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Gender Differences in Financial Decisions

A study on the connection between gender, risk preferences, beliefs and investment behavior with focus on the characteristics of the risky asset

by

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Abstract

Investment behavior is strongly affected by the level of risk we are willing to take and to what extent we believe an investment is going to be successful. It has been found in previous experiments that men and women tend to have different risk preferences and beliefs, with dissimilar investment behavior as consequence. In this study risk preferences and beliefs among men and women are elicited with focus on two factors of the risky asset; the gender of the CEO and the level of sustainability and ethics. This is done by investigating the behavior of men and women in a combined investment game and vignette study. The results show that women in general both invest and believe less in assets than men do. Neither the gender of the CEO nor the level of sustainability and ethics change this relationship, but the level of sustainability and ethics is found to affect the investment behavior to similar extent among both men and women. However, women show significantly higher levels of self reported importance of sustainability and ethics which is inconsistent with the shown investment behavior.

Keywords: gender differences, decision making under risk, investment, sustainability, leadership gender

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Introduction

1.1 Background

Sweden is one of the most gender equal countries when it comes to economic engagement and opportunity (World Economic Forum, 2019). Still, the wage gap between men and women is as high as 11% (SCB, 2020). There are also serious gender differences when it comes to private equity and real estate. Women only hold 33% of the privately owned Swedish stock market and as little as 25% of the total value of properties (SEB, 2020). Additionally, four out of ten shareholders in Sweden are women and only 14.8% of Swedish women trade in stocks compared to 21.8% of men (Euroclear Sweden, 2020).

Aside from the presented gender difference regarding participation in stock investment, research has found significant gender disparity in factors including business types and risk levels when it comes to the actual investments being made. It has been shown that even when controlling for socio-demographic and economic variables, gender still plays a role in the difference in investment behavior between men and women (Marinelli et al., 2017). As men tend to trade more than women, their difference in investment behavior could make an impact on which companies gets a larger share of investors money (Barber and Odean, 2001).

During 2018 less than 1% of Swedish venture capital in the technology industry went to companies with solely female founders, while 84% was invested in the male counterpart. This in spite of the fact that around 20% of companies in the business were started by exclusively women (Jeffery, 2019). It has also been shown in several studies that female company leaders are judged more harshly than men when it comes to e.g. failures and ethical amendments in business (Montgomery and Cowen, 2020; Huston, 2016; Jacobs, 2019). It is essential from an equality perspective to understand whether it is the gender of the leadership or the actual business that is the root of this situation.

Another important finding is that women are likely to invest in large, renowned companies such as H&M, Volvo and ICA while men are over-represented investors in commodities and high risk assets (Kull, 2020). However, in recent years women have increased their presence on the financial market when it comes to a specific

field: responsible investing[1] (Marsh and Bloomberg, 2020; Miljömärkning Sverige, 2018). Increased equality and more female investors could possibly be a step towards not only social sustainability but environmental as well. Therefore, understanding gender differences in investment and possible causes is highly important.

To scientifically investigate whether the gender of the leadership and the level of responsibility are significant factors for men and/or women when making investment decisions, this study investigates the investment behavior among men and women using constructed assets. The investigation is done using an online experiment where 92 participants are asked to invest in twelve different assets with varying gender of the CEO and level of sustainability and ethics. In addition to the investment decisions, the participants are also asked to predict the future success of each asset.

The purpose is to properly examine whether the gender of the CEO and the level of sustainability in the asset matters when making investment decisions, and whether it is more important to one gender than the other. The focus will lie on studying potential differences in two main factors affecting investment behavior. The first factor is the willingness to take risks (referred to as risk preferences in standard economic theory), and the second is the prediction of future success (usually noted as beliefs). The formal research questions that are to be answered are presented in the next section.

1.2 Research Questions

The first question that is to be answered is:

- ◊ Is there a gender difference in investment behavior?

Then the second question will be answered, namely:

- ◊ Is the potential difference driven by a gender difference in risk preferences or a gender difference in beliefs?

Which will lead to the final questions:

- ◊ Do the answers to the first and second question depend on the gender of the leader of the risky asset?

- ◊ Do the answers to the first and second question depend on whether the asset is sustainable and ethical?

Answering these four questions will shed light on whether there is a gender difference in investment behavior between men and women, and if the gender of the leadership and/or environmentally friendliness and ethics of the risky asset affects the results in any direction.

[1] Responsible investing here refers to ESG which is an acronym for Environmental, Social and Governance

1.3 Delimitation

The essay will be limited to investigating differences in risk preferences and beliefs between two genders, namely men and women. The author is well aware that many more gender identities than the two mentioned above exist, but will be unable to take them all into consideration due to the scope of the thesis. The author is also aware of the fact that some people who do identify as 'man' or 'woman' do not identify with the gender they were given at birth. The two gender identities 'man' and 'woman' were chosen for the study since a very large majority of the population do identify themselves as one of the two. However, the number of people who seek help regarding gender dysphoria[2] has seen a steady increase during recent years (Lindblad, 2018), and for example Germany, Australia, India and New Zealand have introduced a third gender to change the traditional binary system (Löfgren, 2013). The question has also been raised in Sweden, and this might be something to consider in future studies concerning gender differences (Eriksson, 2019).

1.4 Outline

The essay will start with a theoretic background of investment decision making, namely decision making under uncertainty. This will cover the theory behind expected utility and its connections to risk preferences and beliefs which are the aspects that will be investigated in the study of this thesis. The implications of risk preferences and beliefs on investment behavior will also be discussed shortly. After the chapter about decision making under uncertainty a review of previous research about gender differences in decision making will follow. This part will show some examples of what has been done before in the specific field. The main focus will lie on studies about gender differences in risk preferences and beliefs, but there will also be a brief review of differences in competitiveness.

After the theoretic background about decision making under uncertainty and previous theories about decision making and gender differences, the specific study of the essay will be presented. Information about the method and the participants can be found here as well as hypotheses, a discussion about the quality of data and the advantages and disadvantages of the chosen method. Thereafter the results from the study will be presented along with a discussion and analysis. The thesis will end with the final conclusions along with recommendations for future research.

[2]Gender dysphoria is usually the term used to describe the situation when a person is born in the wrong body and do not identify with the gender they were given at birth

2

Investing: Decision Making under Uncertainty

2.1 Theory

When investing in assets, a decision is made to pay an amount of money for something whose value in the future is unknown to the buyer. In classic economic terms, a decision of this kind is a *decision under uncertainty*. When a decision is made under uncertainty, the outcomes of the decision are uncertain with probabilities that have to be estimated by the decision maker. In trading, investors estimate the likelihood that an investment will be profitable and thereafter decides if and how much to place in the asset.

As a simple example, let us assume that you are an investor who has 100 SEK which are to be allocated to one or both of the following two assets.

- ◊ Asset 1: Pays back double what you invested with probability 0.5 and half of what you invested with probability 0.5 (for example a stock that will either be worth twice as much or half as much in the future with equal probabilities).

- ◊ Asset 2: Pays back 25% more than you invested with probability 1 (for example having the money in a bank account at 25% interest rate).

What would you choose? Would you invest all your money in asset 1 and have the chance to double it, but also the risk to lose some of it? Put all 100 SEK in the bank account where you know they will grow slightly? Or would you divide the money between the two options? What about if the probabilities in asset 1 were unknown and you had to estimate them yourself? How you make your choice reveals information both on whether you are a person who likes to take risks or not and what your beliefs about the future are. One of the easiest and most used ways to model this mathematically is to use the concept of 'expected utility'.

2.1.1 Expected utility

The theory of expected utility dates back over 200 years, and was used already by Daniel Bernoulli in the eighteenth century (Moscati, 2018, 8). However, it was widely introduced in 1944 when John von Neumann and Oskar Morgenstern published their

now famous 'Theory of Games and Economic Behavior', and since then expected utility is part of the foundation on which classic decision theory builds (von Neumann and Morgenstern, 2007). The idea behind expected utility is simple: an agent (in this case an investor) should choose the investment alternative that gives the highest expected utility, often abbreviated 'EU'. EU is defined in the following way.

$$EU = p_1 \cdot u(x_1) + p_2 \cdot u(x_2) + ... + p_N \cdot u(x_N) \tag{2.1}$$

where p_i, $i = 1, ..., N$ is the probability of outcome x_i for a certain action and $u(x_i)$, $i = 1, ..., N$ is the utility of outcome x_i (Moscati, 2018, 147). Informally, the utility function $u(x)$ is a measurement of how happy an agent will be with a certain outcome x. Let us apply this to the example presented on the previous page and analyse the expected utility for three different investment options. For simplicity it is assumed that 1 SEK is equal to one unit of utility, i.e. $u(x) = x$.

- ◊ Option 1: invest everything in asset 1.

  $EU = 0.5 \cdot u(200) + 0.5 \cdot u(50) = 0.5 \cdot 200 + 0.5 \cdot 50 = 125$

- ◊ Option 2: invest everything in asset 2 (i.e. put everything in the bank account).

  $EU = 1 \cdot u(125) = 1 \cdot 125 = 125$

- ◊ Option 3: invest 50 SEK in asset 1 and 50 SEK in asset 2.

  $EU = 0.5 \cdot u(100) + 0.5 \cdot u(25) + 1 \cdot u(62.5) = 0.5 \cdot 100 + 0.5 \cdot 25 + 1 \cdot 62.5 = 125$

It is clear that no matter how the investor allocates the 100 SEK between asset 1 and asset 2, EU remains the same. This means that according to the theory the investor should be indifferent between investing in asset 1 and putting everything in the bank account, as EU is the same. This result is a direct consequence of the seemingly small assumption that our utility function $u(x)$ is assumed to be linear, which implicates that the investor does not care whether an alternative is risky or not. In reality, it is naive to believe that all investors are neutral when it comes to choosing between a risky and risk free option, even when they have the same EU. To what extent a person like or does not like to take risks is dependent on the person's *risk preferences*. This concept will be introduced next.

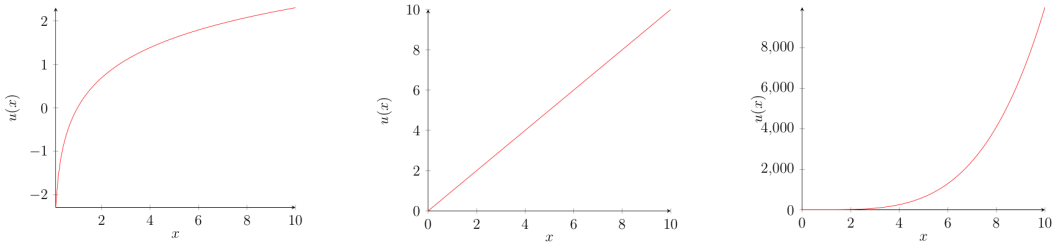
2.1.2 Risk preferences

In short terms risk preferences are a way of describing how a person should behave when making decisions under uncertainty and risk. Risk preferences are usually divided into three groups, either you do not like risk and want to avoid it, or you like it and actively seek it, or you are neutral as in the example given previously. Depending on which group an investor belongs to, their utility function will take different shapes. These are presented in table 2.1 along with mathematical examples. The three examples can also be seen plotted in figure 2.1. To illustrate the difference between the three groups and the results when evaluating an investment, the EU is calculated for each of the three options in our example using each utility function. The result of the calculations can be found in table 2.2. Looking at the

Table 2.1
Shapes and examples of utility functions for different risk preferences.

	Shape	Example
Risk averse	Concave	$u(x) = ln(x)$
Risk neutral	Linear	$u(x) = x$
Risk seeking	Convex	$u(x) = x^4$

Notes: The mathematical functions presented in the table are only examples of concave, linear and convex utility functions. There are many other functions that also fit the requirements.



(a) $u(x) = ln(x)$. **(b)** $u(x) = x$. **(c)** $u(x) = x^4$.

Figure 2.1: Utility functions for a risk averse, neutral and seeking agent.

Table 2.2
Expected utility for different investment options with varying risk preferences.

		EU		
	$u(x)$	Option 1	Option 2	Option 3
Risk averse	$ln(x)$	4.61	4.83	$\boxed{8.05}$
Risk neutral	x	$\boxed{125}$	$\boxed{125}$	$\boxed{125}$
Risk seeking	x^4	$\boxed{8.0 \cdot 10^8}$	$2.4 \cdot 10^8$	$6.5 \cdot 10^7$

Notes: Option 1 corresponds to investing everything (100 SEK) in the risky asset. Option 2 is putting everything in the bank account. Option 3 is allocating half of the investment (50 SEK) in the risky asset and half in the bank account. The magnitude of the utility for each risk preference is not important, as it is only internally comparable. The optimal choice for each risk preference is marked with a box.

calculations in table 2.2, it is clear that the optimal choice of investment has changed depending on the risk preferences (and thereby utility function) in the sense that a risk averse and risk seeking investor allocates more money in the risk free and risky asset respectively. In the real world it is hard, not to say impossible, to determine the exact utility function of a specific person. It seems reasonable to believe that both situational and demographic factors might affect risk preferences, and

also that people's actual behavior is more complicated than simple expected utility theory suggests. To exemplify, Kahneman and Tversky (1979) early presented the so called 'Prospect theory' which says that the utility function has different shapes when a risky decision is leading to gains or losses, and is also asymmetrical in the sense that losses are more negative than gains are positive. Payne et al. (2017) found that risk aversion decreases with increasing inequality, both in a lab and field setting. People participating in an economic game were more likely to take risks when the outcomes were unequal, in order to achieve the higher outcomes. The same result was found when examining data from states with high income inequalities. Finally, demographic factors that have been found to significantly affect risk preferences are gender (females show higher levels of risk aversion), age (decreasing risk aversion with increasing age), income (increasing risk aversion with increasing income) and health status (increasing risk aversion with better health status) (Noussair et al., 2014).

Up until this point, it has consistently been assumed that the probabilities of each outcome ($p_1, ..., p_N$ as seen in formula 2.1) in a decision under uncertainty are known. In reality, naturally these probabilities are not (if they were, there for example would be no such thing as stock analysts). As the probabilities are unknown, it is up to the investor to estimate the probabilities to the best of his or hers ability when making an investment decision. Therefore, in order to analyse why a certain risky decision is made not only the utility function and its shape is important. The way we estimate the probabilities of each outcome also plays a large role when deciding which choice will give the greatest expected utility. Inevitably, the estimation of probabilities and thereby our decisions made under uncertainty will be affected by our perceptions and previous experiences, commonly known as *beliefs*. This will be discussed further in the next section.

2.1.3 Beliefs

As mentioned at the end of the last section, the probability of each outcome in a decision made under uncertainty is generally unknown to the decision maker. In formal terms, this type of probability is called *subjective*. Contrary to empirical or classic probabilities, subjective probabilities takes no historical data or formal reasoning into account. Instead, subjective probabilities are based on the beliefs and previous experiences of the decision maker. Therefore subjective probabilities differ from person to person, and have no correct values (Bar-Hillel, 2001, 15247). Beliefs also play an important role in the sense that they are the basis of the *heuristics*, simply explained as basic rules of thumb, that are used in the decision making process. Heuristic decision making is, contrary to rational, an automatic and intuitive decision making system. It enables us to make fast decisions without first considering all available information, which is a prerequisite for our everyday lives to work smoothly (Yamagishi, 2005, 837).

Beliefs are affected by everything from culture, the environment around us as well as previous experiences we have had through life. Thereby it is imaginable that people of different gender, age and cultural backgrounds have dissimilar beliefs about for example the potential of an investment.

2.2 Implications on Investment Behavior

Naturally, both risk preferences and beliefs have a significant impact when it comes to investment behavior and decision making under uncertainty. Risk preferences affect the level of risk that the decision maker is willing to take, while beliefs helps the decision maker estimate the risks from their own perspective. For example, if an investor is optimistic and has great hopes of an investment paying off, he or she is probably more likely to take the risk. This means that if men and women generally tend to have different risk preferences and beliefs, there are possibilities that their investment behavior looks different. This possible difference can in turn affect the financial strength of the individual, which could contribute to the financial imbalances[3] between men and women already seen in society (Martin, 2019).

Gender differences, in decision making generally and investment behavior in particular, has already been researched by a number of scientists. In the next chapter, some of these studies will be introduced to give an overall overview of the specific field before introducing the experiment of this thesis.

[3]Financial imbalance meaning that men generally earn more than women, even when controlling for job and qualifications.

3

Gender Differences in Decision Making

3.1 Primary Studies

Here previous research on the factors that will be investigated primarily in this study will be introduced. Secondary research, i.e. research on factors that are not the main focus of this thesis but are still interesting and might be mentioned, is presented in part 3.2.

3.1.1 Differences in risk preferences

Gender differences in decision making under uncertainty has been studied by a number of researchers that together have come to some general conclusions. Charness and Gneezy (2007) investigated the question by examining data from ten different experiments, all which had the same simple investment game[4] as method. The results were very consistent in the sense that women invested less than men, and therefore appeared to be more risk averse. What made the findings particularly robust was the fact that the ten experiments were conducted by different researchers in different parts of the world, and also not to investigate gender differences in the first place. The found gender differences was an accidental and unintended result which showed to be both interesting and important.

The result that women are more risk averse than men has been found in many different settings and countries. Baeckstrom et al. (2018) concluded that wealthy women are more risk averse than wealthy men since they tend to hold a larger portion of cash (which is seen as a risk-free asset) in their portfolios compared to men. Meziani and Noma (2018) found that women are more risk averse than men not only in field settings like the previous example, but also when an investment task is brought into a lab environment. Finally Croson and Gneezy (2009) made a study on gender differences in risk preferences, social preferences and competitive preferences. In line with the previous experiments, it gave the result that women are indeed more risk averse than men. The study also showed other results, such as significant gender differences when it comes to competitiveness.

[4]Investment game is an experimental method where participants get to choose how much they want to invest in a certain risky asset

In contrast to the above mentioned studies, Filippin and Crosetto (2016) reconsidered gender differences in risk preferences by gathering data from a number of different studies and then comparing the result. They found that gender differences in risk preferences does depend on the task given to the subjects of the experiment, and that there is no significant gender difference in some of the experiments examined in the paper.

Even though there are examples of studies questioning gender differences in risk preferences, the finding that women are more risk averse than men is still widely accepted. However, fewer studies have been made investigating what the difference could depend on and also if there are certain conditions that decrease the difference or even changes the risk preference order between men and women. Bradley et al. (2019) looked a bit into this by investigating investment in firms that cater mainly toward either men or women and the impact of gender in this case[5]. They found an interesting result, namely that women do trade less than men when looking at investments in general but trade more similar to men when looking at only firms that cater predominantly towards women.

3.1.2 Differences in beliefs

The area of gender differences in beliefs has not been researched as thoroughly as risk preferences, but some studies have still been made. One example is an experiment by Hibbert et al. (2018) where it was investigated if and in that case in what way men and women react differently to prior gains and losses when it comes to investments. They found that after experiencing a loss, men tend to continue to invest in stocks while women tend to avoid doing so. It was also concluded that women to a higher extent expect unfavorable market conditions, independent of the fact that they made a gain or a loss in their previous stock market investments. This suggests that women might have more pessimistic beliefs about future market conditions, and could also be one reason to the fact that women tend to be more risk averse than men.

The result that men are more optimistic than women has also been found in other studies. Bjuggren and Elert (2019) investigated gender differences in beliefs about the future economic situation in Sweden, and found that men indeed are more expectant than women. They also found that the gender difference decreases in times of severe financial deterioration.

When it comes to gender differences in confidence, i.e. beliefs in the own ability, Cueva et al. (2019) investigated to what extent trading behavior is affected by differences in (over)confidence. It was found that men are more confident than women, but also that it can't explain the gender differences seen in investment behavior. Further research has shown that men and women are not significantly different when it comes to confidence, but that there are contrasts in overconfidence where men and women have a tendency to over- and underestimate their own per-

[5]Note that the gender of leadership is not taken into account here but solely the business and its orientation

formance respectively (Cho, 2017). Closely related to confidence, a large study with almost one million participants across 48 nations investigating gender differences in self-esteem found that men report higher levels than women do, but that the gap narrows with increasing age (Bleidorn et al., 2016). Even though the articles mentioned above find slightly different results when investigating gender differences in confidence, the overall trend is undoubtedly that men tend to be more confident and especially more overconfident than women.

3.2 Secondary Studies

3.2.1 Differences in competitiveness

Research in the field of gender differences in competitiveness has found that women are less likely to enter competitions than men are, and also that a competitive environment to a higher extent contributes to better performance among men than women (Niederle and Vesterlund, 2011). Mago and Razzolini (2019) found that when in competition women show greater efforts to win when their opponent is also a woman, while men didn't demonstrate a similar difference. As a final example, Apicella et al. (2017) conducted a large study where gender differences in competition against both self and others were investigated. They found no gender difference when it comes to self-competition, but significant differences (in line with previous mentioned results) regarding competition against others. The gender difference in competitiveness have shown to have long term effects on earnings and promotions, which in turn affects the level of equality (Kesebir, 2019).

3.3 Literature gap

Previous studies in the field of gender differences in investment behavior has put a lot of focus on the finding that women tend to be more risk averse and less optimistic than men, but not if there are factors in the risky asset that could affect this finding. Therefore, this study will investigate two factors, the gender of the CEO and the level of sustainability and ethics, that potentially could have an influence on investment behavior. The experimental design will be introduced in full detail in the next chapter.

4

Experimental Design

4.1 Method: Investment Game Revised

The experiment was implemented using an intervention of a simple investment game[6] and a vignette questionnaire[7]. The idea of the method was to create assets with different characteristics, described using vignettes, which were then used in the investment game. The participants were presented with twelve different assets which they were to evaluate. The information about each asset consisted of a written description of the business, i.e. a vignette, a graph showing the company stock value between January 2017 and July 2019, and a threshold value (noted as X) unique to each asset. The assets were based on real companies with authentic stock prices, but with fictitious company names. For each asset, the participants were endowed with 50 SEK which they could either invest in the asset with the payoff structure as in table 4.1, or put in a virtual bank account. The assets were evaluated independently and during only one period, which means the bank account was reset for each decision and was not accumulated throughout the experiment. The outcome of the decision was continuous, thus the participants could invest anywhere between 0 and 50 SEK. Any money not invested was automatically put in the bank account. The value of the money put in the virtual bank account remained unchanged, thus

Table 4.1
Return of investment.

Stock value on January 1st 2020	Investment return
On or above X	200%
Below X	0%

Notes: The table shows the payoff structure of the investment game used in the study. The break point was January 1st 2020 for all assets, which was six months later than the stock value information showed to the participants.

[6] In a simple investment game the participants are endowed with a certain number of monetary units that they can choose to either keep or invest in a risky asset

[7] A vignette is a short story that creates a feeling around the object it is describing, which is then used to make a decision

no interest rate was given. All twelve assets and the information presented to the participants can be found in Appendix A. For each asset, the participants were asked to answer two questions.

1. How much to you want to invest in this company?
2. What do you believe the chance is that the stock value is X or above in January 2020?

Question one examined both risk preferences and beliefs, while question two captured beliefs only. The participants were given one of two treatments, which are presented in the next section. When all twelve companies had been evaluated, the participants were asked to answer a brief questionnaire. In the questionnaire the participants gave demographic information, but also ranked themselves on a scale from one to five (one meaning "Do not agree at all" and five "Totally agree") for the characteristics below.

◊ I am generally a confident person.

◊ I am generally an optimistic person.

◊ I generally like taking risks.

◊ I am generally a competitive person.

◊ If investing, it is important to me to invest in sustainable assets.

◊ If investing, it is important to me to invest in ethical assets.

Finally, the participants were asked to rank their experience in investing by answering the question

◊ How much experience do you have when it comes to investing in stocks and funds?

with a number between one and five. Answering one meant "No experience at all" and five "A lot of experience". The purpose of the questionnaire was to collect important demographic data but also to investigate if the results found in the experiment were reflected in the characteristics estimated by the participants themselves.

4.2 Treatments

The participants were randomly assigned with either treatment one or treatment two, where the sole proviso was that men and women should be equally divided between the two treatments. First of all, six companies were described as sustainable and ethical and the remaining six companies were not. The distribution can be seen in table 4.2, along with the order of the companies which was the same in both treatments. When it comes to the names of the CEO's twelve generic male and female names were chosen, six of each gender. In treatment one, half of the sustainable and ethical companies were given female CEO's and the other half male CEO's. The same logic was applied to the non-sustainable assets, half were given female CEO's and the other half male. In treatment two the same twelve CEO

names were used, but for other assets than in treatment one. The logic was the same as in treatment one; half of both the sustainable and non-sustainable assets were given female CEO's and the other half male CEO's. The difference was that an asset with a female CEO in treatment one had a male CEO in treatment two and vice versa. This means all twelve companies existed with both a female and male CEO in either treatment one or treatment two. At the same time, both treatments had six sustainable and six non-sustainable companies with half female and male CEO's respectively. This allows for a structural comparison of eventual differences in investment behavior both when it comes to CEO gender and sustainability.

Table 4.2
Framework of treatment one and treatment two.

Company no.	Sustainable/ethical	Treatment 1	Treatment 2
1	Yes	Male CEO*	Female CEO†
2	Yes	Female CEO†	Male CEO*
3	No	Female CEO**	Male CEO‡
4	Yes	Male CEO§	Female CEO¶
5	No	Male CEO‡	Female CEO**
6	Yes	Female CEO¶	Male CEO§
7	No	Male CEO††	Female CEO$^{\|}$
8	No	Female CEO$^{\|}$	Male CEO††
9	Yes	Female CEO‡‡	Male CEO***
10	No	Male CEO¶¶	Female CEO§§
11	No	Female CEO§§	Male CEO¶¶
12	Yes	Male CEO***	Female CEO‡‡

Notes: The CEO names were varied as shown above, where the symbols ($*$, †, § etc.) mark a specific CEO name. In total twelve CEO names were used, but for different companies in treatment one and two respectively. It can also be seen which companies had a sustainable and ethical profile and which did not.

4.3 Hypotheses

The experimental design allows for several research questions to be answered. First, evaluating the average investment made by men and women across both treatments will show whether investment behavior is different between genders. If men and women have the same level of risk aversion and beliefs, no difference should be found regarding investment behavior in the study. However, should there be a significant gender difference in risk aversion and beliefs it should result in different investment strategies. If there indeed is a difference, the evaluation of average beliefs across both treatments gives information about whether the difference in investment behavior is solely due to differences in risk aversion or also a difference in beliefs. If the gender of the CEO and the level of sustainability has no effect on the investment behavior of men and/or women, no difference should be found when comparing investments in

'female' and 'male' companies and companies with sustainable and non sustainable profile. The following hypotheses were formed regarding the result of the study.

4.3.1 Hypothesis 1

Men invest more than women. As presented in section 3.1, many previous studies have shown large differences between men and women when it comes to investment behavior in the sense that men consistently tend to invest more than women. Therefore it is likely to believe that the same result will be found here, despite the sample size being slightly smaller than used in previous research.

4.3.2 Hypothesis 2

The difference in investment behavior is due to differences in both risk aversion and beliefs. Again found in previous studies, women tend to not only show higher levels of risk aversion but also lower levels of optimism and beliefs in the financial markets.

4.3.3 Hypothesis 3A

The gender difference in investment behavior will not be affected by the gender of the CEO. Evaluating the companies with focus on the gender of the CEO, the expectation is that there will be larger investments in companies with male CEO's. This would then be in line with the difference in venture capital distribution mentioned in the introduction. However, it is not expected that men and women change their investment behavior to different extents depending on the gender of the CEO, as this has not been found in any previous research. This results in no 'difference in difference'.

4.3.4 Hypothesis 3B

The gender difference in investment behavior will be affected by the level of sustainability/ethics. When looking at the sustainability/ethics aspect of the companies, it is expected that women value sustainability and ethics to a higher extent than men do. This should result in a smaller gender difference in investment behavior when looking at sustainable and ethical assets compared to the other companies.

4.4 Procedures

The experiment was conducted online through Google forms during five sessions between March 30th 2020 and April 1st 2020. The original plan was to perform the study as a lab experiment, with participants doing the experiment in a controlled environment. However, due to the situation with the spread of the corona virus 'SARS-CoV-2' the halls of Lund University were closed down in the middle of March 2020. Therefore it was no longer possible to conduct the experiment in place physically at Lund University, and the participants instead did the study online from home. The procedures were identical for each of the five sessions. When each session began, an email was sent to each participant with a link to the Google

form containing either treatment one or treatment two. The participants were presented with five pages of instructions for the experiment, which they were to read through before they could start. To make sure the participants had understood the instructions properly, two control questions were asked which had to be answered correctly before the experiment was started. The participants were asked to do the experiment individually and to not talk to anyone about its contents until the 2nd of April 2020 which was the day following the final participant's completion of the experiment. The full instructions can be found in Appendix B. When the participants had answered all questions in the Google form, the results were sent in and collected in an Excel sheet. The participants received an email of gratitude for their participation, and also their payment.

4.5 Payment

The participants were paid to perform the experiment, to increase their incentives to complete the study to the best of their ability and according to their own beliefs and values. The payment consisted of a participation reward of 50 SEK, the outcome of one of the twelve investment decisions (drawn randomly for each participant) and a possible bonus payment of 50 SEK. The probability of receiving the bonus payment was raised by reporting beliefs (the answer to question two) truthfully. To see the full explanation of the mechanism, see section 9.4 and 9.6. On average, the participants were paid 157.50 SEK.

4.6 Participants

The participants in the study were mainly (over 90%) current or former students in industrial engineering and management. A large portion of the participants studied at Lund Institute of Technology at Lund University (about 40%), but there were also participants from KTH Royal Institute of Technology, Linköping University and Chalmers in Gothenburg. A total of 101 people signed up for the experiment, and 92 ended up actually participating. Of the 92 people 47 (51%) were given treatment one and 45 people (49%) treatment two. To determine an appropriate sample size for the study, it is important to decide an acceptable significance level and to calculate statistical power. The power calculation gives an answer as to how large the sample has to be to reliably detect a real effect. Details on how the sample size was determined with respect to significance and statistical power are found in the next section.

4.6.1 Determination of sample size

When performing statistical analysis there are two parameters in particular that matter when it comes to the significance and statistical power of the result, namely α and β. A statistical test also contains a null hypothesis, H_0, which usually assumes that there is no significant difference between the populations being investigated. H_0 is then tested against an alternative hypothesis, H_1, suggesting that there actually is a significant difference and sometimes also in which direction. α and β are the probabilities of receiving a type I and type II error respectively, see table 4.3.

Table 4.3
Power and significance matrix.

	Reject H_0	Confirm H_0
H_0 is true	Type I error, $p = \alpha$	$p = 1 - \alpha$
H_0 is false	Power, $p = 1 - \beta$	Type II error, $p = \beta$

It is important to have low enough α so that the probability of rejecting H_0 when H_0 is actually true (false positive result) is low. It is also important to have a low β to decrease the probability of confirming H_0 when it is actually false (true negative result). Typical values for α is 0.05 or 0.1, and many studies use 0.2 as a default β after Jacob Cohen[8] proposed the theory that type I errors are more serious than type II errors (Ellis, 2010, 54).

To estimate an appropriate sample size for the study, both significance and statistical power needs to be taken into consideration along with other factors such as the number of comparisons that are to made and the number of variables that are to be examined (Dattalo, 2008). Having an appropriate sample size is very important. Too small of a sample has a higher risk of missing significant effects while a sample that is too large often demands more resources collecting the data than the benefits received from it (Ellis, 2010, 52). It is also important to estimate the effect size that is expected between the two study groups in question, in this case men and women. The effect size is a measure of how large the seen effect is when taking the total variation of the data into account. Since a very large sample size can show even small and in many cases negligible effects it is important to look not only at p-values since these depend on the sample size (Meyvis and van Osselaer, 2018, 1160). One of the easiest ways to calculate effect size is to use Cohen's d, which is calculated as

$$d = \frac{|\mu_1 - \mu_2|}{s} \text{ where} \tag{4.1}$$

$$s = \sqrt{\frac{\sigma_1^2 + \sigma_2^2}{2}} \tag{4.2}$$

where μ_1 and μ_2 are the averages of sample 1 and 2 respectively and σ_1^2 and σ_2^2 are the corresponding variances. Values for d when looking at small, medium and large effect size are presented in table 4.4. Looking at previous studies made in the field of gender differences in investment behavior, the found difference is in many cases substantial. Charness and Gneezy (2012) investigated a number of

Table 4.4
Value of Cohen's d for different effect sizes.

	Small	Medium	Large
d	0.2	0.5	0.8

[8]American psychologist who is well renowned for his research on statistical analysis in the behavioral sciences

Table 4.5
Examples of found gender differences.

Study by	Avg. male inv. (N)	Avg. female inv. (N)	Total sample
Dreber et. al[a]	79.5% (105)	48.0% (81)	186
Ertac et. al[b]	72.32% (79)	54.29% (49)	128
Charness et al.[c]	75.82% (136)	60.25% (64)	200

[a] Dreber, A., Rand, D., Garcia, J., Wernerfelt, N., Lum, J., Zeckhauser, R.
[b] Ertac, S., Gurdal, M.
[c] Charness, G., Gneezy, U.

experiments concerning gender differences in risk taking, and looked at the effect seen in the different studies. The findings are summarized in table 4.5. The number of participants needed in group 1 and 2 (n_1 and n_2) to detect the difference found in the example studies can be calculated as

$$n_1 = \kappa \cdot n_2 \text{ where} \tag{4.3}$$

$$n_2 = (1 + \frac{1}{\kappa})(\sigma \frac{z_{1-\alpha/2} + z_{1-\beta}}{\mu_1 - \mu_2})^2 \tag{4.4}$$

where κ is the ratio between the number of participants in the two groups and σ is calculated in the same way as s in formula 4.2. Using this formula to calculate the number of participants needed to detect the difference found by the example studies in table 4.5 (with $\alpha = 0.05$ and $\beta = 0.2$), the result is obtained as in table 4.6. It

Table 4.6
Needed sample size for example studies.

Study by	Minimum N_m	Minimum N_w
Dreber et. al	21	16
Ertac et. al	39	23
Charness et. al	30	23

is clear that the effect shown in the example studies is large enough to be significant even for very small sample sizes. This indicates that a small sample could be enough also for this study. However, as this study is investigating gender differences in investment not only generally but also depending on the the characteristics of the risky asset, a larger sample size than the ones calculated in table 4.6 is preferred (in order to catch smaller effects).

To arrive at a conclusion about a suitable sample size, the following aspects were considered.

◊ **The effects found in previous studies.** All studies above show differences between 20% and 40%, which indicates that a small sample size could be enough.

◊ **The variance in previous studies.** As an example, the standard deviation in the study by Dreber et. al was about 30% of the endowment for both men and women (79.7 and 88.8 on an endowment of $250 for men and women respectively). Using about the same number to calculate a sample size seems reasonable, but it is also important to remember that participants in this study will do twelve investment decisions each instead of only one as in the study by Dreber et. al. This gives more observations which could contribute to a smaller variance, which consequently suggests a smaller sample size.

◊ **The fact that this study is investigating more specific factors than just general investment behavior differences**. This suggest a larger sample size could be needed, since there is no knowledge about how large a possible difference could be.

◊ **The sample size used in previous studies**. What sample size seems scientifically viable?

◊ **Practical reasonableness**. The sample cannot be larger than what can be handled by one person during a limited time frame.

Considering all factors mentioned above, estimating that a difference of 10-12% (much more conservative than the previous studies have shown) will be found between the groups, with $\alpha = 0.05$, $\beta = 0.2$ and $\sigma = 20\%$ of the endowment (slightly lower than the previous studies) an estimated suitable sample size for the study is calculated as below. For simplicity the endowment is assumed to be 100 units.

$$n_1 = \kappa \cdot n_2 = 1 \cdot n_2 \text{ where} \tag{4.5}$$

$$n_2 = (1 + \frac{1}{\kappa})(\sigma \frac{z_{1-\alpha/2} + z_{1-\beta}}{\mu_1 - \mu_2})^2 = (1+1) \cdot (20 \cdot \frac{1.96 \cdot 0.84}{11})^2 = 51.83 \approx 52 \tag{4.6}$$

52 participants in each sub sample gives 104 as the total target sample size. Preferably the group should be divided equally with 52 women and 52 men in each sub sample. As described earlier, the final sample size for the experiment was 92 (52 men and 40 women). While almost reaching the target number of 104 participants, the distribution of men and women was a bit shifted. However, this was as mentioned previously taken into consideration in the analysis. All demographics of the participants are presented in the next section.

4.6.2 Demographics

Gender

The distribution of gender among the participants is presented in figure 4.1. As seen in the diagram, 44% of the participants were women and 56% were men. When it comes to the distribution between the two treatments, treatment one had 21 women and 26 men whilst treatment two had 19 women and 26 men. Because of some last minute drop outs the distribution between men and women was not completely even.

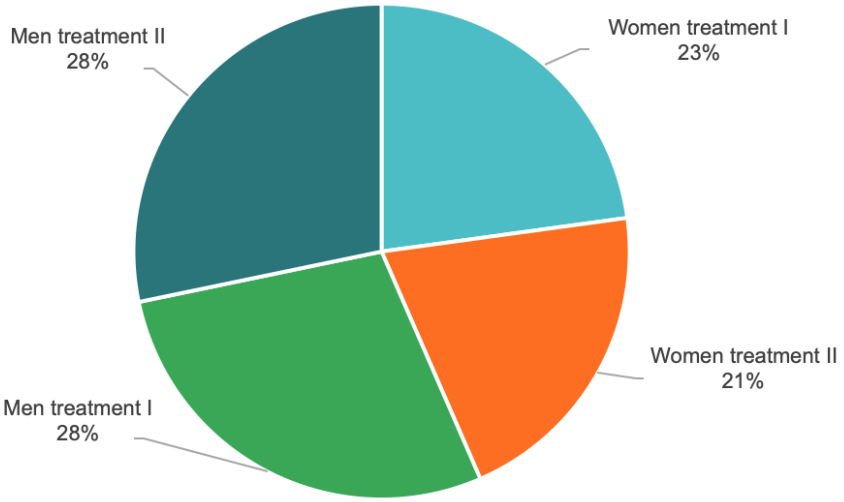
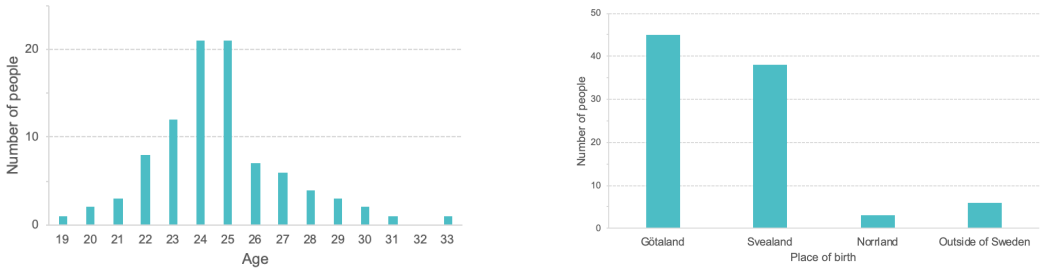


Figure 4.1: Gender distribution of participants.

Age and place of birth

The age and place of birth distributions of the participants are presented in figure 4.2. As can be seen in 4.2a, most of the participants were between 20 and 30 years old with a majority in their mid twenties. Looking at the place of birth distribution in figure 4.2b a clear majority of the participants were born in the southern or middle part of Sweden. About one tenth were born either in northern Sweden or abroad.



(a) Age.

(b) Place of birth.

Figure 4.2: Age and place of birth distribution of participants.

4.7 Quality of Data

Besides having an appropriate sample size, it is important to collect data of high quality when conducting scientific studies. To evaluate this in a structured way, Radhakrishna et al. (2012) presents eight components of data quality that should be evaluated when conducting studies. The eight components are:

1. **Validity:** this refers to the closeness between the found values and true values, and is obtained by careful construction of the questionnaire.

   Data in this study: the questionnaire was very carefully constructed (evaluation of wording etc.), and was reviewed throughout the process.

2. **Reliability:** how consistent the results are in repeated measurements. Rises with careful wording, pilot testing of the questionnaire and a high response rate.

   Data in this study: the wording was reviewed and redone a number of times to avoid influence on the participants. The study was also tested beforehand by a person representative of the study group. The response rate was 91%.

3. **Objectivity:** obtained by using statistically reasonable methods when drawing conclusions.

   Data in this study: the methods used in the analysis were carefully selected to serve the purpose in the correct way.

4. **Integrity:** minimizing errors made when collecting and analysing data.

   Data in this study: the human factor is always present, but the collection and analysis of the data was done carefully to minimize errors.

5. **Generalizability:** sampling in such a way that the individuals conducting the study are representative for the population when it comes to considered variables.

   Data in this study: since the age span of the participants only covers 15 years, the data might not reflect all age groups. Also, as almost all participants were current or former engineering students the sample does not reflect the overall population in Sweden in terms of education level.

6. **Completeness:** if a data set is not complete, the missing values must be considered and handled.

   Data in this study: the few missing values (people who did not perform the study even though they were signed up) were considered random. This was because they were relatively evenly distributed when it comes to geographic location as well as gender. Because of the randomness, they give no effect on the results.

7. **Relevance:** to achieve relevance it is important to conduct literature review of previous research, to understand why the data is important.

   Data in this study: a thorough literature review was done before the study was constructed, to identify data that not already existed.

8. **Utility:** includes for example the data timeliness and accessibility.

   Data in this study: the data was collected at the end of March and beginning of April 2020 which makes it very topical. The data is accessible to anyone through the Lund University Publications Student Papers portal (LUP-SP).

Considering the eight aspects above, the quality of the collected data should be high.

4.8 Method Limitations

The most common critique against experiments made outside the field setting is that since the environment is controlled and often simplified, the results might not reflect the real world. While this is an inevitable fact that must be taken into consideration, performing studies in controlled environments allows for the investigation of specific variables without having to control for surrounding statistical noise[9].

Performing a study online provides great flexibility, but also poses a number of limitations compared to an experiment in a controlled lab environment. The first obvious disadvantage is that there is no way to control the independence among participants to 100%. To avoid interaction between participants it was clearly stated in the instructions that the experiment was individual and that the participants were not allowed to talk about its contents until after all sessions had been conducted. Also, the results of the study were not sent to the participants until all sessions were done, to avoid information about the companies spreading.

Looking at advantages of conducting a study online, it made it possible to have participants from other places than the immediate nearby area of Lund. The representation of people from different areas in Sweden became much better, even though the number of people from northern Sweden were still few.

[9]Statistical noise is random, unexplained variation seen in all real life data

5

Results

Since each of the 92 participants made twelve investment decisions and the same amount of probability estimations, the data set of result consists of 92 independent subsets of twelve dependent observations for investment and probability estimation (beliefs) respectively. To use all observations without compromising independence, either the average over all observations for each participant or clustering on participant level was used. Which method was chosen depended on the specific analysis made. Microsoft Excel and Stata were used to conduct the analysis.

5.1 Summary of Results

A summary of the results are found in table 5.1 below. Details along with comments on each part are found in section 5.2.

Table 5.1
Summary of results.

Question	Result
Gender difference in investment?	Yes**
Due to difference in risk preferences?	Yes**
Due to difference in beliefs?	Yes*
Difference in difference, CEO gender?	No
Difference in difference, sustainability/ethics?	No
Gender difference in confidence?	No
Gender difference in optimism?	No
Gender difference in risk taking?	Yes**
Gender difference in competitiveness?	No
Gender difference in importance of sustainability?	Yes***
Gender difference in importance of ethics?	Yes***
Gender difference in experience?	Yes***

Notes: The table presents the overall results of the study and their significance level.
$***$ = significant on 1% level
$**$ = significant on 5% level
$*$ = significant on 10% level

5.2 Detailed Results

5.2.1 Gender difference in investment behavior

The possible gender difference in investment behavior in general was investigated first. Looking at the average investment among males and females across both treatment one and treatment two, it can immediately be seen that men on average invest more than women (see figure 5.1 and table 5.2). As can be seen in the histograms (figure 5.1), both samples can not be assumed to be normally distributed. Therefore the Wilcoxon rank sum test is used to investigate the significance of the results. Performing the Wilcoxon rank sum test, the null hypothesis (H_0) is tested

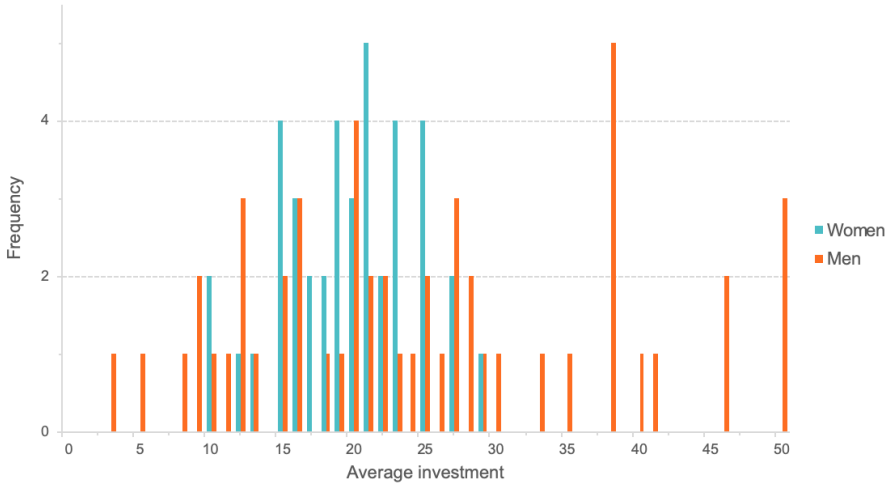


Figure 5.1: Average investment histogram, men and women.

against the alternative hypothesis (H_1).

$$H_0 : \mu_{men} = \mu_{women}$$
$$H_1 : \mu_{men} \neq \mu_{women}$$

In the Wilcoxon rank sum test, the two samples are merged and then sorted from lowest to highest. The lowest observation receives rank 1, and the highest observation receives rank 92 (since the two samples together has 92 observations). Thereafter the ranks of the female and male observations are summarized, here called R_w (rank sum women) and R_m (rank sum men). R_w and R_m are then used to calculate the two test statistics, U_w and U_m. The calculations of U_w and U_m are made according

Table 5.2
Average investment results.

	Men	Women
Average investment (μ)	24.91	19.11
Standard deviation (σ)	12.38	4.63
Number of observations (N)	52	40

to formula 5.1 and 5.2.

$$U_m = N_m \cdot N_w + \frac{N_m(N_m+1)}{2} - R_m \tag{5.1}$$

$$U_w = N_m \cdot N_w + \frac{N_w(N_w+1)}{2} - R_w \tag{5.2}$$

Additionally, a z-value for the test statistic is calculated as in formula 5.3 using a normal distribution approximation (used for sample sizes larger than 20).

$$z_U = \frac{|U_{min} - (N_m \cdot N_w)/2|}{\sqrt{\frac{N_m N_w (N_m+N_w+1)}{12}}} \text{ where} \tag{5.3}$$

$$U_{min} = \min[U_m, U_w] \tag{5.4}$$

The z-value z_U is then used to calculate the p-value that is to be compared to α. The result of the calculations are presented in table 5.3. Since $0.024 < 0.05$ the null hypothesis can be rejected at significance level $\alpha = 0.05$. The effect size of the difference (Cohen's d) is 0.62 which is considered a medium to large value. The significant result in the Wilcoxon rank sum test along with the large value of d strongly indicates that there is indeed a gender difference when it comes to investment behavior. What is not known yet though is whether the gender difference depends on differences in risk aversion, beliefs, or both. To investigate this the results from the second part of the experiment must be analysed, namely the question about beliefs.

Table 5.3
Result of Wilcoxon rank sum test, investment.

	Men	Women	Common
Rank sum (R)	2718.5	1559.5	-
Value of U	739.5	1340.5	-
z_U	-	-	2.367
p-value	-	-	0.024**
Effect size (d)	-	-	0.62

$***$ = significant on 1% level
$**$ = significant on 5% level
$*$ = significant on 10% level

5.2.2 Gender difference in beliefs

Looking at the average belief that a company will reach on or above their stock value threshold level on January 1st 2020, a clear gender difference can be seen in the sense that men seem to be more optimistic about the chances. The average values and standard deviations are presented in table 5.4, and the distributions can be seen in figure 5.2. When looking at the samples using the histograms, it can be seen that

Table 5.4
Average beliefs results.

	Men	Women
Average beliefs (μ)	0.482	0.452
Standard deviation (σ)	0.076	0.081
Number of observations (N)	52	40

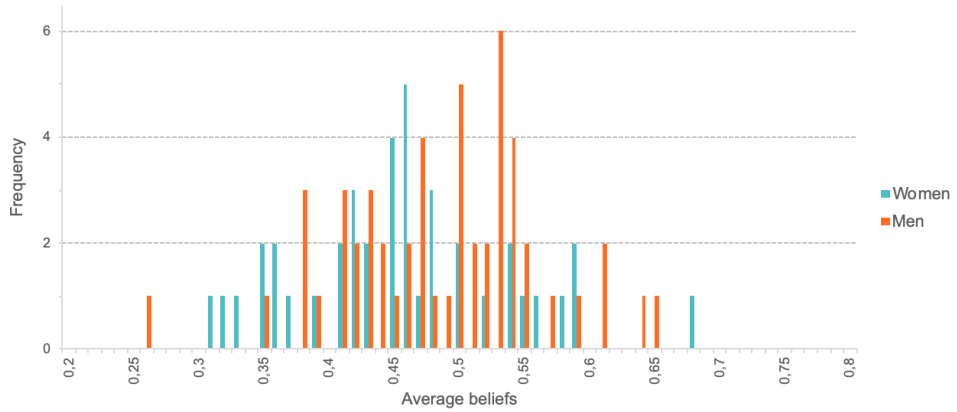


Figure 5.2: Average beliefs histogram, men and women.

the average beliefs among both men and women look close to normally distributed. Therefore both a standard t-test and a Wilcoxon rank sum test is performed to test the significance. As in the test on investment, the null hypothesis and alternative hypothesis in both tests are

$$H_0 : \mu_{men} = \mu_{women}$$
$$H_1 : \mu_{men} \neq \mu_{women}$$

The results of the calculations are presented in table 5.5. None of the tests can reject the null hypothesis on level $\alpha = 0.05$, but lowering the significance level just a little bit quickly gives a significant result. The t-test rejects the null hypothesis on level $\alpha = 0.1$, and the Wilcoxon rank sum test is also significant on the same level. The effect size is not as large as for the difference in investment, which is in line with the lower significance.

Beliefs appear to have effect on the investment behavior difference between men and women, but how large is it? To investigate this, mediation analysis is performed. This type of analysis is a tool to determine if all the variance in investment

Table 5.5
Result of t-test and Wilcoxon rank sum test, beliefs.

	Men	Women	Common
t-test			
t-statistic	-	-	-1.805
p-value	-	-	0.074*
Wilcoxon rank sum test			
Rank sum (R)	2672	1606	-
Value of U	786	1294	-
z_U	-	-	2.001
p-value	-	-	0.054*
Effect size			
d	-	-	0.378

$***$ = significant on 1% level
$**$ = significant on 5% level
$*$ = significant on 10% level

can be directly attributed to gender, or if some of it is explained indirectly by gender and mediated through beliefs (Iacobucci, 2008, 11). To start, two linear regressions with investment as dependent variable are fitted. Controlling first for only gender and then for both gender and beliefs, the regression formulas become

$$Y_{investment} = \beta_0 + \beta_1 F + \varepsilon_1 \tag{5.5}$$
$$Y_{investment} = \beta_0 + \beta_1 F + \beta_2 B + \varepsilon_2 \text{ where} \tag{5.6}$$
$$F = \text{Female} \tag{5.7}$$
$$B = \text{Beliefs} \tag{5.8}$$

and the results are obtained as in table 5.6. Comparing the coefficient for F in the first and second regression gives an indication of the impact of beliefs on the investment decision. When controlling for beliefs, the coefficient for F decreases from -5.799 to -4.261. Therefore an estimation of the effect of beliefs on investment behavior is

$$\frac{-5.799 - (-4.261)}{-5.799} = 0.2652... \approx 26.5\% \tag{5.9}$$

This means that around 75% of the gender difference in investment behavior would then be explained by differences in risk aversion, and the remainder by gender differences in beliefs.

Table 5.6
Regression result, impact of beliefs.

	Dependent variable: estimate of investment		
	Coefficient	Std Error	p-value
Not controlling for beliefs			
Constant	24.91	1.710	0.000***
Female	-5.799	1.858	0.002***
Controlling for beliefs			
Constant	-0.141	1.715	0.935
Female	-4.261	1.819	0.021**
Beliefs	51.986	1.755	0.000***

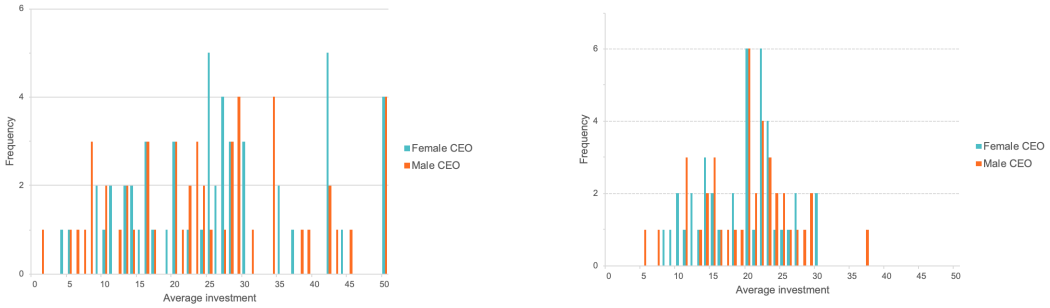
Notes: The table shows the linear regression results for the estimate of the statistic 'investment', first controlling only for a constant and the dummy variable 'Female' and then adding the variable 'Beliefs'. The standard errors were clustered for each participant which gave 92 independent observations.
$***$ = significant on 1% level
$**$ = significant on 5% level
$*$ = significant on 10% level

5.2.3 Gender difference in investment with focus on CEO gender

It has been shown that there are gender differences in investment and that both beliefs and risk preferences contribute to this effect, with risk preferences being the primary factor. Now it is time to evaluate whether participants invested differently depending on the gender of the CEO, and if there is a gender 'difference in difference' when it comes to investing in companies with female or male CEO's. The average investment in companies with female and male CEO's are presented in table 5.7 and can also be seen in figure 5.3a and 5.3b. As can be seen in figure 5.3, both men and women seem to evaluate companies with female and male CEO quite equally. To properly investigate if the companies are evaluated equally and if there actually

Table 5.7
Average investment result, gender of CEO.

	Average investment	Std Error	Number of observations (N)
Men			
Male CEO	24.41	13.04	52
Female CEO	25.40	12.42	52
Women			
Male CEO	19.49	6.48	40
Female CEO	18.73	5.86	40



(a) Average investment by men.

(b) Average investment by women.

Figure 5.3: Average investment in companies with female and male CEO.

Table 5.8
Result of Wilcoxon rank sum test, investment in assets with female or male CEO.

	R	U	z_U	p-value	d
Men					
Male CEO	2678	1404	-	-	-
Female CEO	2782	1300	-	-	-
	-	-	0.338	0.377	0.078
Women					
Male CEO	1671.5	748.5	-	-	-
Female CEO	1568.5	851.5	-	-	-
	-	-	0.496	0.353	0.125

$***$ = significant on 1% level
$**$ = significant on 5% level
$*$ = significant on 10% level

is a gender difference in difference, a Wilcoxon rank sum test and a regression is performed. The results of the Wilcoxon rank sum test are found in table 5.8. The regression set up is found below and the results are presented in table 5.9.

$$Y_{investment} = \beta_0 + \beta_1 F + \beta_2 FC + \beta_3 FFC + \varepsilon \text{ where} \tag{5.10}$$
$$F = \text{Female} \tag{5.11}$$
$$FC = \text{Female CEO} \tag{5.12}$$
$$FFC = \text{Female \& Female CEO} \tag{5.13}$$

Looking at the results of the Wilcoxon rank sum test it can be seen that neither men nor women evaluate assets with female or male CEO significantly different. Regarding the β-values in table 5.9, the coefficient 'Female×Female CEO' is the one testing the hypothesis that the gender difference in investment would change depending on the gender of the CEO. The coefficient is negative which suggest that the gender difference in investment behavior actually becomes larger in the sense that women invest less, when looking at companies with female CEO's. However, the results are not near significant and a larger sample size would be needed to significantly show this small of a difference in difference.

Table 5.9
Regression result, impact of gender of CEO on investment.

	Dependent variable: estimate of investment		
	Coefficient	Std Error	p-value
Constant	24.410	1.802	0.000^{***}
Female	-4.923	2.062	0.019^{**}
Female CEO	0.990	0.824	0.233
Female×Female CEO	-1.753	1.505	0.247

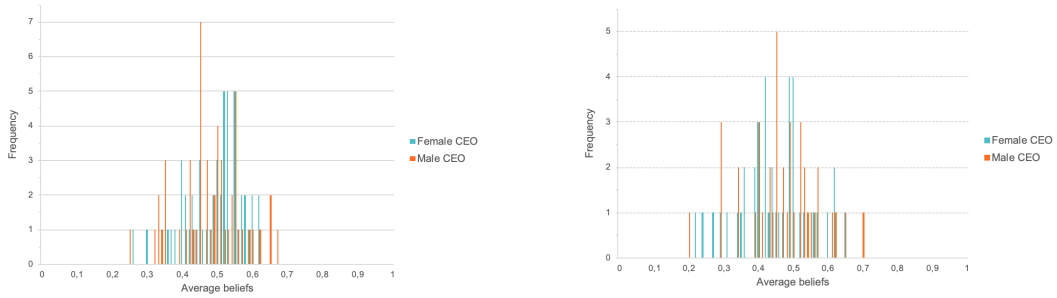
Notes: This table gives the linear regression results for the estimate of the statistic 'investment', controlling for a constant, the dummy variables 'Female', 'Female CEO' and the interaction between the latter two. The standard errors were clustered for each participant which gave 92 independent observations.
$***$ = significant on 1% level
$**$ = significant on 5% level
$*$ = significant on 10% level

5.2.4 Gender difference in beliefs with focus on CEO gender

No significant gender difference in difference was found in investment behavior when focusing on the gender of the CEO, but what about beliefs? The average beliefs in companies with male and female CEO's are presented in table 5.10, and the corresponding histograms can be seen in figure 5.4a and 5.4b. Looking at the histograms in figure 5.4, neither men nor women seem to differ in beliefs when it comes to companies with either female or male CEO. To properly study if there is a significant difference in difference, a Wilcoxon rank sum test and a regression is performed in the same way as in section 5.2.3. The only difference in the regression formula (5.10) is that the dependent variable is now the estimate of beliefs. The results of the Wilcoxon rank sum test can be found in table 5.11 and the regression results in table 5.12. No significant difference nor difference in difference is found when evaluating beliefs among men and women with focus on the CEO gender. The coefficient 'Female×Female CEO' is approaching significance (10% level) which suggest that women tend to believe less in companies with female leadership. However,

Table 5.10
Average beliefs result, gender of CEO.

	Average beliefs	Std Error	Number of observations (N)
Men			
Male CEO	0.475	0.091	52
Female CEO	0.488	0.079	52
Women			
Male CEO	0.463	0.104	40
Female CEO	0.440	0.102	40



(a) Average beliefs, men.

(b) Average beliefs, women.

Figure 5.4: Average beliefs in companies with female and male CEO.

Table 5.11
Result of Wilcoxon rank sum test, beliefs in assets with female or male CEO.

	R	U	z_U	p-value	d
Men					
Male CEO	2582	1500	-	-	-
Female CEO	2878	1204	-	-	-
	-	-	0.962	0.251	0.156
Women					
Male CEO	1737	683	-	-	-
Female CEO	1503	917	-	-	-
	-	-	1.126	0.212	0.227

$***$ = significant on 1% level
$**$ = significant on 5% level
$*$ = significant on 10% level

the difference is still slightly too small to be significant in this sample size. It is also worth mentioning that the coefficient for 'Female' now is clearly insignificant, which means that investor gender does not have a significant effect on beliefs in companies with male CEO's. This result is in line with the indicated smaller investments by women in companies with female CEO's seen in section 5.2.3. Even though none of the results are statistically significant, there are slight indications that women tend to believe less in companies with female CEO's, and also invest less in them.

Table 5.12
Regression result, impact of gender of CEO on beliefs.

	Dependent variable: estimate of beliefs		
	Coefficient	Std Error	p-value
Constant	0.475	0.013	0.000***
Female	-0.012	0.021	0.557
Female CEO	0.013	0.011	0.231
Female×Female CEO	-0.035	0.022	0.125

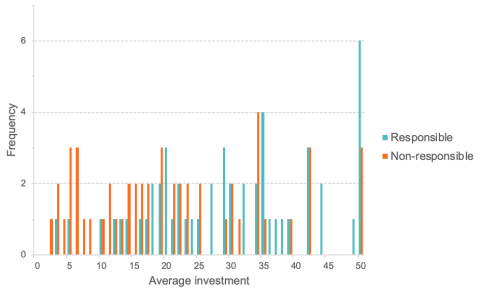
Notes: This table gives the linear regression results for the estimate of the statistic 'beliefs', controlling for a constant, the dummy variables 'Female', 'Female CEO' and the interaction between the latter two. The standard errors were clustered for each participant which gave 92 independent observations.
$***$ = significant on 1% level
$**$ = significant on 5% level
$*$ = significant on 10% level

5.2.5 Gender difference in investment with focus on sustainability and ethics

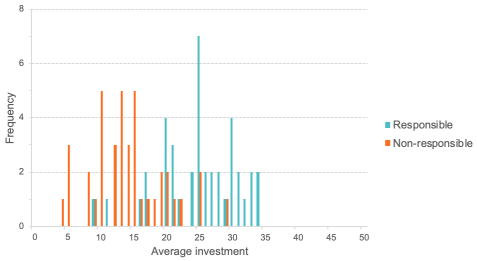
When looking at the sustainability and ethics part of the experiment, the average investment in responsible and non-responsible companies across both versions was investigated among both men and women. It is important to point out that the stock value graphs shown to the participants had both negative and positive trends across the responsible and non-responsible companies. Even if the graphs were not exactly the same for one responsible and one non-responsible company (as with the CEO names that were changed between treatment one and two) there was no clear overweight in responsible companies showing good trends and non-responsible showing bad trends or vice versa. The average investment in responsible and non-responsible companies and the standard deviations are presented in table 5.13 and in the histograms in figure 5.5a and 5.5b. Looking at the averages and histograms it seems likely that there is a significant difference in investment when it comes to responsible and non-responsible companies both among men and women. To

Table 5.13
Average investment result, sustainability and ethics.

	Average investment	Std Error	Number of observations
Men			
Responsible	29.35	12.68	52
Non-responsible	20.46	13.49	52
Women			
Responsible	24.53	5.89	40
Non-responsible	13.68	5.76	40



(a) Average investment by men.



(b) Average investment by women.

Figure 5.5: Average investment in responsible and non-responsible companies.

Table 5.14
Result of Wilcoxon rank sum test, investment in responsible and non-responsible assets.

	R	U	z_U	p-value	d
Men					
Responsible	3151.5	930.5	-	-	-
Non-responsible	2308.5	1773.5	-	-	-
	-	-	2.74	0.009***	0.95
Women					
Responsible	2252.5	167.5	-	-	-
Non-responsible	987.5	1432.5	-	-	-
	-	-	6.09	0.000***	2.64

$***$ = significant on 1% level
$**$ = significant on 5% level
$*$ = significant on 10% level

investigate the differences properly a Wilcoxon rank sum test is performed for both groups, as well as a calculation of the effect size. The results are presented in table 5.14. As can be seen in table 5.14, the difference between investments in responsible and non-responsible companies is significant both for men and women on level $\alpha = 0.01$. The effect size is large in both groups, but especially among women where $d = 2.64$. To properly investigate if the importance of sustainability and ethics actually is significantly more important to women than men, a linear regression is performed as

$$Y_{investment} = \beta_0 + \beta_1 F + \beta_2 R + \beta_3 FR + \varepsilon \text{ where} \tag{5.14}$$
$$F = \text{Female} \tag{5.15}$$
$$R = \text{Responsible} \tag{5.16}$$
$$FR = \text{Female and Responsible} \tag{5.17}$$

with the results as in table 5.15. The results indicate that women might actually be more concerned than men about sustainability and ethics when investing, as the coefficient for 'Female×Responsible' is positive. The p-value is a about the same as when when comparing investments with female or male CEO's, and the result is

Table 5.15
Regression result, impact of sustainable and ethics on investment.

	Dependent variable: estimate of investment		
	Coefficient	Std Error	p-value
Constant	20.465	1.866	0.000***
Female	-6.786	2.074	0.002***
Responsible	8.881	1.181	0.000***
Female×Responsible	1.973	1.620	0.226

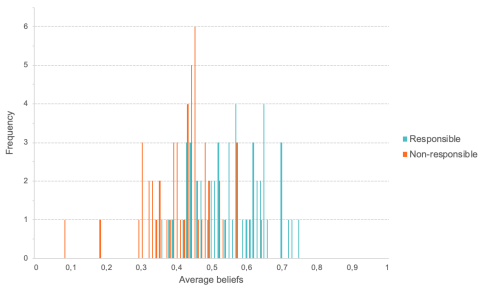
Notes: This table gives the linear regression results for the estimate of the statistic 'investment', controlling for a constant, the dummy variables 'Female', 'Responsible' and the interaction between the latter two. The standard errors were clustered for each participant which gave 92 independent observations.
$***$ = significant on 1% level
$**$ = significant on 5% level
$*$ = significant on 10% level

still not statistically significant. A larger sample size is needed to show a significant gender difference in difference. It can also be seen that the coefficient 'Female' is highly significant which indicates that the gender of the investor has an effect in the sense that women invest less when looking at only non-responsible companies.

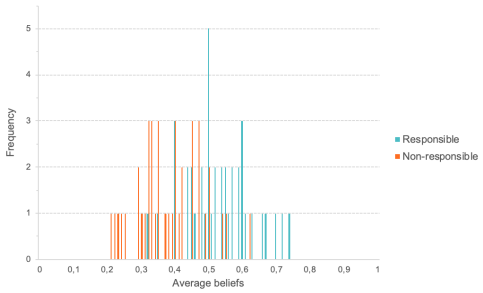
To conclude, it is clear that sustainability and ethics matters a lot to both men and women when investing, and there are indications that women value it to the highest extent.

5.2.6 Gender difference in beliefs with focus on sustainability and ethics

It has already been shown that sustainability and ethics is significantly important to both men and women when it comes to investment behavior. Now it is time to investigate if beliefs about a company change depending on the sustainability profile. The average beliefs in responsible and non-responsible companies among men and women are summarized in table 5.16 and in figure 5.6a and 5.6b. Judging



(a) Average beliefs, men.



(b) Average beliefs, women.

Figure 5.6: Average beliefs in responsible and non-responsible companies.

Table 5.16
Average beliefs result, sustainability and ethics.

	Average beliefs	Std Error	Number of observations
Men			
Responsible	0.552	0.100	52
Non-responsible	0.412	0.096	52
Women			
Responsible	0.527	0.096	40
Non-responsible	0.377	0.097	40

Table 5.17
Result of Wilcoxon rank sum test, beliefs in responsible and non-responsible assets.

	R	U	z_U	p-value	d
Men					
Responsible	3643	439	-	-	-
Non-responsible	1817	2265	-	-	-
	-	-	5.94	0.000^{***}	1.42
Women					
Responsible	2200	220	-	-	-
Non-responsible	1040	1380	-	-	-
	-	-	5.58	0.000^{***}	1.55

$***$ = significant on 1% level
$**$ = significant on 5% level
$*$ = significant on 10% level

from the average values and histograms in figure 5.6, it seems like both men and women have significantly higher beliefs in companies with a responsible profile. To test it formally and to investigate if there is a difference in difference, a Wilcoxon rank sum test and a regression is performed once again. The results can be found in table 5.17 and 5.18. It can clearly be seen that both men and women believe substantially more in companies with a sustainable and ethical profile, and the difference is significant even on level $\alpha = 0.01$ for both genders.

Regarding a possible difference in difference, i.e. if men or women change their beliefs more than the other when focusing on sustainability, it seems like women tend to decrease their beliefs a bit more than men do when the asset is profiled as non responsible. This can be seen by looking at the coefficient 'Female' which shows the effect of investor gender on beliefs in non responsible companies, and is significant on on level $\alpha = 0.1$. However, the combined coefficient 'Female×Responsible' is not near significant which suggest that there is no significant effect on beliefs from investor gender when it comes to responsible assets. This makes it impossible to draw any adamant conclusions, even if there are indications that women value sus-

Table 5.18
Regression result, impact of sustainable and ethics on beliefs.

	Dependent variable: estimate of beliefs		
	Coefficient	Std Error	p-value
Constant	0.412	0.013	0.000***
Female	-0.035	0.020	0.091*
Responsible	0.140	0.017	0.000***
Female×Responsible	0.010	0.024	0.674

Notes: This table gives the linear regression results for the estimate of the statistic 'beliefs', controlling for a constant, the dummy variables 'Female', 'Responsible' and the interaction between the latter two. The standard errors were clustered for each participant which gave 92 independent observations.
$***$ = significant on 1% level
$**$ = significant on 5% level
$*$ = significant on 10% level

tainability and ethics to a higher extent. Comparing the result to the difference in difference seen in investment when looking at sustainability and ethics (see section 5.2.5) the difference in difference in beliefs is smaller than in the investment case. This could indicate that women invest more in sustainable assets not only because they believe in them more, but also because they are more willing to take risks when the cause of the company is good.

5.2.7 Gender difference in characteristics estimated by participants

A summary of the results regarding the characteristics 'confidence', 'optimism', 'risk taking', 'competitiveness', 'importance of sustainability', 'importance of ethics' and 'experience' can be found in table 5.19 below (ranked from one to five). The histograms for each part is presented in figure 5.7, 5.8, 5.9 and 5.10.

The results show that there is no significant gender difference when it comes to confidence, optimism or competitiveness. An interesting finding is the fact that even though there is no significant difference in self reported optimism, a significant gender difference was found in beliefs about the companies in the experiment. This indicated that men are more optimistic than women (at least when investing), but is clearly not reported by participants themselves.

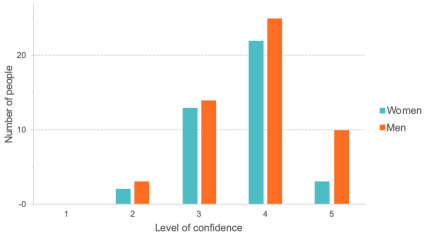
When estimated by participants, there is a significant difference in risk taking, importance of sustainability and ethics, and not least in investment experience. The difference in risk taking is in line with the gender difference seen in investment behavior. This is also the case when looking at sustainability and ethics, where investment behavior showed that women might tend to care more than men about their investments being responsible (even though men also rank it as important).

Last but not least, the most significant difference in characteristics between men and women was definitely in experience. Seeing such an obvious gender difference in investment experience even in this study group of young people who to a large extent study the same education program was a bit unexpected, and will be discussed further in the next chapter.

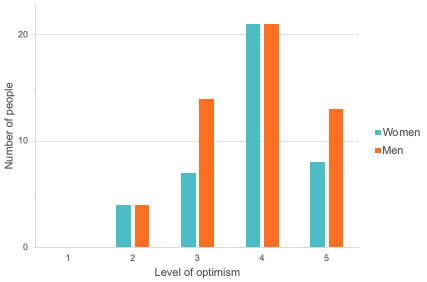
Table 5.19
Result of differences in characteristics.

	Avg. M	Avg. W	Diff. (M-W)	p-value
Confidence	3.808	3.650	0.158	0.322
Optimism	3.823	3.825	-0.002	0.992
Risk taking	3.212	2.750	0.462	0.033**
Competitiveness	3.808	3.950	-0.142	0.491
Sustainability	3.250	3.950	-0.700	0.005***
Ethics	3.308	3.950	-0.642	0.005***
Experience	3.056	1.975	1.081	0.000***

Notes: The table shows the differences in characteristics between men and women, along with the significance level. The averages were computed over all 52 and 40 observations respectively.
$***$ = significant on 1% level
$**$ = significant on 5% level
$*$ = significant on 10% level

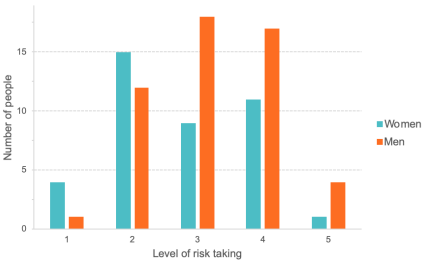


(a) Confidence.

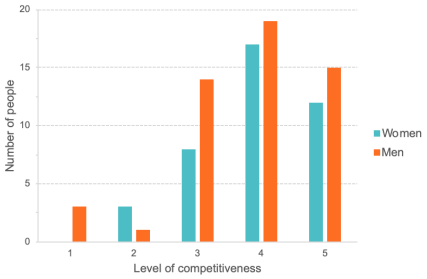


(b) Optimism.

Figure 5.7: Level of confidence and optimism.

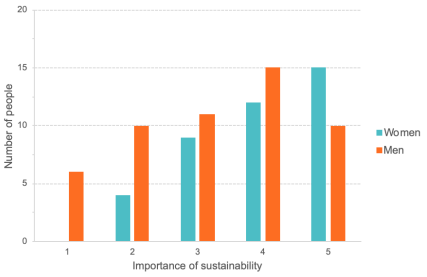


(a) Risk aversion.

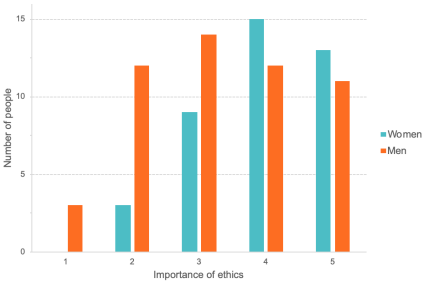


(b) Competitiveness.

Figure 5.8: Level of risk aversion and competitiveness.



(a) Importance of sustainability.



(b) Importance of ethics.

Figure 5.9: Importance of sustainability and ethics.

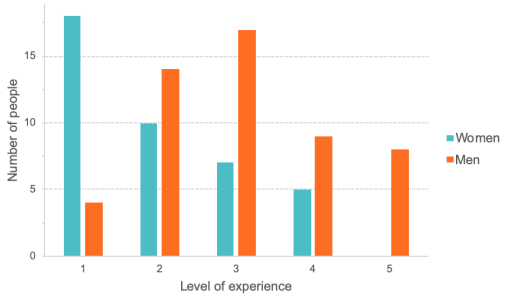


Figure 5.10: Level of experience.

6

Discussion

6.1 Analysis of Results

The results from the experiment show that women invest less than men, and that the gender difference in investment behavior lies both in differences in risk preferences and differences in beliefs. Neither men nor women change their investment behavior or beliefs significantly depending on the gender of the CEO, but do when comparing assets with responsible or non-responsible profiles.

6.1.1 Review of hypotheses

Starting with the difference in investment behavior, the interpretation from a theoretical point of view is that women in general should have a more concave utility function than men do, but also that the probabilities of each outcome are estimated differently. Women tend to estimate the probability that the investment will be successful to be a bit lower than men do, which is also part of the explanation to the difference seen in investment behavior. The result that men invest more than women was highly expected as it has been found in several other studies and experiments (see section 3.1), and confirms hypothesis 1. The same result was also found to be significant when participants themselves were to estimate to what extent they like to take risks, which suggests that both genders seem to be aware of their own risk preferences and not only demonstrating it through their behavior.

Regarding beliefs the results from the study confirms hypothesis 2, that both risk preferences and beliefs are part in the seen difference in investment behavior. However, no significant difference was found when participants were to estimate their own level of optimism. An interesting finding since optimism in many ways is closely related to the beliefs formed by an individual. One might argue that optimism in general is not necessarily directly transferable onto a person's beliefs about the financial market, but it still seems conceivable to believe that a person who generally has an optimistic view on life should also at least partly display it in their beliefs about the future of an investment.

When it comes to the importance of the gender of the CEO, hypothesis 3A which said that the gender difference in investment was not going to be affected by the CEO gender could also be confirmed. However, the sub-hypothesis that the invest-

ment behavior of both men and women would change depending on the CEO gender could be rejected. This result is contrary to what has been seen in for example the technology business in Sweden (mentioned in the introduction), where companies with female leaders get a very small share of total venture capital despite the fact they form almost 20% of the market. Finding no such gender bias here, neither among men or women, indicates that the differences might not be due to the gender of the CEO but are related to other factors.

Hypothesis 3B said that the gender difference in investment behavior will be affected by the level of sustainability and ethics. The results show that both men and women care a lot about sustainability and ethics, and raise both their investments and their beliefs in these companies. It was expected to find that women value sustainability to a larger extent than men do, but this result could not be statistically assured even if there were slight indications in this direction. What is also interesting to mention is that a very significant gender difference was found when participants were asked to rank how important sustainability and ethics are to them when investing. Women ranked both matters substantially higher than men, but it was not significantly shown in the investment behavior.

6.1.2 Other findings

Mentioned in section 3.2, it has been found in several studies that men show higher levels of competitiveness than women do. However, when the characteristic 'competitiveness' was ranked by participants in this experiment, no significant such difference was found. On the contrary, women actually on average ranked themselves as more competitive than men did which was an interesting finding even though the result could not be statistically determined.

Finally, it is worth commenting on the large gender difference when it comes to investment experience. Since the experience level was self reported, it is hard to tell whether men actually had more experience than women or if the reporting was shifted in any way by one or both genders. As mentioned in section 3.1, men generally tend to overestimate and women to underestimate their own ability, which could contribute to the large difference seen here. That being said, since the difference is highly significant some sort of actual gender difference in experience is still likely to exist. This theory is also supported by the fact that no significant gender difference in confidence was reported among the participants.

6.1.3 Strengths and weaknesses

The strength of the study lies in its ability to investigate general gender differences in investment behavior considering two factors, the gender of leadership and level of sustainability and ethics, at the same time. What the study does not capture though, is the reason why this result is found. *Why* men and women behave differently is a complex issue that could involve everything from physiology and psychology to social structures and roles, and is therefore not in the scope of this thesis.

6.2 Impact on Equality

Having observed significant gender differences in investment behavior, it seems inevitable to not at least briefly mention the possible impact this might have on gender equality. The fact that women invest less than men could be one cause of the financial imbalance seen between men and women. Looking at the index OMXS30 over 30 years, it has grown by almost 1000% (Nasdaq, 2020). This means historically, investing in stocks in the long term generally has higher return than saving money in a bank account. Therefore, if women invest less in stocks than men do they also get less of the stock market return which increases the financial imbalance already caused by the wage gap, both adjusted and unadjusted[10]. On the other hand, numerous studies both in Sweden and in other countries have shown that women in general invest better than men when they actually do it, and the number of women who invest in stocks and funds is slowly but steadily increasing (Bratt, 2019; Owen, 2019). However, one of the largest trading platforms in Sweden reports that men still have on average twice as much money invested than women do which indicates there is still a long way to go until we will reach financial equality in terms of savings (Ringberg, 2020).

6.3 Suggestions for Future Research

One of the greatest limitations of this study is the narrow age group and level of education, which possibly could have had an effect on the found results. Therefore, in further research it would be interesting to investigate if the same result would be found in a more diverse group in terms of age and education level. Also, as slight indications were found in investment behavior suggesting that women value sustainability to a higher extent than men do it would be of great interest to investigate this matter further. This could be done either in a similar lab experiment using a larger sample size, or in a field setting using real stock market data. A final suggestion for further investigation would be to look at if there are other factors that might influence the investment behavior of men and women, such as the size of the company or the performance of the company during the past years.

[10]The unadjusted wage gap looks only at actual wage while the adjusted wage gap controls for differences in education, occupation, sector and age

7

Conclusions

Investment decisions are decisions made under uncertainty, which makes them significantly affected by the risk preferences and beliefs of the people making them. Men and women have in previous studies exhibited different risk preferences and levels of beliefs, which makes them invest differently and therefore could affect their financial situation. The same result was also found in this study. Field data has indicated that companies with female leadership tends to get less investments, however this result was not found among men nor women in this experiment. The sustainability and ethics aspect has in the field setting shown to be important among especially women, but was in this study found to be so among both genders. To conclude, neither the gender of the CEO or the level of sustainability and ethics in the risky asset were found to be factors that significantly changed the general difference in investment behavior seen between men and women.

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8

Appendix A: Companies

Following is a presentation of the twelve companies that the participants were to evaluate. Each company is based on a real company, but has a fictitious name. The graphs of the stock values were retrieved from Avanza and are the stock values of the real companies that the investment decision companies were based on. Since the CEO name was either female or male depending on the version, each company has two CEO names. The first name is from treatment one and the second from treatment two. A summary of all companies along with their real company names and threshold values (X) can be found in table 8.1 below.

Table 8.1
The fictitious companies and their real world counterparts.

Company no.	Fictitious company name	Real company name	X
Example	Gr8 Sports Gear	Sportamore	\$60
1	BioFood	Ingredion Inc.	\$85
2	CleanEnergy	TransAlta Renewables Inc.	\$14
3	Beef & Chicken Co.	Tyson Foods Inc.	\$80
4	GreenInvest Inc.	Hannon Armstrong	\$28
5	Auto Motors	Tata Motors Ltd	\$15
6	Supply Organic Ltd	United Natural Foods	\$10
7	Steel & Metals Corp.	Outokumpu Oyj	\$3
8	TrendStore	TJX Companies Inc.	\$55
9	BioDrive	Green Plains Inc.	\$12
10	Petrol & Chem	Exxon Mobil Corp.	\$78
11	EverCoal	Arch Coal Inc.	\$95
12	SolarVolt	Solaredge Technologies Inc.	\$60

8.1 Company 1: BioFood

Business: food industry, predominantly nutrition ingredients and biomaterials
Number of employees: 11 000
Founded: 1906
Revenue (last year): US$ 6 Bn
CEO: Robert Wilson/Sarah Robinson

BioFood is active in the food industry, and has been so for over 100 years. Its primary products include starch, modified starches and different kinds of syrup from corn, potatoes and other fruits and vegetables. BioFood also produces ingredients for the pharmaceutical industry. In October 2019, BioFood made a large investment in plant-based proteins through a joint venture with another food producing company. The CEO (Robert Wilson/Sarah Robinson) has been with BioFood for almost eight years, and has been the CEO since May 2019. S/he has accumulated several decades worth of experience working in the business sector, and also has a Master of Business A from the Wharton school of the University of Pennsylvania. Lastly, BioFood has been selected as one of the world's most ethical companies multiple years in a row.

The stock value for BioFood can be seen in figure 8.1.

Figure 8.1: Stock value for company 1, BioFood (Avanza, 2020a).

8.2 Company 2: CleanEnergy

Business: electricity power, renewable sources
Number of employees: 300
Founded: 2013 (parent company founded in 1911)
Revenue (last year): US$ 450 M
CEO: Sarah Robinson/Robert Wilson

CleanEnergy is operating in the electricity power business, and specializes in renewable sources. The company operates both wind and hydro power generating facilities, and has been recognized for their sustainability work by several sustainability indices. CleanEnergy is part of a larger business group called AllEnergy which all together has over 2500 employees. Though the parent company was founded in the early 1900's, it was not until the early 2010's that it launched its renewable subsidiary, though it did have extensive experience with hydro power even before then. The CEO of CleanEnergy, Sarah Robinson/Robert Wilson, has more than 35 years of experience in the electricity business. S/he has said that sustainability is more than a business strategy to the company, and that it also is a competitive advantage. S/he hopes that CleanEnergy will be the leading clean power company by 2025 by continuing to develop both wind and solar power plants.

The stock value for CleanEnergy can be seen in figure 8.2.

Figure 8.2: Stock value for company 2, CleanEnergy (Avanza, 2020b).

8.3 Company 3: Beef & Chicken Co.

Business: food industry, predominantly meat
Number of employees: 120 000
Founded: 1935
Revenue (last year): US$ 43 Bn
CEO: Melissa Clark/Matthew Hill

Beef & Chicken Co. is active in the food industry and specializes in meat production. Its product range includes chicken, beef and pork and the company sells not only to super markets but also to a number of food chains across the nation. Even though Beef & Chicken Co. operates nationally its products are also exported to other countries. Beef & Chicken Co. was founded about 85 years ago and have since then grown a lot, partly by acquiring other meat producers. It also has a joint venture with an energy company which turn leftover animal fats into biodiesel, in order to increase its profits. The CEO, Melissa Clark/Matthew Hill, has been in her/his position since late 2018. S/he has many years of experience in the business and has worked in the company for many years, in a number of different areas and positions.

The stock value for Beef & Chicken Co. can be seen in figure 8.3.

Figure 8.3: Stock value for company 3, Beef & Chicken Co. (Avanza, 2020c).

8.4 Company 4: GreenInvest Inc.

Business: sustainable investments
Number of employees: 50
Founded: 1981
Revenue (last year): US$ 95 M
CEO: Andrew Thompson/Sandra Harris

This is an investment trust company that specializes in sustainable investments. For almost 40 years it has been dedicated to investments that favor the climate and counteract climate change. The investment focus therefore lies on companies within the renewable energy and energy efficiency sectors, as well as other sustainable businesses. Andrew Thompson/Sandra Harris has been the CEO for almost 20 years, and s/he manages the investment portfolio of almost US$ 2 Bn with the help of an experienced management team and almost 50 employees. S/he currently has decided that the portfolio should consist of about 10% investments in sustainable infrastructure, and the remaining 90% should be invested in energy efficiency and establishing wind and solar power plants. S/he is also very optimistic about the future of the company. So far, the focus of the company is mostly in the national market and the plan is for it to stay that way at least in the near future.

The stock value for GreenInvest Inc. can be seen in figure 8.4.

Figure 8.4: Stock value for company 4, GreenInvest Inc. (Avanza, 2020d).

8.5 Company 5: Auto Motors

Business: automotive
Number of employees: 85 000
Founded: 1945
Revenue (last year): US$ 32 Bn
CEO: Matthew Hill/Melissa Clark

Auto Motors is a large company in the automotive industry. The product range is broad and consists of everything from passenger cars, trucks, buses and sport cars as well as other products. The common denominator for all products is that they are either petrol or diesel driven. There are no plans when it comes to manufacturing electric cars. Auto Motors has a long tradition of providing cars not only nationally but also internationally, even if they have their largest market in their home country. The CEO, Matthew Hill/Melissa Clark, has been with the company since 2016, which is when s/he started in his/her position as CEO. Before joining in 2016 s/he had a long career in the transport industry, but with a focus on other means of transportation (not cars).

The stock value for Auto Motors can be seen in figure 8.5.

Figure 8.5: Stock value for company 5, Auto Motors (Avanza, 2020e).

8.6 Company 6: Supply Organic Ltd.

Business: distribution of organic food
Number of employees: 19 000
Founded: 1996
Revenue (last year): US$ 24 Bn
CEO: Sandra Harris/Andrew Thompson

Supply Organic Ltd. is the largest distributor of organic food in its country. It was formed in 1996 through a merger of two smaller distribution companies, which in their turn both were founded in the mid 1970's. Since the first merger more smaller companies have joined throughout the years, which have made Supply Organic Ltd. the large player that it is today. When it comes to products, the company distributes everything from prepared foods and bakery to seafood and exclusive cheese. Supply Organic Ltd. is engaged in several philanthropic organizations, and supports projects concerning for example environmental conservation, hunger and nutrition education. It also has high sustainability goals and has invested in solar power to reduce its greenhouse gas emissions. Sandra Harris/Andrew Thompson, the CEO, has been in management-level positions in the food industry for almost 30 years, 12 of which have been with Supply Organic Ltd.. S/he is also a board member of several companies in the same industry.

The stock value for Supply Organic Ltd. can be seen in figure 8.6.

Figure 8.6: Stock value for company 6, Supply Organic Ltd. (Avanza, 2020f).

8.7 Company 7: Steel & Metals Corp.

Business: steel production
Number of employees: 10 000
Founded: 1932
Revenue (last year): US$ 6 Bn
CEO: David Lopez/Rebecca Parker

Steel & Metals Corp. was founded in the early 1930's and has since then become a leader in stainless steel production. Before 2000 the company also mined and refined other minerals than iron and coal (which are used for the steel production). However, now all its focus is on producing steel and related products where it aspires to be the global leader. The CEO, David Lopez/Rebecca Parker, is a board member of several steel associations and forums and had worked at several other steel companies before becoming the leader of Steel & Metals Corp. in 2016. The headquarters of the company are still located nationally, but it has sales offices, service centers and production units on almost all continents. Steel & Metals Corp. expect to grow in the coming years due to the increased urbanization and need for new buildings, cars and many other steel products.

The stock value for Steel & Metals Corp. can be seen in figure 8.7.

Figure 8.7: Stock value for company 7, Steel & Metals Corp. (Avanza, 2020g).

8.8 Company 8: TrendStore

Business: fashion
Number of employees: 270 000
Founded: 1987
Revenue (last year): US$ 40 Bn
CEO: Rebecca Parker/David Lopez

TrendStore is a big player in the fashion industry, and has stores in ten countries around the world. The company owns multiple brands, some of which are national and some of which are also sold internationally. When it comes to the manufacturing of its products, TrendStore has factories in multiple countries. The price range of the products sold is in the lower price segment, and the product range is trend-oriented with many new collections and product releases every year. The leader and CEO, Rebecca Parker/David Lopez, is committed to increasing the profits of TrendStore and hope to grow the number of stores in the coming years. S/he held several positions within TrendStore before she became CEO in 2016, and continues to lead the many employees toward what s/he hopes will be a good future for the company.

The stock value for TrendStore can be seen in figure 8.8.

Figure 8.8: Stock value for company 8, TrendStore (Avanza, 2020h).

8.9 Company 9: BioDrive

Business: biofuel production
Number of employees: 1500
Founded: 2004
Revenue (last year): US$ 3 Bn
CEO: Helen Reed/Patrick Barnes

BioDrive is a large ethanol producer and manufactures ethanol from fermented sugars. The most commonly used way to produce ethanol is using corn, but other grains and waste products from for example potatoes can also be used. Even though BioDrive was not founded until 2004 and operations started as late as 2007 when the first ethanol plant was opened, it has grown to become one of the largest ethanol producers in its country. BioDrive has had the same CEO, Helen Reed/Patrick Barnes, for almost its entire lifespan. S/he was appointed to her position in 2009, and it is her/his first CEO position. Except the production of ethanol the company also operates a marketing business for trading its products. BioDrive is a national company both when it comes to production and distribution.

The stock value for BioDrive can be seen in figure 8.9.

Figure 8.9: Stock value for company 9, BioDrive (Avanza, 2020i).

8.10 Company 10: Petrol & Chem

Business: oil
Number of employees: 70 000
Founded: 1999
Revenue (last year): US$ 264 Bn
CEO: Eric Howard/Emma Richardson

Petrol & Chem is active in the oil industry, and a large provider of petroleum in several countries. It was founded 20 years ago by a merger between two formerly separate petroleum companies. Though its revenue is very large, it only accounts for a few percent of the world production of petroleum. However, Petrol & Chem sees itself as an industry leader when it comes to energy and chemical manufacturing business. It also wants to develop new technologies to be able to continue to fuel global economies. For the past three years, Petrol & Chem has been run by its CEO Eric Howard/Emma Richardson. S/he both has a degree in electrical engineering as well as a Master of Business Administration, and has been with the company since 1992. S/he is also a member of several business councils, and a board member of the national petroleum institute.

The stock value for Petrol & Chem can be seen in figure 8.10.

Figure 8.10: Stock value for company 10, Petrol & Chem (Avanza, 2020j).

8.11 Company 11: EverCoal

Business: coal mining
Number of employees: 4000
Founded: 1997
Revenue (last year): US$ 2.4 Bn
CEO: Emma Richardson/Eric Howard

EverCoal is active in the coal mining business, and is operating a number of coal mines in a large country. Though the company was formally founded in the late 1990's its history goes further back as the foundation was a merger between two former mining companies. Apart from mining, EverCoal also engages in processing and marketing of coal products. This puts the company in control of the whole chain from raw material to finished products ready for distribution, and their products are used both to general electricity and to produce steel. EverCoal supplies coal to five continents and over one hundred countries. Emma Richardson/Eric Howard, the CEO, has many years of experience in the company and s/he is also a board member in a number of other companies in the same business.

The stock value for EverCoal can be seen in figure 8.11.

Figure 8.11: Stock value for company 11, EverCoal (Avanza, 2020k).

8.12 Company 12: SolarVolt

Business: solar power
Number of employees: 2500
Founded: 2006
Revenue (last year): US$ 1.5 Bn
CEO: Patrick Barnes/Helen Reed

SolarVolt is active in the solar power business, and works to make photovoltaic systems more efficient when collecting and managing solar energy. Even though the company is only 15 years old, it is already a global leader and has had its systems installed in more than one hundred countries on five continents. The commitment to sustainability is deep within SolarVolt, and it holds several ISO certifications as proof that it fulfills certain standards when it comes to sustainability, ethics and quality. The CEO, Patrick Barnes/Helen Reed, holds a degree in electrical engineering and has been in his/her position for just over a year. Before becoming the CEO s/he was the vice president of SolarVolt for almost ten years. In addition, s/he has also published several articles in the field of chemical disposition.

The stock value for SolarVolt can be seen in figure 8.12.

Figure 8.12: Stock value for company 12, SolarVolt (Avanza, 2020l).

9

Appendix B: Detailed Instructions

Here the instructions given to the participant in the online experiment are presented. Each section represents a page in the instructions, except section 9.6 which contains detailed information on the mechanism behind the belief elicitation task (question two for each asset).

9.1 Page 1

Welcome to this experiment on decision making!

IMPORTANT:

- ◊ My hope is that the instructions for the experiment will be clear, but if you have questions you can always email me at [redacted] where I will answer within minutes.
- ◊ The experiment is individual.
- ◊ Please don't talk to anyone while you are working on the experiment. Answer according to your own beliefs.
- ◊ When you have done the experiment, please don't talk to anyone about its contents until Thursday the 2nd of April. This is to insure no influence between participants during the different sessions.

Practical information:

- ◊ You will be paid 50 SEK just to do the experiment, but also an additional amount depending on your decisions in the experiment.
- ◊ Please think through your decisions carefully, since your decisions will affect your payment. It is therefore in your best interest to do the experiment to the best of your ability.
- ◊ You will get your payment on the same day that you conducted the experiment. However, the details of your result will be sent to you by email as soon as all participants have done the experiment.

On the next page you will find the detailed instructions for the experiment.

9.2 Page 2

Please read through the instructions carefully.

General instructions
You will be given twelve decisions that you are to evaluate. One of the twelve decisions will be chosen at random for each participant at the end of the experiment, and the result will be part of your payment. For each decision, you will receive information about a company. This will include a summary of its business and a graph of their stock value from January 2017 to July 2019. Each company is based on a real-world company; an example will be shown on the next page.

After reading about the company, you will be asked to do two things. First, you will be asked how much money you want to invest in the company. Second, you will be asked to guess the chance that the company's stock value reaches a certain level.

Instructions for question 1
Let's start by discussing the investment decision. For each of the twelve companies, you will start with 50 SEK. You then have to decide how you would like to allocate your money between the following two alternatives:

1) Your virtual bank account. If you put the money in your virtual bank account, its value will remain unchanged.
2) An investment. If the company's stock value on a given date ends on or above a certain level (given in each task), the company is making a profit and will be able to reward your investment with a 200% return (i.e., triple your original investment). On the other hand, if the company's stock value is lower than the threshold level, the company will not make a profit and you will lose your investment.

You can invest anywhere from 0 (nothing) to 50 (everything) SEK; any money you do not invest will be put in your virtual bank account. More details about how the payment works will be given shortly.

Instructions for question 2
Apart from investing directly, you will be asked to guess what you believe the chance is that the stock value of the company is on or above the threshold level on a given date.

You can receive a bonus of 50 SEK for this question. More details about the bonus payment will be given shortly.

To give better understanding, you will now be given an example task.

9.3 Page 3

Example task
This is an example of what the experiment tasks will look like. First there will be a description of the company, along with a graph of the stock value of the company during the past two and a half years. Our example company is called "Gr8 Sports Gear" and is presented below.

NOTE: the example task is not part of the experiment. It is only for you to practice before the real experiment starts.

Example company: Gr8 Sports Gear
Business: sports gear
Number of employees: 1000
Founded: 1973
Revenue (last year): US$ 5 Bn
CEO: James Miller

Gr8 Sports Gear is active in the sports gear business, and has been so for almost 50 years. Its product range includes everything from workout clothes and shoes to sports equipment such as footballs and tennis rackets. Gr8 Sports Gear owns the whole chain of production, from manufacturing the clothes to transporting and distributing them, which allows for short lead times and low risk of interruptions. The CEO of Gr8 Sports Gear, James Miller, has been with the company for over ten years and has had his current position since 2015. He has recently presented the idea of launching a foundation to support local sports clubs for children, which he hopes will be up and running at the end of this year.

The stock value for Gr8 Sports Gear can be seen in the graph below.

Figure 9.1: Stock value for example company, Gr8 Sports Gear (Avanza, 2020m).

Explanation for question 1
You can invest anywhere from 0 to 50 SEK. As seen in the graph, you only have information about the stock value until July 2019. Your first task is now to determine how much much you want to invest based on the information and graph above.

The investment will pay back in the following way: If the stock value is $60 or above on the 1st of January 2020, your investment will pay back what you invested times three. If the stock value is below $60, your investment will pay back zero.

Your answer should be a number between 0 and 50 SEK.

1. How much do you want to invest in this company? You can invest anything between 0 and 50 SEK.

Answer: _____

Explanation for question 2
For this question you state what you believe the chance is that the stock value of the company will be $60 or above on the 1st of January 2020.

Your answer should be a number between 0 and 1. 0 means 0% chance and 1 means 100% chance, so if you believe it is for example 30% chance your answer should be 0.3.

2. What do you believe the chance is that the stock value is $60 or above on the 1st of January 2020?

Answer: _____

Please click 'next' to see the explanation of the payment mechanism.

9.4 Page 4

In the experiment, you will be making twelve decisions like the example task, concerning twelve different companies.

Each of the investment decisions are independent of each other. You will start with 50 SEK for each decision regardless of your investments in the previous companies.

When you have finished all twelve decisions, your payment will be determined in the following way.

One company will be selected at random for each participant (figure 9.2). NOTE: the bars below are just examples and has nothing to do with the actual outcomes of the twelve companies. For the selected company, two

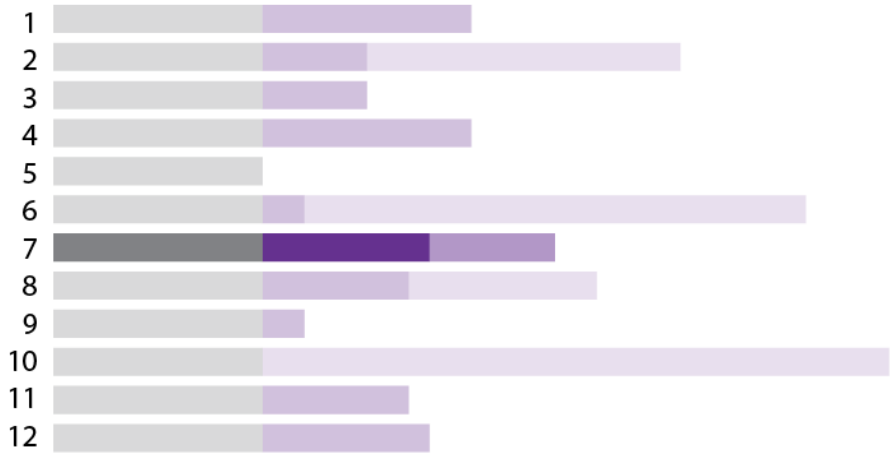

Figure 9.2: Payment information to participants.

different cases can occur. As an example, two different decisions and their outcomes in the two cases are shown below. NOTE: decision a and b are only examples.

- ◊ Case 1: the stock value is on or above the specified threshold level on January 1st 2020.
- ◊ Case 2: the stock value is below the specified threshold level on January 1st 2020.
- ◊ Decision a: The participant invested 0 SEK in the company, and thus put 50 SEK in the virtual bank account.
- ◊ Decision b: The participant invested 25 SEK in the company, and thus put 25 SEK in the virtual bank account.

The different scenarios are shown in the graphs below (figure 9.3 and 9.4).

Possible bonus payment:

Figure 9.3: Case 1: The stock value is on or above the specified threshold level on January 1st 2020.

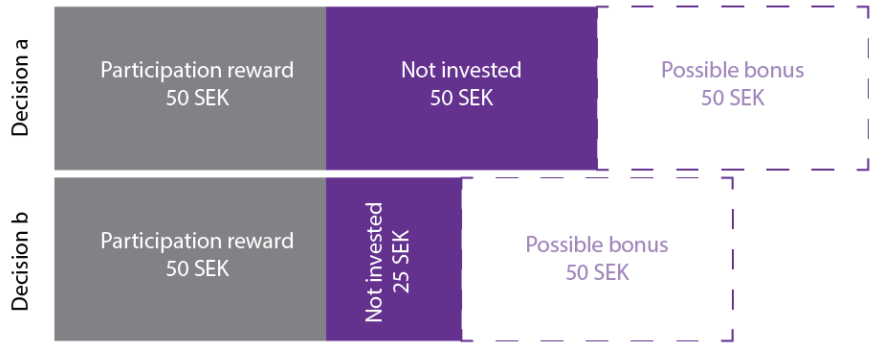

Figure 9.4: Case 2: The stock value is below the specified threshold level on January 1st 2020.

It is possible to receive a bonus of 50 SEK for the second question (concerning your beliefs about the company stock value). Answering truthfully and according to your beliefs will increase your chance of receiving the bonus of 50 SEK. If you would like to get more information about how your chances are increased by answering truthfully, click this link for a more thorough explanation: shorturl.at/lyJT0 (opens in new tab). The additional information can be seen in section 9.6.

Please press 'next' to answer two control questions before the experiment starts.

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The control questions are posed to ensure that you have read and understood the instructions, and how the experiment works. If you want to look at the instructions or payment information again, please click the link and they will open in a new tab.

Link to instructions: shorturl.at/hiwG9.
Link to payment on: shorturl.at/hvIWZ. (Here found in section 9.6).

The instructions will also be available at the bottom of each page of the experiment so that you can open them at any time.

Control questions

Imagine that you invested 20 SEK in the company that was selected for payment. This means 30 SEK was not invested. Answer the two questions below concerning your payment for this investment. Count the participation reward (50 SEK), but not the possible bonus payment.

If you find the question hard, look at the instructions and payment information again. You can also always email me at [redacted] if you need additional help.

What would your payment be if the stock value was on or above the threshold level (i.e. your investment paid off)?

Answer: _____

What would your payment be if the stock value was below the threshold level (i.e. your investment did not pay off)?

Answer: _____

Please press 'next' to start the experiment.

9.6 Additional Information about Bonus Payment

Whether you get the bonus payment is determined in one of two ways, both based on the table at the bottom of the page (table 9.1).

For each participant, one of the 21 rows in the table will be drawn at random. X is the threshold value for the case chosen for payment for a certain participant. You can receive the bonus in two ways, by asset pay or lottery pay depending on your answer to question 2:

1. **Asset pay will be given if:** your estimated chance that the stock value would be over X is larger or equal to the lottery probability in the drawn row. If it turns out that the value was actually larger, you receive a 50 SEK bonus.

2. **Lottery pay will be given if:** your estimated chance that the stock value would be over X is smaller than the the lottery probability in the drawn row. A random number between 0 and 1 will then be drawn. If the drawn number is smaller or equal to the lottery probability in the drawn row, you receive a 50 SEK bonus.

To see why answering according to your beliefs increase your probability of getting the bonus, note that for example the lottery on row 10 has a 55% chance of paying out the bonus. If you believe that the chance that the asset value is larger than X is larger than 55%, it is better for you to get 50 SEK if the value goes above X (i.e. asset pay). In the same way, if you believe that the chance that the asset value is larger than X is smaller than 55%, it is better for you to get 50 SEK with 55% probability (i.e. lottery pay). Therefore, accurately reporting your beliefs will maximize your chance of receiving the 50 SEK bonus.

Table 9.1 Table to determine bonus payment.

Row	Lottery pay	Asset pay
1	50 SEK with probability 1	50 SEK if the value is above X
2	50 SEK with probability 0.95	50 SEK if the value is above X
3	50 SEK with probability 0.9	50 SEK if the value is above X
4	50 SEK with probability 0.85	50 SEK if the value is above X
5	50 SEK with probability 0.8	50 SEK if the value is above X
6	50 SEK with probability 0.75	50 SEK if the value is above X
7	50 SEK with probability 0.7	50 SEK if the value is above X
8	50 SEK with probability 0.65	50 SEK if the value is above X
9	50 SEK with probability 0.6	50 SEK if the value is above X
10	50 SEK with probability 0.55	50 SEK if the value is above X
11	50 SEK with probability 0.5	50 SEK if the value is above X
12	50 SEK with probability 0.45	50 SEK if the value is above X
13	50 SEK with probability 0.4	50 SEK if the value is above X
14	50 SEK with probability 0.35	50 SEK if the value is above X
15	50 SEK with probability 0.3	50 SEK if the value is above X
16	50 SEK with probability 0.25	50 SEK if the value is above X
17	50 SEK with probability 0.2	50 SEK if the value is above X
18	50 SEK with probability 0.15	50 SEK if the value is above X
19	50 SEK with probability 0.1	50 SEK if the value is above X
20	50 SEK with probability 0.05	50 SEK if the value is above X
21	50 SEK with probability 0	50 SEK if the value is above X

Notes: X corresponds to the threshold value for the company that was randomly selected for payment. Therefore X was different for different participants.