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IMPACT OF SOCIO-DEMOGRAPHIC FACTORS, RISK TOLERANCE, STRATEGY, AND BEHAVIORAL BIASES ON RETURNS OF ESTONIAN INVESTORS.

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I hereby declare that I have compiled the thesis independently
and all works, important standpoints and data by other authors
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has not been previously presented for grading.

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TABLE OF CONTENTS

ABSTRACT

This study aims to investigate the impact of behavioral biases, risk tolerance, and strategy choice on the returns of Estonian investors. The study examines the influence of five behavioral biases such as overconfidence, representativeness bias, herd instinct, disposition effect, and anchoring bias. The study uses the quantitative method of analysis. The survey is used as a method of data collection. The Ordinary Least Squares method is used to analyze the effect of various factors on the return on investment. Multiple Linear Regression is constructed to study the effect of multiple independent variables in Gretl software. The study results conclude that risk tolerance, strategy choice, and two behavioral biases, disposition effect, and overconfidence, affect the returns of the respondents. The evaluation of risk tolerance level affects the respondents' return and has a positive dependence on return. The higher the level of risk tolerance a respondent has, the higher the return of respondents. The respondents' assessment of the current investment portfolio's risk level negatively impacts the respondents' return. However, the statistical significance of this variable is not stable. Short-term trading brings the highest return while investing in index funds brings the lowest return to the respondents. With the increasing level of overconfidence, the respondents' return increases, but with an increasing level of exposure to the disposition effect, the respondents' return decreases. Representativeness bias, herd instinct, and anchoring bias do not affect respondents' returns.

Keywords: Behavioral Biases, Risk Tolerance, Strategy, Return

INTRODUCTION

Financial market investment has become more popular among individual investors of different types and needs. The investment environment is constantly developing, the variability of investment instruments has increased, and the accessibility and complexity of investments instruments have increased significantly. (Sahi, 2016) The number of investors is growing rapidly, and more and more unprofessional investors are becoming involved in everyday operations on the market.

Investors need to make investment decisions in order to achieve their investment goals. Investment decision-making is a complex process. Investors must search for a large amount of information to make investment decisions. It is important to emphasize that people may interpret the same information differently. Even with publicly available information, investors build their perceptions differently, leading to different outcomes. (Kartini & Nahda, 2021) This is driven by different factors affecting human perception, information processing, and investment decision-making (Sahi et al., 2011).

Investors have cognitive distortions, preferences, and biases. Institutional and individual investors are often unaware of their exposure to behavioral biases (Sha & Ismail, 2021). Several empirical studies confirm the influence of behavioral biases on investment returns.

The research on the influence of different behavioral biases on investors' investment decision-making is quite relevant and widely studied. Many empirical studies examine the impact of different behavioral biases on investor behavior in different countries and cultures. Several studies focus on examining the impact of behavioral biases on investor returns. The study's author is interested in studying behavioral biases and various non-financial factors and their impact on investor returns. Risk tolerance and investment strategy choice are widely studied non-financial factors affecting investors' returns.

According to the study's author, examining the impact of behavioral biases among Estonian investors is essential because Estonia has its characteristics and is a unique economic environment. Investor behavior is closely related to various cultural, historical, and other aspects. Studying the behavior of Estonian investors will help identify which factors influence their returns. Behavioral biases may have a negative impact on investor returns, which could decrease the well-being of Estonian investors.

Understanding the interactions between these non-financial factors and return on investments will be helpful for individual investors. It helps them understand their possible irrational behavior and propensity to different biases, which would help investors achieve better performance (Kübilay& Bayrakdaroğlu, 2016). Also, studying this topic can help financial advisors, banks, and regulators as it helps them better understand the market and develop personalized approaches to financial planning.

This study aims to investigate behavioral biases and other non-financial factors, such as risk tolerance and strategy choice, and study their impact on the returns of Estonian investors. Based on the objective of the study, the author has developed three hypotheses.

- Hypothesis 1: Risk tolerance has a positive effect on stock portfolio returns.
- Hypothesis 2: Adoption of a more active investment strategy has a positive effect on stock portfolio returns.
- Hypothesis 3: Behavioral biases such as overconfidence, representativeness bias, herd instinct, disposition effect, and anchoring bias have a negative effect on stock portfolio returns.

A quantitative method of analysis was used in the study. A survey was used as a method of data collection. The survey consists of three sections. The first part of the survey contains questions related to socio-demographic characteristics such as age, gender, marital status, education level, and income level. The second part of the survey contains questions related to five behavioral biases: overconfidence, herd instinct, disposition effect, anchoring bias, and representativeness bias. Biases are measured using four or five questions used in previous studies. Responses to the questions were presented on a 10-point Likert scale, where one strongly disagrees and ten strongly agrees. The arithmetic average of the received replies was used to measure each bias. The third part of the survey includes questions assessing the respondents' risk tolerance level, investment strategy, and return on stock investments.

The questionnaire was distributed through social media, especially to investment groups. The period of distribution of the survey was two weeks. The survey was completely anonymous. 207 people took part in the survey; 185 of them were investors, and 22 had no investment experience.

The Ordinary Least Squares method was used to analyze the effect of various factors on the return on investment. Multiple Linear Regression was constructed in the Gretl software to study the effect of multiple independent variables. The dependent variable is investors' returns, and the independent variables are non-financial factors.

The study's main limitation is that the collected data is not a representative sample. This leads to the fact that it is impossible to generalize all Estonian investors based on the respondents' data.

This thesis consists of three chapters. The first chapter of the thesis provides a theoretical literature review. It consists of a brief introduction to the theoretical framework of traditional and behavioral finance. It also describes behavioral biases, risk tolerance, and strategy choices. The second chapter describes the data and methodology of the study. The third chapter presents the results, conclusions, and recommendations for future study.

1. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Every year, the field of investment becomes more dynamic and complex. The growing number of financial products and the amount of information related to them require investors to be able to manage their finances and make investment decisions. (Natasya et al.,2022) Subramaniam and Velnampy (2017) defined an investment decision as the choice of an investment instrument for placing savings. Investment decision-making is a complex process consisting of several stages, requiring high skills, such as processing data and information and analyzing many factors. An investor must know about investment markets, various investment opportunities, the associated risks and returns, and the ability to learn from the investment process. (Nofsinger, 2016)

In order to make an investment decision, a person needs to define investment objectives (Dash, 2010). During the decision-making process, the investor chooses what to invest in, when to invest, and how much to invest in (Natasya et al.,2022).

Traditional financial theories assume that people make rational decisions by collecting and analyzing all available information. In reality, however, people do not have complete information because they do not have the necessary cognitive capacity to obtain and process all the necessary information, which forces them to act under conditions of uncertainty and leads them to irrational behavior. (Asad et al., 2018) Investors are not rational individuals and usually choose acceptable rather than optimal investment decisions. (Subramaniam & Velnampy, 2017).

Jing Chen (2011) stated that individual investors have more difficulty making rational investment decisions than institutional investors and larger entities. Because large companies have more resources to collect and analyze information. For small investors, it is difficult to process financial information, and the lack of all the necessary data makes it difficult to make quick and logical decisions. (*Ibid*) Ahmad and Wu (2022) assert that in addition to the fact that investors' cognitive capacity is limited, factors such as knowledge, routine, a person's values, and environment can also obstruct the decision-making process.

Numerous studies have confirmed that many factors, including demographic, social, and psychological factors, influence the individual decisions of investors (Weixiang et al., 2022). Behavioral finance studies the patterns and mechanisms underlying investment decisions. It is a

discipline that emerged from combining two fields - psychology and finance (Mason, 2021). Behavioral finance assumes that people act in predictable ways when making financial decisions (Weixiang et al., 2022). Therefore, it is essential for behavioral economics to study the factors that influence investment decisions (Ikram, 2016).

1.1. Traditional finance

Finance is the study of how people allocate resources and how they acquire, manage, and invest resources over time (Subash, 2012). Traditional finance is based on three conventional theories: Efficient Market Hypothesis (EMH), Modern Portfolio Theory (MPT), and Capital Asset Pricing Model (CAPM). These theories assume that investors are rational and that markets are efficient. (*Ibid*)

A rational investor is an individual who aims to maximize profit or gain and limit risk when making investment decisions. Moreover, the investor possesses all the information available on the market and consistently makes optimal and intelligent investment decisions. (Mason, 2021) Nofsinger (2001) states that the entire theoretical framework of traditional finance is based on the assumption that investors always act rationally and are not prone to cognitive biases in their predictions about the future.

Barberis and Thaler (2003) analyzed the topic of rational behavior and concluded that rational behavior should encompass two key aspects. Investors need to update and adjust their beliefs every time they are presented with new information. In accordance with their revised beliefs, investors will make decisions in conformity with the principles of traditional finance theories (*Ibid*). Hence, individuals are not prone to biases during the decision-making process, as each individual can select the best option from the available multiple alternatives based on careful analysis, theoretical principles, appropriate methodologies, and effective approaches (Barberis & Thaler, 2003). Traditional finance theory believes that investors make various estimates and use economic models when making investment decisions (Seth & Kumar, 2020).

Harry Markowitz, the inventor of Modern Portfolio Theory, provided a mathematical model for investing in financial markets that helps investors optimize their portfolio and demonstrates how diversification reduces the risk level of a portfolio (Zahera & Bansal, 2017). The central principle

of this theory can be summarized as follows: portfolio formation is based on two primary considerations. The first is optimizing returns at a specific risk level, while the second is minimizing risk at a particular level of return. (Kartini & Nahda 2021). Markowitz believed that investors are rational human beings with a reasonable approach to constructing an investment portfolio, which encompasses two specific stages. In the first stage, the investor reviews and evaluates assets and makes assumptions about the future performance of these assets. In the second stage, investors construct their portfolios by selecting assets based on their pre-existing evaluations. (Sahi, 2011) It is expected that, as a result of rational analysis, the investor will select highly probable assets that will reach the highest utility (Kartini &Nahda 2021).

The CAPM introduced in 1964 by Sharpe is the second fundamental principle in traditional finance (Tomaa, 2015). The model provides a way to analyze the impact of systematic risk on the expected return of an asset (Treynor, 1961). The capital asset pricing model is also based on the assumption that the investor is rational and, following a rational approach, analyses stocks exclusively based on their expected return and non-diversifiable risk (William W. Bratton, 1997).

The rational approach later formed the basis of one of the fundamental hypotheses of traditional finance, the Efficient Market Hypothesis, which was introduced by Fama in 1965 (Fama, 1965). Fama stated that markets are Efficient, and security prices incorporate all the currently available information (Owusu & Laryea, 2022; Putri et al., 2021; Weixiang et al., 2022). Prices comprehensively reflect all information regarding events that have already occurred, along with all current and expected future events that can be predicted as of now (Owusu & Laryea, 2022). Shleifer (2000), explained that prices should instantly reflect new information and not change if there is no new information about the company.

The market consists of intelligent and rational investors who maximize profit by processing and analyzing complete information and correctly determining the value of securities. All market participants have access to all important current information, which is freely available. (Nofsinger, 2001) If some market participants behave irrationally, they trade unpredictably and randomly (Shleifer, 2000). According to the EMH, the market primarily consists of rational investors in the long term because irrational investors make poor investment decisions, face insolvency, and exit the market (Zahera & Bansal, 2017). In consequence, irrational behavior cannot affect securities prices (Nofsinger, 2001). In essence, in an efficient market, securities' market prices are aligned

with their inherent values (Mason, 2021). Hence, an investor can use any of the investment strategies, but none of them can consistently generate excess profits (Nofsinger, 2001).

In 1965, Fama proposed the Random Walk Hypothesis (RWH), which complemented the Efficient Market Hypothesis by suggesting that future stock prices were as unpredictable as a sequence of random numbers. Based on this, Fama concluded that the past cannot be used to predict future prices, and analyzing charts and making forecasts based on past trends makes no sense. (Fieger, 2017)

Fama continued to develop the efficient markets hypothesis and, in 1970, proposed the concept of three forms of efficient markets: a weak, semi-strong, and strong form of efficiency (Fieger, 2017). The more efficient the market, the less likely an investor is to make a profit above the market since prices quickly react to any changes and information (Owusu & Laryea 2022).

In a market with weak efficiency, security price incorporates all past information like security price changes, trading volume, etc. (Raheja & Dhiman, 2019). Historical information instantaneously adjusts securities prices, which are available to everyone (Aguila, 2009). A weak form of efficiency implies the inability to predict future prices relies on examining past price data, and therefore, it is impossible to gain abnormal returns (Fieger, 2017; Chaffai & Medhioub, 2014). Technical analysis also does not result in excessive returns (Raheja & Dhiman, 2019).

The semi-strong form of efficiency implies that prices encompass historical price data and all publicly available information (Raheja, Dhiman, 2019). Public information includes all company financial reports, accounting policy changes, dividend pay-outs or mergers and acquisitions announcements, press releases, etc. (Aguila, 2009). New information is rapidly and impartially reflected in prices, which makes investors unable to beat the market (Fieger, 2017). This makes fundamental analysis ineffective (Subash, 2012).

In strong-efficient markets, security prices reflect all publicly available and private information, and this information is publicly available. This concept implies that trading on insider information does not provide any competitive advantage, which appears improbable. (Malkiel, 2011) Schwert (2003) supported the most audacious form by emphasizing the illegality of trading using insider information, which aligns with the concept of a strong form of efficiency. Seyhun (1998)

scientifically proved that investors obtain excess returns even while trading legally. Aguila (2009) stated that strong efficiency cannot be accomplished in the real world.

Many scientists have supported the weak and semi-strong forms of efficiency and have been perceived with respect in the scientific community (Shiller, 2003). In the 1970s, market efficiency theory was one of the most popular and fundamental theories in traditional economics but was also the most criticized (Subash, 2012). The theory of efficient markets cannot explain common anomalies such as insider trading, market crashes, and bubbles in the stock market (Yaes & Bechhoefer, 1989; Sharma & Kumar, 2019).

The opponents of EMH Grossman and Stiglitz (1980) criticized the theory; they argued that prices could not reflect all available information because the information has a value and investors must spend their resources to obtain it; otherwise, it would be meaningless. Investors make decisions based on information that they consider important, even if it is irrelevant. (*Ibid*)

Consequently, this may lead to a deviation of actual prices of securities from their fair value (Subash, 2012). Kahneman and Riepe (1998) studied investor behavior and found that people are prone to deviation from conventional decision-making models and have different risk appetite levels. Kahneman and Tversky showed that people's behavior has similar patterns and deviation from rational behavior is predictable. Investment decisions are not made randomly and are highly likely to exhibit similarities. (Subash, 2012)

Critics of the EMH, Shefrin and Statman (2011), Pompian (2012), and Barberis (2017) held the belief that investors do not always behave rationally. They argued that behavioral anomalies lead to investors' irrationality (*Ibid*). Various research studies have demonstrated that people's decisions are often influenced by their intuition, habits, personality, or cognitive and emotional biases. (Kahneman, 2013).

1.2. Behavioral finance

The field of behavioral finance emerged from the growing number of anomalies in the stock market that traditional financial theories cannot explain (Agrawal, 2012). Behavioral finance represents a relatively new direction in the financial field. The purpose of stands is to expand the standard

financial theories by taking into account the behavioral aspects of participants in the process of making decisions. (Subash, 2012)

Behavioral finance emerged at the intersection of two disciplines – finance and psychology. Behavioral finance studies how psychological aspects of human beings influence investors' financial decisions and what their impact on financial markets. (Shefrin & Statman, 2011)

People tend to be influenced by cognitive biases, which limit investors' intellectual abilities and lead to deviations from rational behavior (Etzioni, 2014). Behavioral finance, in turn, tries to answer the questions of why people behave irrationally, as well as how exactly people make decisions regarding saving, borrowing, investing, and spending money (Belsky & Gilovich, 1999).

Thus, the concept of behavioral finance is not an alternative to traditional finance. Moreover, behavioral finance complements the standard theory of finance by adding psychographic factors that influence investors' behavior, affecting market efficiency and explaining some of the anomalies that occur in markets. (Athur, 2014)

The behavioral finance theory aims to study the impact of emotions and cognitive errors on the decisions of individual investors. (*Ibid*). Beliefs and preferences shape investors' decisions. Such beliefs and preferences lead investors to under- or over-react to different types of financial information. Which in turn affects the degree of risk tolerance and also affects their adoption of irrational decisions. (Asad et al., 2018; Jain et al., 2020)

Subtypes of behavioral finance theory are Prospect theory, Regret theory, and Heuristic theory. Kahneman & Tversky and Thaler are known as founders of behavioral finance (Hammond, 2015). Prospect theory was developed in 1979 by Daniel Kahneman and Amos Tversky. This theory has been proposed as an alternative and utility to the efficient market hypothesis (*Ibid*). Thaler (1980) extended prospect theory and proposed ways to apply prospect theory to financial markets. While the efficient market hypothesis assumes that investors behave rationally, Prospect Theory suggests that investors are irrational and make investment decisions under the influence of various biases, which can lead to suboptimal financial decisions (Zahera & Bansal, 2017).

Prospect theory describes people's behavior in situations where there is a need to choose between two alternatives when these alternatives involve risk. Kahneman and Tversky conducted a study

in which they studied how investors make decisions under certain risks. According to the study, it was revealed that investors assess the prospects for loss and gain asymmetrically. When making investment decisions, a person determines a personal reference point for assessing profits and losses. All the following gains and losses are measured relative to this point in relative terms rather than in absolute terms. (Kahneman & Tversky, 1979)

The primary idea explored in the study involved investors making decisions by assessing probabilistic alternatives that include risk, especially when the expected outcome of the investment decision is known. (Zahera & Bansal, 2017). It was found that when analyzing risk, people tend to avoid financial risk when making investment decisions. Negative emotions experienced from the probability of materializing a loss are twice as high than positive emotions from the probability of receiving an equivalent gain. That is, the pleasure from a gain is felt twice as weak as the pain from an equivalent loss. This confirms people's tendency to be loss-averse. (Kahneman & Tversky, 1979).

It was also revealed that people are willing to take greater risks to avoid losses but are not willing to take greater risks to increase profits. Thus, inverters will show risk-averse behavior when it comes to profits. However, at the same time, they will show risk-seeking behavior when it comes to losses. The obtained results contradict one of the theories of traditional economics called Expected Utility Theory, proposed by Harry Markowitz in 1952, which assumes that an investor will demonstrate consistent behavior regardless of whether he is risk-averse or not. (Kartini & Nahda, 2021)

Regret theory provides a framework for decision-making under uncertainty, providing a generalized view of the regret approach proposed by Loomes and Sugden (1982). This approach aims to minimize potential losses while maximizing potential gains. It was described by Bell (1982) as people's emotional reaction to comparing actual outcomes with expectations based on thoughts about what would have happened if a different choice had been made. Consider a consumer choosing between an unfamiliar brand and a familiar brand. When an unfamiliar brand may turn out to be worse than a familiar one, the expectation of regret influences the decision-making process. (*Ibid*) Shefrin and Statman (1985) highlight that, consistent with Regret Theory; investors often anticipate the possibility of regret when making investment decisions. A person's tendency to regret even minor mistakes without considering the long-term perspective contributes to decision-making dynamics (Omoruyi & Ilaboya, 2019).

The concept of regret, embodied in Kahneman's (1979) idea, emphasizes the emotional impact of mistakes. Regret Theory allows to understand investor behavior by explaining phenomena such as the tendency to postpone the sale of stocks that have declined in value and to accelerate the sale of stocks that have increased in value. (Omoruyi & Ilaboya, 2019).

One of the theories of behavioral finance is also the Heuristic Theory. The Heuristic theory is based on the idea that an investor uses short, simplified rules and strategies for making decisions under conditions of uncertainty and limited information, which are called heuristics (Brabazon, 2000; Ritter, 2003). Heuristics help a person minimize the complexity of measuring probability and get rid of predicting specific values (Kahneman and Tversky, 1974). To make rational decisions, investors should analyze and process the available information and predict the dynamics of the variables. However, by using heuristics, the cognitive cost of decision making is reduced. (*Ibid*)

Shah and Oppenheimer (2008) assert that heuristics are a simplification strategy that relies on analyzing a small amount of information and exploring only a few alternative options. In case of time limitations, heuristics can be especially useful (Waweru et al., 2008). However, it may lead to behavioral biases. (Kahneman & Tversky, 1974; Ritter, 2003).

1.3. Anchoring bias

Nowadays, we live in a world where people have access to much information. Investors find it difficult to make investment decisions because making them involves processing a large amount of data, as a consequence of which the anchoring bias has emerged. (Lehrer 2009). Anchoring bias is a cognitive distortion in which inverters tend to over-rely on the information they initially received or the only available information, which, as a consequence, causes them to make an anchor (Owusu & Laryea, 2022).

Marchand (2012) explained that during decision-making, investors must study a lot of information, research, and spend much effort analyzing and collecting data. Many investors neglect this strategy, they prefer to be fixated on a single figure, ignoring important data. (*Ibid*)

A stock's buying price, performance, or another reference point becomes an anchor (Owusu & Laryea, 2022). Starting from the moment the anchor is set, all new information is processed by the

person with the correction on the anchor, i.e., the person processes the newly received information not to contradict the anchor. It leads to cognitive errors, bias, and misinterpretation of new information. (Shah et al., 2017)

A empirical study conducted by Montier (2002) has shown that investors are prone to rely on buying stock prices as a reference point for the current stock price, which leads them to under-react to price changes and new fundamentally important news.

According to Bretton (2009), many market participants do not leave a losing position but instead hope that the market will return to the starting point so that they can complete the trade without a loss. According to empirical research results, in case of a poor investment decision, numerous investors refuse to exit a losing position because they fixate on the entry price, which often leads to much more significant losses. (Ngacha, 2019).

Pompain (2006) explained that investors can use illogical and irrelevant information as an anchor and subsequently use it to make investment decisions. It is important to note that information that has become an anchor is not always incorrect or irrational. However, inaccurate estimates from anchors could cause difficulties. (Owusu & Laryea, 2022). A lack of knowledge and investor insecurity cause anchors. Through anchoring bias, investors try to avoid uncertainty and reduce cognitive load. (Bilgehan & Bayrakdaroglu, 2016)

Kengatharan and Kengatharan (2014) assert that anchoring bias significantly impacts investors' decision-making. Shah et al. (2012) found a negative relationship between investment decisions and anchoring bias. Duc Hien et al. (2014) studied Vietnamese financial market efficiency and discovered that the anchoring bias influences market efficiency.

1.4. Representativeness bias

Investors tend to rely on mental stereotypes (Budhiraja, 2018). Hence, investment decisions are made based on inferences related to mental patterns or stereotypes, and such cognitive distortion is called – representativeness bias (Shefrin, 2005). Pompian (2012) stated that to simplify the decision-making process, people categorize thoughts and objects into specific categories based on their previous experiences. Whenever people receive new information, they categorize it into pre-

existing categories, even if the information does not entirely fit into that category. They use the most appropriate generalization and approximation to determine which category to choose in an already established system of categorization and understanding of new data. (*Ibid*) People believe that their categorizations are correct and give them high importance. (Athur, 2014)

In a lack of information, the brain uses shortcuts to process information and achieve desired goals, which can lead to failure in information processing (Athur, 2014). Qawi (2010) noted that people subject to representativeness bias tend to associate two events and perceive them as identical when the events are unrelated but only appear similar at first impression.

In the context of representativeness, two types of systematic errors can be identified. First, investors do not understand the fundamental principles of forecasting and do not correctly estimate the probability of particular investment outcomes (Pompain, 2006). Also, investors misjudge the sample size by making generalizations to the entire population based on a very small sample. Instead of updating their beliefs based on complex data and in-depth analysis, investors use simple classifications and generalizations. (Kahneman &Tversky, 1974)

Various research studies found a positive influence of representativeness bias on investment decisions (Irshad et al. 2016; Ikram 2016). Toma (2015) studied the returns of individual investors who traded at the Romanian stock exchange and concluded that representativeness bias positively affects investors' returns. Similar empirical research results were obtained by Ikram (2016). He stated that investors earned higher returns due to representativeness bias. (*Ibid*)

Some studies give opposite results and stated that representativeness bias negatively affects investment decisions (Chen et al 2007; Onsomu 2014). For example, Waweru et al. (2008) studied investor behavior in the Nairobi Stock Exchange and concluded that representativeness bias negatively affects investment decisions. According to Chen et al. (2007), investors whose representativeness bias is observed to behave irrationally more often make mistakes and make bad investment decisions.

1.5. Disposition effect

The disposition effect is considered one of the anomalies studied in behavioral finance. The disposition effect influences investors to have a tendency to sell well-performing stocks too quickly and keep losing stocks too long (Boebel & Tylor 2000). According to Prospect Theory, investors are loss averse; they do not want to sell stocks whose prices declined in value post-purchase because they hope that future prices will rise and they will avoid losses and feelings of regret. In contrast, investors often sell well-performing stocks prematurely due to the fear that the stock price may fall in the future, thereby refusing the opportunity for further earnings. (Mason, 2021)

According to Wendy (2021), such a strategy can harm investors' returns because winning investments are sold even though they might continue to perform well while constantly being hit by losing investments, which degrades their performance. Based on this, it can be inferred that the investor evaluates each stock in the portfolio separately rather than at the portfolio level, which can lead to poor investment decisions (Raheja & Dhiman, 2019).

Empirical research studies, such as Barber et al. (2007), Grinblatt and Keloharju (2000), and Odean (1998), provided evidence of the existence of the disposition effect. Research conducted by Adil et al. (2021), Toma (2015), and Wendy (2021) show that the disposition effect impacts investment decisions. In 1996, Bremer and Kato conducted a study examining monthly trading volume figures on the Japanese stock market for 15 years. During the study, they found an abnormal turnover of stocks that increased in price, which was significantly higher than the turnover of stocks that lost in price. Thus, it was confirmed that the disposition effect is present among investors trading in the Japanese stock market. (*Ibid*) According to Grinblatt and Keloharju (2000), the disposition effect is also present in the Finnish market.

Shu et al. (2005) studied the effect of disposition on investors trading in Taiwan and U.S. stock markets. U.S. investors sell stocks that have performed better, 1.5 times more often than stocks that have fallen in value. According to the study, Taiwanese investors are even more susceptible to the disposition effect, which is that the selling proportion of losing stocks is 2.5 times lower than that of the selling proportion of winning stocks. (*Ibid*) Shu et al., 2005 also studied Taiwanese investors and came up with similar results. According to their results, 84% of investors tend to sell stocks that perform well faster than poorly performed stocks. (*Ibid*)

Research conducted by Benartzi and Thaler (1995) showed that the disposition effect affects investors' returns. The researchers analyzed winning stocks sold by investors exhibiting the disposition effect and losing stocks held by investors waiting for a rebound. Based on their findings, the following year, winning stocks had a return of 3.4% higher than that of losing stocks. It leads to a decrease in investor returns. (*Ibid*) Goetzmann and Massa (2008) demonstrated that the disposition effect has a negative effect on investors' returns.

1.6. Herd instinct

By nature, humans are social beings. People need to be a part of society, maintain social connections, and feel part of a social group. Social factors play an important role in human life, and this cannot but affect the financial field. (Mason, 2021) Herd instinct is the tendency for an investor to be influenced by the actions of other investors and tend to copy their behavior. The crowd influences the investor; his investment decisions are not different from the majority, whether these decisions are rational or not. (Jain et al., 2020).

According to Bakara (2016), investors tend to rely on other investors' decisions rather than on their analysis because the decisions made by the majority seem correct. Fromlet (2001) came to a similar opinion that investors tend to rely on the majority opinion and act in a similar way so as not to be different from the majority. Investors suffering from herd instinct do not make investment decisions independently. Instead, they seek advice from colleagues and friends. (Jain et al.,2020) or are influenced by the guidance of famous financial experts. (Ngacha, 2019).

Strategies for generating returns by following the investment decisions and advice of other successful investors are also widely known among investors (Scharfstein & Stein, 1990). Investors purchase memberships to investment clubs and communities, hoping to receive investment advice and guidance from more successful investors.

One of the main reasons for exposure to herd behavior is that investors believe the information they possess is of lower quality than that of other market participants. Thus, they give more weight to other investors' opinions than to their judgment. (Sinha, 2015) Investors who are unsure of their abilities and the reliability of the information they possess are prone to herd instinct (Venezia, et al, 2011). It leads them to believe that a larger group of people are less likely to be wrong than

themselves, which creates the illusion that the investor does not possess some important information (*Ibid*).

Several studies have found that investors seek social approval and feel more satisfied when their decisions align with the decisions of their acquaintances (Andersson et al., 2014). Investors are concerned that if their personal investment decision appears to be wrong, their reputation may be lost, so they often seek to follow the general trend (Scharfstein & Stein, 1990). Research conducted by Devenow and Welch (1996) demonstrated that even financial managers use majority strategies to protect their reputation.

Athur (2014) believed that due to the large amount of available information and the speed of its distribution, it has become more difficult for investors to make investment decisions. In addition, investors' decisions are likely to be influenced by the behavior of other investors. The author argues that investors should not completely isolate themselves from the influence of others but should be more skeptical of the actions of other investors and make decisions based on analysis to reduce the effect of bias. (*Ibid*)

Ramalakshmi et al. (2019) provided empirical evidence that herd instinct is one of the most influential biases affecting investment decisions. Herd instinct is based on decisions made by the majority and is not rational decision-making (Kartini & Nahda, 2021). Bikhchandani et al. (1992) argued that herd instinct often lead to inefficient results. Meanwhile, Addinpujoartanto & Darmawan (2020), Wendy (2021), and Kengatharan (2014) stated that herd instinct has a positive impact behavior on investor decision-making.

1.7. Overconfidence bias

One of the most common and well-studied behavioral biases is overconfidence. Overconfidence bias is an overestimation of one's knowledge, skills, and the accuracy of one's judgment. (Pompian, 2006) People with overconfidence bias tend to overestimate themselves and their skills and do not accurately assess their abilities and their level of knowledge (Shefrin, 2000). People believe themselves to be more competent than they are in reality. It does not mean that people are not competent or ignorant, but their opinion of themselves is overestimated (*Ibid*). Overconfident people underestimate risks and their ability to predict and hyperbolize their ability to control events

(Pompian, 2006). People influenced by overconfident bias invest without taking into account the associated risks. It has an impact on the process of rational decision-making. (Odean, 1999; Barber & Odean, 2000; Moore, & Healy, 2008)

Overconfident people also tend to ignore publicly available information and overestimate the knowledge and information they possess. Investors ignore data and signs of potential damage, which can lead to losses. (Lichtenstein & Fischhoff, 1977) Overconfidence bias creates only the illusion of being right, but in most cases, this prejudice is based on a lack of experience and the inability to interpret available information correctly (Kartini & Nahda ,2021).

Overconfident individuals tend to take higher risks, increase their trading activity, and have less diversified portfolios (Merkle, 2017). Overconfident people tend to make large bets on individual stocks, reducing portfolio diversification and increasing investment risk (Hirshleifer, 2015). In the research of Athur (2014), similar findings were made that people prone to overconfidence bias are more likely to have an undiversified portfolio.

Investors who exhibit overconfidence in their trading behavior believe they can easily identify winning stocks, which encourages them to trade more frequently (Odean, 1998), leading to higher transaction costs. Odean (1999) and Barber & Odean (2001) stated that investors with high trading activity earn lower returns compared to less active investors. Gervais and Odean (2001) concluded that overconfidence in trading is neutralized as investors gain experience.

Statman et al. (2003) found a positive relationship between the level of overconfidence bias and trading volume, but they concluded that overconfidence bias positively affects investment decisions. Pompian (2006) also confirmed that overconfidence bias positively affects an investment decision. He explains that an overconfident investor tends to underestimate the risk, overestimating the return, which causes overconfident investors to take more risks that bring higher returns.(*Ibid*). Overconfidence is not always a bad thing (Wang, 2001). According to a study (Glaser and Weber, 2007) comparing investors with similar investment skills and market experience, overconfident investors tend to perform better.

Hence, overconfidence bias can affect an investor both positively and negatively. Overconfidence bias makes a person overestimate his abilities. If a person's investment skills are poor, this can lead to losses. At the same time, if a person has good analytical and investment skills, overconfidence

bias will encourage him to participate more actively in the stock market, which can lead to better results.

1.8. Risk tolerance

Risk is one of the core factors in making investment decisions. One of the main fundamental investment principles is the principle of correlation between the level of return and risk. The higher the risk of an asset, the greater the expected return. Although according to the theory of traditional finance, a rational investor should maximize their return at a certain level of risk in the real world, investors do not always behave rationally, and most investors form their portfolio based on their level of risk tolerance. (Pyles et al., 2016)

A person's attitude towards risk-taking is risk tolerance (Droms, 1987). Risk tolerance can also be defined as the maximum level of uncertainty an investor can tolerate in making personal financial decisions (Grable, 2008; Grable and Joo, 2004). An asset's potential distribution of returns can be defined as financial risk. The greater variance leads to the greater the risk (Olsen, 2008). Consequently, it can be argued that the greater the risk tolerance level of an investor, the greater the variability of the variance of returns they can tolerate, which allows the investor to build a riskier portfolio and acquire riskier assets such as stocks, cryptocurrency, etc. (Heo et al., 2018).

Grable and Lytton (2001) argue that risk tolerance is a significant factor in investment strategy choices and asset selection. For instance, investors with low-risk tolerance are more likely to choose to purchase bonds or hold cash (Grable and Lytton, 2003), while investors with higher risk tolerance are more prone to invest in stocks (Wood and Zaichkowsky, 2004). Vissing-Jørgensen and Attanasio, (2003) confirm that attitude towards risk is an important factor in stock ownership.

Risk tolerance affects the investor's welfare since an investor with a high-risk tolerance obtains higher returns in the long term because the stock's risk level is acceptable to him. An investor with a very low-risk tolerance tends to choose less risky investments, which causes low returns. (Yao et al., 2004). Grable (2008) revealed a significant influence of risk tolerance on investment decisions. The level of risk tolerance is a significant factor in the examination of investment behavior because it impacts the asset allocation decision and investment strategy. (Grable & Joo,

2004) An investor's risk tolerance level is not a constant value and can vary depending on different factors (*Ibid*).

Numerous research studies have investigated the different effects of factors on risk tolerance, and one of the important factors is socio-demographic factors. Socio-demographic factors can be divided into biopsychosocial characteristics and environmental factors. For example, biopsychosocial characteristics include such factors as gender, age, and personality traits, while environmental factors include education level, income level, and financial literacy level. All these factors have a direct impact on the level of risk tolerance of an individual. (Grable & Joo, 2004)

Many studies confirm that gender has a strong influence on risk tolerance. Men tend to take more risks than women. (Bashir et al., 2013) Age is also an important factor, so young people are more likely to make risky decisions to invest in riskier assets compared to older people (*Ibid*). Brooks et al. (2018) in their study concluded that there is a non-linear negative relationship between age and risk tolerance. Zhang et al. (2018) found similar results and argued that older investors are less likely to invest in riskier assets, such as stock, and more likely to favor less risky assets, such as bonds. Guiso and Jappelli (2000) concluded that age substantially influences the decision to invest in risky assets. However, if the decision to invest has already been made and a choice of the share of risky assets has to be made, age has less influence (*Ibid*).

In their research, Jureviciene and Jermakova (2012) have found that people with a high level of education are not prone to take high risks; they prefer safe investment instruments and a medium level of risk.

The results of studies examining the effect of income on risk tolerance are inconsistent. Some studies find a positive relationship between income and tolerance because increasing levels of wealth allow individuals to take more risks. (Guiso & Jappelli, 2000; Grable & Joo, 2004). Meanwhile, Mazzoli and Marinelli (2014) found no significant relationship between the level of wealth and the choice of riskier assets. Marital status also affects the level of risk tolerance, such that people with a partner have a higher level of risk tolerance. It may also be conditioned by income level, as people merge income and resources and share investment risks. (Bertocchi et al., 2008)

One important factor that influences the level of risk tolerance is financial literacy, as people with high financial literacy are generally more risk-tolerant (Grable & Joo, 2004). Pyles et al. (2016) argue that the investor's nationality and culture also affect the risk level. Cultures with a tendency towards collectivism are more tolerant of risk than cultures with a predominant individualism (Pyles et al. l, 2016).

Stock market cycles also affect risk tolerance: investors are more risk tolerant during market growth, while investors' risk tolerance decreases during market downturns and asset prices decline (Grable et al., 2006).

Hence, an investor's risk tolerance is an important factor influencing investment decisions. Before investing in any asset, an investor should assess its risk level because every investment opportunity is associated with potential risk. (Oehler et al. 2018)

1.9. Investment strategy

Investment style determines which strategies are implemented by investors when making investment decisions. The choice of strategies is based on the personal preferences of each investor, as well as on the needs and goals that the investor aims to achieve by investment. An investor can follow an active or passive investment strategy. (Nyamute, 2016)

An investor with an active investment strategy target returns above the market average. He takes an active position in buying and selling his assets to take advantage of profitable opportunities. Consequently, active investors trade much more frequently than the average investor. An active strategy requires the investor to have good investment skills and extra time spent researching and trading stocks. Good asset selection allows investors to outperform the market, but at the same time, the active approach is more risky. (Nyamute, 2016)

An investor with a passive investment strategy has a long investment horizon. He buys assets and expects their value to increase, keeping them in his portfolio for a long time. (Goldman, 2010) Many studies have concluded that passive investing is more profitable than active investing. However, there are exceptions to this rule. Some qualified and active investors can earn above-

market-average returns. (*Ibid*). Mamudi (2009) noticed that passive investors have higher returns due to trading costs in emerging markets.

A passive investor can choose a strategy of investing in stock market indices, for example, NASDAQ-100, S&P 500, etc., or copy stock market indices on their own. This strategy is simple and convenient; it allows the investor not to have extensive knowledge of investing as well as financial markets, and at the same time, it is efficient. This strategy allows the investor to avoid taking on a level of risk higher than the market risk and a diversified patrol to mitigate the risk. (Dinis, 2020)

An investor's portfolio strategy may also focus on buying value or growth stocks. Value stocks are considered undervalued, and their market value is lower than their true value. Such stocks have high dividend yields and low P/E ratios. Growth stocks represent stocks of companies with high growth rates and profits. Such companies have low dividend yield, and their P/E ratio is high. (Lakonishok et al., 1994)

In 1977, Basu conducted a study that compared the returns of stocks with low and high P/E ratios. He compiled two portfolios consisting of value and growth stocks. The results showed that the portfolio of value stocks had significantly higher returns than those with growth stocks. (*Ibid*) Chan et al. (2002) also studied the return rate of these two strategies in the Japanese market. They came to a similar conclusion that investing in value stocks brought higher returns than investing in growth stocks. Fama and French (1992) explained this phenomenon and stated that investments related to value stocks have higher risk and, thus, higher returns.

To summarize, each investor independently chooses his investment strategy based on his investment goals and preferences, as well as the amount of available resources and level of knowledge. Each of these strategies has a different impact on the portfolio's efficiency and the level of return.

1.10. Hypothesis development

Based on the results of previous studies, the author formulated hypotheses regarding risk tolerance, strategy choice, and behavioral biases. According to Yao et al. (2004), investors with a low-risk

tolerance tend to choose less risky assets, which leads to low returns in the long term. In turn, respondents with a high level of risk tolerance can choose riskier instruments with a higher variability of returns, which leads to higher returns in the long term. The author forms the following hypothesis – Hypothesis 1: Risk tolerance positively affects stock portfolio returns.

Nyamute (2016) argues that each investor independently chooses a strategy depending on the investment objectives and the ability and willingness to participate in investing actively or passively. Research examining active and passive strategies came to contradictory results regarding the return on investment. The study's author suggests that less active investment strategies generate lower returns than more active ones. Active investment strategies require higher cognitive and time investment from investors than passive strategies. Therefore, we can assume that people choose more active strategies and invest their time in them because they earn higher returns compearing with passive strategies. Otherwise, there would be no reason to spend many resources with no additional gain. The author of this study divides the strategies presented earlier into three levels where the passive strategy is investing in index funds. Investing in growth and value stocks is a more active strategy than investing in index funds because the investor needs to explore different companies to buy stocks. The most active strategy is short-term trading. On this basis, the author proposed the following hypothesis. Hypothesis 2: Adoption of a more active investment strategy has a positive effect on stock portfolio returns.

Therefore, the authors suggest that investing strategies in index funds will earn the lowest returns. Higher returns will come from investing strategies in value or growth stocks, and the highest returns will be achieved by short-term trading.

Some studies examining the impact of behavioral bias on investor returns and investment decision-making do not always show consistent results. For example, Ikram (2016) found that representativeness bias has a positive relationship with investor returns, while Chen et al (2007) and Onsomu 2014 found that representativeness bias negatively affects investment decisions. Benartzi and Thaler showed that exposure to the disposition effect leads to a decrease in investor returns. Shah et al. (2012) state that exposure to anchoring bias negatively affects investment decisions. Herd instinct also affects investment decisions and returns both positively and negatively. According to the author, this may be due to different tendencies within the studied crowd. Overconfidence induces individuals to overestimate their knowledge and skills in

investing. At the same time, it may lead to more active participation in the stock market, which brings higher returns (Glaser and Weber, 2007).

Thus, not all studies of behavioral biases obtain similar results. It should be emphasized that behavioral biases help simplify the process of information processing and decision-making, which deviates from rational analysis and leads to cognitive errors. Hence, the author has proposed the hypothesis as follows: Hypothesis 3: Behavioral biases such as overconfidence, representativeness bias, herd instinct, disposition effect, and anchoring bias have a negative effect on stock portfolio returns.

2. DATA AND METHODOLOGY

2.1. Data collection

This study examines the impact of socio-demographic factors, behavioral biases, risk tolerance, and strategy choice on the returns of Estonian investors. A questionnaire was designed to obtain the necessary data. A questionnaire was designed (see Appendix 1) based on questions that have already been presented in previous studies.

A question identifying whether the survey participant had invested in the stock market and was an investor was presented to the participant before the survey. The survey ended at this stage for participants without investment experience in the stock market. Investors were invited to continue participating in the survey.

The survey was divided into three sections. The first part of the survey contained questions related to socio-demographic characteristics such as age, gender, marital status, education level, income, and occupation. In the first part of the survey, the respondent was also asked questions about their work experience in finance and the number of years of experience, in case they had working experience in finance.

The second part of the survey contained questions related to five behavioral biases: overconfidence, herd instinct, disposition effect, anchor bias, and representativeness bias. Five statements were used to assess overconfidence bias, disposition effect, and representativeness bias. Four statements were used to assess herd instinct and anchoring bias. The questions were adopted from previous studies. Questions assessing overconfidence, representativeness bias, and herd instinct were taken from Jain et al.'s (2020) study. Questions assess the disposition effect and anchoring bias from the studies of Khan (2020) and Baker (2022). The respondent was asked to rate each statement on a 10-point Likert scale, where one strongly disagrees and ten strongly agrees. The average of received responses was used to evaluate each behavioral bias.

The third part of the survey includes questions assessing the correspondent's risk tolerance level, investment strategy, and stock investment returns. The level of risk tolerance was studied using two questions. The first question assessing the level of risk tolerance was taken from the study by Yao et al., 2004. These statements also were used in Household Finance and Consumption Survey (HFCS). Respondents were offered four statements, from which the respondents had to choose the most appropriate statement assessing their level of risk tolerance. The four statements were as follows:

1) „not willing to take any financial risks;“
2) „take average financial risks expecting to earn average returns;“
3) „take above average financial risks expecting to earn above average returns;“
4) „take substantial financial risks expecting to earn substantial returns.“ (Yao et al., 2004)

The second question asked the respondent to rate the risk level of his portfolio on a 10-point scale, where 1 is very low risk, and 10 is very high risk. Then, the investor was asked to choose his leading strategy from four proposed strategies: investment in stock market index funds, investment in value stocks, investment in growth stocks, and short-term trading. The final question of the fourth section assessed the average investor's return over the last five years. The question was taken from the study of Athur, 2014. The answers to this question are subsequently used as the dependent variable.

The survey was completely anonymous, comprised 40 questions, and took approximately 7 minutes to complete. The online environment Google Forms was used as a platform for survey creation and collection of responses. Social networks like Facebook and Instagram were used to collect data on Estonian investors. Links to the survey were distributed to investment groups on Facebook, such as "Finantsvabadus" (Financial freedom), "Naisinvestorite klubi" (Female investors club), "Клуб инвесторов" (Club of Investors), etc. Several Instagram investment bloggers also shared the link to the survey with their followers.

The survey was presented in Estonian, Russian, and English. The survey was disseminated over two weeks. During this period, 207 people participated in the survey, 185 participants were investors, and they participated in the stock market, and 22 participants had no experience in stock investing. After the data collection was completed, the responses were saved and coded for future

analyses (see Appendix 2). Gretl software was used to study the impact of various non-financial factors on investors' returns.

One of the limitations of this study is that the data obtained from the survey is not representative because the convenience sampling method was used as the data collection method instead of the random sampling method. It was not possible to conduct a representative survey within the framework of the Master's thesis research. There is no information in the public domain about the exact number of Estonian investors and their social and demographic profiles. Estonian investors have the opportunity to invest in stocks listed on the Baltic Stock Exchange as well as on various international stock markets. Various banks and other investment platforms offer the possibility to create an investment account, allowing the investor to invest simultaneously using several platforms. It makes it difficult to determine the exact number of investors residing in Estonia.

A convenience sample was used in this research study due to disseminating the question through social media. The sample is not representative so that no strict generalizations can be made. The author concludes the sample of 185 survey participants based on the study's limitations. It is impossible to conclude about all Estonian investors.

2.2. Descriptive Statistical Analysis

207 people participated in the survey; 185 participants were investors and had experience investing in the stock market, and 22 participants had no experience investing in stocks. A total of 106 men (57%) and 79 women (43%) participated in the survey (see Appendix 3). The lowest age of the survey participants was 18, and the oldest was a respondent at the age of 66. The average age of the respondents was 35 years old. (see Appendix 4)

The majority of respondents, 136 (74%), have higher education. Out of them, 75 respondents (41%) have a bachelor's degree, 60 respondents (32%) have a master's degree, and only one of the respondents has a doctoral degree (1%). 27 participants (15%) have secondary education or below, and 22 of the respondents (12%) have professional education. (see Appendix 3)

Considering the survey participants by occupation, we can see that most respondents were private sector employees, and their number was 139 people (75%). 29 respondents were entrepreneurs,

which represented 16 % of all respondents. At the time of the distribution of survey, 10 respondents (5%) were unemployed and 6 (3%) were students. One pensioner (1%) took part in the survey. (see Appendix 3)

132 respondents (71%) had a partner, and 53 respondents (29%) were single (see Appendix 3). The average income of the respondents was approximately €2100 (see Appendix 4). Almost every fourth of the respondents has experience in finance; the number of them was 44 respondents (24%). On average, these people have about 7 years of experience in finance, and the greatest experience was 22 years (see Appendix 4).

The majority of respondents, 71 (39%) and 72 (38%) prefer to take medium or above-average financial risks, respectively. 17 respondents (9%) are unwilling to take any financial risk, and 25 (14%) prefer substantial financial risks. The most popular investment strategy among the respondents is investment in index funds. 67 (36%) of the respondents prefer to invest in index funds or replicate them by themselves. The least popular strategy among the respondents is short-term trading, in which only 26 (14%) are engaged.

Respondents also answered questions assessing susceptibility to various behavioral biases, where the minimum value was one. It showed no exposure to a particular bias; the maximum value was ten, meaning the person was highly susceptible to bias. Based on the survey results, the respondents are most susceptible to the disposition effect, with an average of 6,90. The respondents were slightly less prone to representativeness bias; the average was 6,37. The average value of the respondents' susceptibility to herd instinct and anchoring bias was 5,53. The respondents were the least susceptible to overconfidence bias, with the average value being 5,24.

Table 1. Average susceptibility to bias per gender

Gender	Disposition effect	Representativeness bias	Herd instinct	Overconfidence bias	Anchoring bias
Female	7,149	6,451	6,053	5,184	5,641
Male	6,723	6,304	5,140	5,277	5,452

Source: compiled by the author.

Men and women have different susceptibility rates to biases (see Table 1). For instance, women are more prone to the disposition effect; the average for the female respondents is 7,15, while for

men, it is 6,72. Women are also more prone to representativeness bias, herd instinct, and anchoring biases. Men, meanwhile, are more prone to overconfidence bias.

Among the respondents, men, on average, have a higher rate of return than women. The average rate of return for women was 12,77%, while the average rate for male respondents was 15,39% (see Appendix 3). The standard deviation of returns for females is lower than for males; for example, the standard deviation for females was 14,73, while the standard deviation for males was 26,09.

The average annual return of respondents not ready to take any financial risks is 3,84% and has the lowest variability. Respondents who prefer to take average financial risks have an average return of 9,99%. Respondents who prefer to take higher-than-average risks have a return of 16,48%. Respondents who prefer substantial financial risks have the highest return, with an average return of 30,27% per year.

Looking at the average return of respondents to the chosen strategy, respondents who prefer to invest in index funds have an average annual return of 6,97%. Respondents who prefer to invest in Value stocks have an average return of 11,08% per year. Respondents whose leading strategy is investing in growth stocks have an average return of 17,88%. The highest returns have people who prefer short-term trading; their returns are 34,99% per annum. However, these people also have the highest standard deviation of returns, and it is 36,93. The lowest standard deviation is for respondents who invest in index funds; their standard deviation is 9,80.

2.3. Research methodology and model composition

The study aims to analyze the impact of various behavioral biases, socio-demographic factors, risk tolerance, and strategy on stock investment returns.

The Ordinary Least Squares method was used to analyze the effect of various factors on the return on investment. Multiple Linear Regression was constructed to study the effect of multiple independent variables. Subsequently, it was found that the dependent variable does not follow a normal distribution, and heteroskedasticity was present in the model. Application of Inverse Hyperbolic Sine (IHS) transformation was performed in order to stabilize the variance of the

dependent variable (see Formula 1). This method is widely used in econometrics to overcome the problems associated with heteroscedasticity, which violates one of the basic assumptions of classical linear regression models.

$$IHS(y^i) = \beta_0 + \beta_1 x_1^i + \beta_2 x_2^i + \beta_3 x_3^i + \ldots + \beta_k x_k^i + \epsilon^i \quad (1)$$

where

$IHS(y^i)$– transformed dependent variable for observation

x_j^i – independent variable for the i^{th} observation

ϵ^i – error term for the i^{th} observation

β_0 – the intercept coefficient

β_j – regression coefficient for the i^{th} independent variable

The IHS transformation is applied to each individual observation of the dependent variable. The definition of the inverse hyperbolic sine transform is as follows:

$$IHS(y) = sihn^{-1}(y) = \ln\left(y + \sqrt{y^2 + 1}\right) \quad (2)$$

All data obtained through the survey was coded. (see Appendix 2). The author of the study decided to divide the level of education (*Education*) into two categories: professional education and secondary education, and below and the second category is higher education. Occupation (*Occupation*) was also divided into two categories. It was decided to separate entrepreneurs from all other categories. Thus, the level of education profession, as well as gender, were represented as binary variables. Four types of strategy (*Strategy*) as well as a variable assessing the risk tolerance of the respondent (*Risk1*) were used as dummy variables. Analyses were conducted using Gretl software. The author suggested three hypotheses.

- Hypothesis 1: Risk tolerance has a positive effect on stock portfolio returns.
- Hypothesis 2: Adoption of a more active investment strategy has a positive effect on stock portfolio returns.
- Hypothesis 3: Behavioral biases such as overconfidence, representativeness bias, herd instinct, disposition effect, and anchoring bias have a negative effect on stock portfolio returns.

The first step to constructing the model was to check the assumptions necessary to build the Ordinary Least Squares model. One of the assumptions is the distribution of data. The independent variables follow a normal distribution (see Appendix 5) reasonably well. The average annual return of respondents does not follow a normal distribution (see Figure 1).

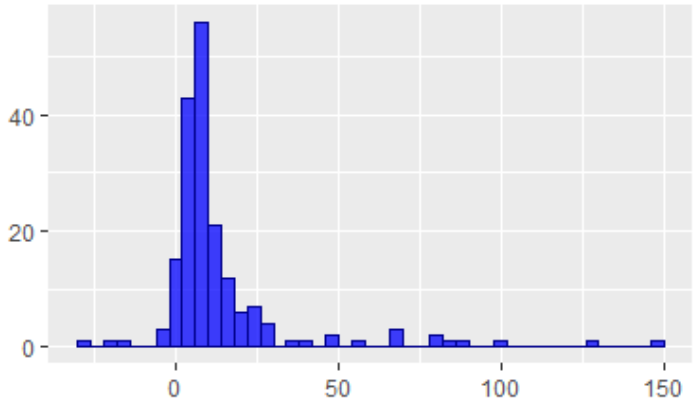

Figure 1. Distribution of return
Source: Compiled by the author.

The author applied an inverse hyperbolic sine transformation to achieve a normal distribution for the dependent variable. Subsequently, the distribution exhibited a closer approximation to normality (see Figure 2).

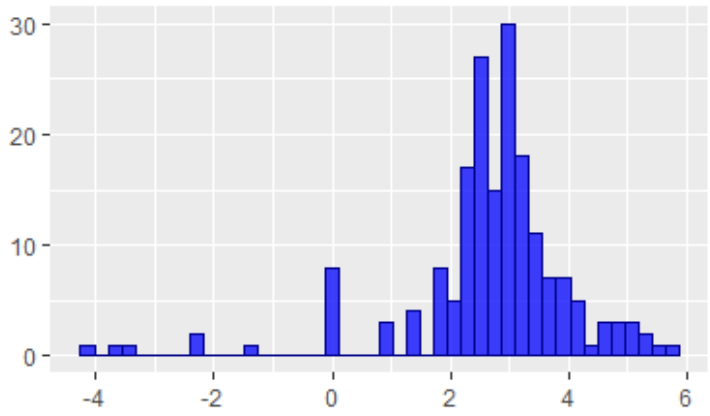

Figure 2. Distribution of return after inverse hyperbolic sine transformation
Source: Compiled by the author.

The independent variables were then tested for correlation. It was found that the independent variable representing work experience in finance (*Finance*) and the number of years (*Yearsfinance*) the respondent has worked in finance have a high correlation of 0,746. Such a high correlation has a risk of creating multicollinearity problems during regression estimation. The risk factors is not highly correlated with socio-demographic variables; the highest value is –0,27.

Two risk assessment factors were used in this study. *Risk1* – reflects the respondent's assessment of their risk tolerance, and *Risk2* – reflects the respondent's assessment of the risk level of their current investment portfolio. The correlation between these two variables is 0.42, which suggests a moderate strength of the relationship.

Since *Risk2* is a subjective assessment of respondents and does not have a strong correlation with *Risk1,* which assesses the level of risk they would like to take, it can be concluded that people do not follow their risk level preferences. Thus, it can be assumed that *Risk2* represents an assessment of excessive or insufficient risk, the presence of which investors have in their portfolio contrary to their preferences.

Three hypotheses were tested by constructing a regression model where the dependent variable was the IHS transformation of average annual stock portfolio return, and the independent variables were behavioral biases, strategy, risk tolerance, and socio-demographic characteristics.

To test the three hypotheses, the author built seven models. Initially, a basic model was created where the dependent variable was transformed into the average returns of respondents. All independent variables except for biases were added to the model. Thus, the model consists of socio-demographic variables, variables measuring risk tolerance, and strategy variables.

Since the dependent variables, such as *Finance* and *Yearsfinance*, have a high correlation, the authors decided to include the *Finance* variable as it has more influence on the dependent variable. The *Yearsfinance* variable was excluded from the model. In the next step, the author removed some socio-demographic independent variables that had the lowest statistical significance, which were occupation (*Occupation*), marital status (*Partner*), and the number of years the respondent has participated in the stock exchange (*Experience*).

The base Model 1 has the following structure:

$$IHS(Y) = \beta_0 + \beta_1 \cdot Gender + \beta_2 \cdot Age - \beta_3 \cdot Education + \beta_4 \cdot Income + \beta_5 \cdot Finance + \beta_6 \cdot DRisk1_2 + \beta_7 \cdot DRisk1_3 + \beta_8 \cdot DRisk1_4 - \beta_9 \cdot Risk2 + \beta_{10} \cdot DStrategy\_2 + \beta_{11} \cdot DStrategy\_3 + \beta_{12} \cdot DStrategy\_4 \quad (3)$$

Model 1 is statistically significant with p = $8{,}65 \cdot 10^{-6}$ and accounts for 17,26% of the variance in the dependent variable (see Appendix 7). The model does not demonstrate heteroscedasticity with a p-value of 0,161. Only one socio-demographic factor, *Finance*, reaches statistical significance at the 0.1 level. *Risk1* and *Strategy* are also statistically significant variables.

In the next step, the author built five more models, including five biases (Appendix 8). Each subsequent model consists of the variables included in the base model 1 and one of the five biases added. Model 2 includes all variables from the base model 1 and the disposition effect (*DispositionEffect*).

The model 2 is statistically significant with p = $5{,}01 \cdot 10^{-6}$The descriptive power of the model 2 increased by 1,09%. Heteroskedasticity is not presented in Model 2. The *DispositionEffect* reaches statistical significance at the 0,1 level (see Appendix 8).

Model 3 includes all variables of the base Model 1 as well as the representativeness bias (*RepresentativenessBias*). Model 3 shows statistical significance with a p-value of $1{,}82 \cdot 10^{-6}$. The adjusted coefficient of determination for the model is 0,168. The model does not demonstrate heteroscedasticity. *RepresentativenessBias* is not a statistically significant variable (Appendix 8).

Model 4 included a bias named herd instinct (*HerdInstinct*). The models are statistically significant. The descriptive power of Model 2 increased by 0,48% compared to Model 1. The model does not demonstrate heteroscedasticity. *HerdInstinct* is not a statistically significant variable (see Appendix 8).

Model 5 contains overconfidence bias (*OverconfidenceBias*). The significance of Model 5 is established as indicated by a p-value of $1{,}35 \cdot 10^{-9}$, and it accounts for 27,15% of the variance of the dependent variable, which is 9,90% higher than that of the base Model 1. The model 5 does

not exhibit heteroskedasticity. The *OverconfidenceBias* reaches statistical significance at the 0,01 level (see Appendix 8).

Model 6 includes anchoring bias (*AnchoringBias*). Model 6 shows statistical significance with a p-value of $1{,}18 \cdot 10^{-5}$. The adjusted coefficient of determination of the model is 0,173. The model does not demonstrate heteroscedasticity. *AnchoringBias* is not a statistically significant variable (see Appendix 8).

Model 7 includes socio-demographic variables such as gender, age, education, income, finance, risk factors, strategies, and all five biases. Model 7 is statistically significant, and its descriptive power is 26,86%. The model does not demonstrate heteroscedasticity (see Appendix 7).

3. EMPIRICAL RESULTS

The dependent variable was transformed using inverse hyperbolic sine (IHS) transformation, so the coefficient estimates refer to the transformed data. Based on the results of the seven models, the only important statistically significant factor among the social demographic factors is *Finance.* In five out of seven models, the factor attains statistical significance at the 0,1 level.

Table 2. Model 1. Factors affecting returns on investment.

Variable	Coefficient	Std. error	T-ratio	P-value	
Const	0,992	0,720	1,378	0,170	
Gender	0,263	0,224	1,173	0,243	
Age	0,022	0,013	1,649	0,101	
Education	-0,211	0,260	-0,812	0,418	
Income	$-5{,}38 \cdot 10^{-5}$	$9.69 \cdot 10^{-5}$	$-5{,}55 \cdot 10^{-1}$	0,579	
Finance	0,459	0,251	1,832	0,069	*
DRisk1_2	0,921	0,394	2,334	0,021	**
DRisk1_3	1,131	0,412	2,749	0,007	***
DRisk1_4	1,374	0,473	2,903	0,004	***
Risk2	-0,093	0,062	-1,503	0,135	
DStrategy_2	0,525	0,259	2,024	0,044	**
DStrategy_3	0,704	0,301	2,340	0,020	**
DStrategy_4	1,674	0,349	4,795	0,000	***
R-squared	0,226				
Adjusted R-squared	0,173				
P-value(F)	$8.65 \cdot 10^{-6}$				

Source: compiled by the author.
Notes: dependent variable rate of return, * – significance level 0.1; ** – significance level 0.05; *** – significance level 0.01.

The variable *Finance* is a binary variable; based on the results of the baseline Model 1, we can conclude that if a respondent has experience in finance, all other things being equal, their IHS transformed returns on average will be 0,46 higher compared to a respondent with no experience in finance, that is one third of one standard deviation.

Demographic factors such as *Gender, Age, Education, Income* are not statistically significant factors and have no effect on respondents' returns.

Looking at the risk variables, *Risk1* is a statistically significant variable. Only in Model 7, where all behavioral biases are present, *Risk1* is not statistically significant. Positive coefficients indicate that higher levels of risk tolerance are associated with higher returns compared to the base variable. A closer look at the coefficients of Model 1 suggests that respondents who are not willing to take any financial risks have the lowest returns compared to respondents who prefer to take any financial risks. Thus, respondents who prefer to take average financial risks have, on average, 0,92 higher returns after transformation, all other things being equal, compared to respondents who are not willing to take any financial risks. It is two-thirds of the standard deviation of the dependent variable.

All other things being equal, respondents who prefer to take above-average financial risks have, on average, a 1,13 higher return after transformation compared to respondents not willing to take any financial risks. Respondents who prefer to take substantial financial risks have the highest returns. All other things being equal, their IHS transformed returns on average will be 1,37 higher compared to the baseline variable after transformation, which is approximately one standard deviation of the variable.

Risk2 is not statistically significant in the base model but becomes statistically significant when factors such as *DispositionEffect* and *OverconfidenceBias* are present (see Appendix 8). The independent variable has a negative coefficient; increasing the level of portfolio risk decreases the return. Since *Risk2* is a subjective assessment of respondents and does not have a strong correlation with *Risk1*, which assesses the level of risk they would like to take, it can be concluded that people do not follow their risk level preferences. Thus, it can be assumed that *Risk2* represents an assessment of excessive or insufficient risk, the presence of which investors have in their portfolio contrary to their preferences. This leads to the conclusion that insufficient or excessive portfolio risk that does not reflect respondents' preferences regarding their willingness to take a certain level of risk has a negative impact on respondents' returns.

Hence, regression results are in line with Hypothesis 1. Risk tolerance positively affects stock portfolio returns. The independent variable *Risk1* is statistically significant, the increase in risk tolerance increases the respondents' returns, and the statistical significance of *Risk2* is not stable.

Strategy choice is a statistically significant factor. The statistical significance of this variable is observed in all presented models. The lowest average return has the respondents with the main leading strategy of investment in index funds because this strategy is the basic one in the models, and the strategy variables presented in the model have a positive coefficient. For example, people who chose the strategy of investing in value stocks, all other things being equal, on average, have 0.55 higher IHS transformed returns compared to respondents who invest in index funds. It is equal to two-thirds of the standard deviation of the dependent variable. Respondents investing in growth stocks have even higher returns. All other things being equal, after transformation, their average return is 0,18 higher than that of respondents investing in value stocks and 0,70 units higher than those investing in index funds. The strategy that earns the highest returns is short-term trading. Respondents engaging in short-term trading, all other things being equal, have an average return of 1,67 units higher after transformation than respondents investing in index funds, which is slightly higher than the standard deviation of the dependent variable. Yao et al. (2004) found a similar result in their study. Hypothesis 2 is not rejected; the results of the regression are in line with the proposed hypothesis.

Six models were constructed to test hypothesis 3. Models 2, 3, 4, 5, and 6 (see Appendix 8) represent a combination of socio-demographic factors, risk tolerance factors, strategy, and, additionally, one of the biases. Model 7 includes all five biases (see Appendix 7). Based on the obtained results, we can conclude that *RepresentativeBias*, *HerdInstinct*, and *AnchoringBias* do not influence the return of respondents since these variables are not statistically significant.

DispositionEffect is a statistically significant variable in Model 2, where social demographic factors, risk factors, and strategies are represented. The factor attains statistical significance at the 0,1 level. *DispositionEffect* has a negative coefficient, i.e., when the effect of disposition increases, the level of return decreases. In Model 7, *DispositionEffect* has a p-value close to statistically significant. Benartzi & Thaler (1995) and Goetzmann & Massa (2008) came to the same results.

OverconfidenceBias affects respondents' returns. The independent variable is statistically significant. The factor attains statistical significance at the 0.01 level. The coefficient is a positive value, indicating that increasing overconfidence increases respondents' return. This result is consistent with the results obtained in the studies of Barber & Odean (2001) and Glaser & Weber, (2007).

Hypothesis 3 is rejected, only *DispositionEffect* has negative effect on respondents' return. *OverconfidenceBias* has a positive effect on respondents' stock portfolio returns. *RepresentativeBias*, *AnchoringBias,* and *HerdInstinct* does not affect to respondent’s stock portfolio returns.

CONCLUSION

The purpose of this study is to examine the impact of behavioral biases, risk tolerance, and strategy choice on the returns of Estonian investors. The study examines the influence of five behavioral biases such as overconfidence, representativeness bias, herd instinct, disposition effect, and anchoring bias.

In the course of the study, the author proposed three hypotheses. Hypothesis 1 assumes that risk tolerance has a positive effect on stock portfolio returns. To test this hypothesis, regression models were built, where two variables were taken as risk: the respondents' assessment of their risk tolerance and the respondents' assessment of the risk level of their current investment portfolio. The author failed to reject Hypothesis 1. The respondent's evaluation of their risk tolerance is statistically significant and positively impacts portfolio returns. At the same time, the respondent's assessment of the risk level of their current investment portfolio has a negative impact on returns but, the variable is not stable in the regression specification.

Hypothesis 2 was formulated: adoption of a more active investment strategy has a positive effect on stock portfolio returns. Variables of the selected strategies are statistically significant in all models. Authors failed to reject Hypothesis 2. Respondents who prefer investing in index funds or replicating stock indexes with themselves have the lowest returns. Respondents who prefer to invest in value stocks have higher returns than investments in index funds. Respondents investing in growth stocks have higher returns compared to the previously mentioned strategies. Respondents engaged in short-term trading have the highest returns.

Hypothesis 3 implies that behavioral biases such as overconfidence, representativeness bias, herd instinct, disposition effect, and anchoring bias have negative effect on stock portfolio returns. This hypothesis is rejected, because only one of the presented biases which statistically significant has negative effect on respondent’s return, this is disposition effect. Overconfidence bias has a strong positive effect on respondent’s stock portfolio return. The more a respondent is affected by

overconfidence, the higher their returns are on average. Representativeness bias, herd instinct, and anchoring bias are not statistically significant and do not affect respondents' stock portfolio returns.

The study also revealed the influence of work experience in finance on the return of respondents. In case a respondent has work experience in finance, respondents have, on average, higher profitability than respondents who have no work experience in finance. Such socio-demographic factors as gender, age, level of education, income, occupation, marital status, and the number of years the respondent has participated in the stock exchange do not affect the returns of respondents.

The main limitation of the study is that the data collected does not represent a representative sample. Therefore, it is impossible to make generalizations about all Estonian investors based on the collected data. In the author's opinion, this topic is important and relevant, so in the future it is necessary to conduct a follow-up study on a larger scale using a representative sample so that it would be possible to make generalizations about all Estonian investors. The author also advises to include a larger number of biases in the study. In the author's opinion, the most important part of the study is the disclosure of the topic of biases and their influence on investment decisions and returns. It is necessary to raise people's awareness of the presence of biases influencing investors, especially it is important to raise awareness of the biases that have a negative impact on the profitability of investors.

KOKKUVÕTE

SOTSIAAL-DEMOGRAAFILISTE TEGURITE, RISKITOLERANTSUSE, STRATEEGIA JA KÄITUMISHARJUMUSTE MÕJU EESTI INVESTORITE TOOTLUSELE

Anastassia Kobõljanskaja

Käesoleva uurimuse eesmärk on uurida käitumuslike eelarvamuste, riskitaluvuse ja strateegiavaliku mõju Eesti investorite kasumlikkusele. Uuringus uuritakse viie käitumusliku eelarvamuse mõju: liigne enesekindlus (overconfidence), esinduslikkus (representativeness bias), karja instinkt (herd instinct), dispositsiooniefekt (disposition effect) ja ankurdamise efekt (anchoring bias).

Lähtuvalt uuringu eesmärgist esitas autor kolm hüpoteesi:

- Hüpotees 1: Riskitaluvus avaldab positiivset mõju aktsiaportfelli tootlusele.
- Hüpotees 2: Aktiivsema investeerimisstrateegia rakendamisel avaldub positiivne mõju aktsiaportfelli tootlusele.
- Hüpotees 3: Käitumuslikud eelarvamused, nagu liigne enesekindlus, esinduslikkus, karja instinkt, dispositsiooniefekt ja ankurdamise efekt, avaldavad negatiivset mõju aktsiaportfelli tootlusele.

Finantsturgudele investeerimine on muutunud üksikinvestorite seas populaarsemaks. Investeerimiskeskkond areneb pidevalt, kuid muutub samal ajal keerukamaks. Iga aastaga suureneb erinevate investeerimisinstrumentide varieeruvus ja ka nende kättesaadavus. (Sahi, 2016) Investeerimiseesmärkide saavutamiseks peavad investorid tegema investeerimisotsuseid, mis omakorda on keeruline protsess. Investorid peavad investeerimisotsuste tegemiseks otsima ja töötlema suures koguses teavet. Inimesed töötlevad sama teavet erinevalt, mis viib neid erinevate tulemusteni. (Kartini & Nahda, 2021) Selle põhjuseks on erinevad tegurid, mis mõjutavad inimeste arusaamu, infotöötlust ja investeerimisotsuseid.

Traditsioonilised finantsteooriad on üles ehitatud eeldusele, et investorid on ratsionaalsed, kuid käitumuslik finants viitab sellele, et investorid on allutatud erinevatele kognitiivsetele eelarvamustele, mis panevad neid käituma irratsionaalselt. Üksikinvestorid ei ole sageli teadlikud oma käitumuslikest eelarvamustest, mis omakorda mõjutavad investeerimisotsuseid ega ka tootlust. (Sha & Ismail, 2021)

Selles uuringus kasutatakse kvantitatiivset analüüsimeetodit. Kasutatud andmekogumismeetodiks on küsitlus. Küsitlus koosneb kolmest osast. Küsitluse esimene osa sisaldab küsimusi, mis on seotud sotsiaaldemograafiliste tunnustega, nagu vanus, sugu, perekonnaseis, haridustase, palk jne. Küsitluse teine osa sisaldab küsimusi, mis on seotud viie käitumise eelarvamusega, nagu liigne enesekindlus, karja instinkt, dispositsiooniefekt, ankurdamise efekt ja esinduslikkus. Eelarvamusi mõõdetakse mitmete küsimustega, mida on varem uurimistöös kasutatud. Vastused küsimustele esitati 10-pallisel Likerti skaalal, kus 1 tähendab, et ei nõustu täielikult ja 10 tähendab, et olen täiesti nõus. Iga käitumise kõrvalekalde mõõtmiseks kasutati saadud vastuste aritmeetilist keskmist. Küsitluse kolmas osa sisaldab küsimusi, mis hindavad vastaja riskitaluvuse taset, investeerimisstrateegiat ja aktsiatesse tehtud investeeringu tootlust.

Küsitlust levitati sotsiaalvõrgustike kaudu, eelkõige investeerimisgruppidele. Uuringu jagamise periood oli kaks nädalat. Küsitlus oli täiesti anonüümne. Erinevate tegurite mõju analüüsimiseks investeeringu tootlusele kasutati tavalist vähimruutude meetodit. Mitme sõltumatu muutuja mõju uurimiseks koostati Gretli tarkvaras mitu lineaarset regressiooni. Sõltuv muutuja esindab investorite tootlusi ja sõltumatud muutujad on mitterahalised tegurid.

Uuringu tulemused näitavad, et strateegia valik, riskitaluvus ja kaks käitumuslikku eelarvamust, nagu dispositsiooniefekt ja liigne enesekindlus, mõjutavad vastajate tootlust. Hüpotees 1 leidis kinnitust, kuna hinnang vastaja riskitaluvusele mõjutab tema tootlust ja näitab positiivset seost vastaja tootlusega. Mida kõrgem on vastaja riskitaluvus, seda suurem on tema tootlus. Vastaja hinnang praeguse investeerimisportfelli riskitasemele avaldab negatiivset mõju vastaja kasumlikkusele, aga muutuja ei ole regressioonispetsifikaadis stabiilne.

Strateegia valik mõjutab vastajate tootlust, aktiivsema strateegia valimine toob suurema tootlust. Hüpotees 2 leidis kinnitust. Kõige väiksema tootlusega on vastajad, kes eelistavad investeerida indeksifondidesse. Vastajatel, kes otsustavad investeerida väärtusaktsiatesse, on suurem tootlus

võrreldes indeksifondidesse investeerimisega. Kasvuaktsiatesse investeerivad vastajad näevad isegi suuremat tootlust kui eelnevalt mainitud strateegiad. Kõige suurem tootlus on lühiajalise kauplemisega tegelevatel vastajatel.

Kaks käitumuslikku eelarvamust mõjutavad vastajate kasumlikkust. Liigse enesekindluse taseme tõustes suureneb vastaja tootlus, kuid dispositsiooniefektiga kokkupuute taseme tõustes vastaja tootlus väheneb. Esinduslikkus, karja instinkt ja ankurdamise efekt ei mõjuta vastajate tulusid. Hüpotees 3 ei leidnud kinnitust.

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APPENDICES

Appendix 1. Questionnaire

Part 1., Socio-demographic variables	Answer options
1. Have you ever made any stock market investments yourself?	Yes /No
2. What is your gender?	Male/Female
3. What is your age?	Number
4. Please indicate your level of education	Secondary Education and below / Professional education / Bachelor / Master / PhD
5. What is your occupation?	Student / Private sector employee / Entrepreneur / Retired / Unemployed
6. What is your monthly income after taxes?	Number
7. Do you have a partner?	Yes /No
8. Do you have any work experience in the field of finance?	Yes /No
8.1 How many years of experience do you have in the field of finance?	Number
Part 2., Behavior Biases	Answer options
9. I am more sensitive to losses than to gains in trading.	Number from 1 to 10
10. I prefer to make profits or at least break even in all trades.	Number from 1 to 10
11. I hold stocks that have declined in value after my purchase with expectations for that stock to re bounce	Number from 1 to 10
12. I sell stocks when there is increase in prices rather than decrease in price.	Number from 1 to 10
13. I tend to treat each element of your investment portfolio separately.	Number from 1 to 10
14. I usually invest in familiar stocks.	Number from 1 to 10
15. I evaluate Past Price trends for predicting future price.	Number from 1 to 10
16. I buy hot stocks and avoid stocks having poor performance in past.	Number from 1 to 10
17. I buy stocks on the basis of present performance.	Number from 1 to 10
18. I buy the new equity offering of the same company, in which I have already invested.	Number from 1 to 10
19. I seek advice from brokers, while investing.	Number from 1 to 10
20. My investment decision is based on recommendations given by famous analyst.	Number from 1 to 10

Source: Compiled by the author.

Appendix 1 continued

21. I seek opinion from my friends and colleagues.	Number from 1 to 10
22. News about the company (Newspapers, TV and magazines) affects my investment decision.	Number from 1 to 10
23. I am Confident about my own ability to do better than others.	Number from 1 to 10
24. I am Confident about time to enter in the market and exit from market.	Number from 1 to 10
25. I Possess Specific skills and experience for making investments.	Number from 1 to 10
26. I Possess Complete knowledge about various investment avenues.	Number from 1 to 10
27. I am Satisfied regarding past investing decision making.	Number from 1 to 10
28. A stock's initial purchase price is important when considering whether to sell it.	Number from 1 to 10
29. I recommend selling a stock that has reached a 52-week high price level.	Number from 1 to 10
30. My recent experiences in the stock market influence my trading and investment decisions.	Number from 1 to 10
31. I regret missing the opportunity to sell a stock that was recently at a high price and usually wait until it returns to that price before considering selling.	Number from 1 to 10
Part 3., Risk tollerance, startegy and return	Answer options
32. How long have you invested in the stock market in years?	Number
33. In general terms, what proportion of your income would you prefer to invest? (in percent)	Number
34. Which of the statements on this page comes closest to the amount of financial risk that you are willing to take when make investments?	Take substantial financial risks expecting to earn substantial returns
	Take above average financial risks expecting to earn above average returns
	Take average financial risks expecting to earn average returns
	Not willing to take any financial risks."
35. What is the degree of risk in your portfolio?	Number from 1 to 10

Source: Compiled by the author.

Appendix 1 continued

36. Which of the following most resembles your main investing strategy?	I prefer to invest in stock market index fonds or replicate stock indexis with myself.
	I prefer to invest in value stocks.
	I prefer to invest in growth stocks.
	I prefer short term trading.
37. How many trades do you make on the average in one month?	Number
38. What is your average annual return over the past 5 years? (in percent)	Number
39. What was your average annual return during your best year over the past 5 years? (in percent)	Number
40. What was your average annual return during your worst year over the past 5 years? (in percent)	Number

Source: Compiled by the author.

Appendix 2. Variables used in the analysis

Variable	Description	Code
Return	average annual return over the past 5 years	number
Gender	gender of respondent	0 – male
		1 – female
Age	age of respondent	number
Education	level of education	0 – secondary education and below
		0 – professional education
		1 – bachelor
		1 – master
		1 – phd
Occupation	occupation of respondent	0 – student
		0 – private sector employee
		0 – retired
		0 – unemployed
		1 – entrepreneur
Income	month income of respondent after taxes	number
Partner	marital status	0 – single
		1 – has a partner
Finance	working experience in the field of finance	0 – do not have experience
		1 – have experience
Yearsfinance	years of experience in finance	number
DispositionEffect	disposition effect	number
RepresentativenessBias	representativeness bias	number
HerdInstinct	herd instinct	number
OverconfidenceBias	overconfidence bias	number
Anchoringbias	anchoring bias	number
Experience	number of years of participation in the stock market	number
DRisk1_1	respondent's assessment of risk tolerance	1 – not willing to take any financial risks.
DRisk1_2		2 – take average financial risks
DRisk1_3		3 – take above average
DRisk1_4		4 – take substantial financial risks
Risk2	risk assessment on a 10-point scale	number from 1 to 10
Dstrategy_1	main investing strategy	1 – investment in stock market index funds
Dstrategy_2		2 – investment in value stocks
Dstrategy_3		3 – investment in growth stocks
Dstrategy_4		4 – short term trading

Source: Compiled by the author.

Appendix 3. Variance of return

Variable	Min	Max	Std. Dev	Average	Median	Total	%
Gender:							
Female	-5,00	84,00	14,73	12,77	9,00	79,00	43%
Male	-30,00	150,00	26,09	15,39	8,00	106,00	57%
Education:							
Secondary Education and below	0,00	130,00	25,33	14,95	7,00	27,00	15%
Professional education	2,00	90,00	18,96	11,66	6,00	22,00	12%
Bakalaureus	-30,00	150,00	24,74	14,97	10,00	75,00	41%
Master	-5,00	80,00	17,90	14,17	10,00	60,00	32%
Doktor	7,00	7,00	–	7,00	7,00	1,00	1%
Occupation:							
Student	1,00	70,00	26,66	18,67	6,50	6,00	3%
Private sector employee	-30,00	150,00	23,47	14,48	8,00	139,00	75%
Entrepreneur	-15,00	90,00	16,10	12,76	11,00	29,00	16%
Retired	8,00	8,00	–	8,00	8,00	1,00	1%
Unemployed	0,00	40,00	13,30	13,70	10,00	10,00	5%
Marital status:							
Single	-15,00	100,00	24,39	18,15	9,00	53,00	29%
Has a partner	-30,00	150,00	20,79	12,71	8,00	132,00	71%
Experience in finance:							
No experience	-30,00	100,00	13,94	10,29	7,00	141,00	76%
Some experience	-15,00	150,00	34,80	27,04	13,40	44,00	24%
Risk1:							
Not willing to take any financial risks	0,00	13,80	3,10	3,84	3,00	17,00	9%
Prefer average financial risks	-30,00	70,00	14,32	9,99	8,00	72,00	39%
Prefer above average financial risks	-15,00	130,00	21,86	15,48	10,00	71,00	38%
Prefer substantial financial risks	-5,00	150,00	35,85	30,27	18,00	25,00	14%
Strategy:							
Index funds	-30,00	55,00	9,80	6,97	6,50	67,00	36%
Value stocks	-5,00	90,00	16,36	11,08	8,00	50,00	27%
Growth stocks	-20,00	100,00	21,87	16,88	10,50	42,00	23%
Trading	3,00	150,00	36,93	34,99	21,00	26,00	14%
Grand Total	-30,00	150,00	21,95	14,27	–	185,00	100%

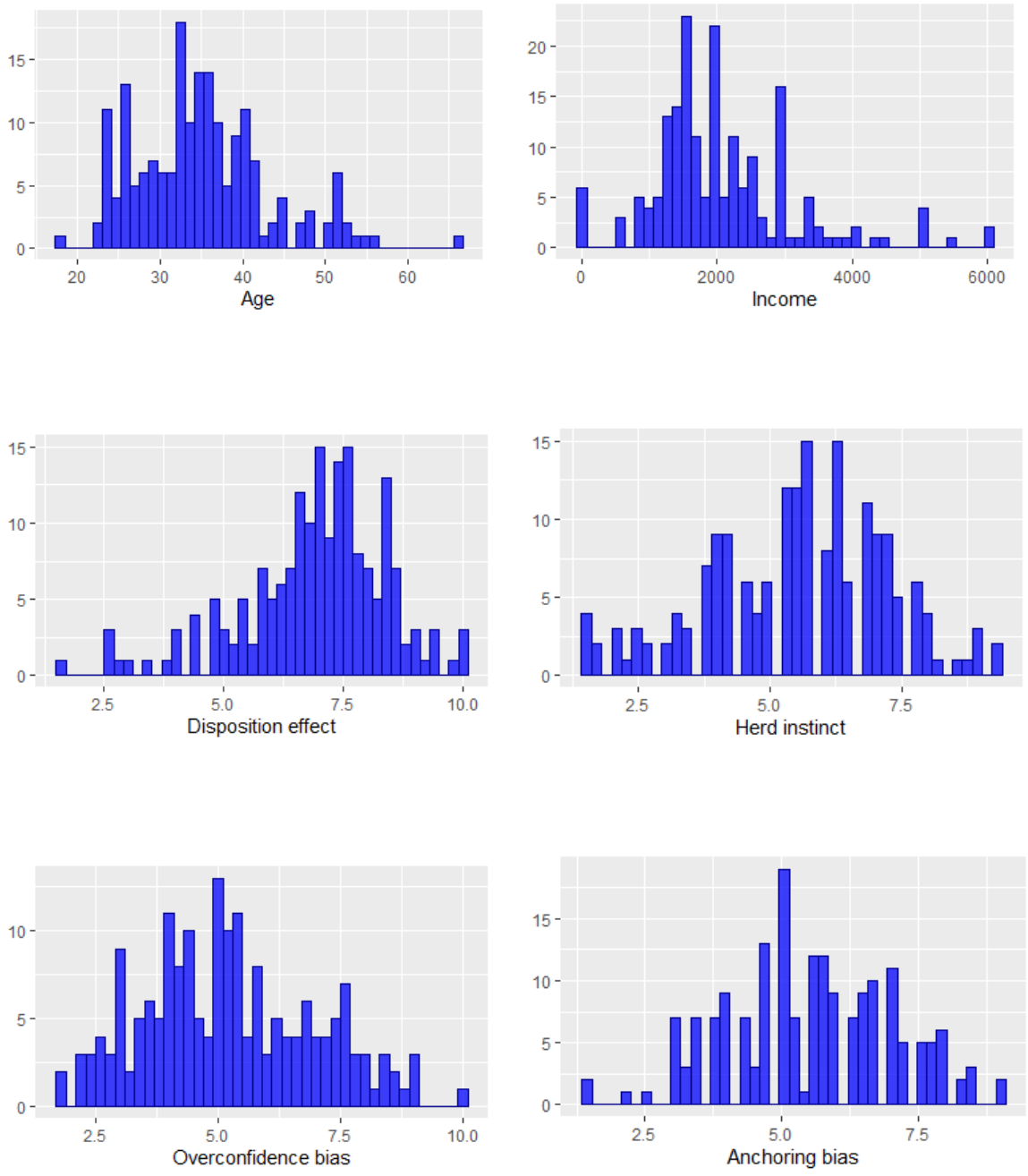
Source: Compiled by the author.

Appendix 4. Descriptive statistics: variables

Variable	Min	Max	Std. Dev	Average	Median
Return	-30	150	21,95	14,27	8
IHS return	-4,10	5,70	1,465	2,68	2,78
Gender	0	1	0,50	0,43	0
Age	18	66	8,05	35,09	35
Education	0	1	0,44	0,74	1
Occupation	0	1	0,36	0,16	0
Income	0	6000	1062,62	2083,06	2000
Partner	0	1	0,45	0,71	1
Finance	0	1	0,43	0,24	0
Yearsfinance	0	22	3,92	6,85	0
Disposition Effect	1,6	10	1,52	6,90	7,00
Representativeness Bias	3	9,60	1,46	6,37	6,40
HerdInstinct	1,5	9,25	1,72	5,53	5,75
Overconfidence Bias	1,8	10	1,75	5,24	5,10
Anchoring bias	1,5	9	1,52	5,53	5,50
Experience	1	28	3,71	4,32	3
Risk1	1	4	0,84	2,56	3
Risk2	1	10	1,86	5,98	6
Strategy	1	4	1,07	2,15	2

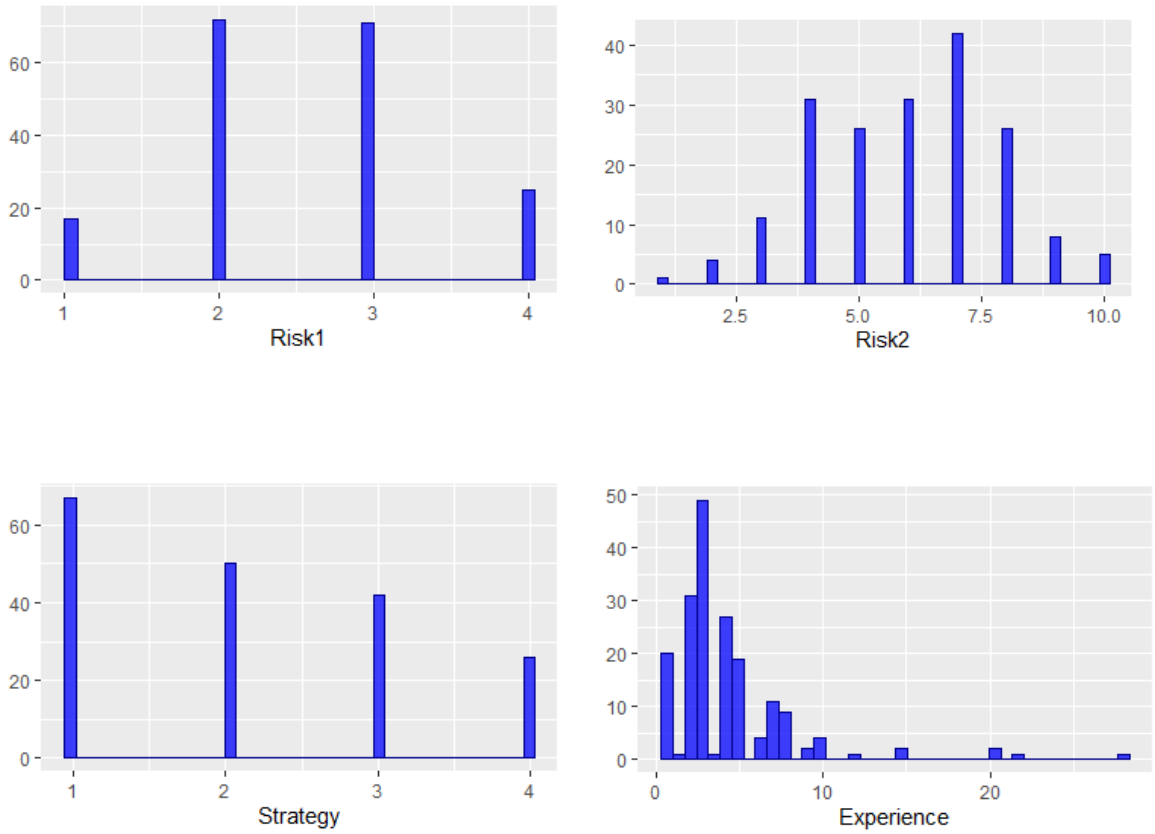
Source: compiled by the author.

Appendix 5. Distribution of variables



Source: compiled by the author.

Appendix 5 continued



Source: compiled by the author.

Appendix 6. Correlation matrix

Gender	Age	Education	Occupation	Income	Partner	Finance	Yearsfinance	DispositionEffect	RepresentativeBias	HerdInstinct	OverconfidenceBias	Anchoringbias	Experience	Risk1	Risk2	Strategy	
1	0,04	0,29	-0,07	-0,13	0,04	0,06	0,10	0,14	0,05	0,26	-0,03	0,06	-0,07	-0,12	-0,26	-0,17	Gender
	1	-0,13	0,03	0,02	0,01	-0,22	0,00	0,07	0,17	-0,13	-0,21	0.11	0,12	-0,27	-0,07	-0,29	Age
		1	0,02	0,15	0,06	0,19	0,14	-0,15	-0,24	0,37	0,19	-0.24	0,06	0,15	-0,03	0,00	Education
			1	0,25	0,01	0,00	0,01	-0,07	-0,01	0,04	0,06	-0.05	0,16	0,14	0,02	0,12	Occupation
				1	0,17	0,08	0,15	-0,11	-0,05	0,01	0,07	-0.14	0,30	0,08	0,15	0,03	Income
					1	-0,04	-0,01	0,09	-0,08	0,04	-0,17	0.00	-0,02	-0,05	0,00	-0,14	Partner
						1	0.75	-0,05	-0,17	0,14	0,38	-0.03	0,13	0,22	0,03	0,27	Finance
							1	-0,05	-0,09	0,17	0,32	-0.07	0,28	0,19	0,08	0,18	Yearsfinance
								1	0,38	-0,14	-0,25	0.51	-0,15	-0,30	-0,23	-0,19	DispositionEffect
									1	0,05	-0,18	0.32	-0,11	-0,23	-0,09	-0,25	RepresentativeBias
										1	0,19	-0.14	-0,06	0,23	0,09	0,07	HerdInstinct
											1	-0.23	0,08	0,48	0,24	0,46	OverconfidenceBias
												1	-0,12	-0,34	-0,12	-0,11	Anchoringbias
													1	0,07	0,14	0,11	Experience
														1	0,42	0,40	Risk1
															1	0,26	Risk2
																1	Strategy

Source: compiled by the author.
Notes: Correlation coefficients, using the observations 1 – 185.

Appendix 7. Factors affecting returns on investment

Variable	Model 1	Model 7
Const	0,992 (0,720)	1,223 (1,029)
Gender	0,263 (0,224)	0,316 (0,217)
Age	0,022 (0,013)	0.018 (0.013)
Education	-0,211 (0,260)	-0,357 (0,263)
Income	$5{,}38 \cdot 10^{-5}$ $(9{,}69 \cdot 10^{-5})$	$6{,}99 \cdot 10^{-5}$ $(9{,}18 \cdot 10^{-5})$
Finance	0,459 * (0,251)	0,146 (0,248)
|DRisk1_2	0,921 ** (0,394)	0,491 (0,391)
DRisk1_3	1,131 *** (0,412)	0,600 (0,417)
DRisk1_4	1,374 *** (0,473)	0,464 (0,498)
Risk2	-0,093 (0,062)	-0,124 ** (0,059)
DStrategy_2	0,525 ** (0,259)	0,375 (0,246)
DStrategy_3	0,704 **	0,629 **
	(0,301)	(0,286)
DStrategy_4	1,674 *** (0,349)	1,032 *** (0,361)
DispositionEffect		-0,121 (0,077)
Representativeness - Bias		0,042 (0,077)
HerdInstinct		-0,022 (0,063)
Overconfidence		0,332 *** (0,069)
AnchoringBias		-0,021 (0,076)
R-squared	0,227	0,336
Adjusted R-squared	0,173	0,269
P-value(F)	$8{,}65 \cdot 10^{-6}$	$1{,}24 \cdot 10^{-8}$

Source: compiled by the author.

Notes: dependent variable rate of return, * – significance level 0.1; ** – significance level 0.05; *** – significance level 0.01.

Appendix 8. Factors affecting returns on investment

Variable	Model 2	Model 3	Model 4	Model 5	Model 6
const	2,181 ** (0,969)	0,878 (0,882)	0,996 (0,756)	0,148 (0,697)	1,571 * (0,899)
Gender	0,319 (0,225)	0,257 (0,226)	0,263 (0,229)	0,256 (0,210)	0,283 (0,225)
Age	0,021 (0,013)	0,022 (0,013)	0,022 (0,013)	0,020 (0,013)	0,022 * (0,013)
Education	-0,278 (0,261)	-0,197 (0,267)	-0,210 (0,268)	-0,339 (0,245)	-0,258 (0,263)
Income	$6{,}19 \cdot 10^{-5}$ $(9{,}64 \cdot 10^{-5})$	$5{,}45 \cdot 10^{-5}$ $(9{,}73 \cdot 10^{-5})$	$5{,}39 \cdot 10^{-5}$ $(9{,}73 \cdot 10^{-5})$	$5{,}71 \cdot 10^{-5}$ $(9{,}10 \cdot 10^{-5})$	$6{,}38 \cdot 10^{-5}$ $(9{,}73 \cdot 10^{-5})$
Finance	0,466 * (0,249)	0,462 * (0,252)	0,460 * (0,252)	0,116 (0,245)	0,477 * (0,251)
DRisk1_2	0,811 ** (0,396)	0,921 ** (0,396)	0,922 ** (0,400)	0,592 ** (0,376)	0,820 ** (0,405)
DRisk1_3	1,010 ** (0,414)	1,138 ** (0,414)	1,132 *** (0,419)	0,697 ** (0,396)	1,004 ** (0,428)
DRisk1_4	1,167 ** (0,484)	1,382 ** (0,476)	1,375 *** (0,482)	0,639 ** (0,468)	1,201 ** (0,500)
Risk2	-0,104 (0,062)	-0,093 (0,062)	-0,093 (0,062)	-0,115 ** (0,058)	-0,092 (0,062)
DStrategy_2	0,513 ** (0,258)	0,522 ** (0,260)	0,525 ** (0,260)	0,394 ** (0,245)	0,507 * (0,260)
DStrategy_3	0,752 ** (0,300)	0,702 ** (0,302)	0,704 ** (0,302)	0,578 (0,283)	0,732 ** (0,302)
DStrategy_4	1,569 *** (0,352)	1,692 *** (0,359)	1,674 *** (0,350)	1,075 *** (0,349)	1,646 *** (0,350)
DispositionEffect	-0,131 * (0,072)				
Representativeness Bias		0,017 (0,075)			
HerdInstinct			-0,001 (0,065)		
Overconfidence				0,340 *** (0,069)	
AnchoringBias					-0,078 (0,073)
R-squared	0,241	0,227	0,227	0,323	0,232
Adjusted R-squared	0,184	0,168	0,168	0,272	0,173
P-value(F)	$5{,}01 \cdot 10^{-6}$	$1{,}82 \cdot 10^{-5}$	$1{,}86 \cdot 10^{-5}$	$1{,}35 \cdot 10^{-5}$	$1{,}18 \cdot 10^{-5}$

Source: compiled by the author.

Notes: dependent variable rate of return, * – significance level 0.1; ** – significance level 0.05; *** – significance level 0.01.

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