

What do you expect?

Individual Investors' Subjective Expectations, Information Usage, and Social Interactions in Financial Decision-Making

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To my relief.

Abstract

This thesis consists of an introductory part and four self-contained papers related to individual investors' subjective expectations and their financial behavior.

Paper [I] analyzes multiple measures of individual investors' expectations of risk and return regarding an index fund and two stocks using survey data on a random sample of individual investors in Sweden. The results indicate that, even though expectations from different measures are correlated, the magnitude of especially the risk expectations varies considerably between measures. The variations in the expectations mainly relate to differences in the responses to the questions underlying the different measures, rather than to the methods used to obtain them. Evaluation of the measures using three different comparisons indicates that the expectation measure proposed by Dominitz and Manski (2011) is the only measure for which it is possible to distinguish between individuals' expectations using all of the comparisons considered in the paper.

Paper [II] addresses the relationship between sophistication and the expectations of individual investors with respect to risk and return. The findings show that sophisticated investors have lower (higher) risk (return) expectations that are closer to objective measures than less sophisticated investors. These results are important, since they enhance the understanding of the underlying mechanisms through which sophistication could influence individuals' financial decisions.

Paper [III] provides new evidence for the sources of information individual investors' use when making financial decisions and the relationship between how frequently investors' use different sources of financial information and their expectations of the risk and return in a stock market index, their confidence in these expectations, and their portfolio risk and return. The findings indicate that individual investors use different sources of filtered financial information (e.g., information packaged by a professional intermediary) more frequently than unfiltered financial information (e.g., information from annual reports and financial statements). However, an increase in the frequency with which investors use filtered financial information is positively related to their confidence in their stock-market expectations and the risk in their stock portfolios. For investors who instead use unfiltered financial information more frequently than filtered financial information, the results indicate that they have more accurate stock-market expectations, lower portfolio risk, and higher portfolio return.

Paper [IV] links individual investors' financial risk-taking to the behavior of peers within their community. By using detailed data at the individual level, it is found that the risk-taking among peers affects individuals' choice of portfolio risk. The results hold for the full sample of individuals concerning their choice of the overall proportion of risky assets and stock market participants' choice of total and systematic stock-portfolio risk. Overall, the results stress that interaction with peers is an important channel through which individual risk-taking is affected.

Keywords: Behavioral finance, Beliefs, Confidence, Expectations, Financial information, Financial risk-taking, Household finance, Individual investors, Panel data, Portfolio choice, Portfolio return, Return, Risk, Social interaction, Sophistication, Stock market, Subjective probability, Survey research

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Oscar Stålnacke
Umeå, May 4th 2017

Appended Papers

Paper I

Stålnacke, O., Olsson, R., and Hellström, J., 2017. Evaluating Measures of Individual Investors' Expectations of Risk and Return.

Paper II

Stålnacke, O., 2017. Individual Investors' Sophistication and Expectations of Risk and Return.

Paper III

Stålnacke, O., 2017. Individual Investors' Information Use, Subjective Expectations, and Portfolio Risk and Return.

Paper IV

Hellström, J., Stålnacke, O., and Olsson, R., 2017. Individuals' Financial Risk-Taking and Peer Influence.

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1. Introduction

Blessed is he who expects nothing, for he shall never be disappointed.

- Alexander Pope

1.1 Background

In recent decades, there has been a growing interest within academia in the field commonly known as consumer or household finance, which can be described as the study of how consumers/individual investors or households attain their financial objectives (Campbell, 2006). One reason for this is the observed difference between how finance models assume that individuals act and what empirically has been observed (Merkle and Weber, 2014).¹ These models are, however, largely normative and thus describe how investors should behave rather than how they do behave (Campbell, 2006). Consequently, studies of the actual behavior of individuals has found that they systematically deviate from what finance models assume when making financial decisions (Kuhnen and Knutson, 2005); for example, they tend to take great idiosyncratic risks (Calvet et al., 2007) and gamble in the stock market (Kumar, 2009).

One further reason to study individual investors is that the decisions that they make are important to both the national and international economy (Weber et al., 2013). This becomes apparent when the total size of their investments is considered. In Sweden, 12.3 percent of the total stock wealth was directly owned by households in June of 2016, in which the market value of the stocks owned by households reached 706 billion SEK (approximately 79 billion USD) by the end of June 2016 (Statistics Sweden, 2016). Given that a large part of the population also owns stocks indirectly, either through funds and/or the premium pension system (PPS), the actual proportion of stock owners is significantly higher and has been relatively stable for the last decade at approximately 80 percent of the population (Lundstedt, 2008).² A majority of Swedish households are thus to some extent invested in the financial markets. Since the financial decisions that individuals make have long-lasting effects on their future wealth, it is necessary that they have the ability to make sound investment decisions (Barber and Odean, 2005).

The financial decisions individuals make are also likely to influence how wealth is distributed within an economy. One reason for this is the long-run tendency for the rate of

¹ One example of such an assumption is that standard models of portfolio choice assume that investors are fully informed and able to make rational asset allocations to maximize lifetime utility (Brown et al., 2008).

² The PPS, for example, included 6.7 million individuals in 2013. The total market value of their investments during the same year was 602 billion SEK (Pensionsmyndigheten, 2013).

return on capital to exceed the growth rate of the economy (Piketty, 2014). In the Swedish context, these effects are likely to have become larger in recent years as a consequence of the increased responsibility that individuals now have for their investments, e.g., through the PPS.³ Since many individuals are not willing or able to take this increased responsibility (Dahlquist and Martinez, 2015), and since those who do are mainly the same individuals who already participate in the stock market (Engström and Westerberg, 2003), it is possible that the wealth differences could increase between those that take responsibility in the PPS and those that do not. Related to this reasoning, both Campbell (2016) and Lusardi et al. (2017) emphasize that if, for example, poorer individuals invest inefficiently, their wealth will increase at a slower rate than the wealth of richer individuals even if they have the same savings rate. This makes it important not only to consider individuals' decisions to participate in the stock market but also their asset-allocation decision. Furthermore, the wealth differences are also likely to have become larger due to the rapid growth of the Internet, which, according to Glaser and Klos (2013), increases the probability that individuals—especially financially literate individuals—participate in the stock market. Since these individuals are already more likely to participate in the stock market than less financially literate individuals, it is possible that the growth of the Internet reinforces the wealth differences in the economy. Finally, since the number of financial innovations and investment possibilities that individuals can choose between has also increased over the last decades (Ricciardi, 2004; Campbell et al., 2011), financial decisions have become more complex and thus even more important.

It is therefore necessary that individuals are able to make sound investment decisions. One of the most well-documented empirical finding in finance is, however, that individuals tend to differ in investment behavior, such as in the decision to invest in the stock market and in their asset allocation decisions⁴ (Barnea et al., 2010). This observation makes it necessary to understand the reasons for the differences in these decisions. Moreover, Guiso et al. (2002) argue that, even though there has been a considerable amount of research on households saving behavior, less is known about their portfolio decisions and both Campbell (2006) and Tufano (2009) emphasize that much is still unknown regarding how individuals or households make their financial decisions. Furthermore, existing empirical studies of individuals' financial decisions have traditionally focused on modeling the outcome (i.e., the decision to participate in the equity market or the asset allocation decision) rather than the decision process. As a consequence, less is known about how

³ This is, however, not unique for Sweden. According to Barberis and Thaler (2005), the increased financial responsibility among individuals is part of a worldwide trend.

⁴ These decisions involve many underlying choices. See Table A.1 in the Appendix for an overview of the different components in households' financial portfolios.

different factors are incorporated into individuals' financial decisions (Merkle, 2011).⁵ One such factor is expectations⁶ (Merkle, 2011). Since one of the basic principles of economics in general is that expectations influence behavior (Gennaioli et al., 2016), it is important to increase the understanding of how individuals' expectations are formed and of the factors that are associated with their expectations.

1.2 Individuals' expectations

Expectations have a long history in financial and economic research. Keynes (1936) brought expectations into focus and emphasized the central role of expectations in order to understand outcomes such as investments and employment. However, despite widespread agreement that expectations play a fundamental role in explaining behavior, direct measurement of expectations is a relatively recent endeavor (Bover, 2015). Researchers have traditionally inferred individuals' decision processes by using the revealed preference analysis introduced by Samuelson (1938, 1948), according to which the decision processes can be inferred from data on observed choices and the inferences can be used to predict behavior in other settings (Manski, 2004). However, such analysis requires some strong assumptions. For example, it requires that individuals have expectations that are rational and homogenous (Bover, 2015). Although findings by Benítez-Silva et al. (2008) indicate that such assumptions cannot be rejected in situations in which individuals, for example, have substantial private information (e.g., education attainment and mortality risk) expectations for situations in which there is public information but less individual information (e.g., inflation, house prices, and stock returns) tend to be systematically biased and heterogeneous (Bover, 2015).

Though many of the standard theories assume that investors have homogeneous expectations, several influential papers that have used the assumption—such as Tobin (1958) and Sharpe (1964)—describe it as unrealistic. Furthermore, McInish and Srivastava (1984) argue that, although expectations play an important role in finance, few, if any, believe that investors actually hold homogeneous expectations. The assumption of rational expectation is nonetheless still commonly made, though it has become more difficult to justify (Manski, 2004), partially because an increased amount of empirical research has documented that individuals' expectations instead tend to be heterogeneous. Given the vast

⁵ Merkle (2011) provides two reasons for this. First, in theoretical (normative) modeling, on which economics and finance are traditionally based, the decision outcomes tend to be the objects rather than beliefs and preferences, which are treated either as given or are assumed to be inferred from the models. Second, and perhaps more importantly, it is challenging to obtain data on both input variables of financial decisions (i.e., beliefs, preferences, attitudes) and output variables (i.e., transactions, portfolio choices, financial risk-taking).

⁶ Expectations throughout this thesis are defined in accordance with Feather (1982) as subjective beliefs about future events.

amount of research that has documented that individuals unconsciously use different heuristics to make their decision-making process easier (e.g., Tversky and Kahneman, 1974; Kahneman and Tversky, 1984), the finding that individuals tend to have heterogeneous expectations is, perhaps, not that surprising. If individuals, for example, rely on heuristics to make their decisions, one way the heuristics could influence these decisions would be through their expectations, which might result in differences in individuals' expectations.⁷ Since individuals' expectations are commonly found to be heterogeneous, Manski (2004) argues that the analysis of decision-making cannot be based only on choice data. Instead, Manski suggests that to get a better understanding of decision-making, choice data should be combined with self-reports of individuals' expectations, thereby making it necessary to measure individuals' financial expectations.

1.2.1. Measuring expectations

Even though there is a long history of regarding individuals expectations as important to understand their choices (Manski, 2004), empirical studies tend to differ in how the expectations are obtained. Measures of individuals' expectations have a long history within attitudinal research in other social sciences in which verbal questions⁸ are commonly used. However, expectation measures that rely on such questions can be problematic. The interpretation of phrases such as "very certain" or "not at all certain" is likely to differ across individuals, which makes it difficult to compare answers interpersonally or to test whether an individual provides answers that are consistent across questions (Manski, 2004). Findings from empirical studies also support this argument and it is commonly found that interpretations of verbal expectation questions varies between individuals (e.g., Lichtenstein and Newman, 1967; Beyth-Marom, 1982; Budescu et al., 1988). An additional problem with verbal questions concerning individual's expectations is that they do not capture the uncertainty individuals experience when they answer the questions (Manski, 2004).

To overcome the problems associated with verbal expectation questions Manski (2004) propose the use of probabilistic questions. Measures that rely on such questions have a long history in economics originating from Juster (1966), and they are now used in many large-scale surveys to measure expectations (e.g., Guiso et al., 1992; Dominitz and Manski, 1997; Das and Donkers, 1999; Guiso et al., 2002; Dominitz and Manski, 2011; Gouret and

⁷ There are also other reasons—such as differences in the information individuals have access to—that are likely to result in differences in their expectations. Furthermore, Wärneryd (2001) argue that the formation of expectations may explain more of investors' behaviors than heuristics if they are treated outside of the expectation formation.

⁸ Verbal questions are questions in which the response alternatives are predetermined and are expressed in words using either a Likert scale or a yes/no/uncertain alternative (Manski, 2004).

Hollard, 2011; Hurd et al., 2011). Probabilistic questions provide an absolute numerical scale for responses, which facilitates interpersonal comparisons of respondents and tests of internal consistency (Manski, 2004). Expectation measures that rely on these questions also capture the uncertainty individuals might experience when stating their expectations, for which the standard deviation of the answers often is obtained. Even though probabilistic questions tend to correct the problems that are associated with verbal questions, there has been a discussion regarding the way in which individual's beliefs are represented internally and whether they are willing and able to express their beliefs as numerical probabilities (Manski, 2004). According to Zimmer (1983; 1984), humans use verbal rather than numerical modes when they think and expectations are therefore best measured by verbal rather than by numerical questions. There are also results which indicate that individuals prefer to communicate beliefs verbally rather than numerically (e.g., Erev and Cohen, 1990; Wallsten et al., 1993; Renooij and Witteman, 1999). However, due to the advantages associated with probabilistic questions, the relevant question, according to Manski (2004), is not what mode (i.e., verbal or numeric) individuals prefer, but rather which modes they are willing and able to use. Since there is not much evidence to indicate that individuals are unable to express expectations numerically, Manski argues that this method is to be preferred in both theory and practice.

The probabilistic questions, and the methods used to obtain expectations, tend, however, to differ across studies. This makes it difficult to know whether the differences observed regarding expectations across studies (e.g., Dominitz and Manski, 1997; Glaser and Weber, 2005; Dominitz and Manski, 2011; Gouret and Hollard, 2011; Weber et al., 2013) are due to the measures used or to differences in, for example, the participants and the periods of concern for different studies. Moreover, these differences tend to be particularly large when comparing risk expectations across both different studies and different measures, which makes it necessary to understand the reasons for such differences.

Although there is, to the best of my knowledge, no study comparing different expectation measures that uses probabilistic questions, results from studies on overconfidence that compare probabilistic and verbal measures similar to those used for expectations indicate that differences exist between the two (e.g., Juslin et al., 1999; Winman et al., 2004; Juslin et al., 2007). Juslin et al. (1999) conclude that the observed difference is due to format dependencies and consequently individuals can be either under- or overconfident in their judgments of the same tasks depending on the response format of the question. Similarly, comparing different elicitation methods for individuals willingness to take risk Menkhoff and Sakha (2014) find that although many elicitation methods are positively correlated, the magnitude of risk individuals are willing to take differs across

methods. These findings are also consistent with studies concerning choices, according to which the way information is provided can have a strong influence on the choices individuals make (e.g., Russo, 1977; Kahneman and Tversky, 1984; Benartzi and Thaler, 1999).

The results from the studies by Juslin et al. (1999, 2007), Winnman et al. (2004), and Menkhoff and Sakha (2014) thus indicate that the answers individuals provide are likely to differ across questions. Since the results from studies on expectations indicate that they are of importance for individuals financial decisions (e.g., Weber et al., 2013; Merkle and Weber, 2014; Hoffmann et al., 2015), it is necessary to determine whether individuals also are format dependent when they state their financial expectations and how their expectations should be measured.

1.2.2. Potential factors related to differences in expectations

Although several studies have observed great heterogeneity in the expectations of individual (e.g., Kézdi and Willis, 2008; Dominitz and Manski, 2011; Gouret and Hollard, 2011; Hurd et al., 2011), the factors related to this heterogeneity are not as well known. Kézdi and Willis (2008) is one of the few studies examining the underlying factors associated with differences in expectations. The authors find that singles (especially single women), African Americans, and less-educated Americans tend to have lower return expectations, which partially explains why they are less likely to participate in the stock market. Hurd et al. (2011) expand these findings by studying individuals' expectations of risk and return. Contrary to the findings of Kézdi and Willis (2008), Hurd et al. (2011) find that single households do not differ from other households in their expectations of risk and return and that gender and education only are weakly associated with expectations. Instead, Hurd et al. find that return expectations are positively related to a household's level of income, trust, and if they have traded assets in the last three months. They find that return expectations are negatively related to risk aversion and a low estimate of the historic return for the stock market. Their results further indicate that risk expectations are negatively related to a household's age, trust, optimism, and if they follow the stock market.

Though previous studies (e.g., Kézdi and Willis, 2008; Hurd et al., 2011) provide some information regarding the factors that are associated with differences in individuals expectations of risk and return, much is still unknown. There are, however, several factors that previous studies have related to differences in individuals' financial decisions, and it is therefore possible that they are also related to individuals' expectations of risk and return.

Sophistication

One such factor is an individual's ability to avoid making investment mistakes⁹, which is commonly defined as the individual's level of sophistication (Calvet et al., 2009b). The intuition here is that those who are more sophisticated participate in the stock market to a greater extent and hold more well-diversified portfolios than less sophisticated individuals or households.

Sophistication tends, however, to be studied using relatively broadly measures and previous studies have used a wide range of characteristics to proxy for sophistication. Examples of such proxies are age and gender (Feng and Seasholes, 2005), educational attainment (Calvet et al., 2007, 2009b), and financial wealth and disposable income (Vissing-Jørgensen, 2004; Dhar and Zhu, 2006; Calvet et al., 2007, 2009b). Mankiw and Zeldes (1991), Haliassos and Bertaut (1995), Vissing-Jørgensen (2004), Kimball and Shumway (2006), Christiansen et al. (2008), and Grinblatt et al. (2011) relate sophistication to willingness to participate in the stock market, while Calvet et al. (2007) and Goetzmann and Kumar (2008) relate sophistication to individuals' portfolio composition. Seru et al. (2010), Grinblatt et al. (2012), and Bodnaruk and Simonov (2015) also relate sophistication to the portfolio performance of individual investors. Taken together, the findings of these studies indicate that more sophisticated individuals and households come closer to the investment strategies recommended by standard financial theory.

Though previous studies find sophistication to be of importance to the financial decisions individual investors make, less is known about how sophistication is related to these decisions. Studies on expectations by Hurd et al. (2011), Kempf et al. (2013), and Hoffmann and Post (2015) relate differences in expectations to an individual's income, age, and financial literacy, which also have been used as proxies for sophistication (e.g., Feng and Seasholes, 2005; Calvet et al., 2007, 2009; van Rooij et al., 2011). Thus, one way that sophistication could be related to individuals' financial decisions is through their expectations of risk and return.¹⁰ However, to test for the relationship between sophistication and individuals expectations it is necessary to have a larger number of sophistication proxies than previous studies have used to ensure that sophistication is correctly measured.

Furthermore, utilizing Finnish data about financial advisers, Kaustia et al. (2015) use a factor analysis to measure the shared variation of different sophistication proxies which they find to be positively related to the advisers' long-term (20-years) stock-market return

⁹ Investment mistakes are decisions that are difficult to reconcile with standard financial theory. They include non-participation in the stock market, portfolio underdiversification, and failure to exercise options to refinance mortgages (Calvet et al., 2009b). For a review of the literature on investment mistakes made by individuals and households, see Guiso and Sodini (2009) and Campbell (2016).

¹⁰ Related to these studies are findings from Kuhn and Miu (2017), who show that individuals with lower socioeconomic status tend to form more pessimistic beliefs about the distribution of stock returns and that they are less prone to invest in stocks when stocks are likely to have good outcomes.

expectations. Because financial advisors differ in a number of aspects from the average individual who participates in the stock market, such as in their knowledge and information usage, it is necessary to test whether similar results are also observed in a more general sample of individual investors. Moreover, since Kaustia et al. (2015) focus on financial advisors' long-term return expectations, less is known regarding how sophistication relates to their short-term return expectations and their risk expectations, which makes it necessary to study the potential relationship between sophistication and expectations further.

Information usage

Another factor that often is assumed to influence individuals' financial decisions is their information usage (e.g., Conlisk, 1996; Hirshleifer, 2001). According to standard models in finance, individuals are often assumed, (1) to use all available information to maximize their utility, (2) to have an unlimited capacity to process this information, and (3) to update their beliefs based on newly acquired information (García, 2013). These models tend to be normative and are therefore developed to describe how individuals should behave rather than how they actually behave (Campbell, 2006). Consequently, empirical studies find that individuals do not behave as the standard models suggest, for they often fail to update their beliefs based on new information, ignore relevant information, and use irrelevant information (Conlisk, 1996).

Though the information individuals use is thought to be important to their financial decisions, the understanding of how they are related is still limited (Elliott et al., 2008). To the best of my knowledge, only two studies have investigated the sources of information individual investors use and how it relates to financial decisions, these are Deaves et al. (2006) and Elliott et al. (2008).¹¹ Both of these studies find that individuals tend to use filtered financial information (e.g., information packaged by a professional intermediary) more frequently than unfiltered sources of financial information (e.g., information from annual reports and financial statements). Furthermore, Elliott et al. (2008) relate the use of information to individuals' self-assessed portfolio returns, in which higher usage of unfiltered financial information relative to filtered financial information (i.e., unfiltered financial information/filtered financial information) is negatively associated with their portfolio returns.

Although Elliott et al. (2008) find that information usage is related to investors' financial decisions less is known regarding how it is related. According to the rational

¹¹ Related to these two studies is van Rooij et al. (2011), that provides some descriptive statistics for how households' information usage varies with level of financial literacy. According to van Rooij et al., households tend to regard "parents, friends, or acquaintances" as the most important sources of information followed by information from "professional financial advisors."

expectation hypothesis, expectations are rationally formed on the basis of information (Muth, 1961), thereby indicating that one way information might be related to financial decisions is through expectations. The importance of information in the formation of expectations and decision making also have a long history in psychology. Katona (1951) argues that past experience and new information is integrated into the formation of expectations and that changes in expectations and genuine decision making occur only when there is radically new information. Furthermore, previous studies in related fields, such as expectations of inflation, indicate that there is a relationship between information and inflation expectations and that individuals who benefit most from collecting information also have the most accurate inflation expectations (e.g., Batchelor and Jonung, 1980). It is thus possible that one mechanism through which information usage is associated with financial decisions, found by Elliott et al. (2008), is through investors' financial expectations, making it necessary to further study the potential relationship between expectations and information usage.

Social interactions

A final factor that has gained a lot of attention in empirical studies is whether individuals' financial decisions are influenced by their social interactions with others. In this literature, social interactions tend to be seen as a central channel through which information that is important to individuals' financial decisions can be communicated. Several studies—including Duflo and Saez (2002), Hong et al. (2004), Brown et al. (2008), Kaustia and Knüpfer (2012), and Hvide and Östberg (2015)—have documented that social interactions are important to individuals' decisions to participate in the stock market. In this literature, social interaction is often defined as a peer, neighbor, or community effect. The main finding is that social interactions, on average, are positively related to individuals' willingness to own stocks. This result can mainly be motivated in three ways: Social interactions could (1) lower fixed non-monetary participation costs (e.g., Vissing-Jørgensen, 1999) through social learning, (2) create a desire to be included in the social context (e.g., Hong et al., 2004), and/or (3) be related to a “keeping up with the Joneses” effect in which individuals strive not to fall behind the consumption level of their social group (e.g., Abel, 1990; Galí, 1994; Bakshi and Chen, 1996; DeMarzo et al., 2004).

Although previous studies find that social interactions are important to individuals' decisions to participate in the stock market, less is known about how it is related to their asset-allocation decisions and the portfolio risk they take. These questions are important to consider to understand what individuals actually do with their money (Buccioli and Miniaci,

2014).¹² Moreover, social interactions are also likely to be important to the expectations individuals form, as suggested by various studies on inflation expectations (e.g., Bowden and McDonald, 2006; Carroll, 2006; Easaw and Golinelli, 2009). Findings from Carroll (2006), for example, indicate that inflation expectations are socially transmitted via conversation with neighbors. It is, therefore, possible that related expectations, such as stock-market expectations, could also be influenced by social interactions. Furthermore, Carroll (2003) finds that there is a diffusion of news from professional forecasters to the rest of the public that influences the aggregated expectations of inflation and unemployment, which could be an alternative route of social interaction.

Since findings from expectations of inflation indicate that expectations are influenced by social interactions, it becomes important to determine whether social interactions are related to financial decisions by influencing expectations. However, before such a potential relationship can be studied, it is first necessary to understand which financial decisions are influenced by social interactions. Because existing studies in finance have focused mainly on the role of social interactions in individuals' decisions to participate in financial markets, there is a need for further studies that consider the other financial decisions individuals make and on how interactions with others are related to these decisions.

1.3 Research purpose

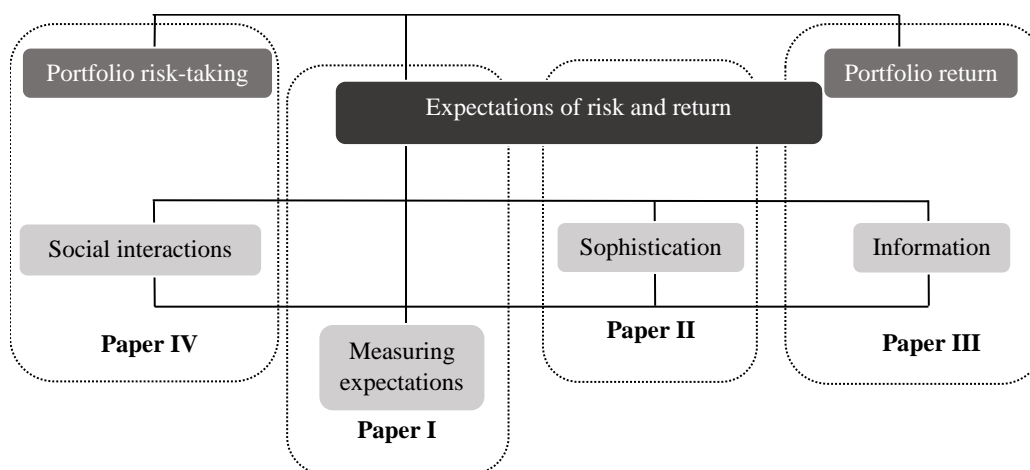
The overall purpose of this thesis is to enhance the understanding of the financial decisions individual investors make by especially considering the role of expectations in their decisions. The thesis is thus a contribution to the research field of household finance, which concerns how individuals or households attain their financial objectives (Campbell, 2006). Even though this field has grown in recent years—driven mainly by access to better data—knowledge about how individuals make financial decisions is still relatively limited (Campbell, 2006). It is, therefore, necessary with further studies in the area. This thesis considers different measures of risk and return expectations and the potential relationship between expectations, sophistication, and information usage. I also seek to increase understanding of the role of social interactions in the financial decisions of individual investors by focusing on whether social interactions are associated with the financial risks individuals take in their portfolios.

Figure 1.1 illustrates the areas studied within the four papers in this thesis and how they relate to the overall research area. The light gray boxes represent the different factors that

¹² One possible reason for the limited knowledge of how social interactions are associated with individuals' financial risk-taking is a lack of detailed data to facilitate the analysis of individuals' portfolios. Moreover, while the question of social interaction is conceptually straightforward, it is not easily measured, since it is associated with identification problems (Manski, 1995, 2000).

could potentially influence individuals' expectations of risk and return and are therefore of interest in this thesis. The middle gray boxes represent the financial decision (i.e., portfolio risk-taking) and the output from the decision (i.e., the portfolio return) that is considered in the papers. The dotted lines illustrate the areas considered in the respective papers. Although Figure 1.1 is a simplification of how financial decisions are made and the role of expectations in these decisions, it is mainly intended to illustrate how the different papers in the thesis fit together.

Figure 1.1: Individual investors' expectations and the papers in the thesis



Paper I considers whether individual investors differ in their expectations of risk and return depending on the expectation measure used and evaluates the measures by using different comparisons. Paper II tests whether a number of variables that previous research has used as proxies of sophistication are related to individuals' expectations of risk and return. Paper III studies the sources of information individual investors' use and investigates whether the frequency investors use different sources of financial information is related to their expectations of risk and return, their confidence in these expectations, and their portfolio risk and return. Finally, Paper IV builds on the work of Brown et al. (2008) to empirically identify social interactions and to test whether they are related to the financial risk-taking of individual investors.

The organization of the thesis is as follows. Chapter 2 constitutes a review of literature on individual investors' financial decisions, with a focus on the role of expectations in these decisions. Chapter 3 presents the data and the methods used in the papers. Chapter 4 summarizes the four papers. Finally, Chapter 5 presents the contributions of the thesis and discusses the limitations of the appended papers.

2. Literature Review and Theoretical Framework

This chapter reviews literature regarding how individuals make, or should make, financial decisions and the role of expectations in these decisions. Since research in finance can be either normative (that is, describe what economic agents should do) or positive¹³, (that is, describe what they actually do) (Campbell, 2006),¹⁴ I first present some of the normative theories for individuals' financial decision-making and the assumptions of these theories regarding expectations. Since the normative theories tend to be the starting point for descriptive studies, I next present some of the main critiques and concerns that are often raised about normative theories and introduce some descriptive models of financial decision-making that involves expectations. I then review the rational expectation hypothesis and some descriptive models of how expectations are formed. Finally, since previous research tends to pay more attention to the question of how expectations should be measured rather than on the factors that are related to individuals' expectations, less is known regarding the factors associated with individuals' expectations. There is, however, a growing literature on factors associated with financial decisions. Since many of these factors can also be related to expectations, I present a literature review of the findings from these studies.

Though many of the theories and studies that are discussed in this section are not explicitly mentioned in the respective papers included in this thesis, they have been important when developing and motivating the research questions considered in these papers.

2.1 Normative models for decisions under risk

2.1.1. Expected utility theory

One of the most commonly used theories within economics and decision theory is the expected utility theory developed by Bernoulli (1738/1954). The expected utility theory builds on expected value theory and concerns individuals' preferences for choices with uncertain outcomes. In contrast to expected value theory, which assumes that individuals always choose an alternative with the highest expected value, expected utility theory assumes that individuals place subjective values, or "utilities," on monetary outcomes and

¹³ The models that are developed tend, however, to be classified as either normative or descriptive. Thaler (2016) describes normative models as those that characterize the optimal solution to specific problems, and descriptive models as those that describe how individuals actually behave. Furthermore, Thaler (2016) argues that both of these types of models are important.

¹⁴ The distinction between normative and positive research has a long history. It has previously been used by Friedman (1953) and Keynes (1955), among others.

that the value of a gamble, therefore, is the expectation of these utilities (Starmer, 2000), which individuals seek to maximize. For a gamble that gives p_i chance at outcome x_i , which can be represented as $(p_1, x_1; \dots; p_n, x_n)$, the expected utility can be expressed as follows

$$EU(X) = \sum p_i u(x_i), \quad (1)$$

where $u(x_i)$ represent the utility of receiving x_i (Wu et al., 2004). Bernoulli originally developed the expected utility theory to resolve the St. Petersburg paradox, in which individuals only tend to be willing to pay a small price to play a game with a highly skewed payoff (Weber and Johnson, 2008). One of the assumptions underlying the expected utility theory is that the relationship between actual wealth and the utility of wealth is not linear but concave, which postulates that wealth is diminishing in value such that, for example, \$1,000 is worth more at lower initial levels of wealth than at higher levels (Weber and Johnson, 2008). The utility function can be used to further explain an individual's risk attitude according to which risk-averse behaviors, such as the purchase of insurance, require the utility function to be concave, while risk-seeking behaviors, such as purchase of lottery tickets, requires the utility function to be convex (Wu et al., 2004). Interest in the theory took off in the 1940s and 1950s through the work of von Neumann and Morgenstern (1947), who show that it can be derived from a set of axioms¹⁵ on preference (Wu et al., 2004).¹⁶ These axioms are of importance for finance, in which it can be used to understand trading behavior, since the expected utility function represents individuals preferences if their preferences satisfy the axioms (Barberis and Thaler, 2005).

For the expected utility theory, outcomes are assumed to be objective and known. Individuals are thus assumed to make their decisions based on the objective probability of an outcome rather than on their expectation of the outcome. Since this is not the case in most natural settings for which the probabilities of outcomes rarely are known (Camerer, 1995), Savage (1954) proposes a subjective expected utility (inspired by Ramsey, 1931), which is a generalization of expected utility to situations in which probabilities are not given (Wu et al., 2004). Even though subjective expected utility generalizes expected utility theory individuals' expectations of the utility for different outcomes are essential to both theories,

¹⁵ One important implication of these axioms, related to individuals' financial decisions, is that individuals will select the portfolio that maximizes the expected utility of their final consumption (Gollier, 2002). Examples of the axioms are, for example, transitivity (if A is preferred to B and B is preferred to C, then A is preferred to C), and substitution (if A is preferred to B, then an even chance to get A or C is preferred to an even chance to get B or C).

¹⁶ There are many good papers that describe different variants of the expected utility model and how it has been developed since von Neumann and Morgenstern (1947) proposed their axioms. These developments will, however, not be covered in this thesis, as expected utility theory mainly serves as a starting point for how individuals make risky decisions. For the interested reader, examples of papers that provide such reviews include Schoemaker (1982), Machina (1987), and Camerer (1995).

in which the expectations, according to the axioms provided by von Neumann and Morgenstern (1947), are those that correspond with rational choice.

2.1.2. Modern portfolio theory

In parallel with the developments of the expected utility theory, Markowitz (1952) proposes what is known as modern portfolio theory, which concerns how investors should choose their portfolios. The theory assumes individuals to be risk averse. Consequently, if faced with two portfolios with the same expected return, individuals are assumed to prefer the one with less risk. According to the theory, the risk investors take is assumed to depend on their risk attitudes and their estimates of the expected return and volatility (variance) of the investment. The risk attitude (i.e., the trade-off between the expected return and the risk)¹⁷ is determined by the curvature of the investor's utility function. For an individual i the risk-taking can thus be regarded as follows

$$\text{Risk-Taking}_i = f(\text{Expected Return}_i, \text{Volatility}_i, \text{Risk Attitude}_i). \quad (2)$$

An important contribution made by Markowitz (1952) is the notion of risk to construct portfolios for investors who, “consider expected return a desirable thing *and* variance of return an undesirable thing” (Markowitz, 1952 p. 77). Markowitz thus identifies variance of return as an “undesirable thing” that investors try to minimize, thus making risk and variance synonymous (Bernstein, 1996). Furthermore, although the expected return tends to be calculated as the mean return of a security (see Markowitz, 1959), Markowitz (1959) acknowledges that expectations of return are based on probability beliefs. Consequently, individuals will have different subjective estimates of the expected return based on the probabilities they place on different outcomes and expectations, therefore, become important when they create their portfolios.

2.2 Critique of normative models and of descriptive models that are based on normative grounds

Much of the research that uses mean-variance analysis, which traces its origins to

¹⁷ According to Gollier (2002), the trade-off between risk and expected return is determined by three broad categories. The first category is genetic, since it is possible that differences in risk attitudes are due to either different genes or different human capitals. The second category is related to the objectives that households or individuals have for investing in the financial markets, since the risk attitudes are likely to differ depending, for example, on whether the purpose is to accumulate wealth for retirement, to finance lifetime consumption, or for their own or their children's consumption. The last category consists of factors that are external to the decision maker, such as the distribution of returns, tax incentives, liquidity and short-sale constraints, and access to credit.

Markowitz (1952), is founded on the assumption that an investor's objective is described by the expected utility function (Polkovnichenko, 2010).¹⁸ However, two properties of the standard models are difficult to reconcile with findings from empirical studies. First, according to the standard models, if there are no participation constraints, all individuals should invest a strictly positive amount in stocks (e.g., Merton, 1969, 1971). Furthermore, most rational models of portfolio choice suggest that investors hold diversified portfolios to reduce or eliminate systematic risk (Goetzmann and Kumar, 2008). However, findings from Mankiw and Zeldes (1991), among others, indicate that individuals participate in the stock market far less than theory suggests, and Friend and Blume (1975), Kelly (1995), and Goetzmann and Kumar (2008) find that individuals tend to hold portfolios that are more concentrated than suggested by theory.

There are several reasons why the differences between the models and actual behavior might exist, and researchers have therefore tried to explain the differences in various ways. The underdiversification of investors' portfolios, for example, has been explained in the models with reference to psychological biases such as familiarity or overconfidence¹⁹ and through introducing constraints such as informational costs, in the models.²⁰ Similarly, nonparticipation in the stock market has been explained either through behavioral biases or through fixed costs that are related to participation in the stock market (Polkovnichenko, 2010).²¹ These explanations tend to focus on factors that could be associated with the participation and diversification decisions rather than on how they are associated with the decisions. These findings are, therefore, also related to results from studies on expectations which find that, although expectations tend to differ from those assumed by standard models (Gennaioli et al., 2016), they are positively correlated with financial decisions, such as individuals decisions to participate in the stock market and inflows into mutual funds (e.g., Hurd et al., 2011; Greenwood and Shleifer, 2014). Since the results of these studies partially explain differences in individuals' financial decisions, it is important to consider them to understand these decisions.

Although the standard models have contributed significantly to the understanding of

¹⁸ Although Markowitz does not discuss expected utility in his 1952 paper, he later strove to find a way to reconcile the mean-variance criterion with the maximization of expected utility (i.e., Markowitz, 1959). The expected utility framework has also been used in other influential papers, such as Tobin (1958) and Sharpe (1963).

¹⁹ See, for example, Hilton (2001) for a more thorough review of psychological biases.

²⁰ For a review of models of optimal portfolio composition that incorporate such constraints, see Gollier (2002) and Curcuro et al. (2009).

²¹ These studies find that the one-time cost needs to be approximately 5 percent of the annual household income to explain non-participation (Gomes and Michaelides, 2005; Paiella, 2007). However, though this cost can explain why many poor households do not participate in the stock market, it cannot explain why wealthier households choose not to participate (Polkovnichenko, 2010).

individuals' financial decisions,²² a large number of researchers, in both finance and in related fields, have recognized a need for more studies that focus on describing how individuals actually make these decisions and on developing models that better correspond to individuals' financial decisions. Empirical studies in this area are mainly based on experiments, surveys, and registry data. More recent studies have, however, also considered genetic (e.g., Cesarini et al., 2009; Kuhnen and Chiao, 2009; Cesarini et al., 2010) and neuroscience techniques (e.g., Gonzalez et al., 2005; Kuhnen and Knutson, 2005; Weber et al., 2009; Frydman et al., 2014) to further increase the understanding of how individuals make financial decisions.

One of the main reasons for the developments of these studies is that researchers have questioned the validity of some of the assumptions that underlie the normative models, making it necessary to obtain a better understanding of how individuals actually make financial decisions. Perhaps the most commonly questioned of these assumptions are the assumption that individuals are rational,²³ and a large amount of empirical research consequently departs from this assumption²⁴. However, although this is, perhaps, the assumption that most commonly underlies individuals' behaviors in various disciplines (Shafir and LeBoeuf, 2002), there is a long history of questioning its validity and seeking alternatives to it (Ben-Akiva et al., 1999).²⁵ One reason for this, according to Shafir and LeBoeuf (2002), is that individuals base their decisions on expectations that are often systematically inaccurate and they will consequently fail to maximize their utility in accordance to the standard tenets of the rationality assumption.²⁶

²² Perhaps especially by emphasizing the role of risk aversion in these decisions (Haliassos and Michaelides, 2002).

²³ According to Barberis and Thaler (2005), *rationality* means two things. First, when individuals receive new information they update their beliefs correctly in accordance with Bayes' law. Second, given their beliefs, they make choices that are normatively acceptable, in the sense that they are consistent with Savage's notion of subjective expected utility. Simon (1978) defines *rationality* slightly differently: "The rational man of economics is a maximizer, who will settle for nothing less than the best." The main argument for the rationality assumption is that a combination of market forces (i.e., competition and arbitrage) and evolution should lead to a world in which only the rational individuals survive (Mullainathan and Thaler, 2000). There is also a discussion regarding what is actually meant by rationality. Rubinstein (2001) distinguishes between maximally rational markets, in which all investors are rational, rational markets, in which assets prices are set as if all investors are rational, and minimally rational markets, in which prices are not set as if investors are rational but nonetheless no arbitrage opportunities exist for the rational investor. Rubinstein (2001) argues that even though most models of finance are based on the assumption of maximally rational markets, no researcher in the field takes this assumption seriously and that the financial markets instead are rational or at least minimally rational. For some of the counter arguments of this view see Barberis and Thaler (2005).

²⁴ According to Camerer (1995), many psychological studies on individual decision-making can also be seen as direct attacks on the assumption of rationality.

²⁵ See for example Shafir and LeBoeuf (2002) for a review of some of the work that questions the rationality assumption.

²⁶ One example of such an inaccuracy is the Allais paradox (Allais, 1953), which illustrates that individuals decisions can be inconsistent with expected utility theory.

Since individuals tend to make decisions that systematically deviate from how an idealized agent would behave (Altman, 2010)—partially because of inaccurate expectations, as described by Shafir and LeBoeuf (2002)—several studies have tried to find alternatives to the rationality assumption. Simon (1957) propose bounded rationality as one of the first alternatives. Instead of assuming that individuals are fully rational and make decisions to maximize their expected utility, bounded rationality assumes that the rationality is affected by limitations in information, time and in an individual's cognitive ability (Conlisk, 1996; Hirshleifer, 2001).²⁷ One consequence of such limitations is that individuals do not search for an optimal solution. Instead, they search for solutions that are acceptable given that a better solution would cost more in terms of time and information. According to Conlisk (1996), a further reason why individuals choose an acceptable solution instead of the optimal solution is that the optimal solution, under most conditions, is very hard to find. Although one might expect that the financial domain is least affected by bounded rationality, as investors are able to identify arbitrage opportunities that allow prices to return to their fundamental values²⁸, Mullainathan and Thaler (2000) argue that it is in this domain that bounded rationality is likely to have the largest contribution. This is because, given the large amount of data available, it is possible to test the predictions of the standard financial theories, such as the efficient market hypothesis (EMH)²⁹. Moreover, Starmer (2000) argues that bounded rationality seems to provide the missing link needed to explain an increasing range of economic phenomena. Therefore, one cannot assume that the models that best describe individuals' choices are those based on the principle of rational choice.

One of the implications of bounded rationality is that individuals need mental shortcuts or rules of thumb to render decision-making easier (Conlisk, 1996). These mental shortcuts are often defined as heuristics, and individuals are likely to use them when making decisions under risk and uncertainty because probabilistic assessments are often too demanding (Rabin, 1998). According to Tversky and Kahneman (1974), heuristics thus help to reduce complex tasks that require probabilities to simpler judgmental operations. However, though the heuristics make the decisions easier, they are likely to make decisions deviate from rational alternatives and thus make them biased, which can cause systematic errors (Tversky and Kahneman, 1974).

The results of studies on bounded rationality and heuristics are relevant for studies on

²⁷ Other reasons for deviations from rationality are, according to Wärneryd (2001), feelings, emotions, and deep-seated driving forces over which the individual has little control.

²⁸ Other features of financial markets that should make it difficult to find misbehavior are low transaction costs, high stakes, lots of competition, and (what is necessary for taking advantage of the arbitrage opportunities) the ability to sell short (Thaler, 2016).

²⁹ Although this can, for example, be done by studying twin shares (i.e., two versions of the same stock that trades in different market places), Fama (1991) argues that EMH itself tends not to be easily testable and is therefore often jointly tested with an asset pricing model, such as CAPM or the three-factor model.

expectations, as one way through which the heuristics can be related to individuals' decisions is through the heterogeneity in individuals' expectations. Furthermore, according to Campbell et al. (2011), deviations from rational choice tend to be more severe for financial decisions, mainly because of the difficulty of learning from experience in the financial domain. Since the outcomes of a decision are often delayed in time and subject to large random shocks, it becomes difficult to correctly interpret the outcome of a decision.

According to Campbell (2006), researchers can respond to the findings from empirical studies that observe differences from the normative models in two main ways. The first is to consider nonstandard behavioral models. Although these models still assume that actual and ideal behaviors coincide, they expand the standard models by including findings from empirical studies to better understand the financial decisions that individuals make. The second alternative is to regard the deviation of individuals' actual decisions from the suggestions made by standard theory as evidence that individuals are not able to express their beliefs and preferences optimally. Under such circumstances, it becomes important to separate between the observed choices that individuals or households make and the choices that standard theory suggests. One of the main purposes with the second approach is thus to compare individuals' choices to the recommendations of the normative standard models (Glaser et al., 2004).³⁰ This thesis emphasizes theories and findings from the latter of the two ways suggested by Campbell (2006), which are described more thoroughly in the following section.

2.3 Descriptive models for individuals decisions under risk

2.3.1. Prospect theory

Since the developments of von Neumann and Morgenstern (1947), many experimental researchers have shown that individuals systematically violate the expected utility theory when making decisions (Barberis and Thaler, 2005).³¹ According to Barberis and Thaler, these violations are central to understand many financial phenomena. Accordingly, it is important to consider alternatives to the expected utility theory. To do this, a considerable amount of work has been done on non-expected utility theories, which try to account for the experimental findings to provide better models for individual risk-taking decisions.

³⁰ Identifying these deviations are important since they, potentially, can be reduced by financial education and professional advice (Guiso and Sodini, 2013).

³¹ See, for example, Camerer (1995) or Rabin (1998) for overviews of empirical findings on deviations from expected utility.

Even though researchers have employed many different approaches to this,³² Barberis and Thaler argue that the prospect theory developed by Kahneman and Tversky (1979), might be the most promising for financial applications, since it best captures the experimental results.³³ As discussed by Thaler (2016), prospect theory should, however, be regarded as a complement to the expected utility theory. Thus, expected utility theory is the standard for how risky decisions should be made, while prospect theory describes how individuals actually make these choices.

For prospect theory, Kahneman and Tversky (1979) argue that the outcomes of risky prospects, or gambles, are evaluated by a value function with three essential properties. These properties are, (1) reference dependence, which suggests that values are coded as gains or losses relative to a reference point³⁴; (2) diminishing sensitivity, which suggest that the value function is concave in the domain of gains and convex in the domain of losses; (3) loss aversion, which implies that the value function is steeper in the loss domain than in the gain domain. According to Kahneman and Tversky (1979), the reference point can either be determined by the current level of one's assets or coded relative to the individual's level of expectation (e.g., an objective improvement in wealth can be experienced as a loss when, for example, an employee receives a smaller raise than everyone else at the office). Consequently, individuals' expectations influence how outcomes are evaluated. Since these evaluations also are related to individuals' future decisions, the expectations are likely to play a role in these decisions as well. Kahneman and Tversky also argue that losses are more painful for individuals than corresponding gains. The value function they propose is, therefore, asymmetric and S-shaped. To account for the properties of the prospect theory, this value function is concave above the reference point and convex below the reference point. The function is also steeper below the reference point than it is above it (i.e., loss

³² Some of the different approaches are the weighted-utility theory (Chew and MacCrimmon, 1979; Chew, 1983), regret theory (Bell, 1982; Loomes and Sugden, 1982), the rank-dependent utility theories (Quiggin, 1982; Segal, 1987, 1989; Yaari, 1987, and the prospect theory (Kahneman and Tversky, 1979, Tversky and Kahneman, 1992).

³³ One reason for this is that most of the other non-expected utility models tend to be quasi-normative: i.e., they try to capture some of the experimental evidence by slightly weakening the axioms provided by von Neumann and Morgenstern (1947). In so doing, these models try to be both normative and descriptive, and according to Barberis and Thaler (2005), they end up doing an unsatisfactory job at both. One reason for this, according to Tversky and Kahneman (1986), is that the choices individuals make tend to be impossible to justify based on normative grounds since they violate the axioms laid out by von Neumann and Morgenstern (1947). Prospect theory is therefore not intended to be a normative theory of individuals' risky decisions; it rather tries to capture individuals' attitudes to risky gambles as accurately as possible. Although prospect theory only concerns a subset of the issues raised in the behavioral finance literature, the issues that are raised are of importance when understanding individuals' risky decisions, such as their decision to participate in the financial markets (Altman, 2010).

³⁴ However, as Camerer (1995) points out, this is a relatively old idea, which was first proposed by Markowitz (1952). It also fits with the way a gamble is presented and discussed in everyday life. More generally, it is consistent with the way people perceive attributes such as brightness, loudness, or temperature relative to earlier levels, rather than in absolute terms (Barberis and Thaler, 2005).

aversion). When individuals are faced with risky choices, it, therefore, becomes more important to minimize the risk of a potential loss than to maximize the possibility of a possible gain.

The original version of the prospect theory was designed for gambles with at most two nonzero outcomes. For this version, Kahneman and Tversky (1979) propose that, when offered a gamble $(x, p; y, q)$ ³⁵ in which $x \leq 0 \leq y$ or $y \leq 0 \leq x$, people assign it a value of

$$\pi(p)v(x) + \pi(q)v(y), \quad (3)$$

where v is the proposed value function and π is the probability weighting function. The value individuals will assign to this gamble will depend on the three properties identified previously. When choosing between different gambles, individuals will consequently choose the one with the highest value (Barberis and Thaler, 2005).³⁶

In the experiments in which Kahneman and Tversky (1979) illustrated the properties of the prospect theories, and in much of the work that followed, the probabilities for the different choices were given. In reality, however, probabilities are rarely objectively known. Consequently, individuals are likely to make their decisions based on subjective probabilities for alternatives that are influenced by, among other things, their expectations of the alternative. However, though prospect theory discusses neither how individuals obtain these subjective probabilities nor the role of expectations in constructing these probabilities, it does emphasize the role of expectations in the evaluation of the outcome of a choice, which is another way through which expectations can influence individuals' decisions. Furthermore, although prospect theory can describe how individuals make risky decisions, it does not focus on the underlying factors—such as individuals' experiences, emotions, and attitudes—that previous studies have related to decision-making. Because such factors are likely to be important to understand how individuals make their financial decisions and to determining the role of expectations in these decisions, they are further considered in the following subsection.

2.3.2. Behavioral decision theory

Though a number of empirical studies have related different factors—such as experiences, emotions, and attitudes—to decision-making, there is no “standard model” that condenses the findings of these studies. According to McFadden (1999), one reason

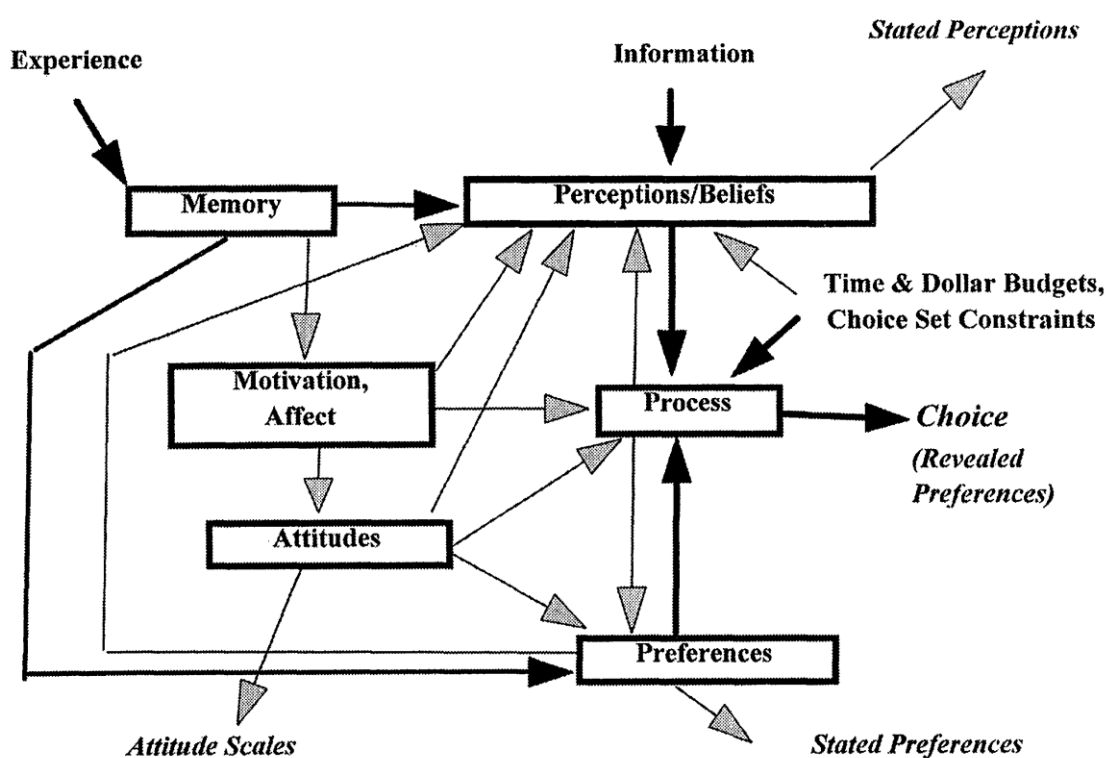
³⁵ This can be read as “get outcome x with probability p , outcome y with probability q ”.

³⁶ Based on additional evidence Tversky and Kahneman later developed prospect theory by generalizing it, which makes it possible to apply it to more than two outcomes. Tversky and Kahneman (1992) define this new version of the prospect theory the cumulative prospect theory, which employs cumulative rather than separable decision weights.

for this is that many would argue that it is neither possible nor useful to construct such a model. It is, however, possible to identify some major features that behavioral decision theory has found to be related to decision-making. To illustrate how these features differ from the standard choice model, McFadden (1999) provides a figure that he later revises in McFadden (2001).³⁷ The revised figure is shown in Figure 2.1. According to McFadden, the heavy arrows in the figure correspond to the standard model, which assumes rational choice. According to this model, (1) individuals process information to form perceptions and beliefs by using strict Bayesian statistical principles to convert the information to perceived attributes; (2) individuals have stable and consistent preferences; and (3) individuals try to maximize their preferences given the constraints that could exist in the market. The lighter arrows in the figure, in addition to the heavy arrows, correspond to psychological factors. Although McFadden uses the terms *perception* and *beliefs* in the figure, previous studies tend to use the words *perception* and *expectation* interchangeably (e.g., Manski, 2004). *Perception* tend, however, to be more commonly used in psychology (e.g., Slovic, 1987; Sjöberg, 2000; Slovic and Peters, 2006; Sjöberg, 2007; Slovic, 2010), while *expectation* is used mainly in economics (e.g., Kézdi and Willis, 2008; Gouret and Hollard, 2011; Hurd et al., 2011). Because McFadden (1999, 2001) refers mainly to findings from psychological studies, it is natural that he uses the terms *perception* and *beliefs* rather than *expectation*. A common distinction between *perception* and *expectation* is drawn by Ranyard et al. (2008), who describe perceptions as judgments of retrospective events and expectations as judgments of prospective events. Though McFadden (1999, 2001) does not explicitly mention the term *expectation*, one can assume it to be incorporated in his use of the terms *perception* and *belief*.

³⁷ This figure is, however, influenced by previous work that McFadden has co-authored, which can be found in Ben-Akiva et al. (1999).

Figure 2.1: The Choice Process, from McFadden (2001)



Similar to the standard model, the findings from behavioral studies also indicate that individuals' decision-making processes are influenced by their perceptions and beliefs, which are based on the information available to them. However, according to behavioral research, perceptions and beliefs are also associated with attitudes, motivations, preferences, and feelings of affect. This framework thus recognizes that the choice process in practice deviates from the standard model, since it is related to factors that are not incorporated in the standard model (Christensen et al., 2006).³⁸ The psychological factors thus extend the standard model—which assumes that there is a one-way flow from perception and preferences to the cognitive task of preference maximization—by including feedback in the model from, for example, the process to perception (Ben-Akiva et al., 1999).

According to McFadden (1999), the differences between the two models would not be problematic if the economic choice models were always successful at explaining market behavior. However, since there is accumulating evidence that the standard models tend to

³⁸ McFadden (1999) defines the different factors included in the model in the following way. *Perceptions* are the cognition of sensation, which in this model is used broadly to include individuals' beliefs, which are mental models of the world. *Affect* refers to an individual's emotional state. *Attitudes* are tendencies to evaluate different outcomes or activities (i.e., entities) with either favor or disfavor. *Preferences* refer to comparative judgments between entities. *Motivations* are the drives that are directed toward perceived goals. Finally, *Process* is a mental mechanism that both defines the cognitive task and the role of the perceptions, beliefs, attitudes, preferences, and motivations when performing the task in order to make a decision.

fail, at least under some market conditions, the role of the processes underlying individuals' decision-making becomes important (McFadden, 1999). McFadden provides three examples of deviations from the standard model: (1) that individuals struggle to form perceptions that are consistent with the information provided; (2) that individuals use heuristics that affect them so that they do not maximize their preferences; and (3) that individuals make decisions that are sensitive to changes in context.³⁹ Although these deviations can be observed for risk-free choices, McFadden argues that they are most apparent for risky choices, since they include probability judgments, which makes the decision more complex. One area in which individuals need to make such judgments is when they make financial decisions. Figure 2.1 can thus be used to understand how individuals make these decisions.

Although the figure presented by McFadden (1999, 2001) is unlikely to cover all of the factors that influence individuals' choices, it illustrates the complexity of decision-making and the number of factors that interplay when choices are made. Furthermore, this framework also puts individuals' expectations in a larger context that illustrates how individuals' expectations could be related to their choices and different factors that might influence expectations. However, since the framework focuses on the choices individuals make rather than on their expectations, the next subsection provides a more extensive discussion of how expectations are formed.

2.4 The role of expectations in financial decisions

Wärneryd (2001) distinguishes between three main hypothesis of expectations in economics: (1) a more or less sophisticated extrapolation of earlier experience, (2) adaptive expectations, and (3) rational expectations. "Earlier experience" refers here to objective data on past development rather than to subjective experiences. Although both (1) and (2) deal with earlier experience, they differ in that extrapolations from earlier experiences are based on past developments, which can be weighted or not. If the earlier experiences are weighted, a larger weight is usually given to more recent developments. Adaptive expectations, on the other hand, involve letting earlier discrepancies between expectations and outcomes affect the new expectation, in which an expectation based on previous experience is corrected by using some factor that is weighted relative to earlier discrepancies between the expectation and the outcome (Wärneryd, 2001).

Rational expectations are conditioned on all of the information available to the individual (Evans and Honkapohja, 2001). It is thus assumed that these expectations are formed using the best of economic knowledge (Muth, 1961). The rational expectations

³⁹ For more information on how individuals make judgments and decisions, see, for example, Rabin (1998).

approach thus assumes that economic agents have a great deal of knowledge about the economy. However, even in simple examples, in which expectations are constant, computing these constants requires, among other things, full knowledge of the structure of the model, and full knowledge of the values of the parameters (Evans and Honkapohja, 2001). Barberis and Thaler (2005) stress the role of consistency in the rational expectations equilibrium framework. Consistent belief means that agents' beliefs are correct, so that the subjective distribution they use to forecast the future realizations of unknown variables is the same as the distribution from which those realizations are drawn. According to Barberis and Thaler (2005), this requires not only that agents are able to process new information correctly but also that they have enough information about the structure of the economy to be able to figure out the correct distribution of the variables of interest.

The advantage with the rational expectation approach is that it imposes a strong discipline on the forecasts individuals make, which minimizes the number of free parameters to be explained in the data (Massaro, 2012). The rational expectation hypothesis, however, makes some strong assumptions about perfect knowledge of the economy. An example is discussed by Sargent (1993), who notes that, "when implemented numerically or econometrically, rational expectations models impute much more knowledge to the agents within the model (who use the equilibrium probability distributions in evaluating their Euler equations) than is possessed by an econometrician, who faces estimation and inference problems that the agents in the model have somehow solved." Sargent thus emphasizes the amount of information agents are assumed to have and the strong computing capabilities that are required for them to solve the model, i.e., to make decisions such that all predictions and beliefs are consistent with the outcome of all agents' choices. Although rational expectation is an equilibrium concept (Evans and Honkapohja, 2001) that therefore allows agents' expectations to be wrong but assumes that they are correct on average and over time, the strong assumptions that underlie rational expectations have been frequently discussed in previous literature.⁴⁰ The rational expectations hypothesis became, however, widely used in the 1970s and 1980s. It is now the benchmark paradigm in macroeconomics (Evans and Honkapohja, 2001) and is assumed in most asset-pricing models (Barberis and Thaler, 2005). However, due to the assumptions that underlie rational expectations, several researchers, including Manski (2004), have concluded that it often is implausible in the extreme. According to Wårneryd (2001), however, there are situations in which all three of the hypothesis concerning how expectations are formed can explain expectations. One such example is when economic conditions are stable and do not vary much or vary in the same

⁴⁰ One such example is Arrow (1986), who discusses some of the main concern with rational expectations.

way over long periods of time (Wärneryd, 2001). Under such circumstances, extrapolation of previous outcomes can be a successful way to forecast the future.

Since the expectations that rational agents should hold are determined by the model, and since individuals' expectations are assumed to be consistent with the model (Muth, 1961), one consequence of rational expectations is that there is no use for other sources of data (Gennaioli et al., 2016). Gennaioli et al. argue that this is problematic, since important information is neglected. Furthermore, several tests of rational expectation models that have been conducted during the last decades show that the predictions of the models are often at odds with empirical observations (Massaro, 2012). Since humans tend to have a limited cognitive capacity, Wärneryd (2001) argues that many researchers see it as unrealistic to think that any individual really has rational expectations. Based on economic and psychological theories of expectations, Wärneryd (1997) instead proposes the following equation concerning how expectations are formed. According to the equation, expectations are assumed to be based on three sets of beliefs. The importance of the beliefs varies across contexts, which are indicated by the weights. Equation (4) presents the model in its simple, individual form

$$EXP_{t+1} = w_1 B_{Pt} + w_2 B_{At} + w_3 B_{Lt} , \quad (4)$$

where EXP_{t+1} is expectations about period $t+1$ stated at time t_0 , B_{Pt} is a set of beliefs that are based on extrapolation of the individual's experience at time t_0 . B_{At} is a set of beliefs that are due to discrepancies between expectations and outcomes (learning) at time t_0 , B_{Lt} is a set of beliefs based on new information at time t_0 , and w_1, w_2, w_3 are (empirical) weights, which can vary from 0 to 1. According to Wärneryd (2001), the set of beliefs included in B_{Lt} can be divided into two subsets: one related to information from the individual/household and the other to economy-wide information. The sets of beliefs that involve learning, B_{At} , can be interpreted as the part that individuals bring to the situation, which replaces pure extrapolation. B_{At} thus involves learning from earlier outcomes, in which the learning is a cognitive calculation of differences between earlier expectations and outcomes. Furthermore, according to Wärneryd (2001), all three of the beliefs are subjective and could, therefore, be influenced or biased by cognitive processes and emotions. The basic idea of the model is that expectations are formed and revised on the basis of, (1) past experience of a phenomenon (or similar phenomena, involving generalization), (2) learning from how successful earlier expectations were, and (3) new information in the individual's immediate or more distant environment (Wärneryd, 1997). Wärneryd (2001) further argues that, since individuals form their expectations based on interpretations of the past and on the information available from various sources, there is room for cognitive bias and miscalculation due to limitations of cognitive capacity. According to Wärneryd, these

problems tend to be larger in situations that involve risk, which is one reason why heuristics are important since they simplify decisions that would otherwise be difficult for individuals to make.

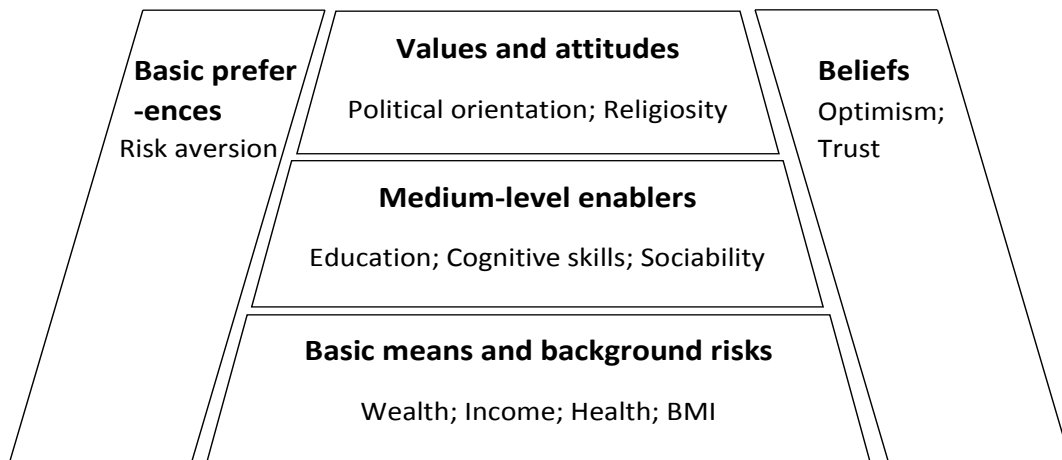
Although expectations are a central concept in economics and economic psychology, Wärneryd (2001) argues that more attention has been paid to the problems associated with measuring expectations than to the factors that influence individuals' expectations. However, studies in finance have found a number of factors to be related to individuals' financial decisions. Since these factors could also influence their expectations, it is necessary to consider them to understand how individuals form their expectations. The following subsection presents some of the main findings from these studies. Though these studies do not explicitly focus on the relationship between expectations and financial decisions, many of the factors they cover are likely to be related to expectations and are therefore important to consider.

2.5 Empirical findings of individual investors' financial decisions

According to Curcuru et al. (2009), there are three ways to explain differences in individuals' financial decisions in a traditional, utility maximizing framework. The differences may either be accounted for by heterogeneity in preferences, heterogeneity in circumstances, or a combination of the two; both have therefore been emphasized in recent literature on portfolio choice. Here *circumstances* includes many potential explanatory factors, including the presence of non-diversifiable background risk (e.g., labor income and proprietary business income), demographics, information asymmetries, and transaction costs (Curcuru et al., 2009).

Though it is of obvious importance to understand the factors that are associated with individuals' decisions to participate in financial markets and their asset-allocation decisions, knowledge of how individuals actually make these decisions is still relatively limited. Having studied the decision to participate in the stock market by using most of the factors that previous studies have found to be important for this decision, Kaustia and Luotonen (2016) find that these factors explain only about thirty percent of the variation in the participation decision and a large proportion of the variability is left unexplained. To summarize the main findings concerning how individuals make financial decisions, such as the stock market participation decision, Kaustia and Luotonen (2016) propose the model presented in Figure 2.2.

Figure 2.2: Conceptual hierarchical model of stock-market participation drivers, from Kaustia and Luotonen (2016)



According to Kaustia and Luotonen, the idea behind the model is that low-level factors (i.e., basic needs such as wealth) must be satisfied before medium-level factors (i.e., enablers such as cognitive skills) can be expected to influence the decision to participate in the stock market. If both low- and medium-level factors are satisfied, the high-level, self-actualizing considerations (i.e., values and attitudes) can help to separate individuals that participate in the stock market from nonparticipants (Kaustia and Luotonen, 2016). This hierarchical model thus provides some insight into how individuals make their financial decisions. To describe the different factors that are related to these decisions, Kaustia and Luotonen further distinguish between three different groups of factors. These are, (1) “country factors” (i.e., factors concerning the institutional and cultural environment), (2) “traditional factors” (i.e., individual-level determinants from the early literature), and (3) “new factors” (i.e., factors that are recently identified as important determinants for individuals decision to hold risky assets). Using measures from all three groups, Kaustia and Luotonen find that they differ in the explained variability of individuals’ stock-market participation decision: Country factors contribute 9.5 percentage points, traditional factors contribute 15 percentage points, and new factors contribute 5.5 percentage points of the observed variability. I use this classification to describe empirical findings from previous studies as a way to structure the presentation of these studies.⁴¹

2.5.1. Cultural factors

⁴¹ For a more extensive discussion, see Kaustia and Luotonen (2016). Findings from empirical studies related to individuals’ decision to participate in the stock market and their asset allocation decisions are also summarized in Table 1 of Barnea et al. (2010, p. 587). For a summary of findings on individual investors’ performance, see Barber and Odean (2011, pp. 1536–1538).

According to Kaustia and Luotonen (2016), there are multiple ways that cultural factors can influence financial decisions. One example has to do with the culture of stock ownership in a country, which can increase an individual's propensity to participate in the stock market. This is exemplified by Guiso et al. (2002), who find large differences in portfolio risk-taking between countries. It is also exemplified by Georgarakos and Pasini (2011) who find substantial differences in stock-market participation rates between European countries. One other way by which a country can influence financial decisions is by offering protections and regulations to investors (Pagano and Volpin, 2006; Giannetti and Koskinen, 2010). For example, Pagano and Volpin (2006) find that better investment protection induces companies to issue more equity, which leads to an increase in the size of the stock market. Having studied individuals who live in Sweden but have a different cultural background, Haliassos et al. (2015) find persistent differences in individuals financial behaviors that they argue might be attributed to individuals culture of origin. These differences tend, however, to decrease with exposure to common institutions. The cultural factors are, however, not restricted to the economic characteristics of a country and could also influence financial decisions through non-economic characteristics (Kaustia and Luotonen, 2016). One such characteristic is the religious beliefs in the country (Barro and McCleary, 2003; Stulz and Williamson, 2003). Guiso et al. (2003) find, for example, that religious beliefs are associated with more positive economic attitudes, and Bucciol and Stuefer (2012) find them to be related to investors' portfolio risk-taking.

2.5.2. Traditional factors

As described in Section 2.2, standard theories impose some strong normative implications on the optimal portfolio, one of which is that, in the absence of participation constraints, all individuals irrespective of their level of risk aversion should invest in stocks. However, if there are fixed costs associated with participation, a combination of low wealth and risk aversion can lead to rational nonparticipation (Vissing-Jørgensen, 2002; Vissing-Jørgensen, 2004). Empirical studies confirm that both wealth and risk aversion are related to individuals' financial decisions. In these studies, higher risk tolerance is found to be positively associated with propensity to participate in the stock market (Charles and Hurst, 2003) and with the risky assets in investors' overall portfolio (Barsky et al., 1997). Several studies have also found a positive relationship between levels of wealth and individuals' decision to take financial risk (e.g., Massa and Simonov, 2006; Calvet et al., 2007). Moreover, Cohn et al. (1975) and Calvet and Sodini (2014) find that relative risk aversion tends to decrease with wealth. Riley and Chow (1992) find that the largest decline in relative risk aversion exists for those individuals with the highest levels of wealth. Though both risk aversion and wealth partially explain stock-market participation, the participation rates

among wealthy households are still surprisingly low, indicating that non-economic costs could be of importance (Mankiw and Zeldes, 1991; Campbell, 2006; Curcuru et al., 2006; Kaustia and Luotonen, 2016). For this reason, many researchers have studied different circumstances—such as non-diversifiable background risk, information asymmetries or information costs, and basic demographic factors—that could potentially explain the decision not to participate.

Non-diversifiable background risk can arise, for example, from uncertain labor market income, entrepreneurial income, or fixed assets such as real estate. One way these risks can influence financial decisions is, according to Heaton and Lucas (2000b), by creating a need to reduce total risk by avoiding stocks. In a study of Italian households, Guiso et al. (1996) find that variability in household income reduces holdings in risky assets. Moreover, by focusing on fixed assets, Fratantoni (1998) finds that mortgage payments are negatively related to holdings of risky asset, and Kullmann and Siegel (2005) find that larger real estate exposure is associated with reductions in the holdings of risky assets. Furthermore, using U.S. data, Heaton and Lucas (2000a) expand these results and find that entrepreneurial income risk decreases the size of individuals' stock portfolios.

Guiso and Jappelli (2005) study information asymmetries through the information barriers for Italian households. They report that households express a lack of basic financial information. Thirty-five percent of the households sampled in their study were not aware of stocks, and 50% were not aware of mutual funds. Related to these results, Haliassos and Bertaut (1995) and Yamashita (2003) find that education is positively related to the decision to participate in the stock market. Moreover, Rosen and Wu (2004) find that education is associated with individuals' holdings of risky assets, even after controlling for wealth and income. Furthermore, by taking advantage of changes in compulsory schooling laws in U.S., Cole (2012) estimates that one additional year of education increases the probability of financial market participation by seven to eight percentage points when other variables such as income are held constant.

Basic demographic factors that could influence individuals' financial decisions include age, occupation, and inherited wealth (Curcuru et al., 2009). These factors are relevant if, for example, they are related to risk aversion or background risk (Kaustia and Luotonen, 2016). Testing for the relationship between occupation and stock-market participation by focusing on economists, Christiansen et al. (2008) find that economists are more likely than non-economists to hold stocks. Several of the demographic factors are difficult to measure, however. One such factor is age, as it is necessary to control for both cohort and time effects to isolate the age effect (Poterba and Samwick, 2001; Ameriks and Zeldes, 2004). Addressing these issues, Ameriks and Zeldes (2004) find that the probability of investing in the stock market tends to decline with age, which is further supported by Guiso et al. (2008).

Moreover, findings from previous studies also indicate that gender is related to financial decisions. Men are more likely to participate in the stock market and hold riskier portfolios than women (e.g., Jianakoplos and Bernasek, 1998; Sundén and Surette, 1998; Barber and Odean, 2001). Christiansen et al. (2010) and Halko et al. (2012), however, report that this effect is negligible given differences in background characteristics and potential self-selection biases in previous studies.

2.5.3. New factors

In recent years, researchers have started to test whether factors other than the traditional ones are also related to individuals' financial decisions. Examples of such factors include social interactions, trust, cognitive skills, financial literacy, health, religiosity, and political orientation.

As described previously, social interactions are viewed as an important channel for information sharing, either by word-of-mouth communication or through observational learning (Banerjee, 1992; Bikhchandani et al., 1992; Ellison and Fudenberg, 1993, 1995). Duflo and Saez (2002) study individuals saving decisions and report that decisions to enroll in a tax-deferred account plan are positively associated with the decisions of other employees in the same workplace department. Focusing on stock-market participation, Hong et al. (2004) find that households that interact with neighbors or attend church (proxies for sociability) are more prone to participate in the stock market. Findings from Brown et al. (2008) and Kaustia and Knüpfer (2012) support this result, and also indicate that the relationship could be causal. Finally, Hvide and Östberg (2015) find that individuals' decisions to buy and sell stocks are related to their coworkers stock-trading practices.

A number of papers have related trust to individuals' financial decisions. One early example is Guiso et al. (2004), who use Italian data and find that stock-market participation rates are higher in provinces that have more social capital, which they argue enhances trust. Guiso et al. (2008) find that individuals' level of trust is positively related to their decision to participate in the stock market, and, conditioning on participation, is positively associated with the risky share in their portfolio. Furthermore, Georgarakos and Pasini (2011) find that both trust and sociability are positively associated with stock-market participation. Moreover, Giannetti and Wang (2016) find that stock-market participation among U.S. households tends to decrease when corporate fraud is revealed in the state they live in and that households not only reduce their stock holdings in the fraudulent firms but also reduce their holdings in non-fraudulent firms. According to Giannetti and Wang, these results can be explained to result from a loss of trust in the stock market, which further stresses the importance of trust for individuals' financial decisions.

Cognitive ability is another factor that has been related to financial decisions. Christelis et al. (2010) find that individuals' propensity to invest in stocks—measured as both direct stock-market participation and indirect participation through mutual funds and pension savings—is positively associated with their cognitive abilities. These findings are further supported by Grinblatt et al. (2011), who utilize an IQ test from Finland's military service that they find to be positively correlated with individuals' decision to participate in the stock market. Using similar data, Grinblatt et al. (2012) find that high-IQ individuals also tend to make better financial decisions: they exhibit better market timing, stock-picking skills, and trade execution.

Related to studies on education, results from Cardak and Wilkins (2009), van Rooij et al. (2011), Allgood and Walstad (2016), and Anderson et al. (2016) suggest that financial literacy is important for individuals' financial decisions. Using data on a sample of Dutch households, van Rooij et al. (2011) find that scores on a financial literacy test are positively associated with stock-market participation. Allgood and Walstad (2016) expand these findings using U.S. data. They show that both actual and perceived financial literacy is positively related to the propensity to hold stocks. Similarly, utilizing data for LinkedIn members Anderson et al. (2016), find financial literacy to be positively related to both precautionary savings and retirement planning. However, their results indicate that it is mainly individuals' perceived financial literacy rather than their actual literacy that is related to these decisions. Moreover, using proxies for financial literacy, Cardak and Wilkins (2009) find that financial literacy is also positively associated with the size of individuals' risky asset holdings.

Studies by Rosen and Wu (2004), Atella et al. (2012), and Bressan et al. (2014), among others, investigate the effect of health on financial decisions. Rosen and Wu (2004) find that households in poor health are less likely to hold risky assets. Similarly, Atella et al. (2012) find that individuals with self-assessed bad health are less likely to hold stocks. However, Atella et al. (2012) find these results to be significant only in countries that lack national healthcare systems, thereby indicating that the relationship between health status and financial decisions could vary between countries. Finally, Bressan et al. (2014) find that self-assessments of health are more important to financial decisions than objective health measures.

Related to these findings are studies of how aspects of appearance—such as height and weight—are associated with financial decisions. Korniotis and Kumar (2010) find that taller individuals are more likely to participate in financial markets, and, conditioned on participation, tend to hold riskier portfolios. Addoum et al. (2015) find that individuals of normal weight are more likely to participate in the financial market and to hold riskier portfolios. Addoum et al. find these results to be driven mainly by education and race. They

therefore argue that lower financial sophistication by the obese leads to less financial risk-taking.

Several studies have also investigated the relationship between religiosity and individuals' financial decisions. Hong et al. (2004) find a positive relationship between going to church and stock-market participation. Changwony et al. (2015) find, however, that people who state that religion makes a difference in their lives are less likely to own stocks. One interpretation of the differences in the results between the two studies is that going to church is a proxy for sociability, which is positively associated with stock-market participation, while religious belief alone is negatively related to participation. There are also studies that test for differences in risk-taking between religions. Halek and Eisenhauer (2001), for example, find that Catholics and Jews are more tolerant of taking speculative risk compared to individuals that are Protestant. Moreover, building on findings from Kumar (2009) which indicate that propensity to gamble is associated with the probability of investing in the stock market, Kumar et al. (2011) find that Protestant groups tend to gamble less than Catholic groups and consequently financial risk-taking behavior in Catholic groups is higher than for Protestant groups. The results from these studies thus indicate that risk-taking could differ among religious groups.

Similarly, results from Kaustia and Torstila (2011) and Changwony et al. (2015) also indicate that stock-market participation is related to political orientation. Using Finnish data, Kaustia and Torstila (2011) find that right-wing voting is positively related to the decision to invest in stocks. Using UK data, Changwony et al. (2015) find supporters of the conservative party and the liberal democratic party (i.e., right-wing voters) to be more prone to participate in the stock market than those who support either the labor party (i.e., left-wing voters) or other smaller parties.

Although the results of empirical studies have been described separately in this subsection, several of the factors discussed are likely to be related. One such example is cognitive ability, which Dohmen et al. (2010) measure through an IQ test and find to be negatively correlated with risk aversion. The results from Dohmen et al. thus indicate that cognitive ability might be related to individuals' financial decisions through a willingness to take risks. Another example is education. Though previous studies have related education to individuals' financial decisions, education can also be indirectly associated with these decisions in multiple ways. For example, education can increase financial literacy and cognitive skills and influence social networks, job opportunities, beliefs, and attitudes (Kaustia and Luotonen, 2016). Similarly, several of these factors are also likely to be related to expectations. Examples of such factors include income, trust, and risk aversion, which Hurd et al. (2011) relate to individuals' expectations of risk and return. The results from Hurd et al. thus indicate that one way through which these factors can influence individuals'

financial decisions is through expectations. However, since only a few of the factors that previous studies have related to financial decisions have also been related to expectations, this potential relationship needs to be studied further.

3. Data Description and Methods of Analysis

Although studies of the financial decisions of individual investors are conceptually straightforward, they are hard to carry out due to the difficulty encountered in obtaining reliable data. Many of the studies conducted on the portfolio choices of households have therefore used survey data (Campbell, 2006).⁴² According to Campbell, this is problematic, since survey data both relies on individuals' willingness to participate and on the accurateness of the answers they provide. According to von Gaudecker (2015), an additional problem with survey data is that the information about households' portfolios obtained from surveys tends to be rather crude.⁴³ To overcome these problems Campbell (2006) proposes five criteria that should be fulfilled by an ideal dataset. First, the sample in the data should be representative. Second, the dataset should include a detailed measure of wealth that can be broken down into smaller relevant categories. Third, the categories should be disaggregated and possible to distinguish between different asset classes and to thereby facilitate studies of diversification within asset classes. Fourth, reporting of the data should be highly accurate. Finally, the dataset should observe households over time and a panel dataset is therefore preferred.

This thesis relies on two datasets that cover a broad sample of individual investors. The first dataset consists of registry data from three different sources compiled by Statistics Sweden. The data is available due to the wealth tax that existed in Sweden up until 31 December of 2007. It should meet the five criteria proposed by Campbell (2006). First, the data consist of two full cohorts (individuals born in 1963 and 1973) of individual investors in Sweden. Second, it includes detailed information about their wealth that can be broken down into smaller categories. Third, it is possible to distinguish between different asset classes in the data. Fourth, the wealth data is collected by the Swedish Tax Agency and should, therefore, be highly accurate. Finally, the data observes the same individuals over time, for which the period 1999-2007 is considered. Moreover, Campbell has used similar data previously (Calvet et al., 2007, 2009a, 2009b) and argues that it fulfills his criteria (Campbell, 2006). This dataset should also meet the requirements by Vissing-Jørgensen

⁴² Examples of such studies include Guiso and Jappelli (2005), who study the relationship between awareness and stock-market participation using the Bank of Italy Survey of Household Income and Wealth; Brunnermeier and Nagel (2008), who study household portfolio allocation using the Panel Study of Income Dynamics (PSID); Guiso et al. (2008), who use data from the DNB Household Survey to study the relationship between trust and stock-market participation; and Georgarakos et al. (2014), who also use the DNB Household Survey to study the relationship between social interaction and household debt. Table A.2 in the Appendix also presents an overview of some of the data sources used in previous studies that have relied on surveys. Cardak and Wilkins (2009, p. 852) also provide a good overview of different studies using survey data.

⁴³ Survey research has, however, become more accepted in financial research, perhaps especially when linked to transaction data or when repeated surveys are used to obtain panel datasets (see Merkle, 2011 for a review).

(2004), who emphasizes the need for more direct evidence about investors' beliefs and actions than what is provided, for example, by psychological and experimental studies. The richness of this dataset thus makes it possible to study the financial decisions of individuals in greater detail than many of the existing studies of individuals' or households' financial decisions that tend to focus on the decision to participate in the stock market. This is necessary if we are to better understand the observed heterogeneity in individuals' financial decisions.

The second dataset that is used in this thesis derives from a mailed survey that was sent out to a stratified random sample of Swedish equity owners for the purpose of studying expectations of risk and return and usage of financial information. The two datasets are described more thoroughly in the following subsections.

3.1 Registry data on individual investors

The registry data used in this thesis, which was compiled by Statistics Sweden, represents data from several different sources. Demographic characteristics are obtained from the "longitudinal integration database for health insurance and labor market studies" (LISA), which is provided by Statistics Sweden. Paper IV uses two full cohorts born in 1963 and 1973, which are observed annually over the years 1999-2007. The ages within the cohorts are thus 36-44 and 26-34 for the considered period. The data includes a large number of individual characteristics such as gender, age, marital status, educational attainment, educational orientation, disposable income, working industry, municipality of living, and the municipality of working. LISA data is also used in Paper II and Paper III. For these two papers, LISA data for the period 1999-2012 is considered for individuals born between the years 1940-1995.

Data on holdings of stocks, mutual funds and derivatives and real-estate wealth is obtained at the end of each year for the period 1999-2007 and is provided by the Swedish Tax Agency. This data also includes information about bank holdings, investments in debt securities, taxable income, and liabilities. The data should thus provide information about the total value of individuals' financial assets and the value of the respective asset categories. Data from the Swedish Tax Agency is used in Paper II, Paper III, and Paper IV.

In addition to data from the Swedish Tax Agency, data from Euroclear Sweden (former Nordic Central Securities Depository Group, NCSD) is also considered. Euroclear Sweden maintains a database of the ownerships in all stocks that are listed in Sweden. This data consists of the ownerships for each investor reported semiannually (i.e., at the end of June and December each year). The Euroclear data is used in Paper II, Paper III, and Paper IV (for the period 1999-2007). It has also been used to construct the sample for the survey (using data for the period 1999-2007).

Paper IV also use data from the Swedish Investment Fund Association (SIFA). The data includes the fund's name, the International Securities Identification Number (ISIN), and the daily net asset values (NAV) for all funds marketed in Sweden. In total, 3,400 funds are included in this list. For Paper IV, gambling data from the government-owned Svenska Spel (Swedish Games) is also used. This data consists of the amount of gambling per inhabitant (measured at the county-level) in Sweden, for which data from the years 1999-2007 is considered. This data concerns gambling in Swedish Games, ATG, and Bingo, and it covers approximately 60 percent of the total gambling market in Sweden (Lotteriinspektionen, 2014). Finally, Paper IV uses news data from the database Affärsdata, which includes printed media in newspapers and business press. The news data is utilized for the period 1999-2007, for which the total amount of news for all listed companies in Sweden is considered.

The data records used in this thesis are unique for the Scandinavian countries and provides reliable and highly disaggregated information for variables such as individuals income, wealth, education attainment, and demographic characteristics (Calvet et al., 2009a). Previous studies that use similar sources of data to study individual investors in other Scandinavian countries include Grinblatt and Keloharju (2001a, 2001b), who study Finnish investors; Christiansen et al. (2008, 2015), who study Danish investors; and Hvide and Östberg (2015), who study Norwegian investors. Studies that do not use data from official registries and do not rely on surveys tend to measure portfolios either through information from brokerage records (e.g., Barber and Odean, 2001; Glaser and Weber, 2007; Strahilevitz et al., 2011; Hoffmann et al., 2013) or from the 401(k), or other tax-favored retirement accounts (e.g., Benartzi, 2001; Benartzi and Thaler, 2001; Duflo and Saez, 2002). Though such data sources are accurate, they tend not to include both individuals' stock and mutual-fund portfolios, thereby making it difficult to study individuals' asset allocation. Furthermore, since these studies do not sample from the general population of individual investors, there is also a risk that their results are biased. To my knowledge, the only previous studies that include measures of both stock and mutual fund portfolios are those that use data from Scandinavian countries. In Sweden, most of these studies have been conducted by Massa and Simonov (Massa and Simonov, 2005, 2006) and Calvet, Campbell, and Sodini (Calvet et al., 2007, 2009a, 2009b, 2014).

Paper IV combines the different sources of data into a panel dataset (i.e., a cross-sectional time series) that covers the years 1999-2007. The three remaining papers mainly rely on survey data, for which some background variables are obtained from the registry data. Even though panel data is more complex compared to either pure cross-sectional or pure time-series data, it has the advantage of observing the same individuals over a given period and thus provides more information about the individual (Wooldridge, 2013).

According to Wooldridge, there are also two additional reasons why it is beneficial to have data over time for the same cross-section units. First, it allows the researcher to control for unobserved characteristics of individuals that can facilitate causal inference in situations in which it would otherwise not be possible. Second, it enables the researcher to study lags in behavior, which is beneficial, since there often is a difference in time between the establishment of economic policies and when they can be expected to influence behavior. This is particularly useful for Paper IV, which studies individuals' portfolio risk-taking based on lagged risk-taking in their community peers birth communities.

3.2 Motivation for the use of survey data

Despite the previously mentioned problems related to survey data, there are some situations in which surveys are preferred. One such situation is when measuring the expectations of individual investors (Manski, 2004; Glaser and Weber, 2005; Dominitz and Manski, 2011). According to Manski (2004), the reason for this is that there are situations in which choice data is insufficient to explain how individuals make decisions. However, some researchers are skeptical towards the use of subjective data (i.e., survey data). The main concern raised by the critics of such data sources is that what individuals say might not correspond with their actual behavior, which makes it necessary to study their actual behavior rather than relying on what they say (Manski, 2004). According to Cochrane (2011), an additional problem with survey data is that it can be sensitive to language and interpretation. According to Manski (2004), the general arguments for skepticism towards survey measures of expectations are meager. Manski therefore argues that reluctance to use subjective measurements of expectations should be abandoned.

Moreover, previous studies that rely on survey measures of expectations show that individuals tend to have heterogeneous expectations (e.g., MacDonald, 2000; Dominitz and Manski, 2004; Manski, 2004) and that survey measures are also associated with financial decisions (e.g., Hurd et al., 2011; Weber et al., 2013; Merkle and Weber, 2014; Hoffmann et al., 2015).⁴⁴ The results of previous studies thus indicate that survey measures of expectations both capture the heterogeneity in individuals' expectations and provide important information related to differences in financial behavior.

An alternative to using surveys to measure individuals' return expectations is to use realized returns as proxies of expected returns. Both Black (1993) and Shefrin and Statman (2003) argue that this is a problematic approach, as it is likely to be exposed to data-mining problems, thereby making it a noisy measure of expected returns. According to Shefrin and

⁴⁴ One such example is Weber et al. (2013), who find investors' financial risk-taking to be negatively (positively) correlated to their risk (return) expectations.

Statman (2003), survey measures of expectations can solve these problems and are therefore to be preferred to the use of realized returns. An additional reason for the recent revival of survey methodology in finance, according to Merkle (2011), is the “missing-link”-problem connected to many of the studies that are based solely on transaction data. The problem is that transaction data allows the researcher to identify patterns in financial behaviors but does not explain the observed phenomena. According to Shiller et al. (1996)—who study investors’ expectations related to the Japanese stock market crash during the years 1989 and 1992—a final argument for using survey methods to measure expectations is that “We will not know what they are thinking unless we ask...”.

3.3 Survey data on individuals expectations

Data about individuals’ expectations was obtained from a mailed questionnaire that Statistics Sweden sent out to 3,500 Swedish individual investors at the beginning of January 2014. Two weeks later, Statistics Sweden sent a reminder to those who had not answered the questionnaire within the first two weeks. In total, 971 useful responses were reported in which the respondents answered at least some of the questions, thereby making the overall response rate 28%. The response rate differs between questions, however, and the lowest number of responses was reported for some of the expectation measures that are used in Paper I. Both the sampling procedure for the survey and the questionnaire were designed in collaboration with Ph.D. student Stefan Anchev, Professor Jörgen Hellström, and Associate Professor Rickard Olsson.

3.3.1. Sampling procedure

The sample was constructed using data from Euroclear Sweden to ensure that it consists only of individuals with a history of being equity owners. For this purpose, data was considered for all equity owners in Sweden between the years 1999-2007. The sample was restricted to individual investors born between 1940 and 1995—i.e., to investors between 18-73 years at the time of answering the questionnaire—to increase the probability that those who received the questionnaire would be able to answer it.

The character of some of the questions included in the questionnaire requires that the respondents were more active when managing their investments. An example of such a question regards self-assessed portfolio returns, which is something that those who actively manage their portfolios should be able to answer more accurately than individuals who manage their portfolios less actively. To ensure that individual investors who actively manage their portfolios answered the questionnaire, a stratified random sampling procedure

was used⁴⁵ in which individuals with larger portfolios (in terms of both money invested and number of stocks in the portfolio) was oversampled. This procedure thus increased the probability that individual investors who manage their portfolios more actively would answer the questionnaire. An additional advantage of the sampling procedure is that individuals who manage their portfolios less actively and have smaller portfolios are also included in the sample. The sample thus covers the whole population of Swedish equity owners between ages 18-73, thereby making it possible either to weight the sample so that it represents the general population of Swedish equity owners or to focus on individuals with larger portfolios. The results presented in papers I-III, which use the survey data, is based on the unweighted sample. The robustness of the results, however, has been controlled for by weighting the sample. Weighting the sample has not affected the main results presented in the papers, and the results for the unweighted sample are therefore presented.⁴⁶

For the sampling, the 1,919,238 individuals—who according to Euroclear Sweden’s database, owned at least one stock during the period 1999-2007—were divided into four groups (or strata). These strata were constructed based on the size of individuals’ stock portfolios and the number of companies in which they owned stocks. The four strata were constructed as follows:

- Criteria for Stratum 1: During at least one of the nine years, individuals have owned stocks in three or more companies in which the total value of their stock portfolio is equal to or larger than 20,000 SEK (approximately 2,228 USD). In total, 634,962 individuals were included in Stratum 1.
- Criteria for Stratum 2: Individuals have owned stocks in three or more companies in which the value of the stock portfolio is less than 20,000 SEK. 55,663 individuals were included in Stratum 2.
- Criteria for Stratum 3: The total value of the stock portfolio should be equal to or larger than 20,000 SEK during at least one of the nine years, in which the number of unique stocks owned should be less than three. 498,898 individuals were included in Stratum 3.
- Stratum 4 consists of individuals who did not meet any of the two criteria. In total, 729,715 individuals were included in Stratum 4.

In total, 3,500 individual investors were sampled for the study. 1,200 individuals were

⁴⁵ Similar sampling strategies have previously been used by Weber et al. (2013), among others.

⁴⁶ An additional reason for presenting the unweighted results is that for multivariate regressions usage of sample-specific weights tend to reduce the precision of the estimates without providing any real benefit (Winship and Radbill, 1994; Deaton, 1997).

randomly drawn from the first stratum, 1,000 from the second stratum, 1,000 from the third stratum, and 300 from the fourth stratum. The survey data is utilized in papers I-III. Paper I focuses on the expectation measures considered in the questionnaire. Therefore, the registry data is not used in this paper. A combination of the two sources of data is used for Paper II and Paper III.

3.3.2. Questionnaire

In the process of developing the final questionnaire, a pilot study was conducted on 67 students in master programs in accounting and finance at Umeå School of Business and Economics. The pilot study resulted in revisions to the length of the questionnaire and in changes in some of the questions included. In the process of developing the final questionnaire, a group of researchers with prior experience with survey research — Professor Tommy Gärling, Associate Professor Anders Isaksson, Associate Professor Johan Jansson, and Associate Professor Vladimir Vanyushyn—were also consulted. After revising the questionnaire, the final questionnaire was constructed based on the suggestions of these researchers and on comments from survey specialists at Statistic Sweden. The questionnaire includes 51 separate questions covering 17 pages.

The questions included in the questionnaire were constructed based on careful consideration of literature in the area, for which well-established measures have been used when possible. The included questions regard the financial portfolios of individual investors, their views on various matters related to financial markets, the sources of information they use, their expectations of the risk and return for a stock-market index and two stocks, a measure of their level of risk aversion, a numeracy measure, and questions regarding their investment objectives. Although all of these variables are important to the thesis, the key variables for Paper I and Paper II are those connected to expectations of risk and return. For Paper III, the key variables are related to the sources of information that individuals use when making financial decisions. The expectation measure used in papers I-III is further described in the following subsection. Two different questions were used regarding information usage. The first question concerns how often the respondent used information from sources such as newspapers, TV, radio, company websites, financial websites, brokers, and analysts when making investment decisions during the last 12-month period. The second questions concerns how often the respondent used information from sources such as company balance sheets, income statements, and cash flow statements when making investment decisions during the last 12 month. The respondents answered each of the alternatives separately. Their answers were provided on a 4-point Likert scale ranging from “Never” to “Always.”

3.3.3. Measuring individuals expectations of risk and return

The expectation measure—which is first introduced in Paper I and thereafter used in Paper II and Paper III—is obtained from a probabilistic expectation question. These types of questions were originally developed to measure income expectations (e.g., Dominitz and Manski, 1997; Das and Donkers, 1999; Dominitz, 2001), but they are now also frequently used to measure individuals' expectations towards the general stock market and specific stocks. Examples of previous studies that use similar questions to measure expectations include Dominitz and Manski (2011), Gouret and Hollard (2011), Hurd et al. (2011), and Arrondel et al. (2014). To obtain the expectations of risk and return, the survey asked the following question:

Suppose you invested 10,000 SEK in the index OMXS30. Based on this assumption, estimate the probability that the investment of 10,000 SEK within a year..... – The sum of all your answers must be equal to 100%.

- a) ... decreased in value with more than 4,000SEK _____%.*
- b) ... decreased in value with between 0 and 4,000SEK _____%.*
- c) ... increased in value with between 0 and 4,000SEK _____%.*
- d) ... increased in value with more than 4,000SEK _____%.*

Sum = 100%

OMXS30 is a stock-market index that is used to represent the general Swedish stock market. Similar questions have also been asked for the stocks of the Swedish companies Volvo and TeliaSonera, with which most Swedish investors are familiar. Many of the sampled investors have also owned stocks in the companies. Although the results presented in Paper I – Paper III concern OMXS30, the responses to the expectation questions for the two stocks have been used to test for the robustness of the results.

The answers to the question make it possible to fit individuals' subjective probability distributions for the return of the index fund and the two stocks in the coming year. I have done this following Dominitz and Manski (2011), who assume that individual i has a normal subjective distribution $N(\mu_i, \sigma_i^2)$ ⁴⁷ and use a least-squares criterion to find the value (μ_i, σ_i) that best fits the responses.

The first step of obtaining the individual's expectations of risk and return is to rescale the thresholds for the investment values to returns. By doing so I obtain $Q_{i,k} \equiv$

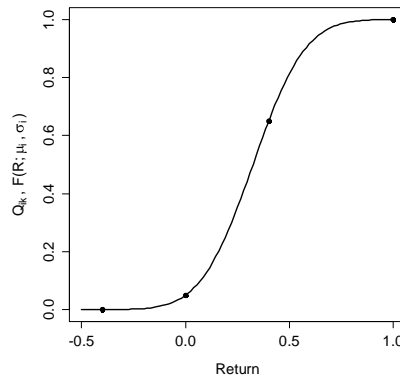
⁴⁷ To ensure that the expectations of risk and return obtained from this question are not driven by the choice of distribution, I have redone the analysis presented in papers I-III. For this analysis, I have instead assumed that individual i has a lognormal distribution, as Dominitz and Manski (1997) assume when fitting individuals' income distributions. Changing the distribution did not affect the results presented in the papers, and a normal distribution has therefore been used.

$\text{Prob}(R_i < R_{i,k}), k = 1, 2, 3, 4$, for each individual i that respond to the question, in which R_i denotes the investment return one-year ahead and $R_1 < R_2 < R_3 < R_4$ are the thresholds for the investment returns (i.e., -0.4, 0, 0.4). I assume that the individual's max, R_4 , is equal to 1. By letting $F(R; \mu_i, \sigma_i)$ denote the cumulative normal distribution function with mean μ_i and standard deviation σ_i , evaluated at any point R , it is possible to find the values for μ_i and σ_i that solve the following least squares problem for each individual i

$$\inf_{\mu_i, \sigma_i} \sum_{k=1}^4 [(1 - Q_{i,k}) - F(R_{i,k}; \mu_i, \sigma_i)]^2. \quad (5)$$

Figure 3.1 illustrates how the expectations are fitted to an individual with the sequence of probabilities $Q_{i,k} = \{0.00, 0.05, 0.65, 1.00\}$ to the sequence of return $R_{i,k} = \{-0.4, 0, 0.4, 1\}$.

Figure 3.1: Fitting return expectations



The μ_i and σ_i obtained are in this case 0.324 and 0.197, respectively. These values would be unchanged even if the three lowest estimated probabilities were used only when fitting individuals' return expectations. The consistency of the two measures depends, however, on the probability mass for the fourth threshold. If it increases and the individual was instead to estimate the sequence of probabilities $Q_{i,k} = \{0.00, 0.05, 0.2, 1.00\}$, then the obtained measures would be $\mu_i = 0.552$ and $\sigma_i = 0.181$, which would change to $\mu_i = 0.806$ and $\sigma_i = 0.484$ if the highest threshold was excluded. To ensure that the results presented in the papers are not driven by the highest threshold, the analysis for papers I-III have been redone excluding the estimated probabilities for R_4 . Since only a few individuals place a large probability mass on the fourth threshold, the exclusion of the fourth threshold does not change the overall findings of these papers.

3.4 Methodological considerations

In order to answer the questions outlined in this thesis, the analysis builds on a combination of the datasets described previously. These sources of data were chosen on the basis of the research questions in the papers and based on a concern for how they could best be answered. This decision was also based on a review of prior studies and the data used in them. Although many of the questions outlined in this thesis—such as the question concerning how expectations could be measured—can be studied using qualitative methods, for example, the main purpose of the chosen sources of data is to facilitate comparisons between the results in the thesis with prior studies and to obtain results that are more generalizable. Moreover, if qualitative methods had been used for this research question, it is likely that I would have obtained individuals' preferences for different expectation measures instead, which is not necessarily the same as answering the research question. Furthermore, as previously stated, the relevant question in this thesis is not how individuals prefer to communicate their beliefs but rather whether they are willing and able to communicate their beliefs using a certain method or question (Manski, 2004). An additional reason for the methods chosen is that—even though there is now wider acceptance of different types of methods in financial research (Merkle, 2011), such as experiments and surveys—qualitative methods are still not commonly used. Though this was not the main argument for deciding which method to use, it would most likely influence how the papers are received. Finally, although survey research has become more accepted in financial research, there is still some skepticism about the information obtained from surveys, since one cannot know how accurate it is. It was therefore important that information regarding individuals' portfolios and their wealth—for which detailed registry data exist—was obtained from sources other than the survey when possible.

3.5 Methods of analysis

The specific methods used in the papers enclosed in this thesis are presented in Table 3.1. The first article utilizes measures of expectations that have been commonly used in previous empirical research to study individuals' expectations of risk and return. Specifically, the paper draws upon Dominitz and Manski (2011) to fit individuals' subjective probability distribution, upon Davidson and Cooper (1976) to obtain individuals' mean and volatility estimates by using their proposed two-point estimation technique, and upon Gouret and Hollard (2011) to calculate volatilities by using the minimum and maximum of individuals' expectations of the returns. Apart from previously tested expectation measures, the risk expectations of individual investors have also been estimated by translating their risk assessment on a verbal (i.e., qualitative) question into a quantitative measure. This was done by using a scale from the European Securities and Market Authorities (ESMA), which provides a recommendation for how risk should be expressed

in scale formats. The estimates from the different measures have thereafter been compared by using pairwise t-tests and two-sided Mann-Whitney rank-sum tests, for which the studied sample was restricted to individuals who have provided answers to all of the different expectation questions.

Both papers II and III use the expectation measure proposed by Dominitz and Manski (2011). In Paper II, the relationship between the expectations of risk and return obtained from this measure and individual investors' sophistication are tested mainly by using OLS regressions and a factor analysis. Furthermore, to compare the expectations between sophisticated and less-sophisticated investors, two-sided Mann-Whitney rank-sum tests are also used for this paper. In Paper III—which focuses on individual investors' information use—OLS regressions have mainly been considered. For this paper, the confidence investors has in their expectations are also considered. Since confidence is measured using a five point Likert scale (i.e., an ordinal variable), I have tested for a relationship between the frequency investors use financial information and their confidence in their expectations using both OLS and Ordered logit regressions.

Paper IV applies an instrumental variable technique to determine whether social interaction (through community effects) is related to individual investors' financial risk-taking. The main analysis in this paper is based on an instrumental variable estimation using a fixed effects model.⁴⁸ A number of controls, such as individual fixed effects, time-varying individual-level controls, time-varying community-level controls, and state-year fixed effects are also included in the analysis. Since the sample is restricted to non-moving individuals (i.e., natives), the individual fixed effects control for community fixed effects (Brown et al., 2008). The model thus accounts both for variability across individuals and for variability across time for the same individual. The robustness of the results presented in this paper has been tested using random effects (RE) models, since they allow for the inclusion of time-invariant explanatory variables such as gender, which would be absorbed in the intercept if fixed effects (FE) models were used (Wooldridge, 2013).

A main concern within Paper IV is to find valid instruments. For this purpose, three different instruments are considered and three diagnostic tests are performed. The instruments considered are average financial risk-taking, financial education, and gambling within the nonnatives' birth communities.⁴⁹ The first diagnostic test considered is a Durbin-Wu-Hausman test (Durbin, 1954; Wu, 1973; Hausman, 1978). It tests whether the regressors are endogenous (i.e., it tests the null hypothesis that risk-taking in the nonnatives' birth communities can be treated as an exogenous regressor) by comparing

⁴⁸ For this purpose, the user-written STATA command `xtivreg2` (Schaffer, 2015) has been used.

⁴⁹ The gambling instrument is, however, constructed using county-level data, since I have not been able to obtain community-level data from the big bookmakers in Sweden.

instrumental variable estimates to the OLS estimates (Wooldridge, 2010). The second test is a Sargan-Hansen test (Sargan, 1958; Hansen, 1982), which tests for the overidentification of the instruments. The null hypothesis in this test is that the instruments are valid (i.e., that they are uncorrelated with the error term) (Wooldridge, 2010). The third test is a test for instrument relevance, for which the Kleibergen-Paap Wald F-statistic is used. The null hypothesis of this test is that the instruments are weak. A critical value of 8.75 (Stock and Yogo, 2005: Table of Critical Values for Weak Instrument Test Based on TSLS Size) is used to test the instruments.

Table 3.1: Methods used in the different papers

Study	Methods used
Paper I: <i>Evaluating Measures of Individual Investors' Expectations of Risk and Return</i>	<ul style="list-style-type: none"> - Pairwise t-tests with Holm's adjustment (Holm, 1979). - Two-sided Mann-Whitney (Wilcoxon ranksum test) rank-sum tests. - Principal component factor analysis.
Paper II: <i>Individual Investors' Sophistication and Expectations of Risk and Return</i>	<ul style="list-style-type: none"> - OLS regressions. - Two-sided Mann-Whitney (Wilcoxon ranksum test) rank-sum tests. - Principal component factor analysis.
Paper III: <i>Individual Investors' Information Use, Subjective Expectations, and Portfolio Risk and Return</i>	<ul style="list-style-type: none"> - OLS and Ordered logit regressions.
Paper IV: <i>Individuals' Financial Risk-Taking and Peer Influence</i>	<ul style="list-style-type: none"> - IV regressions using fixed effects models. - IV regressions using random effects models. - Test of instrumental variables using Durbin-Wu-Hausman test (Durbin, 1954; Wu, 1973; Hausman, 1978), Sargan-Hansen test (Sargan, 1958; Hansen, 1982), and the Kleibergen-Paap Wald F-statistic.

4. Summary of Papers

Paper I: Evaluating Measures of Individual Investors' Expectations of Risk and Return

This paper uses survey data on individual investors in Sweden to analyze multiple measures of expectations of risk and return. Specifically, it considers three different return and four different risk measures. The first is a probabilistic measure obtained from Graham and Harvey (2001) and Ben-David et al. (2013), among others. For this measure, the respondent provides a mode, a 10th percentile, and a 90th percentile estimation of the one-year return for the index fund OMXS30 and the stocks of two Swedish companies: Volvo and TeliaSonera. For the second measure, which follows Dominitz and Manski (2011), the respondent is asked to imagine that a one-year investment in the index fund or the two stocks decreases/increases in value with four different thresholds. The respondent is then asked to provide probabilities for these thresholds. The third measure, which follows Gouret and Hollard (2011), asks the respondent to provide a minimum and maximum estimate of the one-year return in the index fund and the two stocks. The fourth measure follows Weber et al. (2013) and Hoffmann et al. (2015). For this measure, the respondent estimates how risky a one-year investment in the index fund is. Answers are provided on a Likert scale that ranges from “very low risk” to “very high risk.” The answer to this measure is then translated into a volatility estimate using the recommendation for how risks in mutual funds should be expressed in scale formats provided by the European Securities and Market Authorities (ESMA).

The results in this paper indicate that even though the different measures are significantly correlated there are considerable differences in the magnitude of especially the risk expectations between the measures. Consequently, the same individual can express risk expectations that either under- or overestimate objective risk measures depending on the expectation measure used. These variations in expectations are mainly related to differences in individuals' responses to the questions that underlie the expectation measures rather than to the methods that are used to obtain the expectations. Since differences are observed between the measures, they are evaluated using three different evaluation perspectives. The results from this analysis indicate that the expectations obtained following Dominitz and Manski (2011) correspond the most with what is expected from the different evaluations.

The results presented in this paper contribute to the literature by demonstrating that there are differences in the expectations of risk and return obtained from different measures. Future research should consider these results when deciding upon which expectation measure to use. Furthermore, because it makes some preliminary comparisons of the

different measures, this paper could also be used to make such a decision.

Paper II: Individual Investors' Sophistication and Expectations of Risk and Return

This paper tests for the relationship between the individual investors level of sophistication and their expectations of risk and return. Since there is no well-established measure for investors' sophistication, I use eleven sophistication proxies that previous studies have related to individuals' financial decisions. The findings in the paper indicate that sophisticated investors have lower (higher) risk (return) expectations that are closer to objective measures than less sophisticated investors. Furthermore, similar to previous studies (e.g., Hurd et al., 2011; Hoffmann and Post, 2014), different sophistication proxies tend to be related to investors' expectations of risk and return. Investors' risk expectations are negatively associated with their numerical ability and financial experience, while their return expectations are positively related to gender, financial experience, and level of education. Since none of the sophistication measures is likely to be a perfect measure of sophistication, a factor analysis that reflects the shared variation in the different measures, is also considered. The results of this analysis indicate that the sophistication measures can be reduced to two factors.

The results in this paper expand previous studies in two important ways. First, by focusing explicitly on sophistication, this paper considers several sophistication proxies that previous studies have not related to individuals' expectations of risk and return but that have been related to their financial decisions. Examples of such measures include numeracy, financial knowledge, whether the investor is working in the financial industry, and financial experience. Thus, it is possible to determine whether the results observed in previous studies hold when more proxies for sophistication are included. Second, this study focuses on individuals that have a history of participating in the stock market instead of sampling from the general population or using students, as is common in previous studies (e.g., Hurd et al., 2011; Kempf et al., 2013). Since these individuals have experience making financial decisions, it should be easier for them to act in accordance with their expectations than for individuals who lack previous experience with equities.

Paper III: Individual Investors' Information Use, Subjective Expectations, and Portfolio Risk and Return

This study analyzes the sources of information individual investors' use when making their financial decisions and the relationship between how frequently investors use this information and their stock market expectations, their confidence in these expectations, and their portfolio risk and return. The results in this paper indicate that individual investors use different sources of filtered financial information (e.g., information packaged

by a professional intermediary) more frequently than unfiltered financial information (e.g., information from annual reports and financial statements). Investors that use filtered financial information more frequently tend, however, to be both more confident in their stock market expectations and to have higher risk in their stock portfolios. For investors that instead use unfiltered financial information more frequently than filtered financial information the results indicate that they have more accurate stock market expectations, lower portfolio risk, and higher portfolio return.

The results in the paper is related to Elliott et al. (2008), who study the relationship between how frequent investors use different sources of information and their self-assessed portfolio returns, but extend their paper in a number of aspects. First, and most importantly, the paper is, to the best of my knowledge, the first to relate detailed data on the information individual investors' use to their expectations and their confidence. Second, the portfolio returns used by Elliott et al. (2008) is based upon a survey question. Although a similar measure also is considered in the current study I extend their paper by calculating investors actual portfolio risk and return for the period 1999-2007 and compare it to the information that they use during the same period. Third, Elliott et al. (2008) use a sample that is encouraged to use a fundamental approach to their investment analysis (i.e., the sample is drawn from the National Association of Investor Corporation) and the investors in their sample could therefore be more prone to use unfiltered financial information.⁵⁰ In contrast, the sample in the current study is drawn from data that includes all equity owners in Sweden during the period 1999-2007. Finally, Elliott et al. (2008) has a relatively low response rate to their survey (3 percent), which could increase the possibility that their results are affected by a nonresponse bias. In the current study, the response rate is considerably higher (17 percent for the corresponding analysis) and the risk that the results are influenced by such a bias is therefore reduced.

Paper IV: Individuals' Financial Risk-Taking and Peer Influence

This paper tests whether social interaction, measured as a community effect, is associated with portfolio risks taken by individual investors. In particular, it addresses the identification problems that exist when measuring social interactions. An instrumental variable technique is used for this purpose, following Brown et al. (2008). For this paper, individuals are divided into "natives" and "nonnatives" according to whether they live in their birth-community or not. Guiso et al. (2004) find that the social capital of an individual's birthplace has long-lasting effects on future economic decisions. Based on this finding, the analysis in this paper is restricted to native individuals, but with average

⁵⁰ This is also indicated by the descriptive statistics in their study. A larger proportion of the investors in their study use unfiltered financial information more frequently compared to the investors in the current study.

community portfolio risk taking (measuring word-of-mouth effects) instrumented with nonnatives birth-community peer risk indicators. To ensure the validity of the instrumental variable approach, i.e., that instruments satisfy the exclusion restriction and are relevant, an over-identified setting with three potential instruments (capturing features of nonnatives' birth-community peers' risk-taking) is considered. In the analysis, we consider the average birth-community peer portfolio risky share, the average proportion of individuals with a financial education in nonnative community members' birth-community, and the amount of spending on gambling per community member in nonnatives' birth-region, as potential instruments. The first two of the instruments are found to both satisfy the exclusion restriction (based on Hansen J tests) and being relevant (significantly correlated with the native individuals' community risky share) and are therefore used in the main analysis.

The results indicate that risk-taking among peers affect individuals choice of portfolio risk. These results hold for the full sample of individuals' participating in the stock and/or fund market born in 1963 and 1973 measuring risk-taking as the individual's risky share (i.e., the proportion of directly held stocks and risky mutual funds in the total portfolio of directly held stocks, money market funds, risky mutual funds, and cash). These results are further strengthened by restricting the sample to individuals who participate in the stock market and by measuring risk-taking as the proportion of risky shares they own and the total and systematic portfolio risk. Specifically, for the full sample, a ten percentage points' increase in the instrument increases the native individuals' risky share by approximately 9 percent on average. Conditioning on participation in the stock market further strengthens these results, for which a ten percent percentage points' increase in the instrument increases the native individual's risky share by an average of 12 percent.

These results are important for two main reasons. First, they increase the understanding of how individuals make financial decisions—specifically asset allocation decisions. Second, since stock purchasing decisions between individuals could be correlated for reasons other than social interaction—such as non-random assignment to communities (e.g., Manski, 1993)—it is difficult to design an empirical strategy that overcomes the identification problems. By following Brown et al. (2008), the three obstacles proposed in previous studies for identifying causal effects—namely, correlated unobservable, endogenous group membership, and reflection (Hvide and Östberg, 2015)—should be controlled for, thus making the results more robust.

5. Conclusion, contributions, and future research

5.1. Contributions

The overall purpose of this thesis is to enhance the understanding of the financial decisions individual investors make. It is thus an answer to calls for further studies in the field of household finance (e.g., Campbell, 2006). For this purpose, a detailed and comprehensive dataset is used that fulfills the requirements for studies on individual investors (e.g., Campbell, 2006; Merkle, 2011). The results contribute to this literature by increasing the understanding of how individual investors make their financial decisions and focuses on the role of expectations, information usage, and social interactions in these decisions. Specifically, the contributions of the individual papers can be summarized as follows.

- Paper I evaluates different measures of individual investors' expectations of risk and return and makes some recommendations for how expectations of risk and return can be measured.
- Paper II analyzes the role of sophistication for individual investors' expectations of risk and return and the relationship between sophistication and the accuracy in investors' expectations.
- Paper III explores the information individual investors' use when making their financial decisions and the relationship between the frequency investors use different sources of financial information and their expectations of risk and return, their confidence in these expectations, and their portfolio risk and return.
- Paper IV expands the literature on how individuals' financial decisions are related to those of their peers by focusing explicitly on individuals' portfolio risks.

Taken together, these papers make several contributions to the existing literature on individual investors' financial decisions. The results of Paper I provide new insights into how expectations can be measured. Though this is of relevance to researchers interested in individuals stock market expectations, it also has implications for other related areas, such as studies on inflation (Bruine de Bruin et al., 2011), exchange rates (Frankel and Froot, 1987), and GDP growth (Engelberg et al., 2009; Boero et al., 2014) in which measures of expectations often are used. These results also have implications for institutions that provide suggestions for how individuals' expectations should be measured. This is, for example, important when banks try to match individuals with mutual funds based on their stated risk preference.

Paper II increases the understanding of how individuals' expectations of risk and return

are formed by focusing on the role of sophistication. By using multiple measures of sophistication, this paper also contributes to studies that relate different proxies of sophistication to investors' financial decisions (e.g., Vissing-Jorgensen, 2003; Feng and Seasholes, 2005; Dhar and Zhu, 2006; Calvet et al., 2009b; Grinblatt et al., 2011, 2012), by providing some insight into how sophistication can be measured. This is important, since a variable can proxy for many different behaviors, which makes it difficult to determine whether it actually measures what it is assumed to measure when used in isolation (see Merkle, 2011 for a discussion).

Paper III contributes both to research and business societies by documenting how frequently investors use different sources of financial information when making their financial decisions. This should be of concern to listed companies when they consider different strategies for communicating with both existing and potential investors. The results in this paper further indicate that the frequency investors use different sources of information is positively correlated and that investors who use unfiltered financial information more frequently relative to filtered financial information have lower portfolio risk and higher portfolio returns on average. These results are likely to be related to studies that find financial literacy to be positively associated with the decision to participate in the stock market (e.g., van Rooij et al., 2011; Balloch et al., 2014) and to plan for retirement (e.g., Almenberg and Säve-Söderbergh, 2011; van Rooij et al., 2012). The results should thus be important to policy makers who have embraced financial education as a tool whereby individuals may overcome the increasing complexity in their financial decisions (Fernandes et al., 2014).

Paper IV extends the results of Hong et al. (2004), Brown et al. (2008), Kaustia and Knüpfer (2012), and Hvide and Östberg (2015) by documenting that social interaction is not only related to decisions to participate in the stock market and to buy stocks, but is also associated with the financial risk individuals take. These results thus provide further evidence that interactions with others are related to financial decisions.

Furthermore, as pointed out by Weber et al. (2013), better understanding of individual investors' financial decisions is not only of theoretical interest, it has also practical implementations for financial regulatory requirements in Europe and for ongoing discussions about similar regulation in the U.S. In Europe, the Markets in Financial Instruments Directive (MiFID), which was initiated by the European Parliament and the European Council (2004, 2006), places two requirements on the information that investment firms should elicit from their customers. First, investment firms should obtain "information as is necessary for the firm to understand the essential facts about the customer" (Article 35, 1). Second, they should elicit the customer's "preferences regarding risk-taking, his risk profile, and the purpose of the investment" (Article 35, 4). Although

consumers risk-taking preferences are regarded as important, the MiFID does not provide any guidelines regarding how (or how often) investment advisors should elicit the risk preferences and risk profiles of their customers. Nor does it specify what “essential facts” should be collected. This thesis contributes to closing this gap by providing some suggestions for how investors’ risk expectations could be measured and by identifying some of the “essential facts” that are associated with investors’ financial decisions. Moreover, investment advisors also need to understand the causes and implications of investors’ heterogeneity if they are to provide them with good advice (Curcuru et al., 2009). By focusing on some of the factors associated with the heterogeneity in individuals’ financial decisions, this thesis should provide some guidance to investment advisors.

More generally, by expanding the literature on the factors that are related to individual investors’ financial decisions, the results of the studies also contribute to individuals who are participating in financial markets. By shedding some light on how their financial decisions can be influenced by non-fundamental factors, the results could help them to identify these factors and, by doing so, help them make better financial decisions.

Finally, the findings in this thesis have also some governmental implications. If governments are interested in decreasing the observed wealth gap between participants and non-participants in financial markets, as described by Piketty (2014), one way of doing so is to increase participation rates within the economy. In order to do this, it is necessary to understand the financial decisions that individuals make and the factors that are associated with these decisions. The findings in this thesis contribute to increasing the understanding of how these decisions are made, and it should, therefore, together with previous studies in the field, constitute a good starting point for understanding individuals’ financial decisions. Furthermore, since the results indicate that individuals are heterogeneous in their financial decisions, one regulatory implication, if governments are interested in helping individuals make better financial decisions, is that it might be necessary to develop policies that induce individuals to behave more optimally. Examples of such policies include tricking people into behaving in a desired manner (i.e., nudging) or changing their attitudes or preferences (Altman, 2010).

5.2. Limitations

As in all research, choices have been made during the research process that to some degree entail limitations in the findings. The main limitation of this study concerns the data that is used in the different papers.

The main limitation for papers I-III, that rely on survey data, is related to the difficulty of knowing whether investors’ stated expectations are equal to the true expectations they will base their decisions on. As suggested by Paper I, investors’ expectations tend to differ

depending on the format of the questions that are used to obtain their expectations. Since investors' portfolios are not observed for the one-year period considered in the expectation questions, it becomes difficult to determine which, if any, of their stated expectations that correlate the most with their financial decisions. Although Paper I evaluates the different expectation measures by using other comparisons, investors' actual financial decisions would have been preferred when evaluating the expectations measures. Furthermore, the expectations of risk and return used in papers I-III were obtained using a measure similar to that used by Dominitz and Manski (2011). There are, however, some differences between their measure and the one used within the papers in this thesis that could affect comparisons of the results of the two studies. Most importantly, Dominitz and Manski (2011) conducted their survey using telephone interviews, which allowed them to fit the thresholds for the expectation measure to individuals' minimum and maximum expectations. The thresholds thus vary depending on the individuals' stated minimum and maximum values. Since this thesis instead use a mailed questionnaire, fixed thresholds like those used by Hurd et al. (2011) were used. Although individuals' minimum and maximum values were also obtained in the survey, they cannot be used when fitting the thresholds for this measure, since the thresholds might lay outside of these values. It is also difficult to interpret the minimum and maximum values, since it is not stated in these questions what percentile of the probability distribution they should represent. Based on the differences between the two measures, it is possible that the results would differ if individuals' expectations had been obtained using the exact same question asked by Dominitz and Manski (2011).

A further limitation of the results in papers I-III is that they are based only on a single evaluation period. One cannot know whether similar results would have been obtained if repeated measures of investors' expectations had been used instead. It is also possible that the results presented in these three papers are affected by a non-response bias. Even though the characteristics of the investors who responded to the survey largely correspond to the general population of individual investors, and though the response rate is higher than in comparable studies⁵¹, it is not possible to rule out these possibilities. Related to these potential problems is also the sampling procedure used. Although one of the ideas behind a stratified sample is to facilitate comparisons between the different groups, the relatively low response rate for some of the questions did not make this possible. An alternative strategy that might have been more suitable is to follow Calvet et al. (2007, 2009a) and impose a restriction on the sample that excludes investors who have the smallest fraction of their wealth invested in financial markets and to randomly sample among the remaining investors.

⁵¹ For example, Elliott et al. (2008) and Weber et al. (2013) both have a response rate of approximately 3 percent, and Hoffmann and Post (2015) have a response rate of approximately 4 percent.

Furthermore, one of the portfolio return measures considered in Paper III is the investors self-assessed portfolio return for the 12-month period preceding the survey. Although comparison of the self-assessed returns and the market return for the considered period does not indicate that investors have exaggerated their returns in any systematic way, it is still possible that they do not know their actual portfolio return, for example, and that it would therefore deviate from their stated returns. Even though survey measures of different portfolio characteristics are relatively common in financial research (e.g., Guiso et al., 2008; Christelis et al., 2013; Jappelli and Padula, 2015; Lee and Veld-Merkoulova, 2016), such measures may be biased, and it would, therefore, have been preferred to use the actual returns for the period.

One potential problem related to Paper IV is that social interactions are measured at the community level. Since this is a relatively broad measure, it is likely that many of the natives and nonnatives considered in the paper are not familiar with each another. Though additional analyses (such as conditioning on age) have been considered in order to capture social interaction more accurately, it is almost impossible to rule out alternative mechanisms that could cause the relationship observed in the paper. Second, for this paper, individuals' portfolios are measured on an annual basis. There are thus relatively long time spans between the portfolio observations, which make it difficult to measure the exact timing of individuals' financial decisions. Third, since Paper IV focuses only on two cohorts (individuals born 1963 and 1973), it is not possible to determine whether similar results would be obtained if the whole population of individual investors in Sweden was observed. The results in the paper therefore cannot be generalized to this larger population. Finally, the use of registry data also restricts the number of characteristics that are possible to control for in the analysis of this paper, which makes it possible that the results are driven by some unobserved characteristic. Though the inclusion of similar control variables as in previous studies and the inclusion of individual and community fixed effects should reduce this possibility, it does not eliminate it completely. Replications of the results in future studies are therefore necessary.

5.3. Suggestions for future research

Even though this thesis provides some new evidence for how individuals make their financial decisions—particularly concerning the role of expectations in these decisions—there are still several gaps that may be fruitful for future studies to consider. First, related to the three papers that rely on survey data, it would be of interest to test whether the results presented in these papers are robust for repeated measures of expectations. Related to this, it would also be valuable if future studies were to evaluate the different expectation

measures that exist by using individuals' actual financial decisions. Though some previous studies (e.g., Weber et al., 2013) relate individuals' financial decisions to their expectations, there is, to the best of my knowledge, no previous study that has taken a more comprehensive approach and compared different expectation measures with individuals' financial decisions. If data on individuals' financial decisions and expectations of risk and return was obtained, it would also be of interest if future studies were to investigate whether individuals' expectations and confidence in the expectations have a mediating role on their financial decisions.

Furthermore, individual investors' expectations of risk and return are most likely associated with several factors outside the scope of this thesis that could be fruitful for future studies to consider. One of these is the role that emotions have for individuals' expectations. Although some previous studies indicate that emotions are related to financial risk-taking (see Merkle, 2007 for an overview), there is, to the best of my knowledge, no study directly testing for the relationship between individuals' emotions and expectations. It would also be of interest for future studies to investigate whether the relationship between emotions and financial decisions can be mediated through expectations. Since studies in psychology find individuals' emotions to be associated with perception of risk (e.g., Peterson, 2007), it is possible that they also are associated with expectations of risk and return. It would also be interesting for future studies to consider individuals' financial literacy. Jappelli and Padula (2013) propose a model in which investors with higher financial literacy have access to better investment options and therefore expect returns to be higher. These results are related to those presented in Paper II but since there exist better-defined measures for financial literacy than for sophistication, it would be of interest for future research to test the relationship between financial literacy and expectations of risk and return.

Related to the limitations regarding Paper IV, it would also be interesting if future studies on individual investors' portfolio risk measured social interactions through, for example, individuals' zip codes or workplace. Such analyses are likely to capture the peer groups in which individuals interact more closely. Although this has been done for both decision to participate in the stock market and buying/selling decisions (e.g., Kaustia and Knüpfer, 2012; Hvide and Östberg, 2015), there is, to the best of my knowledge, no study that uses such data to study individual investors' portfolio risk taking.

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Appendix

Table A.1: Household portfolio components

Assets	Liabilities
<i>Financial assets</i>	Mortgage and home equity
Liquid accounts (checking, saving, money market deposit accounts)	Loans for investment real estate
Certificates of deposit (time accounts)	Credit card balances
Government bonds	Other debt (home improvement loans, student loans, vehicle loans, unsecured credit lines, loans against pension and life insurance policies)
Other bonds (including corporate and foreign bonds)	
Stocks (directly held)	
Mutual funds (excluding money market funds)	
Retirement accounts (individual and employer-sponsored)	
Cash value of life insurance	
Trusts and other managed assets (including managed investment accounts)	
Other financial assets (e.g., royalties, futures contracts)	
<i>Nonfinancial assets</i>	
Primary residence	
Investment real estate (residential and nonresidential)	
Business equity (privately owned, with or without management role)	
Other nonfinancial (mainly vehicles and recreation tools, artwork, antiques, furniture, valuable collections)	
Source: Guiso et al. (2002 p. 6)	

Table A.2: Data sources for international comparison of household portfolios

Country	Data source	Sample size	Data years
United States	Survey of Consumer Finances (for ownership and amounts)	4,000-4,500	1983, 1989, 1992, 1995, 1998
United Kingdom	Family Expenditure Survey (for ownership only)	7,000	1978-1996
	Financial Research Survey (for ownership and amounts)	58,000	1997-1998
Netherlands	CentER Savings Survey (for ownership and amounts)	2,000	1993-1998
Germany	German Income and Expenditure Survey	40,000-46,000	1978, 1983, 1988, 1993
	German Socioeconomic Panel (for ownership only)	5,000	1990-1997
	Spiegel-Verlag Survey Soll und Haben (for ownership only)	4,000-8,500	1980, 1985, 1989, 1995
Italy	Survey of Household Income and Wealth (for ownership and amounts)	7,000-8,000	1989, 1991, 1993, 1995, 1998

Source: Guiso et al. (2002 p. 7)