16. Is environmental investing a good way to affect the climate according to you?

- Yes
- No

17. Do you consider yourself being environmentally friendly in your everyday life?

- To a great extent
- To some extent
- No