

Essays on investment decisions of households across the wealth spectrum

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Aalto University publication series

DOCTORAL DISSERTATIONS 225/2016

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ISBN 978-952-60-7100-8 (printed)

ISBN 978-952-60-7095-7 (pdf)

ISSN-L 1799-4934

ISSN 1799-4934 (printed)

ISSN 1799-4942 (pdf)

<http://urn.fi/URN:ISBN:978-952-60-7095-7>

Unigrafia Oy

Helsinki 2016

Finland



Author

Niilo Luotonen

Name of the doctoral dissertation

Essays on investment decisions of households across the wealth spectrum

Publisher School of Business

Unit Finance

Series Aalto University publication series DOCTORAL DISSERTATIONS 225/2016

Field of research Financial economics

Date of the defence 4 November 2016

Language English

☐ **Monograph**

☐ **Article dissertation**

☒ **Essay dissertation**

Abstract

This dissertation consists of an introductory chapter and four essays.

The first essay provides first field evidence on the effect of financial resources on real economic decisions. A sudden increase in inventory costs tightens consumption budgets in a population of self-employed vendors of a Big Issue-type "street paper". After the budget shock, vendors become more responsive to expected demand in their stock-up decisions, and increase their inventory turnover. The timing of the behavior changes is consistent with the tightening budget having a causal impact on vendors' decisions.

In the second essay, I study whether and how expectations about financial safety nets may affect decisions to save and invest. Expected pensions are known to crowd out households' risk-free savings, but evidence on how they affect household participation in risky asset markets is mixed. Using rich survey data from Finland, I show that a negative outlook on the public pension system triggers private risky investments only among high-earning, financially sophisticated males. The less financially sophisticated appear to perceive risky securities and pension benefits as complements.

The third essay analyzes stock market participation in 19 European countries over 2004-2013, jointly controlling for all relevant variables from prior literature. Previous work relies on a subset of these factors, and often lacks good risk aversion proxies. Our full model explains 30% of the variation in the participation decision. Institutional factors captured by country fixed effects contribute 9.5 percentage points; traditional individual-level factors, such as risk aversion and income, contribute 15 pp; recently identified factors, such as trust and health, contribute 5.5 pp. We suggest a hierarchical framework for thinking about effects in the high versus low end.

The fourth essay, in contrast to the economics of happiness literature focusing on the link between income and reported life satisfaction, explores the relation between life satisfaction and holding stocks. We find that stock market participation explains happiness over and above other measures of financial affluence. Changes in individual participation status and happiness over time provide some evidence consistent with a causal relation. A potential channel that we study and find evidence for is increased social utility.

Keywords Economic decision making, household finance, investment decisions, portfolio choice, economics of happiness

ISBN (printed) 978-952-60-7100-8

ISBN (pdf) 978-952-60-7095-7

ISSN-L 1799-4934

ISSN (printed) 1799-4934

ISSN (pdf) 1799-4942

Location of publisher Helsinki

Location of printing Helsinki

Year 2016

Pages 157

urn <http://urn.fi/URN:ISBN:978-952-60-7095-7>

Acknowledgements

Like with this dissertation once, I don't know where to begin. In total, I spent about six years and three months with this undertaking, almost a fifth of my entire life so far. That is a long time, and a lot has happened during those years. Perhaps luckily, also in the life outside of the sphere of this dissertation.

At some points on this journey, quite many to be honest, it seemed like this project will never end. With the support and encouragement of certain people, I carried on each time. Perhaps the most important motivational discussions were had with Sonja, who always found a way to make me believe in myself and the meaningfulness of finishing. Sonja: While in the end it was indeed me who had to, time and time again, go back to the drawing board, I am enormously grateful for your caring and patience.

When it comes to the actual work behind the dissertation, I would never have completed it without my supervisor and co-author, Markku Kaustia. He, too, patiently supported me in different stages of the process, providing invaluable help in the development of research ideas, and making sure that I properly finish the work I have started. His sharp vision and dedication made it rewarding to work together, and I look forward to continuing this relationship in the future.

The insightful comments from my pre-examiners, Ari Hyytinen and Karolin Kirschenmann, were highly useful in the final stages. With Karolin, I had the privilege to discuss my research topics, and other aspects of life, already during the earlier, more formative phases of the project.

The faculty at the finance department have contributed significantly to my work and my thinking. Elias Rantapuska was instrumental as a source of feedback and ideas. Mikko Leppämäki was thoughtful and supportive in situations related and unrelated to the dissertation process; with his help through the GSF, practicalities were never an issue. Discussions with Sami Torstila always left me with a feeling of understanding the world just a little better. Peter Nyberg taught me how to teach and was great to work with. The list goes on: Eero Kasanen, Matti Keloharju, Matti Suominen, Vesa Puttonen, Bünyamin Önal, Matthijs Lof, Sevinc Cukurova. The non-faculty staff including Antti Lehtinen, Milja Koski,

Sanna Pesonen, Sara Viitala. Being around you has been a splendid opportunity for personal development.

The friendship, inspiration and insight from fellow PhD students is something I will carry with me for the rest of my years. Deniz Okat and Ville Rantala, with whom I started together back in 2010, and who shared with me many a jolly evening as well as their much appreciated thoughts on both life and research. Petra Vokatá, Mikael Paaso, Ellapulli Vasudevan, Yijie Li, Joona Karlsson, Markus Sihvonen, Mikko Niemenmaa, Antti Lehtoranta, Joni Kokkonen, Petri Jylhä, Kalle Rinne, Li Zhang, Emre Güven, Anna Makkoeva, Wenjia Yu, who all at some stage were part of my Aalto student community. The important extensions to this community, especially from Hanken (Magnus Blomkvist, Salla Pöyry) and Stockholm (Kristoffer Milonas, Egle Karmaziene, Nikita Koptuyug, Tomas Thörnquist, Mariana Khapko, Valeri Sokolovski, Fatemeh Hosseini, Jieying Li, Mats Levander, Valentina Gavazza, Arieda Muco, Jürg Fausch, Gulzat Zhetibaeva Elvung, Nathaniel Lane). I hope I was, and will be, able to give back at least some of the positive things I got from you guys!

I also wish to thank some of the people at SIFR (and later SHoF) in Stockholm, who made it possible for me to spend one year and more in the best of company and circumstances. Anki Helmer, Anders Anderson and Per Strömberg, among others, provided warm hospitality that was of great importance both personally and professionally.

Data and time: these are what writing the dissertation most concretely required. I am indebted to the staff at the Hirundo day center, especially Anca Enache, Maria Dorofte, Borislav Borisov, and Ralitsa Dimitrova, for their assistance efforts in the data collection process for the first essay. I am also grateful to a number of Iso Numero vendors for their co-operation in that process. I thank TNS Gallup Oy for providing the data for the third essay. My full-time commitment to the dissertation has partly been enabled by funding from the OP Group Research Foundation, the Graduate School of Finance, and the Foundation for the Advancement of Securities Markets in Finland.

Last but not least, I am lucky to have people around me to whom the work-me is not what counts. Ritva and Klaus, my mom and dad who are there for me without exception. Elisa, my ever-amazing sister. Close ones including relatives and friends, a wonderful bunch who repeatedly have taken my thoughts away from this project and thus broadened my perspective. Thank you for helping me understand what is, perhaps, most crucial: in the end, although I am now proud to have completed it, this is just a dissertation.

Time to turn the page and face some new beginnings.

Helsinki, 13 October 2016

Niilo Luotonen

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List of Original Essays

1. Luotonen, Niilo. Street smart. Unpublished manuscript.
2. Luotonen, Niilo. Pension system outlook and household demand for risky securities. Unpublished manuscript.
3. Kaustia, Markku; Luotonen, Niilo. What drives the heterogeneity in portfolio choice? The role of institutional, traditional, and behavioral factors. Unpublished manuscript.
4. Kaustia, Markku; Luotonen, Niilo. Shiny, happy people holding shares? Exploring links between subjective well-being and stock market participation. Unpublished manuscript.

Introduction

The investment decisions of households are at the core of behavioral economics and finance. A key objective in these fields of research is to understand why the observed decisions are made, and what consequences they may have. The four essays in this dissertation aim to bring us closer to that objective by empirically studying investment decisions in various contexts.

How might changes in financial resources, relative to one's needs, affect the way decisions are made? How do expectations regarding financial safety nets associate with the willingness to invest in risky securities? Which households end up participating in the stock market and why? Through seeking answers to these questions and more, my work, in the end, also sheds light on why we see such stark differences in economic outcomes across individuals. If stress from having to cope with insufficient resources, for instance, causes suboptimal financial decisions among the poor, a self-reinforcing cycle of poverty may arise (e.g., Shah et al., 2012; Haushofer and Fehr, 2014). People who decide to invest in stocks, on the other hand, accumulate more wealth than those who do not, even when differences in the level of active saving are accounted for (e.g., Mehra and Prescott, 1985; Cocco et al., 2005).

The dissertation contributes to a number of different branches of literature, in each of which a vast amount of work has been done before me. First, a relatively recent line of research, jointly pursued by economists and psychologists, studies how poverty may influence the mind of a decision-maker. The contributions in this area so far have reached contradictory conclusions, showing that having too little of a given resource – e.g., money or time – can plausibly cause both improvement and decline in the quality of decisions. By being first to provide evidence based on real economic decisions before and after a resource shock, my dissertation gives new insight on how and why behavior may be affected by the tightness of one's budget. Second, the effects that a pension system may have on households' financial decisions have received considerable attention, particularly in the field of public economics. In this area, the main contribution of my dissertation is to show how certain individual characteristics can influence the portfolio effects of pension system outlook. Third, an entire strand of literature in financial economics is dedicated to household finance, a field dominated by studies of stock market participation and

portfolio choice. In this domain, the dissertation helps reconcile the findings to date, testing which established reasons behind the decision to invest in stocks truly seem important and when. A novel framework for conceptualizing different types of stock market participation determinants is also presented, offering new ways forward in this field. Finally, the economics of happiness literature has a long tradition of studying the interplay between financial affluence and subjective well-being. To this field, my dissertation contributes by taking a household finance approach, showing that participation in the stock market predicts life satisfaction over and above other affluence measures and demographic factors. Evidence of a causal relation between participation and happiness is also presented.

1. Essay 1

The first essay deals with the allocation of funds between earnings-generating investment and consumption. The study relates to a rapidly expanding field of research in the intersection of economics and psychology, examining the effect of poverty on decision making. The central conjecture in this literature is that the mental strain caused by (near-) binding resource constraints can influence time and risk preferences, even cognitive abilities. While existing evidence largely appears consistent with poverty having an adverse effect on decisions (e.g., Haushofer and Fehr, 2014), it has also been shown that through eliciting greater focus, having limited resources can lead to more trade-off thinking and greater consistency in valuations (Shah et al., 2015).

For my study, I collect data on the behavior of vendors of a “street paper”. The vendors pay a fraction of the sale price for a magazine that they can later sell on the street. For about fourteen months, I observe the stock-up decisions of the population of 351 vendors. Four months into this period, a shock in pricing occurs, making vendors’ budgets tighter through an increase in the unit cost of inventories. Prior research has not been able to observe real economic decisions before and after a budget shock. Further, the shocks utilized previously have been temporary in nature (e.g., Carvalho et al., 2016), while the pricing change used here is indefinite.

After the budget shock, vendors become more responsive to expected demand in their stock-up decisions, and increase their inventory turnover. Evidence on the timing of the behavior changes is consistent with the cost increase having a causal impact on

vendors' decisions. Binding budget constraints could plausibly explain these findings, but when I suggestively evaluate their importance, it seems unlikely they would be the main driver of behavior. Although too crude to warrant strong interpretations, the analysis points toward cognition-related factors as potentially significant determinants in the decision-making of those who have little.

The results in the essay can be seen as encouraging for entrepreneurship-oriented reactivation efforts of the unemployed. They show that people with little education or entrepreneurial experience are responsive to changes in their economic environment, and appear to utilize their resources efficiently. In activities with better possibilities of achieving economies of scale, these “street smarts” could well become successful enough to eventually rise out of poverty. Creating an environment that fosters such activities could be what is left for governments to focus on.

2. Essay 2

In the second essay, I study whether and how expectations about financial safety nets may affect decisions to save and invest. The safety net I focus on is the public pension system. A well-established finding says that expected benefits from a pension system decrease households' private saving (e.g., Feldstein, 1974; Attanasio and Brugiavini, 2003). This “crowd-out” effect is consistent with households being aware of their expected pension benefits, and reacting to them by adjusting savings levels. In my study, the composition of those savings is of central importance: Does the crowd-out effect specifically concern risk-free cash savings, or is it perhaps even stronger for investments in risky securities? While the link from pension expectations to portfolio choice has been studied before (e.g., Bottazzi et al., 2006; 2011; Guiso et al., 2003; Gormley et al., 2010), results are mixed.

The essay utilizes nationally representative survey data from Finland, containing detailed individual-level information. Finland is an environment well-suited for the study, as its public pension system is extensively relied upon.

I first study the association between pension system outlook and non-risky saving, and find results consistent with the canonical crowd-out effect. Regardless of attributes such as gender, income, or education, people are less likely to save when pension benefits are expected to be sufficient. The same does not apply to risky forms of saving, however. The main contribution of the essay is to show that pension

expectations only affect the propensity to hold stocks among men who are well paid and educated, willing to take financial risk, and knowledgeable in economic issues.

If, as my results suggest, only those who are well-off to begin with use stocks as an instrument for retirement saving, concerns related to widening economic inequality may arise. The essay discusses a potential policy response that could curb this development. The results do not warrant interpretations regarding causality, however. In future work, built on panel data or experimental setups, for instance, this issue can hopefully be addressed.

3. Essay 3

The third essay studies the relative importance of environmental and individual-level factors in the decision to participate in the stock market. For data, we utilize the first four main waves of the Survey of Health and Retirement in Europe (SHARE), covering 19 European countries. We find that the bulk of the variation in participation probability is accounted for by individual attributes, such as age, wealth, and personality. Country fixed effects, which we use as a proxy for environmental factors, together account for roughly a third of the explanatory power we achieve in the baseline model. This contrasts prior work by Christelis et al. (2013) who suggest country-level factors to be more important than household characteristics.

Individual-level factors are divided into traditional and new ones in the essay. The traditional factors include gender, age, education, income, wealth, and risk aversion. The new factors, which have more recently been proposed in the literature, are social activity, interpersonal trust, political preferences, general optimism, cognitive skills, self-assessed health, bequest motives, religiosity, and physique. Of these two groups, traditional factors jointly contribute two to three times as much as new ones to explanatory power, depending on the specification we use.

The essay is also first to combine all the new factors together and directly pit them against each other. In contrast to most earlier studies, our data include a directly queried financial risk aversion measure. We report several new stylized facts about the role of the new factors individually. As a conclusion to our analyses, sketch a hierarchical taxonomy of the various types of factors, summarizing the circumstances under which each type should be important.

4. Essay 4

The fourth essay focuses on the outcome-side of investment decisions, asking how these decisions might end up affecting other domains of life. Specifically, we study whether individuals who have decided to participate in the stock market tend to report being happier with their lives. We establish links between economics of happiness, household finance, and psychology research that theoretically justify why investing in stocks could, besides its wealth effects, be associated with higher life satisfaction.

The essay utilizes the same set of SHARE data as the third one. We show that, even when controlling for income, wealth, and demographic factors, stockholders report higher levels of life-satisfaction than non-stockholders. We also present evidence consistent with a causal relation, showing that life satisfaction has developed more positively for those who have entered the stock market between survey waves. This result is not very strong, however, and the direction of a potential causality cannot be inferred.

Of potential channels through which stock ownership could increase happiness, we investigate one where an individual gains social utility from holding stocks. Assuming that marginal utility from participating in social groups is diminishing in their number, an individual with fewer other social communities should derive more social utility from being or becoming a stockholder. Our results are consistent with this idea.

We also find that levels of income and wealth are not as strongly associated with happiness among stockholders, and that owning stocks influences life satisfaction most among those with least income and wealth. We interpret these results to be consistent with the existence of a “satiation point” in financial affluence, something that is debated in the economics of happiness literature. Finally, among stock market participants, changes in personal wealth are particularly strongly associated with changes in happiness. We cannot pinpoint any specific explanation, but hypothesize that the accumulation of wealth may be generally more important for life satisfaction among stockholders.

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Essay 1: Street smart^{*}

ABSTRACT This study provides first field evidence on the effect of financial resources on real economic decisions. A sudden increase in inventory costs tightens consumption budgets in a population of self-employed vendors of a Big Issue-type “street paper”. After the budget shock, vendors become more responsive to expected demand in their stock-up decisions, and increase their inventory turnover. The timing of the behavior changes is consistent with the tightening budget having a causal impact on vendors’ decisions. My findings suggest that binding budget constraints are unlikely to drive the results, indicating that cognition-related factors may be important in explaining the economic decisions of those who have little.

^{*} I thank Pascaline Dupas, Mika Haapanen, Markku Kaustia, Nikita Koptug, Timo Korkeamäki, Deniz Okat, Elias Rantapuska, and Christian Schmaltz, as well as seminar participants at Aalto University, Graduate School of Finance PhD Workshop, and the Research Institute of Industrial Economics (IFN) in Stockholm, for valuable comments.

1. Introduction

Poor people have been shown to make adverse economic decisions that are less common among the well-off. Examples include playing lotteries with a negative expected value (Haisley et al., 2008), not enrolling in assistance programs (Bertrand et al., 2004), and engaging in short-term borrowing subject to sky-high interest rates (e.g., Chin, 2004). Demographic factors typically associated with being poor, such as having little education (Bernheim et al., 2001) or living in circumstances that foster unfavorable outcomes (Ludwig et al., 2001; Allard et al., 2003), fail to fully explain these behaviors. Consequently, a number of recent studies ask whether having low resources relative to needs, as such, might influence the mind of a decision-maker.

Having to cope with less than you feel you need has been found to have twofold effects on the quality of decisions. On the one hand, resource scarcity may be a strain on mental capacity, degrading performance in cognitively demanding tasks (Haushofer and Fehr, 2014). Self-control issues could also arise due to poverty (Bernheim et al., 2015). On the other hand, lack of resources may lead to the emergence of a “scarcity mind-set”, inducing us to engage more deeply in decisions that most affect those resources (e.g., Shah et al., 2012; 2015). Accordingly, those with little have been found more attentive to prices, more prone to trade-off thinking, and less susceptible to context effects and framing (Binkley and Bejnarowicz, 2003; Goldin and Homonoff, 2013; Shah et al., 2012; 2015).

As discussed by Carvalho et al. (2016), identifying causal links from poverty to behavior is challenging. Time and risk preferences may systematically differ between the poor and the better-off (e.g., Haushofer et al., 2013; Gloede et al., 2015), and reverse causality can confound results. To tackle the identification issue, experiments based on surveys or cognitive tasks have been conducted in laboratory settings (Shah et al., 2012; 2015) and in the field (Mani et al., 2013; Carvalho et al., 2016).

This study is first to analyze the effect of a resource shock on real economic decisions. A sudden change in the unit cost of inventory effectively makes financial resources more scarce in a population of self-employed vendors of a Big Issue-type “street paper”.¹ The setting is familiar in larger cities across the globe, with mainly

¹ *The Big Issue*, established 1991 in London, UK, is the most widely known street paper in Europe. Other well-known street papers include *Street News* (launched in New York City, US, in 1989) and *StreetWise* (Chicago, US, 1992).

homeless or otherwise disadvantaged people selling magazines in order to enhance their financial situation. Vendors invest in their stock of papers by paying a fraction of the selling price for each copy. This price is unexpectedly raised, making vendors' consumption budgets tighter by tying up additional cash in inventory. In contrast to related research utilizing resource shocks that are known to be temporary (Mani et al., 2013; Carvalho et al., 2016), the shock in the current study is plausibly permanent *ex ante*, and has been so *ex post*.

The increased cost of inventories significantly alters the vendors' behavior. First, vendors become more responsive to expected demand in their stock-up decisions, which suggests that their behavior more closely corresponds to utility maximization. Second, they increase their inventory turnover, shown as more frequent stock-ups and a lower number of papers bought at a time. The findings are partly stronger in, and partly confined to, the subsample of vendors who were active both before and after the cost increase, i.e., those plausibly *reacting* to it. Evidence on the timing of the behavior changes is consistent with the tightening budget having a causal impact on vendors' decisions.

Binding budget constraints could plausibly explain the observed changes in behavior. If a vendor can no longer afford a stock-up matching expected demand with the higher price, she will have to stock up more frequently to meet demand. To assess the importance of budget constraints for vendors' decisions, I look at the subsample active in both pricing regimes, and estimate each vendor's likelihood to face a binding budget constraint. Assuming that, on average, lot sizes (the number of papers purchased at a time) in the past are informative about budget flexibility in the future, I use pre-change average lot size as a proxy for this likelihood. I find that those expected to have most slack in their budget significantly shrink their average inventory when its cost rises, while those considered likely to be budget constrained increase their average stock. While this analysis is too crude to warrant strong interpretations, I conclude that binding budget constraints seem unlikely to drive the changes I observe in vendors' behavior.

My conclusion stands in contrast to Carvalho et al. (2016), whose results suggest that lack of available resources is more important than behavioral factors in explaining the economic decisions of the poor.² Instead, cognition-based explanations seem

² Carvalho et al. (2016) emphasize that their finding regarding the greater importance of resource constraints is only suggestive.

more promising for the increased responsiveness to demand and quicker turnover. One possibility is that, as available resources effectively get lower due to the larger budget fraction tied up in inventory, the scarcity mind-set renders decisions closer to normative predictions. In other words, because the vendors have less, their decisions become “smart”. This would be in line with Shah et al. (2015). However, several alternative explanations are also plausible. For instance, the larger budget fraction tied up in inventory may make its cost and risk more salient, and as a result, increased attention could be paid to matching stock-ups with expected demand.

Besides the existing research on poverty and decision making, my results contribute to the emerging literature studying small-scale (informal) self-employment, where evidence so far mainly comes from developing countries. Dupas et al. (2016) find that bicycle taxi drivers in Kenya are more likely to work on days when expected income is high; my result of vendors being responsive to expected demand is consistent with this. Underinvestment due to capital constraints (Fafchamps et al., 2014; De Mel et al., 2008) or suboptimal inventory management (Kremer et al., 2013) has been found to hurt the profitability of microenterprises; my results suggest budget constraints are not of first-order importance, and again, the fact that lot sizes generally follow expected demand indicates that inventories are reasonably managed.

Many developed economies currently face structural unemployment, with a bulk of their industrial jobs relocated or made redundant through new technology. To spur economic activity, governments seek to reactivate the long-term unemployed – often overlooked by employers (Kroft et al., 2013; Ghayad, 2013) – through programs helping them access self-employment (for such programs in the U.S., see Kugler, 2015). The results in this paper can be seen as encouraging for these reactivation efforts. They show that people with little education or entrepreneurial experience are responsive to changes in their economic environment, and appear to utilize their resources efficiently. In activities with better possibilities for achieving economies of scale, these “street smarts” could well become successful enough to eventually rise out of poverty. Creating an environment that fosters such activities could be what is left for governments to focus on.

The paper is organized as follows. The following section explains the setting of the study. Section 3 outlines my hypotheses, while Section 4 discusses the data and provides descriptive analysis. Section 5 presents the main results, and Section 6 concludes.

2. The setting

The *Iso Numero* magazine (“IN”) was started 2011 in Helsinki, Finland, by *Kultti ry* (“the publisher”), a Finnish not-for-profit association of cultural, scientific, and advocacy magazines. Similarly to street papers like *The Big Issue* in the United Kingdom, the motivation behind launching IN was to provide an additional source of income for anybody who needs one. The costs incurred in the publishing process are covered by income from advertisers and vendors. Most of the contents consist of reprints from the approximately 200 member magazines of the publisher, and the few journalists and staff working for IN are volunteers. In contrast to many street papers around the globe, no contents are produced by the vendors themselves. Poverty, homelessness, and social inequality are characteristic topics, but lighter subjects, such as popular culture, are also covered.

A. The vendors

“Nomadic” migrants from the EU area were one group that the publisher expected to particularly benefit from the paper. These migrants typically remain in foreign cities only for some months at a time in search of informal earnings opportunities.³ Once a sufficient amount of money has been earned they return home, only to travel again once the savings accumulated abroad have run out. A severe shortage of work opportunities in their regions of origin appears to drive the phenomenon.⁴ During their time in Helsinki many of the migrants are “homeless”, sleeping in illegal encampments or abandoned buildings, for instance. Selling street papers under the brand of a local organization was seen by the publisher as a way to enhance both their legitimacy and their economic situation.

The main distribution site is a day center where the migrants are provided with daily necessities.⁵ The center is operated by the Helsinki Deaconess Institute, a public utility foundation. IN was first also distributed at similar day centers providing services to permanent residents of Helsinki, but among locals, the opportunity to

³ EU citizens can stay in any EU country for up to three months with no permit requirements.

⁴ For an account of the economic strategies of migrants traveling between Slovakia and the UK, see Grill (2015).

⁵ The services include showers, computers, laundry machines, and cooking facilities, along with assistance related to, e.g., housing, healthcare, work, and travel arrangements.

become a vendor was not met with enthusiasm. The few locals who are occasionally active as vendors are left out of the sample.

I interview about 10% of the vendors at the distribution site, asking questions about their background and daily life. The information summarized in Table 1 shows that the interviewed vendors, who are often in prime working age, have gone to school an average of five years, with less than half of them ever having worked for salary. The most commonly cited job is construction worker. Many used to work in Southern European countries such as Italy or Spain, but were forced to emigrate after 2009, when the European debt crisis made masses of people in these countries jobless. In Helsinki, their income sources besides selling IN include deposit bottles, begging, and, preferably due to the better pay, day-labor activities such as cleaning or snow clearing. Table 1 also shows that an average day's earnings from street papers are around 15-30 euro in the interviewed subsample of vendors, slightly more than from deposit bottles or begging. With daily consumption at 10-15 euro, a surplus of 5-10 euro per day appears typical. When asked how they decide on the number of papers to buy on a given day, the majority of the interviewed vendors stress the importance of expected demand rather than the availability of cash.

Based on discussions with vendors and social workers at the distribution site, it appears that vendors typically finance their travel by borrowing from informal moneylenders. Monthly interest rates are said to be around 50%, so in the first weeks abroad paying down debt is highly prioritized.⁶ After that, a fraction of earnings is regularly sent back home to family members through cash transfer services.

B. Rules and legal framework

Vendors are not employed by the publisher, but work on their own account. In taxation, the papers are considered tradeable assets, and selling them is treated similarly to trading financial securities, for instance. Trading profits are tax free in Finland until the annual value of assets sold (i.e., gross revenue) reaches 1,000 euro.

⁶ A common belief, cited, e.g., in the popular press, is that the earnings of these migrants, whether from street papers, begging, or something else, in the end go to criminal organizations. The same organizations would be responsible for bringing the migrants into the country. I saw no evidence of this, and in the case of IN, it seems unlikely. However, I know little about the informal moneylenders that reportedly finance many vendors' travels. If they are associated with criminal organizations with coercive terms of lending, organized crime could play a significant role in the migration process, not much different from human traffickers.

This means that after 200 papers sold in a given year (250 before the increase in selling price), revenues should be self-declared to the tax authority.

Against common street paper practice, IN vendors do not need to sign a code of conduct that would prohibit selling under the influence of alcohol or drugs, for instance. Vendors are made aware, however, that (1) selling should be strictly separated from begging, so that the vendor badge or papers are not kept visible if begging, and (2) selling is only allowed outdoors in public places, not inside, e.g., public transport vehicles or stations.

C. The price change

In mid-September, 2014, the publisher noticed that roughly half of the revenue it should have received from sales earlier that year was missing. The number of papers sold to vendors during the year, according to reports from the distribution site, was far greater than what their cash balance justified. To be able to print the next issue and keep the paper alive, the publisher needed to increase the price vendors paid for the papers.

The change in pricing became effective upon publication of the next issue, October 17th, 2014. To maintain a vendor's net income per paper sold at three euro, the selling price was also raised. Before the change, a paper cost one euro for a vendor to buy, and was sold on the street for four euro. After the change, a paper costs two euro for a vendor, and five on the street.

D. Practices at the distribution site

Purchases are generally made in cash. An exception is the occasional trade-in of outdated papers, which are exchangeable on a one-to-one basis for current ones in the first weeks of a new issue. In connection to the price change, the ratio was two outdated ones (that had been purchased for the old price of one euro) for one current (worth two euro).

Refunds for unsold papers are explicitly not allowed. Due to the financially fragile situation of many vendors, however, a small number of *ad hoc* exceptions have been made. During the sample period, a refund was granted on 25 occasions, for an average of eight papers at a time.

Finally, to lower the threshold of trying, each newly registered vendor receives one free copy of the paper. Although small in size, this grant theoretically makes the cash constraint to entry redundant. With the proceeds from selling the first copy, the vendor can buy two more, and so forth.

3. Hypotheses

To establish a benchmark against which to compare my results, I first sketch an idea about the way an expected utility maximizing vendor should behave. In this setting, maximizing utility involves a tradeoff between maximizing income, which linearly increases with papers sold, and minimizing its cost. The cost of income will include (a) the cost of tying up cash in the stock of papers, thereby reducing consumption possibilities, and (b) the time spent selling, because this time could also be spent on other utility-enhancing activities. I hypothesize that when, in terms of demand and competition, expected daily sales are high, an expected utility maximizing vendor is more active. Conditional on her stock-up frequency, this will mean increased lot size. Hence:

H1: Conditional on expected competition and stock-up frequency, an expected utility maximizing vendor's lot size increases with expected demand.

The increase in purchase price, from one euro to two, will enter a vendor's maximization problem as a doubling of the unit cost of inventories. On the other hand, the rise in selling price from four euro to five will increase gross income, so that net income per paper sold remains constant at three euro. Effective return on investment is halved from $3/1=300\%$ to $3/2=150\%$. How should an expected utility maximizing vendor respond to these changes?⁷

For an example, imagine a vendor stocking up in the morning. Her budget for the day is 20 euro, and she expects to be able to sell 10 papers during the day. When the price of a paper is one, she would spend 10 euro, or half her budget, on a stock-up matching

⁷ A response to the price change may also be expected from the readers' side. In the case of a usual consumption good, an increase in price should lead to a decrease in demand. Any such response will be incorporated in vendors' demand expectations, and can be abstracted from at this point. In Section 5.D, I discuss the probability and potential implications of a demand-side response in more detail.

expected sales. When the price is two, the entire budget of 20 needs to be tied up. At the end of the day, her wealth will be 50 euro in both cases, assuming she sells all papers. In the latter case, however, she needs to give up the 10 euro “consumption backup” that will be highly valuable in case no buyers are found. In other words, the higher price, and the larger wealth fraction tied up in inventories, effectively makes the vendor poorer when papers are still in stock.

The example vendor, whose budget is tight, has a high cost of tying up the additional cash required to meet expected demand. The cost could be even higher: if the initial budget was only 10 euro, borrowing would be the only way for the vendor to afford a stock-up matching expected demand. It seems plausible she will not incur this cost, but instead makes smaller stock-ups relative to expected demand after the price change. If she does not wish to miss out on sales, her purchases will consequently become more frequent. Hence:

H2: A budget-constrained vendor will make more frequent stock-ups after the price change.

H2 comes with an important corollary: a vendor with slack in her budget, who needs not to worry about the consumption backup, will not change her behavior in this manner. With a daily budget of 50 euro, for instance, 10 papers can be bought in both pricing regimes without risk of ending up with an empty stomach for the day. If such a vendor changes her behavior when the unit cost of inventory rises, the change will not be forced by a binding budget constraint. As her resources do get lower *relative to needs*, however, one plausible reason for her behavior to change may be the emergence of a “scarcity mind-set”, as argued by, e.g., Shah et al. (2012; 2015).

Finally, as described, a budget’s tightness depends on expected demand. When expected demand is high, relatively large lots are needed to meet that demand, which means relatively large amounts of cash need to be tied up in inventories. Hence:

H3: Any effects caused by the price change are particularly strong in times of peak demand.

4. Data and descriptive analysis

The data mainly consist of statistics kept at the distribution site.⁸ With each stock-up, the date, the vendor’s ID-number, and the number of papers bought is documented. This allows the tracking of individuals through time. A file of ID-numbers and names further enables me to identify the gender and nationality of each vendor. The rest of this section further elaborates on the variables, as well as provides descriptive analysis of vendor behavior.

A. Variables

Lot size i,s is defined as the number of papers vendor i buys at stock-up s . Here, i refers to a specific vendor in the population of 351 vendors, and s to the stock-up number of that vendor in her personal sequence of stock-ups. For example, if s equals 3, we are examining the third stock-up of vendor i , counting from the beginning of the sample period. As seen in Table 2, the average lot size is 13. Negative values indicate refunds. Lot sizes of 100 or more appear only four times during the sample period (110 twice, 130 and 195 once each), all of them by different vendors on the day Issue 1 was published.

Stock-up frequency is measured both as the vendor-specific *# days since last stock-up* i,s and the weekly average *Stock-ups per vendor*. Table 2 suggests that during active spells, vendors typically stock up quite frequently, while there can be several months between these active spells. Of the 2,168 observations on the time between consecutive stock-ups, half are three days or less, but the maximum is more than a year.

Demand from the buyers’ side, which is not directly observable, is controlled for in several ways. First, assuming that more vendors are active when demand is high, I control for the number of vendors buying papers on day t in the variable *# active vendors* t . Second, I use the strong variation in vendor activity over an issue’s life cycle (demonstrated in Figure 1 below) to construct rough periodic indicators of demand levels. Specifically, I split issue life cycle into three periods, counting from the date of publication: *Days 1-5* (“peak demand”); *Days 6-20* (“intermediate

⁸ Keeping statistics only started with my data collection, in June 2014. Prior to this, there was no systematic bookkeeping, which perhaps contributed to the mismatch between magazines sold to vendors and the publisher’s income noticed in September 2014.

demand”), and the rest (“low demand”).⁹ Table 2 shows that almost a fifth of all stock-ups are made during the first five days, although the days only account for 8% of the sample period. Similarly, the following fifteen days continue to be busier than the rest of the life cycle: 32% of all stock-ups are made on these days, while they only cover 24% of the sample period.

Papers are mainly sold around hubs of public transit. Arguably, when more people use public transit, there is a higher chance for a vendor to find a buyer. I therefore use the daily number of people boarding the subway at the Helsinki Central railway station, the busiest subway station both in terms of passengers and IN vendors, as a further demand proxy. This number is shown in the variable *Public transit*_{*i*}.

Finally, people may be less willing to take the time and effort to buy a paper on rainy or cold days. To control for weather-induced demand fluctuations, I include daily temperatures and millimeter amounts of rain in some of the regressions.

I control for competition in a weekly Herfindahl index that indicates how equally the market is split among vendors. A high Herfindahl value means that purchases are dominated by relatively few vendors. In *Herfindahl (adjusted)* shown in Table 2, I have reverted the index so that a high value means large dispersion in purchases, i.e. high competition.¹⁰

Individual-level statistics are shown at the bottom of Table 2. About 40% of the vendors are female. Importantly, a large fraction of vendors do not regularly engage in selling. An average vendor has bought papers on about four separate weeks during the sample period, as seen in the variable *# active weeks*_{*i*}. 132 of the 351 vendors only bought once during the sample period, and 143 were active during just one week. 24 vendors sold all four issues that came out during the sample period, while 89 were active both before and after the price change. An average vendor bought about 90 papers in total during the sample period.

Two vendors have claimed refunds for more papers than they paid for, making their total purchases negative. This shows that papers bought and papers sold do not match for all vendors, but papers also change hands *between vendors*. In interviews, vendors

⁹ Stock-ups can only be made on weekdays. These periods thus vary in their “calendar length” depending on the weekday of publication, and also on potential public holidays.

¹⁰ The original values are on the interval (0,1]. In this adjusted version, I have also multiplied the values by 100 and shifted them downwards so that the minimum value of the distribution becomes one.

confirm that a secondary market exists, and that the vendor-to-vendor price typically equals the price paid at the distribution site. Unfortunately, the exact functioning and scope of the secondary market is beyond my analysis due to data limitations.

B. Vendor activity over the sample period

Figure 1 shows, for each week of the sample period, (1) the aggregate number of papers bought; (2) the number of vendors who bought at least once; and (3) the ratio between (1) and (2). Four issues were published during the sample period: Issue 1 in June 2014; Issue 2 in October 2014; Issue 3 in March 2015; and Issue 4 in June 2015. Issues 1, 2, and 3 were sold for 13 to 20 weeks, and their respective total sales were about 9,400, 8,600, and 7,700 copies. On Issue 4, I only have data for the first eight weeks, during which it sold about 5,700 copies.

The clear spikes in vendor activity suggest that demand from buyers shoots up when a new issue is published, and gradually diminishes to a “base level”. Vendors confirm this pattern in discussions. The fact that many vendors are only active in the first weeks of new issues suggests that for them, other income opportunities dominate during quiet times. The average size of a stock-up is large in weeks of high expected demand, but also when there are few other active vendors.

The reason for Issue 1 selling more than other issues in its initial weeks appears to be the larger number of active vendors. Purchases per vendor are similar, and even higher, in the first weeks of the following issues. Besides the publication weeks, a period that clearly stands out in Figure 1 is January and February of 2015. During these months, relatively few vendors seem to have been dominating the market, buying unusually large lots on average.

C. Lot size and stock-up frequency in the two pricing regimes

To see whether vendors behave differently in the two pricing regimes, I first make distributional comparisons of lot size and stock-up frequency between regimes. Figure 2 shows the distributions.

The main difference between the lot size distributions before and after the change is the increased occurrence of purchases of five, 15, and 25 papers at a time, with the apparent expense of 10-paper purchases. One potential reason could be that with the new price, these lots became payable with more “round” sums of money, which

vendors seem to prefer. Exceptionally large lots of more than 30 papers at a time made up 6.7% of stock-ups before the price change, and 3.8% after. Whether they are considered or not, a Wilcoxon rank-sum test cannot reject the equality of the two distributions.¹¹ That is, the increase in price did not shift the full-sample lot size distribution to the left, for instance, as H2 would have predicted if the sample solely consisted of budget-constrained vendors present in both regimes.

The number of days between a vendor's consecutive stock-ups is more often three or less after the price change. Situations where the preceding gap is very long, 30 days or more (4.6% of cases before the change, 10.7% after), are not reasonably comparable before and after the price change. A vendor active with Issues 1 and 4 only, for instance, can have more than 300 days between consecutive purchases, while such long breaks are not possible in the pre-change period alone. When this is taken into account, the typical number of days between stock-ups is significantly longer in the low-price regime.¹² This change is consistent with the quicker turnover hypothesized in H2, but whether it is caused by the price change cannot be inferred.

5. Results

A. Is vendor activity responsive to demand?

In Table 3, I study whether lot size increases with expected demand when other relevant factors are held constant. Specifically, I run regressions of observed lot size on measures of expected demand, controlling for stock-up frequency and expected competition. While finding a positive relation between lot size and demand will not unequivocally mean that vendors are utility maximizers, it would suggest that an average vendor's behavior is consistent with utility maximization. H1 summarized this prediction.

Shah et al. (2015) show that the tightness of one's budget may, as such, affect decision-making. In this study's context, the increase in the paper's price led to an effective tightening of vendors' budgets. To see whether behavior consistent with utility maximization is more or less prevalent when budgets are tighter, I separately

¹¹ The p-values for the full and restricted sample tests are 0.188 and 0.895, respectively.

¹² A Wilcoxon rank-sum test, including purchases where the preceding gap is 30 days or less, returns a p-value of 0.002.

run the analysis for the pre- and post-change periods. Importantly, to see whether any differences across regimes may reflect a reaction induced by the price increase, as opposed to changes in sample composition, I also separately focus on a “restricted” subsample of vendors who were present in both pricing regimes.

The results for the full sample of vendors and the full sample period, in columns (1) and (2), suggest that the vendors’ behavior is, on average, consistent with expected utility maximization. When expected demand appears high, i.e., when many vendors are active and when a new issue has just been published, lot sizes are larger. Also, when only one day has passed since the previous stock-up, meaning that a vendor has quickly sold out her papers, relatively large lots are bought.¹³ On the other hand, when a second stock-up is made on a single day, it is typically smaller than average. These stock-ups often result from uncertainty in expectations. For example, a vendor might first buy five or 10 copies, but then observe that others are more optimistic about sales, and buy a few more before heading out for the day. This is suggestive of vendors actively updating their demand expectations.

Columns (4) and (6) split the sample period by the two pricing regimes. The finding consistent with utility-maximization – that lot sizes are responsive expected demand – is robust only in the high-price regime. In the pre-change period, where price is low, the number of papers purchased is less intuitively associated with the explanatory variables. While stock-ups are larger when more vendors are active, vendors accumulate, if anything, larger inventories when competition is high relative to demand. Importantly, in the low-price regime, lots are no larger in the peak demand period of the first five days than during the rest of the life cycle.

Columns (3), (5), and (7) repeat the analysis for the restricted sample. Also in this subsample, responsiveness is weak in the low-price regime, but strong in the high-price regime. Furthermore, almost all the coefficients in column (7) are larger than in column (6), implying that these vendors drive the full-sample finding of greater responsiveness to expected demand when price is high. The result is in line with an interpretation where the greater responsiveness is a *reaction* to the higher price, and shows that it is not caused by differences in sample composition across regimes.

¹³ Time since last stock-up was included in the regression up to six days, but all the coefficients are not shown. In the full sample, the coefficient remains positive and significant up to a gap of four days.

In sum, Table 3 provides evidence that behavior consistent with utility maximization, as described in H1, mainly occurs in the high-price regime, and mainly by vendors who were present in both regimes. These vendors may, for example, have reacted to the tighter budget constraints by becoming more attentive to expected demand. Alternatively, however, the results might not be driven by price, but reflect, e.g., learning over time: as experience accumulates, behavior could converge toward an equilibrium of utility maximization.

B. What causes the post-change increase in stock-up frequency?

Table 4 studies whether the price change plausibly caused the increase in stock-up frequency observed in Figure 2. The timing of the increase is examined in more detail by looking at the sample period issue by issue. If the reason for the frequency increase is the change in price, the two should occur simultaneously. The regressions control for factors that should partly determine how soon a vendor returns, such as the size of the previous stock-up. The dependent variable is defined in two alternative ways: as the number of days between the stock-ups of an individual vendor (columns 1-4), and as the weekly total number of stock-ups (by all vendors) divided by the number of active vendors (columns 5 and 6). Vendors who were present in both periods are again separately analyzed. Finally, for comparability, columns (1)-(4) only use the first 35 weekdays (seven to eight weeks) of sales for each issue, as this is the maximum time period available for Issue 4.

First of all, columns (1) and (2) show that in the full sample, the estimated increase in average stock-up frequency is small and not statistically significant. The likely reason for this contrast to the distributional test is the restriction of data to the first 35 days of each issue. The only factor that significantly predicts the interval between stock-ups is backward-looking demand, in column (2). When the number of other vendors buying papers is high on a stock-up day, vendors tend to take a longer pause.

Importantly, however, columns (3) and (4) show that vendors in the restricted sample do stock up more frequently after the change, and that the main shift in average stock-up intervals coincides with the price increase. As seen in column (3), the unconditional means for the dependent variable in Issues 1, 2, 3, and 4 are 5.3, 4.4, 4.2, and 4.0, respectively. The backward-looking control variables have no significant impact of their own, but including them makes the frequency estimate for Issue 2 lose accuracy.

Column (5) shows that, compared to Issue 1, the weekly average number of stock-ups per vendor is higher by about 0.31 to 0.35 in all of the high-priced issues. The only real jump is seen between Issues 1 and 2, in tandem with the price change. The unconditional average is 1.47 in Issue 1, and 1.82 in Issue 2.¹⁴ In fact, while the *maximum* of the dependent variable is 1.91 in the low-priced issue (“in no week did the average vendor stock up twice”), its 75th percentile is 2.11 in Issue 2 (“a quarter of the weeks saw the average vendor stock up at least twice”). In other words, vendors become substantially more likely to stock up several times per week, just when the unit cost of inventories is raised.

In an unreported robustness check, I further confirm that the greater average stock-up frequency does not merely reflect large behavior changes by a few individuals. Around each issue-to-issue transition, I identify the vendors who were active both pre- and post-transition. The transition from Issue 1 to Issue 2 is the only one where it is most common for the involved vendors to increase their average weekly number of stock-ups.

In H3, I hypothesized that any effects caused by the price change will be most visible when expected demand is highest. In column (6), I test this hypothesis. I proxy weekly expected demand by the number of papers bought by the average vendor that week. If the cost of inventories truly becomes an issue, several stock-ups should be seen particularly on weeks when a large number of papers is required to meet demand. The results support this idea. When price is low, the weekly number of stock-ups per vendor is unrelated to the number of papers bought that week. Once the unit cost of inventories increases, a positive, statistically significant relation emerges. With this finding included, Table 4 provides compelling evidence that the increase in turnover was caused by the higher inventory costs.

C. The role of budget constraints

The jump in the unit cost of inventories caused vendors who were present in both regimes to increase their stock-up frequency. The underlying reason, however, remains unclear. One hypothesis is that vendors face tight budget constraints, as in H2. As they cannot afford to tie up additional cash in inventories, they buy fewer

¹⁴ The regressions in Table 4 include an unreported dummy for weeks when the issue changes, as these weeks see sales from two separate issues. This is why the unconditional averages do not exactly match those seen in the table.

papers relative to expected demand in the high-price regime. Cognition-based explanations are also plausible. For example, the tighter budget may make vendors more attentive to matching inventories with demand.

This section attempts to evaluate the extent to which binding budget constraints account for the observed behavior change. I only focus on the restricted sample, and split this subsample based on the vendors' estimated likelihood to face a tight budget. I assume that, on average, those who have been able to buy exceptionally large lots in response to high demand in the past, will also be able to do so in the future. With this rationale, the split is based on pre-change average lot size, and those in the high-group are hypothesized to be less likely to face budget constraints.

Differences in pre- and post-change behavior in the high- and low-groups are presented in Table 5. For vendors in the low-group, i.e., among those more likely to become constrained, both lot size and stock-up frequency significantly increase with the price change. For those in the high-group, on the other hand, average lot size drops by almost half, and the rise in frequency is insignificant. It seems that as a result of the big buyers diminishing their volume, the others have been able to get a larger share of the market. Vendors in the low-group significantly boost their sales in the high-price regime, as evidenced by the 50% rise in weekly papers bought.

The tests in Table 5 show that vendors who, *ex ante*, may be expected to have most slack in their budget, significantly shrink their average inventory when its unit cost rises. By contrast, those considered most likely to face binding budget constraints increase their average stock. Together, this appears inconsistent with the scenario in H2, where a budget constraint determines a vendor's reaction to the price change. While this analysis is too crude to warrant strong interpretations, I conclude that cognition-based explanations seem more promising in explaining the observed increase in turnover.

D. Are the results confounded by a potential demand-side response?

My analysis abstracts from the fact that readers may be less willing to buy the paper with the increased price. This may be seen as an issue potentially confounding my findings. In this section, I address this concern by discussing the implications that a demand-side response might have on my results, and then arguing that the probability of such a response should be low in the first place.

The finding related to my first hypothesis – that vendors are more responsive to demand in the high-price regime – is arguably independent of the *level* of demand in either regime, as it deals with how vendors react to within-regime fluctuations. The same should apply to the third hypothesis: without taking a stand on whether market-wide demand is high or low on average, vendors will plausibly stock up many times most probably on weeks when, relative to other weeks, they buy a large number of papers.

Regarding my second hypothesis, a decrease in demand could cause behavior to change without an active decision from the vendors' side. In this case, we should witness either smaller average lots, less frequent stock-ups, or both in the high-price regime. Table 5 shows that in the restricted sample, lot size does decrease on average, but at the same time stock-up frequency goes up. As a result, there is an increase in turnover, and no significant change in the number of papers bought per week. In the full sample, Figure 2 shows no change in the distribution of lot size, and more frequent stock-ups. In sum, vendors do not become less active in the high-price regime, as they should if fewer buyers were available. The fact that a decrease in demand would force vendors stock up less frequently, keeping lot size constant, only appears to strengthen the argument that the increased turnover is a vendor-driven decision.

Finally, it appears unlikely *ex ante* that a decrease in demand should be seen in the first place. An increase in price typically leads to a decrease in demand in the context of normal consumption goods. For most buyers, a street paper is not such a good. For example, Hibbert et al. (2005) survey readers of the Big Issue in Scotland and find that “few are able to see the purchase of the magazine as purely commercial” (p. 170). There is a significant charity aspect, and buying can be rather seen as an experience than as pure consumption. As a result, the buyers' sensitivity to price should be low (see, e.g., Wakefield and Inman, 2003; Karlan and List, 2007; Meer, 2013).

Responses to a web-based reader survey provide evidence that also *ex post*, the one-euro price increase was unlikely to affect demand. The survey, conducted in November and December, 2015, was advertised through IN's website and social media channels. While probably not representative, this sample of buyers seems valuable for understanding where IN's demand comes from. Their responses, shown in Table 6, strongly suggest that IN is rather bought for experience than for

consumption, and the demographic profile indicates that paying one euro more for a paper that comes out three times per year should not be an issue.

6. Conclusion

I show that vendors of a street paper significantly alter their behavior in conjunction with a rise in their unit cost of inventories. After this cost is raised, vendors are more responsive to expected demand in their stock-up decisions, suggesting that their behavior more closely corresponds to utility maximization. They also increase their inventory turnover, as evidenced by more frequent stock-ups and a lower number of papers bought at a time. These findings are partly stronger in, and partly confined to, the subsample of vendors who were active both before and after the cost increase, i.e., those plausibly *reacting* to it. Evidence on the timing of the behavior changes is consistent with the cost increase having a causal impact on vendors' decisions.

Binding budget constraints could potentially explain my findings. A vendor whose budget is tight could not afford to tie up additional cash in inventories, and would be forced to buy fewer papers relative to expected demand in the high-price regime. To roughly evaluate the extent to which budget constraints account for the results, I categorize vendors based on their pre-change average lot size, assuming that it reflects the extent to which they have slack in their budget. Those expected to have most slack in their budget shrink their average inventory after costs rise, and those considered most likely to be constrained increase their average stock. This suggestive result appears inconsistent with budget constraints being the main driver of behavior. However, the analysis is too crude to warrant strong interpretations.

If having to cope with insufficient resources, as such, leads to adverse economic decisions, a self-reinforcing cycle of poverty may arise. While a number of important contributions have recently been made, evidence on the effect of financial resources on decision-making is, as it stands, mixed. The current study adds one piece to the puzzle, but cannot conclusively reveal the mechanisms at play. This is a promising area for future research to explore.

While the income from selling street papers will alone be insufficient for lifting a vendor out of poverty, the activity can be important through the legitimately earned economic independence it provides. Inner city crime rates, for instance, have been reduced according to the police in cities where street papers have been introduced

(Swithinbank, 1997). Other forms of supported self-employment, promoted by governments around the globe in efforts to activate their long-term unemployed, may arguably have similar effects. My results further encourage these efforts, suggesting that those who have little are likely to efficiently employ their resources.

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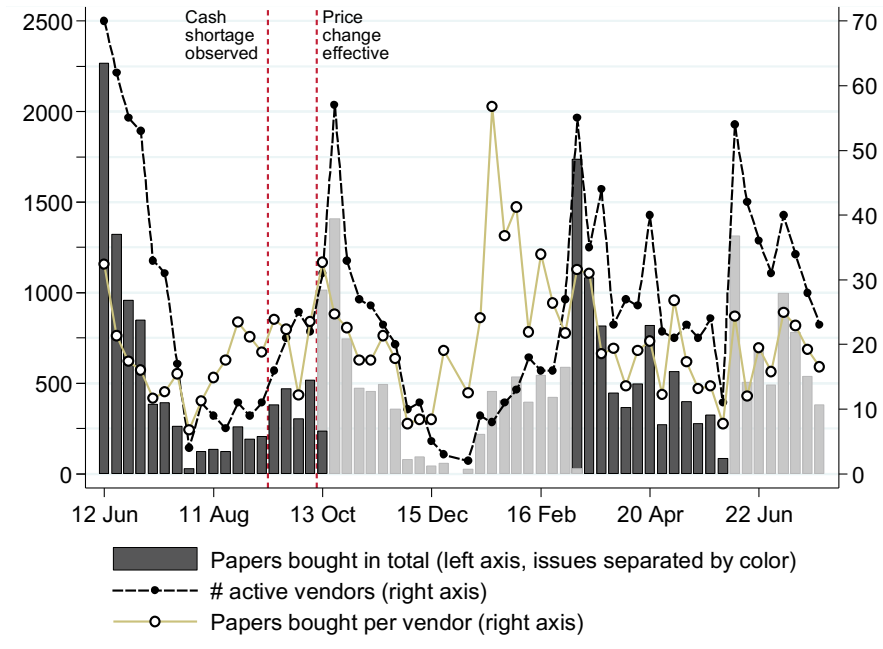


Figure 1. Weekly total and per-vendor purchases during the sample period

The figure depicts vendor activity by calendar week, starting Thursday June 12th 2014 and ending Tuesday July 28th 2015. The bars depict the combined purchases made by all vendors during a week, with values on the left axis. The color of the bars changes when a new issue comes out. If a new issue came out in the middle of a calendar week, that week's bar is split into two colors proportionally to the sales of the old and the new issue. The black dots describe the weekly number of vendors making at least one stock-up, with values on the right axis. The white dots describe the total number of papers bought divided by the number of active vendors, with values on the right axis.

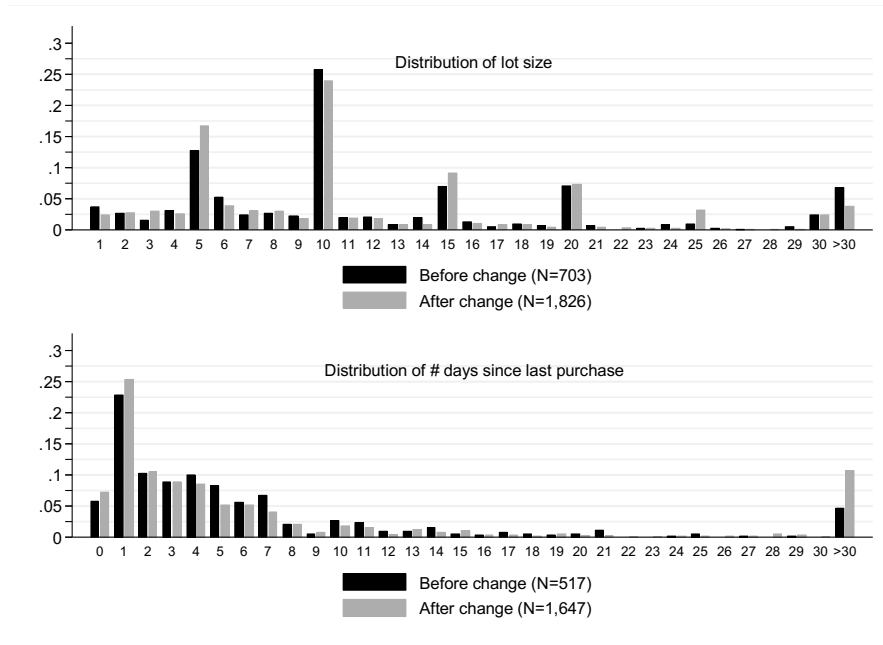


Figure 2. Distributions of lot size and stock-up interval before and after the price change

The top graph shows how often, proportionally, a given lot size occurred before and after the price change. Lot sizes of more than 30, as well as negative lot sizes (refunds), are excluded from the analysis. In the bottom graph, the variable of interest is changed to the interval between a vendor's consecutive stock-ups. Intervals of more than 30 days are excluded from the analysis.

Table 1. Summary statistics from vendor interviews

This table summarizes the information from vendor interviews conducted at the distribution site. The *Has worked*- dummy indicates whether a vendor has ever worked for salary. *Years worked* is the number of years worked for salary. *Bottles* is a dummy indicating if a vendor also collects bottles to earn money, *Other* includes income sources such as cleaning, snow clearing, and playing music on the street. *Mean daily income* includes daily income from the listed income sources on a typical day, as reported by the vendors. Similarly, *Mean daily consumption* reflects spending on consumption on a typical day. Under *Most important consideration* are vendors' responses to the following question: When stocking up, which of the following three factors is most important in limiting the number of papers you buy?

	Average	Min	Median	Max	St. dev.	N
Age	32.16	16	30	55	10.15	38
Female	0.32	0	0	1	0.47	38
Romanian	0.84	0	1	1	0.37	38
Schooling (years)	5.39	0	6.5	12	4.19	38
Has worked (dummy)	0.45	0	0	1	0.50	38
Years worked	11.43	1	8.5	34	9.36	14
Income sources besides paper:						
- Bottles	0.71	0	1	1	0.46	38
- Begging	0.29	0	0	1	0.46	38
- Other	0.13	0	0	1	0.34	38
Mean daily income						
- From paper	31.42	8	25	140	28.37	37
- From bottles	15.41	2	10	125	22.81	27
- From begging	13.05	5	15	20	5.85	11
- From other sources	75.00	20	50	175	59.79	5
Mean daily consumption	12.31	3.50	10	25	5.45	37
Most important consideration:						
- Money	0.24	0	0	1	0.44	37
- Storage capacity	0.08	0	0	1	0.28	37
- Expected demand	0.68	0	1	1	0.48	37

Table 2. Descriptive statistics

The table summarizes the information on stock-ups. *Lot size* i,s is the number of papers vendor i buys at stock-up s . *# days since last stock-up* i,s is the first difference of vendor i 's stock-up date. *Days 1-5* (6-20) [20+] are time periods since an issue's publication, indicating when a given stock-up was done. *# active vendors* t is the number of vendors who made a stock-up on day t . *Public transit* t is the number of people boarding a Metro train at the Helsinki Central railway station on day t . *Rain (mm)* t is the millimeter amount of rain, and *Temperature (°C)* t the average Celsius temperature on day t . *Herfindahl (adjusted)* is the weekly value of an adjusted Herfindahl index, whose higher value indicates that weekly total purchases are more equally distributed across vendors. *Stock-ups (Papers) per vendor* is the weekly total number of stock-ups made (papers bought) divided by the number of vendors stocking up at least once that week. *# active weeks* i is the number of calendar weeks on which vendor i made at least one stock-up. *Total # stock-ups* i is the number of stock-ups made by vendor i during the sample period. *Total # papers* i is the number of papers bought by vendor i during the sample period.

	Average	Min	Median	Max	St. dev.	N
<u>Stock-up level statistics:</u>						
Lot size i,s	12.28	-20	10	195	11.07	2,559
# days since last stock-up i,s	15.38	0	3	385	43.24	2,168
Days 1-5 (dummy)	0.19	0	0	1	0.40	2,559
Days 6-20 (dummy)	0.32	0	0	1	0.47	2,559
Days 20+ (dummy)	0.49	0	0	1	0.50	2,559
<u>Daily statistics:</u>						
# active vendors t	9.59	1	8	56	7.19	247
Public transit t	24,164	13,508	24,721	31,803	2,662	247
Rain (mm) t	1.70	0.00	0.10	26.60	3.86	247
Temperature (°C) t	8.63	-10.70	8.50	24.70	7.06	247
<u>Weekly statistics:</u>						
Herfindahl (adjusted)	42.01	1.00	45.16	50.15	9.54	59
Stock-ups per vendor	1.69	1.00	1.67	2.69	0.37	59
Papers per vendor	20.27	6.75	19.08	56.75	8.84	59
<u>Vendor statistics:</u>						
Female (dummy)	0.38	0	0	1	0.49	351
# active weeks i	4.25	1	2	48	5.58	351
Total # stock-ups i	7.17	1	2	94	12.04	351
Total # magazines i	88.21	-6	25	1,509	174.90	351

Table 3. Determinants of lot size

The table presents results from OLS regressions where each vendor is individually followed from stock-up to stock-up. In the “Restricted” sample, only the vendors who were active both before and after the price change are included. The dependent variable, *Lot size*_{*i,t,s*}, is the number of papers vendor *i* buys at stock-up *s*. # *active vendors*_{*t*} is the daily number of vendors who made a stock-up. *Herfindahl (adjusted)*_{*t*} is the weekly value of an adjusted Herfindahl index, whose higher value indicates that weekly total purchases are more equally distributed across vendors. The *Days 1-5*-dummy indicates if stock-up *s* was made during the first five days following an issue’s publication. In the specifications labeled “Controls included”, the following variables are included but not reported: *Public transit*_{*t*} (the number of people boarding a Metro train at the Helsinki Central railway station on day *t*); calendar month dummies; daily millimeter amount of rain and average Celsius temperature; and vendor characteristics including gender, nationality, and the number of stock-ups made until the one analyzed. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively, and heteroscedasticity-corrected t-statistics are in parentheses below the coefficients.

Time period	Full		Pre-change		Post-change	
	F	R	F	R	F	R
Full / Restricted sample	(1)	(2)	(4)	(5)	(6)	(7)
Time since last stock-up _{<i>i,t,s</i>}						
- 0 days	-1.344** (-2.05)	-2.064*** (-2.71)	-2.483 (-1.41)	1.732 (0.57)	-2.250*** (-2.70)	-3.281*** (-3.04)
- 1 day	2.539*** (6.03)	2.165*** (4.19)	0.404 (0.36)	1.016 (0.62)	2.410*** (4.05)	3.069*** (4.07)
# active vendors _{<i>t</i>}	0.154*** (4.94)	0.193*** (4.91)	0.267*** (2.83)	0.486*** (3.44)	0.170*** (3.66)	0.214*** (3.28)
Herfindahl (adjusted) _{<i>t</i>}	-0.178*** (-3.05)	-0.152 (-1.47)	0.371** (2.08)	0.383 (1.42)	-0.470*** (-3.39)	-0.304* (-1.78)
Days 1-5 (dummy)	1.901*** (3.00)	2.159** (2.21)	-2.150 (-0.93)	-2.656 (-0.69)	2.772** (2.34)	2.781* (1.80)
Constant	16.856*** (6.71)	6.686 (1.19)	-36.213*** (-2.57)	-41.721** (-2.01)	12.298** (2.19)	3.045 (0.43)
Controls included	No	Yes	Yes	Yes	Yes	Yes
R ²	0.067	0.131	0.096	0.153	0.163	0.199
N	2,136	2,136	500	305	1,636	1,028

Table 4. Stock-up frequency issue by issue

The table presents results from OLS regressions. In the “Restricted” sample, only the vendors who were active both before and after the price change are included. The dependent variable in columns 1-4, *# days since last stock-up* i,s , is the first difference of vendor i ’s stock-up date. In columns 5 and 6, the dependent variable is the weekly total number of stock-ups, aggregated across vendors, divided by the number of different vendors making at least one stock-up that week. The *Issue*-dummies indicate during which issue a stock-up was made. *# active vendors* s_{-1} is the number of vendors who made a stock-up on the day vendor i made her previous stock-up. *Lot size* $i, s-1$ is the number of papers vendor i bought at her previous stock-up. *Weekly # papers bought per vendor* is the weekly total number of papers bought, aggregated across vendors, divided by the number of different vendors making at least one stock-up that week. The *Weather and public transit*-controls include the daily millimeter amount of rain, the daily average Celsius temperature, and the daily number of people boarding a Metro train at the Helsinki Central railway station (in thousands). *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively, and heteroscedasticity-corrected t-statistics are in parentheses below the coefficients.

Dependent variable	# days since last stock-up i,s				Total # stock-ups / # active vendors	
Data format	Panel (time unit s = stock-up # i)				Weekly cross-section	
Full/Restricted sample	F	F	R	R	F	F
	(1)	(2)	(3)	(4)	(5)	(6)
Issue 2 (dummy)	-0.301 (-0.69)	0.089 (0.19)	-0.983* (-1.79)	-0.905 (-1.54)	0.351*** (2.99)	-0.162 (-0.58)
Issue 3 (dummy)	-0.493 (-1.09)	-0.233 (-0.48)	-1.101** (-1.98)	-1.045* (-1.78)	0.313*** (2.82)	-0.382 (-1.53)
Issue 4 (dummy)	-0.520 (-1.20)	-0.242 (-0.53)	-1.384** (-2.53)	-1.331** (-2.31)	0.334*** (3.07)	-0.236 (-0.73)
# active vendors s_{-1}		0.052** (2.51)		0.010 (0.50)		
Lot size $i, s-1$		-0.015 (-1.17)		-0.004 (-0.26)		
Weekly # papers bought per vendor						0.009 (0.82)
x I.(Issue = 2)						0.022* (1.84)
x I.(Issue = 3)						0.039*** (3.25)
x I.(Issue = 4)						0.025 (1.66)
Constant	4.920*** (16.06)	3.975*** (7.90)	5.343*** (12.75)	5.164*** (8.25)	1.456*** (22.66)	1.181*** (2.69)
Weather, public transit	No	No	No	No	No	Yes
R ²	0.001	0.008	0.009	0.009	0.189	0.753
N	1,371	1,371	809	809	59	59

Table 5. Pre-change lot size and response to price change in restricted sample

In the table, only vendors who bought papers both before and after the change are analyzed. These vendors are further divided into two groups: those whose average lot size before the price change was below median ("Small lots before change"), and those at or above median ("Large lots before change"). *Lot size* is the number of papers a vendor buys at a single stock-up. *# stock-ups per week* is the average number of stock-ups a vendor made on weeks when he stocked up at least once. *Papers per week* is the average total number of papers a vendor bought on weeks when he stocked up at least once. *# stock-ups in total* is the total number of stock-ups made by a vendor during the pre- and post-change periods. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively, based on a two-tailed t-test for differences in means.

Small lots before change (N = 43)

	Median			Mean			
	Pre	Post	Diff.	Pre	Post	Diff.	t-stat
Lot size	8.37	10.00	1.63	7.83	10.70	2.87***	(2.72)
# stock-ups per week	1.00	1.29	0.29	1.28	1.46	0.18*	(1.68)
Papers per week	10.00	14.83	4.83	9.94	15.71	5.78***	(3.53)
# stock-ups in total	2.50	4.00		4.40	11.24		

Large lots before change (N = 42)

	Median			Mean			
	Pre	Post	Diff.	Pre	Post	Diff.	t-stat
Lot size	18.80	12.33	-6.47	23.73	13.34	-10.39***	(-4.18)
# stock-ups per week	1.25	1.50	0.25	1.47	1.60	0.14	(1.11)
Papers per week	27.00	20.00	-7.00	32.80	22.11	-10.69***	(-2.93)
# stock-ups in total	3.50	7.00		4.71	11.90		

All (N = 85)

	Median			Mean			
	Pre	Post	Diff.	Pre	Post	Diff.	t-stat
Lot size	12.00	10.67	-1.33	15.87	12.04	-3.84**	(2.38)
# visits per week	1.25	1.36	0.11	1.37	1.53	0.16*	(1.92)
Papers per week	15.67	16.00	0.33	21.50	18.95	-2.55	(-1.07)
# stock-ups in total	3.00	5.00		4.56	11.57		

Table 6. Who buys the paper and why?

The table presents a selective summary of responses to a web-based survey aimed at the readers of IN. Responses to the item “I find the reduction of poverty and inequality (1) not at all important; (2) ...; (5) very important” are summarized in the variable *Importance of IN “mission”*. *Knows vendor’s profit* indicates whether a respondent knows that vendors get 3€ for a paper sold. *Motivation for buying* indicates why a respondent says to buy the paper; one or more alternatives could be chosen, and in addition to the ones shown there was an open option. *Would like more issues* summarizes responses to a question asking whether IN should appear more often than the current three times per year. *Preferred price for future issues* shows whether a respondent reported finding the current 5€ price appropriate or wishing to pay more/less for the paper in the future. *Age*, *Master’s degree*, and *Annual income* are as indicated by respondents, who were asked to place themselves in the appropriate bracket or bin.

	Fraction of respondents	N
Considers reduction of poverty and inequality "very important"	95.1 %	265
Knows vendor's profit	95.1 %	266
Motivation for buying:		
- Enjoy contents	70.1 %	261
- To support vendors	96.9 %	261
Would like more issues per year	67.3 %	260
Preferred price for future issues:		
- Higher	6.1 %	263
- Same	90.9 %	263
- Lower	3.0 %	263
Female	79.5 %	239
Age:		
- Under 30	15.1 %	238
- 30-39	30.3 %	238
- 40-49	24.4 %	238
- 50-59	11.8 %	238
- Over 60	18.5 %	238
Master's degree	48.7 %	238
Annual income in euro:		
- Less than 15,000	17.2 %	239
- 15,000 - 25,000	12.1 %	239
- 25,000 - 50,000	29.7 %	239
- 50,000 - 75,000	18.0 %	239
- 75,000 - 100,000	7.5 %	239
- More than 100,000	5.0 %	239

Essay 2: Pension system outlook and household demand for risky securities*

ABSTRACT Expected pensions are known to crowd out households' risk-free savings, but evidence on how they affect household participation in risky asset markets is mixed. Using rich survey data from Finland, I show that a negative outlook on the public pension system triggers private risky investments only among high-earning, financially sophisticated males. The less financially sophisticated appear to perceive risky securities and pension benefits as complements, only investing in stocks when feeling sufficiently insured by the pension system. The pension outlook measure used is distinct from general economic outlook and optimism. Implications for the design of public pension systems are discussed.

* I thank Artashes Karapetyan, Markku Kaustia, Timo Korkeamäki, Mirjam Lehenkari, and Elias Rantapuska, as well as seminar participants at Midwest Finance Association Annual Meeting 2015, Aalto University, and Graduate School of Finance PhD workshop, for valuable comments.

1. Introduction

Expected pensions can crowd out households' private saving (Feldstein, 1974; Attanasio and Brugiavini, 2003; Attanasio and Rohwedder, 2003). In the case of risk-free savings, the logic is straightforward: when sufficient pension benefits are expected, the willingness to postpone consumption for the sake of savings accumulation should be smaller. When it comes to risky securities, however, this rationale may not apply. If an individual emphasizes the possibility of very negative outcomes from these securities,¹⁵ for instance, the implicit insurance provided by a pension system should make her *more* willing to invest in them.

Empirical studies have found mixed results on how expected pensions, and other public safety nets, might influence risky asset holdings. Gormley et al. (2010), building on the theory of Elmendorf and Kimball (2000), show the insurance provided by a safety net to be associated with low saving rates, but high stock market participation. Bottazzi et al. (2006; 2011) and Guiso et al. (2003), on the other hand, provide evidence of expected pension benefits crowding out both saving and stock ownership.

In this paper, I show that household characteristics and asset riskiness play into the way expected pensions influence private wealth accumulation. In a demographically representative survey data set from Finland, where the public pension system is extensively relied upon, I examine the impact of an individual's outlook on the pension system on the probability of three financial outcomes: saving, owning mutual fund shares, and owning stocks. I use the following claim on perceived saving needs to measure pension system outlook: *"I believe that the statutory pension security will weaken to such an extent in the future that I, too, must privately save for my retirement."* The data allows me to comprehensively control for factors previously shown to predict my outcomes of interest.

I find that a positive shift of one standard deviation in pension system outlook is associated with a decrease of 6-9 percentage points in the probability of saving. The magnitude corresponds to about one fourth of the sample saving propensity.

¹⁵ In theory, this can happen for various reasons. See models with, e.g., loss aversion (Tversky and Kahneman, 1992) or risk vulnerability (Gollier and Pratt, 1996).

This finding is consistent with the crowding out effect, and prevails throughout the sample of 5,500 individuals.

The impact of pension system outlook on the probability of holding risky securities is not as straightforward. While it remains negative on average, in line with Bottazzi et al. (2006; 2011) and Guiso et al. (2003), the effect is far from uniform across groups of people varying in their characteristics. A positive outlook on the pension system is associated with a significantly lower probability of holding risky securities only among men who are well paid and educated, willing to take financial risk, and knowledgeable in economic issues. Similar characteristics have been shown to predict financial literacy and knowledge about pension rules (van Rooij et al., 2011; Gustman and Steinmeier, 2005), and they arguably serve as measures of financial sophistication. Along all the measures, the effect gets more polarized as securities get riskier. Among those in the lowest quartiles of education, financial risk tolerance, and knowledge in economic issues, the estimated effect of pension system outlook is the opposite: those with confidence in the pension system are *more* likely than others to hold stocks. Although these estimates are not statistically significant, their coherence appears compelling.

As a whole, my results outline a story where different people view risky securities, and especially stocks, in fundamentally different ways. The seemingly contradictory theories of Bottazzi et al. (2006; 2011) and Gormley et al. (2010) could therefore co-exist. The “financially sophisticated”, who are likely to understand the type and sources of risk associated with a stock investment, seem to consider stocks a lucrative long-term saving instrument, very suitable for a purpose like pension saving. For them, private stock investments and public pension benefits appear substitutes: they resort to these investments when faith in the pension system is low. On the other hand, those for whom the functioning of the stock market and the economy is more ambiguous may see stocks as more of a gamble, overweighting the probability of very negative outcomes. These “unsophisticated” individuals are not willing to place savings of future importance in risky securities, and see stocks and pension benefits as complements: they only invest in stocks when feeling sufficiently insured by the pension system.

My findings imply that risky securities are used for retirement preparation by those relatively affluent in the first place. Considering the large historical return premium on these securities (see, e.g., Fama and French, 2002), this could mean that economic inequality across workers will further amplify during retirement. To curb this development, some measure of “libertarian paternalism”, in the spirit of Thaler and Sunstein (2003), may be justified as many governments currently shift toward pension systems with increased individual choice. For instance, the default allocations could reflect the fact that those most dependent on the system are likely to only use safe assets in their private retirement preparation.

Finally, I corroborate my main story by two additional analyses. First, I address the concern that my measure of pension system outlook merely reflects general optimism about the future. The concern is valid due to a frequent finding that, by and large, knowledge about pensions is very scant. Workers, even those of them who have actually thought about retirement, are widely ignorant about the type (defined benefit vs. defined contribution) and size of their expected pensions (Chan and Stevens, 2008; Lusardi and Mitchell, 2007; Gustman and Steinmeier, 2005). Furthermore, Novy-Marx and Rauh (2011) demonstrate that even in the short run, and even for trained economists, the sufficiency of funds available for paying out public pensions can be ambiguous. One may thus wonder whether households’ subjective pension expectations can plausibly influence financial decision making in any calculated manner. Furthermore, general economic outlook and optimism have previously been found to predict saving and stock market participation (Dominitz and Manski, 2007; Japobson et al., 2014; Puri and Robinson, 2007). I show, however, that my pension outlook variable is determined distinctly from other measures of economic outlook and optimism, and that it predicts financial outcomes over and above those measures.

Second, I conduct a validity check on the mechanism I propose. Specifically, I examine whether outlook on the public healthcare system affects financial outcomes comparably to pension system outlook. If, indeed, the negative relation between pension outlook and household asset accumulation is driven by a perceived need to privately replace weakening public benefits, a similar intuition should apply with healthcare outlook. Those skeptical about public healthcare should be more likely to build a private buffer for future medical

expenses. This hypothesis is supported by Gruber and Yelowitz (1999) and Chou et al. (2003), who provide evidence of public healthcare provision depressing private saving. My results using healthcare outlook as the explanatory variable go in the same direction as the main results do, although their statistical significance is weak.

The paper proceeds as follows. Next, I give a short overview of pensions in Finland to familiarize the reader with the context of the study, and to form a basis for understanding my measure of pension system outlook. In Section 3, I describe my data, show how my variables are constructed, and demonstrate how average pension system outlook varies with other respondent characteristics. The main results and robustness checks are presented in Section 4. Section 5 briefly discusses the implications of the findings and concludes.

2. The public pension system in Finland

This section provides a brief overview of the role of public pensions in Finland to facilitate the understanding of a) why pension system outlook would matter for the financial decisions of a Finnish household, and b) what the pension system outlook variable is measuring.

The statutory pay-as-you-go pension security is important throughout the income distribution. A crucial difference to Social Security in the U.S., for instance, is that benefits accrue according to the same rules to everyone, regardless of the level of earnings. As no upper limit exists either for the earnings on which benefits are calculated or the actual benefits, low- and high-income earners are entitled to similar replacement rates¹⁶. In years 2000-2010, the median first pension was about 60% of earnings in the final working years (Rantala and Suoniemi, 2010). The wide reliance on statutory pension benefits is illustrated by their high share in gross retiree income. In the first income decile it is about 90%, in the fifth decile about 70%, and even in the highest decile about 50% (Rantala, 2011; figures from 2009). For comparison, the income

¹⁶ The replacement rate refers to the level of pensions in retirement relative to earnings when working.

share of Social Security pension benefits is 18.5% in the highest earning *quintile* of the elderly in the U.S.¹⁷

Private or employer-specific supplementary pension plans are not very common in Finland, and only account for about 6% of the total pension provision.¹⁸ A survey conducted by the Finnish Centre for Pensions reveals that in a representative sample of Finns aged 18-67, less than 40% have engaged in any private retirement saving. The fraction believing that private savings will play a significant role in their consumption during retirement is 10% in the aggregate sample, and no more than 16% even among those who have accumulated private retirement savings. (Tenhunen, 2012)

3. Data and descriptive analysis

My data come from the 2009 wave of the RISC Monitor survey, annually conducted in Finland by a company specialized in polls and market research called TNS Gallup Oy. Each year, the respondents form a sample of 5,000-6,000 individuals, selected from an aggregate respondent pool of about 30,000 people. The reason I only use the 2009 data is that, in other survey waves, the questions used to construct the central variables of the study have not been included. The sample is demographically representative of the Finnish population, totaling approximately 5.3 million in 2009. Non-reported items are most often found with income and wealth, and at most, information is missing for about 10% of the respondents. The number of completed responses is shown separately for each variable in Tables 1 and 2 below.

In this section, I first define the pension system outlook variable and summarize its values. Then, I similarly describe my outcome and control variables. Finally, I analyze the way these variables, on a univariate level, relate to pension system outlook.

¹⁷ Source: Employee Benefit Research Institute, Notes Vol. 28, No.12, December 2007.

¹⁸ This figure is for year 2010, provided by the Finnish Centre for Pensions (http://www.etk.fi/en/service/supplementary_pensions/1456/supplementary_pensions).

A. The measure of pension system outlook: Definition and response summary

To measure a respondent's outlook on her statutory pension, I use the following claim stating that the pension security will weaken, making private saving necessary: *"I believe that the statutory pension security will weaken to such an extent in the future that I, too, must privately save for my retirement."* There are five response possibilities: (1) fully agree, (2) partly agree, (3) neither agree nor disagree, (4) partly disagree, and (5) fully disagree. As a result, a higher value indicates a more positive outlook.

As the size of statutory pension benefits, relative to earnings at different stages of one's career, is clearly defined by pension laws, this "weakening" would essentially equal legislation changes that decrease the benefits. Along with the estimated consequences on a respondent's finances, the claim can be seen to measure the perceived probability of these changes happening. This probability should, on the one hand, depend on current and future governmental willingness to execute the changes. On the other hand, it should depend on the ability of mandated pension funds to cope with their liabilities under the prevailing laws: when the money runs out, changes must be undertaken even by the most reluctant government. In this sense, the measure includes expectations about both government agendas and pension system sustainability.

Table 1 shows how people have responded to the claim. The mean value is 2.59, meaning that opinions in the sample tend to be tilted towards the negative end of the scale. The response tendency is further clarified when looking at the frequency of responses in each category. 56% of respondents have at least somewhat negative of an outlook on their statutory pension security, while 23% have a positive one.

There are at least two reasons for choosing the middle category, "do not agree nor disagree". On the one hand, it may indicate that the respondent's opinion on the matter actually is in the middle: she considers the level of confidence she has for the statutory pension security to be intermediate. On the other hand, as there is no "don't know" option, which has been highly popular in pension-related

questions in the Health and Retirement Study¹⁹ (Lusardi and Mitchell, 2007; Gustman and Steinmeier, 2005), choosing this category might indicate that the respondent does not wish to take a stand, is uncertain, or has no opinion. Unfortunately, the data do not allow me to tell apart the varying motives behind responses. What can be said already now, however, is that among the ones who express having either a negative or a positive outlook, the negative one dominates by far.

B. Outcome and control variable definitions

B.1 Measures of general economic outlook and optimism

A valid concern is whether the pension outlook variable actually reflects expectations about pensions in particular, and not about the future in general. Financial decisions have previously been shown to correlate with expectations about economy-wide developments by, e.g., Jacobsen et al. (2014) and Dominitz and Manski (2007), and with general optimism by Puri and Robinson (2007). I therefore want to distinguish pension system outlook from such measures.

First, I construct a one-to-three index for *National economy outlook*, defined as the average response to the following two questions: (i) “*In the next twelve months, do you think the economic situation in our country will get (1) worse, (2) stay about the same, or (3) get better?*” (ii) “*In the next twelve months, do you think unemployment in our country will (1) increase, (2) stay about the same, or (3) decrease?*” The measure is summarized on the first row of Table 2.

Second, I construct a one-to-three index for *Personal economy outlook*, defined as the average response to the following three questions: (i) “*In the next five years, do you believe your standard of living will (1) decrease, (2) stay about the same, (3) or increase?*” (ii) “*In the next twelve months, do you believe your standard of living will (1) decrease, (2) stay about the same, (3) or increase?*” (iii) “*In the next twelve months, compared to your current situation, do you believe you will have (1) less, (2) about the same amount of, or (3) more money at your disposal?*”

¹⁹ The HRS is a national, government-funded study in the U.S. that has biannually surveyed people close to retirement since the early 90s.

Finally, I use a measure of *General optimism* that simply equals responses to the following question: “*Would you mainly consider yourself (1) a pessimist, (2) a realist, or (3) an optimist?*”

B.2 Financial outcome variables

The next rows of Table 2 describe the propensities to save and own risky financial assets in the sample. 30% of the respondents regularly save, 26% own mutual fund shares, and 17% own stocks. The *Saving*-dummy equals one if a respondent reports to regularly save for at least one of the following reasons: *a) unexpected costs, b) old age, c) retirement, d) unemployment*. The purpose is to capture so-called precautionary saving (see e.g. Lusardi, 1998), as this is the type of saving likely affected by a public safety net.

B.3 Control variables

The remaining part of Table 2 summarizes the variables used as controls in my analyses, beginning with basic demographics. As the sample is supposed to be demographically representative, I make comparisons to Statistics Finland population demographics to see how good the match actually is. While overall representativeness is good, it turns out that the respondents are more often married (55% in the sample vs. 37% in the population) and college-educated (36% vs. 23%). In addition, people in paid (non-self-)employment are somewhat overrepresented in my sample. Also geographically, the sample seems to describe the population well. The Large city –dummy indicates that 32% of the respondents live in one of the six largest cities²⁰, which closely corresponds to the 30% population share estimated by Statistics Finland.

To account for the fact that people may not know, remember, or wish to tell their exact income and wealth, the RISC Monitor survey uses 12-step scales to collect approximate levels. For *Income*, monthly personal net income is used, with categories ranging from less than 300€ up to more than 8,000€. ²¹ *Financial wealth* is defined as savings and investments excluding tangible assets, while *Real wealth* is defined as tangible assets, with housing, real estate, forest and land given as examples. The values for both wealth types are reported on a scale

²⁰ These cities are Helsinki, Espoo, Vantaa, Tampere, Turku, and Oulu.

²¹ The categories are 1) less than 300, 2) 301-500, 3) 501-1,000, 4) 1,001-1,500, 5) 1,501-2,000, 6) 2,001-3,000, 7) 3,001-4,000, 8) 4,001-5,000, 9) 5,001-6,000, 10) 6,001-7,000, 11) 7,001-8,000, 12) more than 8,000 euro.

from none up to more than 150,000€.²² The *Homeowner* dummy indicates if a respondent has reported to live in a home that she owns either herself or jointly with her partner.

My final control variables are related to health, financial risk tolerance, and knowledge in economic issues. First, I measure *Self-assessed health* using the following question: “*How would you describe your current health condition?*” The response possibilities are (1) very poor, (2) poor, (3) intermediate, (4) good, and (5) very good. Poor health has been found to negatively affect the portfolio weight of stocks (Love and Smith, 2010; Rosen and Wu, 2004). Poor health should also affect saving through the precautionary motive, as suggested by Lusardi (1998). Further, as Atella et al. (2012) show perceived health to influence financial decisions much more than objectively assessed health, my measure should adequately control for the potential effect.

Second, *Risk tolerance* is measured using the claim “*When saving or investing, I want proper returns even when it means higher risk*”, with response possibilities from (1) fully agree to (5) fully disagree. Risk tolerance is an important determinant of financial portfolios (see e.g. Haliassos and Bertaut, 1995), and this type of a directly queried attitude toward financial risk has been shown to be particularly powerful in explaining actual financial risk taking (Dohmen et al., 2011; Halko et al., 2012).

Finally, the *Economic knowledge*-variable is constructed as the sum of the following indicators: (1) Disagree with the claim “*I am not interested in issues related to the economy*” (2) Agree with the claim “*I actively follow news about the economy on television, the internet, in newspapers, etc.*” (3) Report to, at least from time to time, focus on economic issues when reading a newspaper or magazine. (4) When asked about the specific newspapers and magazines followed, pick at least one out of the five alternatives that mainly focus on economic and financial issues. With this measure, I proxy the knowledge a respondent has in economic issues. For instance, when making choices related to saving and investing, familiarity with basic economic concepts (e.g. interest rates, inflation) and different financial assets has been shown to significantly

²² The categories are 1) none, 2) less than 200, 3) 200-1,000, 4) 1,000-2,000, 5) 2,000-5,000, 6) 5,000-10,000, 7) 10,000-20,000, 8) 20,000-40,000, 9) 40,000-60,000, 10) 60,000-100,000, 11) 100,000-150,000, 12) more than 150,000 euro.

affect outcomes (van Rooij et al., 2011; Guiso and Jappelli, 2005). My assumption is that activeness in following economic issues reflects the level of this familiarity.

*C. How respondent characteristics vary with pension system outlook:
Univariate analysis*

An overriding observation from Table 2 is that respondents in the middle of the pension outlook scale have the lowest scores on many key determinants of financial outcomes. This group is least educated, financially worst off, in their own opinion least healthy, and least knowledgeable in economic issues. Correspondingly, they are least likely to have invested in risky securities. Taken together, the characteristics also match well with those shown to be associated with low average pension knowledge by Gustman and Steinmeier (2005), and with low financial literacy by van Rooij et al. (2011). The pattern seems consistent with the scenario discussed above, where people who would have chosen the “don’t know” option if available have now chosen the middle option instead.

The means of both national economy outlook and general optimism monotonously increase with pension system outlook, indicating that these measures are correlated. The relation between personal economy outlook and pension system outlook exhibits no clear pattern, however. The financial outcome variables partly seem to line up with the hypothesis of the crowding out effect spanning both safe and risky assets: respondents with least confidence in the pension system are most likely both to save and to own risky financial assets. The relation found between saving and pension system outlook is also neatly monotonous. For stocks the pattern is actually u-shaped, with the ownership propensities exactly equal in the opposite ends of the pension outlook scale.

Another u-shaped relation is found between pension outlook and knowledge in economic issues. As the knowledge measure is based on tendency to follow economic issues in the press and on television, this raises an interesting question about the influence of media. For respondents who are equally active in following economic media, but have opposite views of the pension system, does the divergence in outlook stem from different interpretations of the same news and facts? Or could the groups follow distinct media sources where the facts are

presented very differently from each other, perhaps due to political agendas? While my data do not allow me to further explore these hypotheses, DellaVigna and Kaplan's (2007) findings suggest that a news provider, for instance, has the ability to significantly shape the opinions of its audience.

Some further findings on the linkages between my control variables and pension outlook emerge from Table 2. For example, confidence in the pension system monotonously increases with average age, and women are much less likely to have a positive outlook than men. The latter finding echoes the results of Gustman and Steinmeier (2005), who find women to be much more pessimistic about the size of their pension than men²³, and Jacobsen et al. (2014), who show that women tend to be less optimistic than men when asked about broad economic issues. Further, people who are already retired clearly tend to have a positive outlook on the pension system. I include them in the analyses because a drastic change in the pension system could cause also their statutory pensions to be cut. If anticipated, this might induce them to accumulate savings even in retirement. Entrepreneurs tend to have a negative outlook on the pension system, which might reflect negative attitudes toward state responsibilities found among entrepreneurs by Beugelsdijk and Noorderhaven (2005). Financial risk tolerance is highest among respondents with a negative pension outlook, consistent with their higher probability to own mutual fund shares, for instance. Individuals with a positive outlook on statutory pensions seem least willing to take on financial risk.

4. Results

A. The average effect of pension system outlook on financial outcomes

Table 3 shows how the probabilities to save and participate in financial markets are associated with a respondent's outlook on pensions. For all three outcomes describing private asset accumulation – saving, mutual fund ownership, and stockholding – the average marginal effect of pension system outlook is negative. The largest and most accurately estimated effects are seen with the

²³ This pessimism is defined as underestimation of actual benefits, so it does not reflect smaller average benefits among women, for instance.

probability to save. A positive shift of one standard deviation in pension outlook is predicted to result in a 5.6 (all controls included) to 8.6 (univariate regression) percentage point drop in an average respondent's probability to save. Compared to the baseline probability of saving, at 30%, the estimate is highly economically significant.

Risky assets are less closely linked to pension expectations. For mutual fund shares, the effect is still substantial. The ownership probability diminishes by an average of 1.3 to 2.6 percentage points when confidence toward pensions increases by one standard deviation. This translates into 5-10% of the baseline probability for holding mutual fund shares in the sample. For stock market participation, the estimated effect is small and statistically insignificant. An average stock investment thus seems to be made with motivations other than retirement preparation.

The control variables mainly behave as expected. Women are financially prudent compared to men: less likely to hold risky assets, more likely to save. Highly educated respondents only differ from the rest of the sample in that they are more likely to hold individual stocks. The *Economic knowledge*-variable is a significant determinant of all three outcomes, but more so for riskier assets. Entrepreneurs are less likely to save than others, but equally likely to hold mutual funds or stocks. Higher risk tolerance makes people more likely to have invested in stocks or mutual funds, but does not affect the probability to save.

B. Accounting for potential non-monotonicity in the average effect

As discussed above, the sample statistics suggest that some respondents who have no clear opinion on whether the pension system will weaken, and thus would prefer a "don't know" option, might have chosen the "middle" response instead. In this case, the middle group would not only consist of individuals with an intermediate level of confidence toward pensions, but also include those who would rather have skipped the question. This, in turn, would decrease the information content of the pension outlook variable, and could lead to ambiguity in interpreting its effect.

I account for the potential bias in interpretation caused by the middle responses by running the same regressions as those summarized in Table 3, but using

indicators for each level of pension outlook instead of the continuous measure. The marginal effects of each indicator are presented in Table 4, where the rest of the regression output is left out in the interest of brevity. For saving, the effect size monotonously increases through the pension outlook scale, indicating that the continuous variable is perfectly appropriate. For risky assets, however, the middle group causes somewhat of a kink. They are not significantly less likely to hold mutual fund shares than those who are more negative in their pension outlook. With stockholding probability there is no difference in statistical terms between the middle group and the more negative ones.

In an additional, unreported check of the potential bias caused by responses in the middle category I drop them out of the sample altogether, and repeat the analysis summarized in Table 3. The estimated marginal effects of the pension outlook variable remain the same. The largest deviation is seen when predicting saving probability, where the estimate drops from 0.070 to 0.066. The statistical significance of all the estimates rises, suggesting that ignoring the middle group does make the relation between pension outlook and financial outcomes slightly more consistent.

C. Who drives the effect?

I now use sample splits to see how the effect varies with respondent characteristics. Splits are done based on economic knowledge, risk tolerance, and selected demographics. Figure 1 graphs the marginal effect that pension system outlook has among different groups of respondents.

While probability to save is very similarly affected throughout the sample, pension system outlook only influences the decision to hold risky securities among those who appear financially sophisticated. An effect is found for men who are familiar with economic issues, willing to take financial risk, and relatively well paid and educated. On all these dimensions, the group of people responding to a negative pension outlook through investing in stocks is more narrowly defined than the one responding with mutual fund investments. This indicates that the role of financial sophistication grows with asset riskiness.

The negative impact of pension system outlook on the probability of risky security ownership can be economically large. Among the high-earners and

those moderately tolerant toward financial risk, a one-standard-deviation decrease on the pension outlook measure is estimated to increase the probability of investing in mutual funds by 5-6 percentage points, which corresponds to 20-25% of the sample baseline propensity. Among the high-earners and the well-educated, the jump in stockholding probability resulting from the same shift in pension system outlook is estimated at 2-2.5 percentage points, or 10-15% of the baseline propensity.

People who seem least financially sophisticated appear *more* likely to invest in stocks when feeling confident about the pension system. Although the estimates do not reach statistical significance (the one for the least educated comes closest with a z-statistic of 1.42), their direction is consistent with a pension system being seen as insurance that facilitates financial risk taking. People less familiar with stocks may think of them as more of an ambiguous gamble than an attractive long-term saving instrument, and therefore only invest when feeling insured through a safety net. In sum, whereas private stock investments appear a substitute to public pension benefits among the financially sophisticated, the unsophisticated seem to perceive the two as complements.

Table 5 presents the output from regressions where all the grouping variables used in Figure 1 are simultaneously interacted with pension system outlook. Not many of the interactions remain statistically significant, but the table makes an important point in terms of interpreting the coefficients shown in Figure 1. For instance, someone knowledgeable in economic issues is more likely than average to hold mutual fund shares, but a positive outlook on the pension system can *dampen* this effect. Similarly, any negative coefficient in Figure 1 means not that the outcome probability in a group is low, but that pension system outlook lowers the outcome probability in that group.

D. Is pension system outlook merely reflecting differences in general optimism?

This section shows that pension system outlook does not just reflect general economic outlook or optimism, which have previously been linked to portfolio decisions (Jacobsen et al., 2014; Dominitz and Manski, 2007; Puri and Robinson, 2007). The concern is valid, because households have widely been found ignorant about expected pensions (Chan and Stevens, 2008; Lusardi and

Mitchell, 2007; Gustman and Steinmeier, 2005). If, on average, people do not know or even think about pensions, it seems plausible that the pension outlook variable would end up measuring optimism about the future more generally.

Panel A of Table 6 shows that my pension system outlook measure positively correlates with optimism in economic outlook and general optimism. The lower correlation between pension outlook and personal economy outlook intuitively suggests that an average respondent does not consider personal income prospects highly related to whether the pension system will weaken in the future. In contrast to one's outlook on the national economy and the pension system, personal economy outlook should not necessarily depend on expectations about macro-level factors. It is much more idiosyncratic. Things like disability, unemployment, or retirement can have substantial economic impacts on the personal level, but their perceived probability will often be unrelated to economic developments on a national level.

Panel B corroborates this finding: personal economy outlook is not significantly associated with pension system outlook in a multivariate setting. National economy outlook and general optimism remain about equally predictive of pension system outlook, but their explanatory power is moderate enough to indicate that variation in pension system outlook is mainly orthogonal to these measures. Indeed, Panel C shows that the factors characterizing respondents who score high on the different measures are quite distinct from each other.

In Table 7, I finally show that pension system outlook predicts financial outcomes over and above the other measures of future outlook. With these measures included as controls, the marginal effects estimated for pension system outlook remain exactly as in the baseline analyses presented in Table 3. Thus the effect attributed to pension system outlook above does not merely reflect unobserved differences in general future outlook across respondents.

General optimism has been found to positively associate with saving and stock ownership (Puri and Robinson, 2007), and psychology research suggests that optimists should more actively pursue distant goals, such as financial comfort during retirement (Carver and Scheier, 2014). My results indicate, if anything, the opposite. Especially the negative coefficient of general optimism in the

univariate setting, shown in column (3) of Table 7, seems puzzling in the light of Puri and Robinson's (2007) findings.²⁴

At least two reasons might explain the discrepancy between my findings and those of Puri and Robinson (2007). The first is sample differences. The Survey of Consumer Finances (SCF) used by Puri and Robinson (2007) is a household-level study aiming for a representative sample of U.S. families. Differences in population characteristics might make optimistic individuals stand out as likely savers and investors in the U.S., but not in Finland. One key difference is that in the U.S., about 50% of families hold stocks, while in Finland the participation rate is less than 15%.²⁵ Second, our optimism measures might not be capturing the same thing. In my sample, respondents are simply asked whether they consider themselves optimists, whereas Puri and Robinson (2007) use overconfidence in personal life expectancy to proxy for optimism. To assess the similarity of the measures, I compare the determinants of optimism reported by Puri and Robinson (2007) to those I report in Panel C of Table 6. Differences occur with the following determinants: female dummy (positive effect in my sample vs. negative in theirs), education (zero vs. positive), and wealth (negative vs. positive).

E. Test of the suggested mechanism using an alternative safety net outlook measure

Above, I argue that the reason for pension system outlook to negatively predict saving and risky asset ownership is that it reflects differences in the perceived need for private preparation. If this indeed is the underlying mechanism, then also other factors related to perceived saving needs should be associated with observed financial decisions. As a validity test for my argument, I conduct a robustness check using one such factor, namely outlook on the public healthcare system. The intuition is that people considering the national healthcare system

²⁴ In a multivariate "horse race", a general optimism measure actually *should* be a weaker predictor of outcomes than optimism measures more closely linked to the outcome (e.g., optimism about stock price development when predicting stock market participation) (Armor and Taylor, 1998).

²⁵ U.S. figure from the SCF Chartbook, issued by the Federal Reserve Board of Governors in September 2014, available at <http://www.federalreserve.gov/econresdata/scf/files/BulletinCharts.pdf>. Finnish figure from Keloharju and Lehtinen (forthcoming).

sufficient and sustainable should see less of a need to privately prepare for future healthcare expenses.

Like the public pension system, public healthcare is widely relied upon in Finland. The National Institute for Health and Welfare has estimated that about 75% of the total costs of healthcare services in Finland are accounted for by public providers²⁶. The Federation of Finnish Financial Services estimates that the fraction of people covered by private health insurance was 20% in 2008. It thus seems plausible that the weakening of public healthcare could lead to an increase in perceived saving needs among a substantial part of the population.

To measure outlook on the healthcare system, I use responses to the following claim: *“Public services in Finland appear to be weakening to such an extent that, in the future, for example healthcare and medical fees will have to be personally paid for.”* The response possibilities are the same as with the pension outlook claim. The two claims were consecutively presented in the survey, and responses are quite similar: the pairwise correlation is 0.49, and 54% of respondents give the same response to both claims²⁷. The healthcare outlook variable has a mean of 2.57 and a standard deviation of 1.11.

Table 8 presents the results of this robustness check. Although the marginal effects on saving and mutual fund ownership are not statistically significant when full controls are included, all the coefficients point in the same direction as those estimated for the pension outlook variable. The findings are thus in line with the mechanism I propose, where people with confidence in public safety nets end up accumulating less assets privately.

5. Conclusion

The results presented in this paper imply that, depending on personal characteristics, a perceived need to privately prepare for retirement can be associated with very different portfolio outcomes. While saving, in some form, seems to be triggered by this need throughout the population, the group that tends to use risky securities for this purpose can be defined quite narrowly. The people

²⁶ Figures for 2009 and 2008, respectively.

²⁷ 26% of respondents choose response 2 in both claims.

for whom the probability to invest in risky securities is higher when outlook on the pension system is negative are highly educated, high-earning males who are knowledgeable in economic issues. On all these dimensions, the polarization of the effect is more extreme with stocks than with mutual funds, meaning that the group using direct stock investments for retirement preparation is even more exclusive.

Historically, long-term stock investments have earned a high return premium compared to their observed riskiness (see e.g. Fama and French, 2002). Therefore, stocks can *ex post* be said to have been a very valuable instrument for retirement preparation. In the light of my results, it nevertheless seems that they are only being utilized by a select few. Of course, this selection may well be driven by preferences. Even when risk-adjusted returns are known to be attractive, a stock investment may be perceived undesirable (Kaustia and Torstila, 2011). On the other hand, many might actually prefer to use risky securities for retirement preparation, but fail to do so because of informational frictions. Indeed, when it comes to decision making, complexity, horizon length, and lack of personal experience are likely to prevent people from acting according to their true preference (Beshears et al., 2008). It thus appears plausible that individuals not familiar with the stock market view it as an ambiguous gamble, therefore abstaining from using stocks for retirement saving, although they would choose otherwise if they knew, e.g., the historical return distribution.

If, as my results indicate, risky securities are only used for retirement preparation by those relatively affluent in the first place, the expected cumulative returns of these securities can further amplify economic inequality during retirement. An appropriately designed public pension system could be able to curb this development, however. The trend in many post-industrial economies has, in the recent decades, been to move from defined-benefit pension systems, where all assets are centrally allocated, toward defined-contribution pension plans, where personal assets can be independently allocated. Although the shift partly aims to increase freedom of choice, most people have been found to stick with the default allocations of defined-contribution plans, perhaps to avoid the complex task of privately selecting their preferred investments (e.g. Beshears et al., 2009). Arguably, the individuals I find unlikely to invest in risky securities, even when

the need for pension saving is considered high, should be the ones most likely to stick with the default. If this is the case, a relatively high level of riskiness could be justified for the default pension fund, as those sticking to it will probably hold highly safe private portfolios. The high expected return of the default pension fund could thus, in the spirit of Thaler and Sunstein's (2003) "libertarian paternalism", decrease expected inequality in welfare during retirement.

In the current paper, the results do not warrant interpretations regarding causality. In future work, built on panel data or experimental setups, for instance, this issue can hopefully be addressed. My findings also invite more research on the way people with different backgrounds view risky securities and their properties.

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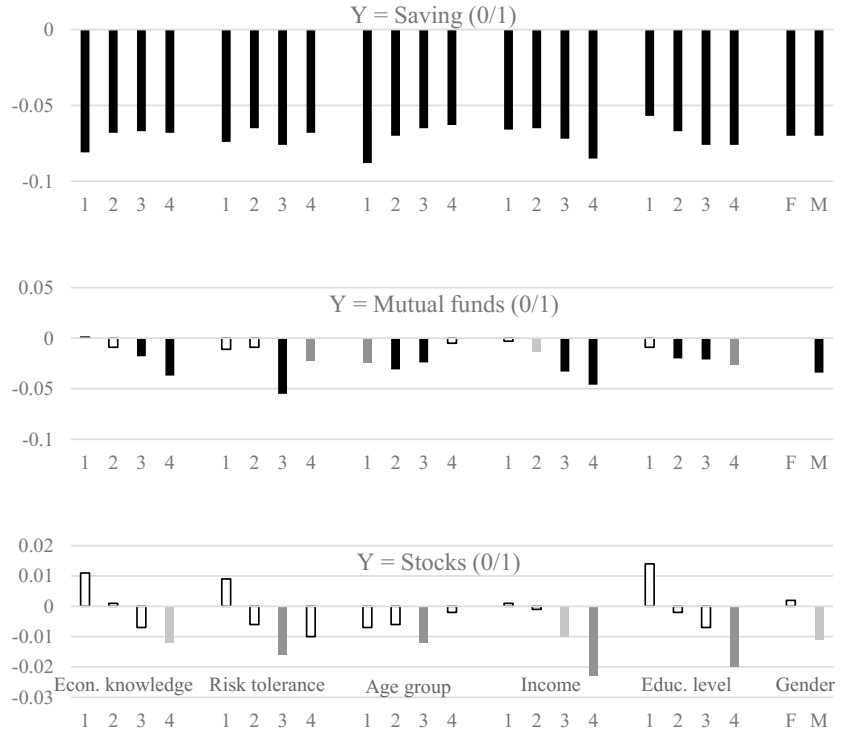


Figure 1. Effect of pension system outlook in subsamples

Average marginal effects (probit) of *Pension system outlook* on the probability of outcome *Y*. The eighteen sets of bars (six for each outcome) all come from separate regressions, where subsample indicators have been interacted with *Pension system outlook*. For example: *Pension system outlook***I*(*Econ. knowledge* = 1), *Pension system outlook***I*(*Econ. knowledge* = 2), The variable used to split the sample (in this example, *Econ. knowledge*) is also controlled for in its basic form. *Pension system outlook* is the response [1 (fully agree) through 5 (fully disagree)] to the claim “I believe that the statutory pension security will weaken to such an extent in the future that I, too, must privately save for my retirement.” *Economic knowledge* is the sum of the following indicators: (1) Disagree with “I am not interested in issues related to the economy” (2) Agree with “I actively follow news about the economy on television, the internet, in newspapers, etc.” (3) Report to focus on economic issues when reading a newspaper or magazine. (4) When asked about the specific newspapers and magazines followed, pick at least one out of the five alternatives that mainly focus on economic and financial issues. Those scoring 0 or 1 are in group 1 (N = 1,389), those scoring 2 in group 2 (N = 1,121), those scoring 3 in group 3 (N = 1,433), and those scoring 4 in group 4 (N = 1,572). *Risk tolerance* is the response [1 (fully disagree) through 5 (fully agree)] to “When saving or investing, I want proper returns even when it means higher risk”. Group 1 means response 1 (N = 1,093), group 2 response 2 (N = 1,874), group 3 response 3 (N = 1,257), and group 4 responses 4 and 5 (N = 1,215). *Age groups* are under 35 (N = 1,187), 35 to 49 (N = 1,624), 50 to 59 (N = 1,412), and 60 and over (N = 1,292). *Income* is monthly personal net income on a scale of 1 (less than 300€) through 12 (more than 8,000€). Group 1 means categories below 5 (N = 1,829), group 2 is category 5 (N = 1,451), group 3 is category 6 (N = 1,335), and group 4 higher than 6 (N = 476). *Education levels* are (1) compulsory (N = 552), (2) secondary (N = 2,921), (3) B.Sc. level (N = 1,005), and (4) at least M.Sc. level education (N = 985). There are 2,756 women and 2,759 men in the sample. In all regressions, age, gender, education level, home city size, employment and marital status, financial affluence, *Risk tolerance*, *Economic knowledge*, and *Self-assessed health* are controlled for. White bars indicate statistically insignificant estimates, while light gray, dark gray, and black bars indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 1. Pension system outlook in the sample

Values are based on responses [1 (fully agree) through 5 (fully disagree)] to the claim “I believe that the statutory pension security will weaken to such an extent in the future that I, too, must privately save for my retirement.”

	Mean	St. dev.	# obs.	Individual responses:				
				Must save	2	3	4	Need not save
Pension system outlook (1-5)	2.59	1.10	5,423	768 (14%)	2,262 (42%)	1,146 (21%)	934 (17%)	313 (6%)

Table 2. Descriptive statistics

National economy outlook is the average response to the following two questions: (i) “In the next twelve months, do you think the economic situation in our country will get (1) worse, (2) stay about the same, or (3) get better?” (ii) “In the next twelve months, do you think unemployment in our country will (1) increase, (2) stay about the same, or (3) decrease?” *Personal economy outlook* is the average response to the following three questions: (i) “In the next five years, do you believe your standard of living will (1) decrease, (2) stay about the same, (3) or increase” (ii) “In the next twelve months, do you believe your standard of living will (1) decrease, (2) stay about the same, (3) or increase?” (iii) “In the next twelve months, compared to your current situation, do you believe you will have (1) less, (2) about the same amount of, or (3) more money at your disposal?” *General optimism* is the response to “Would you mainly consider yourself (1) a pessimist, (2) a realist, or (3) an optimist?” *Saving* indicates if a respondent regularly saves, while *Mutual funds* and *Stocks* indicate if a respondent owns such securities. *Large city* indicates if a respondent lives in one of Finland’s six largest cities. *Income* is monthly personal net income on a scale of 1 (less than 300€) through 12 (more than 8,000€). *Financial wealth* and *Real wealth* are on a scale of 1 (none) through 12 (more than 150,000€). *Homeowner* indicates if a respondent lives in a home owned either by herself or jointly with her partner. *Self-assessed health* is the response [1 (very poor) through 5 (very good)] to “How would you describe your current health condition?” *Risk tolerance* is the response [1 (fully disagree) through 5 (fully agree)] to “When saving or investing, I want proper returns even when it means higher risk”. *Economic knowledge* is the sum of the following indicators: (1) Disagree with “I am not interested in issues related to the economy” (2) Agree with “I actively follow news about the economy on television, the internet, in newspapers, etc.” (3) Report to focus on economic issues when reading a newspaper or magazine. (4) When asked about the specific newspapers and magazines followed, pick at least one out of the five alternatives that mainly focus on economic and financial issues.

	Sample statistics			Mean by reported outlook				
	Mean	St. dev.	# obs.	Must save	2	3	4	Need not save
Nat'l econ. outlook	1.29	0.44	5,500	1.21	1.28	1.32	1.32	1.35
Personal econ. outlook	2.04	0.51	5,515	1.99	2.06	2.01	2.09	2.03
General optimism	2.26	0.57	5,502	2.16	2.25	2.26	2.34	2.38
Saving (0/1)	0.30	-	5,515	0.45	0.36	0.22	0.22	0.17
Mutual funds (0/1)	0.26	-	5,515	0.32	0.27	0.22	0.24	0.23
Stocks (0/1)	0.17	-	5,515	0.19	0.18	0.15	0.16	0.19
Age	48.00	14.50	5,515	43.75	46.02	49.96	51.24	56.33
Female (0/1)	0.50	-	5,515	0.51	0.53	0.52	0.44	0.33
Large city (0/1)	0.32	-	5,515	0.36	0.33	0.29	0.31	0.27
Married (0/1)	0.55	-	5,515	0.53	0.54	0.52	0.60	0.64
College or higher (0/1)	0.36	-	5,463	0.39	0.37	0.32	0.38	0.38
Retired (0/1)	0.21	-	5,515	0.10	0.13	0.31	0.26	0.47
Entrepreneur (0/1)	0.06	-	5,515	0.08	0.07	0.05	0.05	0.04
Unemployed (0/1)	0.03	-	5,515	0.03	0.03	0.04	0.02	0.04
Student (0/1)	0.06	-	5,515	0.06	0.06	0.07	0.05	0.03
Income (1-12)	4.90	1.52	5,091	4.92	4.93	4.65	5.04	5.10
Fin. wealth (1-12)	5.57	2.86	5,143	5.80	5.68	5.10	5.66	5.75
Real wealth (1-12)	8.83	3.95	4,872	8.73	8.87	8.21	9.29	9.76
Homeowner (0/1)	0.40	-	5,515	0.41	0.42	0.34	0.40	0.45

Continued.

Table 2, continued.

	Sample statistics			Mean by reported outlook				
	Mean	St. dev.	# obs.	Must save	2	3	4	Need not save
Self-assessed health (1-5)	3.69	0.71	5,510	3.75	3.73	3.59	3.69	3.71
Risk tolerance (1-5)	2.51	1.12	5,439	2.65	2.53	2.53	2.39	2.43
Econ. knowledge (1-5)	3.49	1.29	5,515	3.70	3.55	3.22	3.54	3.67

Table 3. Effect of pension system outlook and control variables on financial outcomes

Average marginal effects (probit) on the probability of the financial outcome shown on the top row: saving, owning mutual fund shares, or owning stocks. For dummy variables, the effect is estimated for a change from 0 to 1. *Pension system outlook* is the response [1 (fully agree) through 5 (fully disagree)] to the claim “I believe that the statutory pension security will weaken to such an extent in the future that I, too, must privately save for my retirement.” *Income* is monthly personal net income on a scale of 1 (less than 300€) through 12 (more than 8,000€). *Financial wealth* and *Real wealth* are on a scale of 1 (none) through 12 (more than 150,000€). *Homeowner* indicates if a respondent lives in a home owned either by herself or jointly with her partner. *Risk tolerance* is the response [1 (fully disagree) through 5 (fully agree)] to “When saving or investing, I want proper returns even when it means higher risk”. *Economic knowledge* is the sum of the following indicators: (1) Disagree with “I am not interested in issues related to the economy” (2) Agree with “I actively follow news about the economy on television, the internet, in newspapers, etc.” (3) Report to focus on economic issues when reading a newspaper or magazine. (4) When asked about the specific newspapers and magazines followed, pick at least one out of the five alternatives that mainly focus on economic and financial issues. Control variables included in regressions labeled “All controls included”, but omitted from the table, are *Large city*, *Unemployed*, *Student*, *Married*, and *Self-assessed health*. Below the estimates are z-statistics in parentheses. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% levels, respectively.

	Saving		Mutual funds		Stocks	
Pension system outlook (1-5)	-0.078***	-0.070***	-0.024***	-0.020***	-0.006	-0.006
	(-14.12)	(-10.93)	(-4.48)	(-3.42)	(-1.24)	(-1.33)
Age		0.003		0.008**		-0.004
		(0.77)		(2.17)		(-1.15)
Age ²		-0.000		-0.000**		0.000
		(-1.05)		(-2.49)		(1.48)
Female (0/1)		0.041***		-0.015		-0.019*
		(2.82)		(-1.12)		(-1.75)
College or higher (0/1)		0.001		0.016		0.055***
		(0.04)		(1.18)		(5.08)
Retired (0/1)		-0.038		0.027		0.022
		(-1.51)		(1.17)		(1.25)
Entrepreneur (0/1)		-0.077***		-0.040		-0.008
		(-2.64)		(-1.49)		(-0.36)
Income (1-12)		0.002		0.002		-0.001
		(0.30)		(0.37)		(-0.20)
Financial wealth (1-12)		0.030***		0.041***		0.040***
		(10.49)		(15.92)		(18.74)
Real wealth (1-12)		0.005**		0.003		0.001
		(2.26)		(1.49)		(0.37)
Homeowner (0/1)		0.019		0.056***		0.048***
		(1.28)		(4.07)		(4.35)
Risk tolerance (1-5)		-0.004		0.032***		0.031***
		(-0.58)		(5.65)		(7.09)
Econ. knowl. (1-5)		0.022***		0.028***		0.043***
		(3.60)		(5.01)		(8.72)

Continued.

Table 3, continued.

	Saving		Mutual funds		Stocks	
	No	Yes	No	Yes	No	Yes
All controls included						
# obs.	5,430	4,372	5,430	4,372	5,430	4,372
Pseudo R ²	0.028	0.076	0.003	0.130	0.0003	0.265

Table 4. Breakdown of the effect of pension system outlook

In the regressions summarized in this table, *Pension system outlook* has been broken down to five indicators based on responses [1 (fully agree) through 5 (fully disagree)] to the claim “I believe that the statutory pension security will weaken to such an extent in the future that I, too, must privately save for my retirement.” (1) is the omitted category. The table shows the average marginal effects (probit) of these indicators changing from 0 to 1 on the probability of each financial outcome of interest: saving, owning mutual fund shares, and owning stocks. In all three regressions, age, gender, education level, home city size, employment and marital status, financial affluence, *Risk tolerance*, *Economic knowledge*, and *Self-assessed health* are controlled for. Below the estimates are z-statistics in parentheses. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable:	Pension system outlook =				# obs.	Pseudo R ²
	2	3	4	Need not save		
Saving	-0.064*** (-2.94)	-0.129*** (-5.11)	-0.161*** (-6.37)	-0.195*** (-5.91)	4,372	0.109
Mutual funds	-0.038* (-1.94)	-0.031 (-1.34)	-0.047** (-2.01)	-0.065** (-2.06)	4,372	0.139
Stocks	-0.002 (-0.11)	0.012 (0.65)	-0.009 (-0.47)	-0.027 (-1.13)	4,372	0.267

Table 5. Effect of pension system outlook interacted with respondent characteristics

Average marginal effects (probit) on the probability of the outcome shown on the top row: saving, owning mutual fund shares, or owning stocks. *Pension system outlook* is the response [1 (fully agree) through 5 (fully disagree)] to the claim “I believe that the statutory pension security will weaken to such an extent in the future that I, too, must privately save for my retirement.” *Risk tolerance groups* are derived from the distribution of *Risk tolerance*, which equals responses [1 (fully disagree) through 5 (fully agree)] to “When saving or investing, I want proper returns even when it means higher risk”. *Economic knowledge groups* are derived from the distribution of *Economic knowledge*, which is the sum of the following indicators: (1) Disagree with “I am not interested in issues related to the economy” (2) Agree with “I actively follow news about the economy on television, the internet, in newspapers, etc.” (3) Report to focus on economic issues when reading a newspaper or magazine. (4) When asked about the specific newspapers and magazines followed, pick at least one out of the five alternatives that mainly focus on economic and financial issues. *Age*, *Income*, and *Education* groupings are derived from the respective sample distributions. Full controls included in all specifications. Below the estimates are z-statistics in parentheses. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% levels, respectively.

	Saving	Mutual funds	Stocks
Pension system outlook (1-5)	-0.094*** (-2.99)	-0.023 (-0.80)	0.036 (1.42)
Pension system outlook x			
- <i>Econ. knowledge group (1-4)</i>	0.003 (0.52)	-0.010* (-1.76)	-0.005 (-1.06)
- <i>Risk tolerance group (1-4)</i>	-0.001 (-0.10)	-0.004 (-0.77)	-0.005 (-1.23)
- <i>Age group (1-4)</i>	0.015** (2.38)	0.017*** (3.09)	0.003 (0.74)
- <i>Income group (1-4)</i>	-0.006 (-0.88)	-0.011* (-1.66)	-0.002 (-0.36)
- <i>Education level (1-4)</i>	-0.003 (-0.38)	0.004 (0.54)	-0.008 (-1.60)
- <i>Female (0/1)</i>	-0.001 (-0.08)	0.023* (1.88)	0.007 (0.66)
Econ. knowledge group (1-4)	0.017 (1.04)	0.055*** (3.58)	0.059*** (4.45)
Risk tolerance group (1-4)	-0.001 (-0.07)	0.041*** (2.84)	0.046*** (4.05)
Age group (1-4)	-0.052*** (-2.94)	-0.057*** (-3.46)	0.005 (0.39)
Income group (1-4)	0.004 (0.21)	0.030* (1.65)	-0.000 (-0.02)
Education level (1-4)	0.008 (0.39)	-0.003 (-0.17)	0.051*** (3.53)
Female (0/1)	0.039 (1.05)	-0.075** (-2.20)	-0.039 (-1.42)
# obs.	4,372	4,372	4,372
Pseudo R ²	0.078	0.133	0.267

Table 6. How pension system outlook relates to general economic outlook and optimism

In Panel A, correlations between pairs of variables are shown. To the right of the correlation coefficients are p-values in brackets. *National economy outlook* is the average response to the following two questions: (i) "In the next twelve months, do you think the economic situation in our country will get (1) worse, (2) stay about the same, or (3) get better?" (ii) "In the next twelve months, do you think unemployment in our country will (1) increase, (2) stay about the same, or (3) decrease?" *Personal economy outlook* is the average response to the following three questions: (i) "In the next five years, do you believe your standard of living will (1) decrease, (2) stay about the same, (3) or increase" (ii) "In the next twelve months, do you believe your standard of living will (1) decrease, (2) stay about the same, (3) or increase?" (iii) "In the next twelve months, compared to your current situation, do you believe you will have (1) less, (2) about the same amount of, or (3) more money at your disposal?" *General optimism* is the response to "Would you mainly consider yourself (1) a pessimist, (2) a realist, or (3) an optimist?" *Pension system outlook* is the response [1 (fully agree) through 5 (fully disagree)] to the claim "I believe that the statutory pension security will weaken to such an extent in the future that I, too, must privately save for my retirement." In Panel B, the output of an OLS regression of the three measures on pension system outlook is summarized. In Panel C, the results of OLS regressions of respondent characteristics on the measure shown at the top are summarized. *Income* is monthly personal net income on a scale of 1 (less than 300€) through 12 (more than 8,000€). *Financial wealth* is on a scale of 1 (none) through 12 (more than 150,000€). *Self-assessed health* is the response [1 (very poor) through 5 (very good)] to "How would you describe your current health condition?" *Risk tolerance* is the response [1 (fully disagree) through 5 (fully agree)] to "When saving or investing, I want proper returns even when it means higher risk". *Economic knowledge* is the sum of the following indicators: (1) Disagree with "I am not interested in issues related to the economy" (2) Agree with "I actively follow news about the economy on television, the internet, in newspapers, etc." (3) Report to focus on economic issues when reading a newspaper or magazine. (4) When asked about the specific newspapers and magazines followed, pick at least one out of the five alternatives that mainly focus on economic and financial issues. In all regressions, home city size, marital status, real wealth and homeownership, and being unemployed is controlled for. Below the estimates are z-statistics in parentheses. In Panels B and C, *, **, and *** stand for statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Pairwise correlations between optimism measures

	Pension system outlook	National economy outlook	Personal economy outlook
Nat'l econ. outlook (1-3)	0.080 [0.000]	1	
Pers. econ. outlook (1-3)	0.029 [0.034]	0.225 [0.000]	1
General optimism (1-3)	0.087 [0.000]	0.091 [0.000]	0.081 [0.000]

Panel B: OLS regression of pension outlook on other measures

Independent variable	Coefficient	t-stat	Reg. stats
Nat'l econ. outlook (1-3)	0.178***	(5.10)	# obs. 5,404
Pers. econ. outlook (1-3)	0.010	(0.34)	R ² 0.015
General optimism (1-3)	0.175***	(6.66)	

Continued.

Table 6, continued.

Panel C: OLS regressions of each measure on respondent characteristics

	Pension system outlook (1-5)	Nat'l economy outlook (1-3)	Personal economy outlook (1-3)	General optimism (1-3)
Age	0.018*** (10.81)	-0.001 (-1.25)	-0.010*** (-11.96)	0.006*** (6.99)
Female (0/1)	-0.260*** (-7.60)	-0.028** (-1.99)	-0.054*** (-3.45)	0.060*** (3.25)
College or higher (0/1)	0.074** (2.08)	-0.016 (-1.08)	0.054*** (3.41)	0.009 (0.46)
Retired (0/1)	0.316*** (5.78)	0.042* (1.92)	0.077*** (3.37)	-0.015 (-0.53)
Entrepreneur (0/1)	-0.207*** (-3.20)	0.021 (0.72)	0.096*** (3.00)	0.134*** (3.96)
Student (0/1)	0.320*** (4.07)	0.044 (1.26)	0.194*** (4.80)	0.015 (0.31)
Income (1-12)	0.008 (0.55)	-0.004 (-0.75)	0.034*** (5.20)	0.010 (1.32)
Financial wealth (1-12)	-0.043*** (-6.20)	-0.003 (-1.03)	-0.005 (-1.49)	-0.021*** (-5.74)
Self-assessed health (1-5)	0.055** (2.26)	0.028*** (2.75)	0.086*** (7.64)	0.125*** (9.59)
Risk tolerance (1-5)	-0.062*** (-4.00)	0.031*** (5.00)	0.025*** (3.75)	0.013* (1.72)
Econ. knowledge (1-5)	-0.071*** (-5.13)	-0.015** (-2.50)	0.010 (1.48)	0.006 (0.78)
Constant	2.025*** (14.94)	1.245*** (22.73)	1.911*** (29.60)	1.442*** (19.69)
# obs.	4,372	4,377	4,386	4,379
R ²	0.101	0.015	0.121	0.050

Table 7. Comparing the effects of different measures of future outlook

Average marginal effects (probit) on the probability of the outcome shown on each panel's top row: saving (Panel A), owning mutual fund shares (Panel B), or owning stocks (Panel C). *National economy outlook* is the average response to the following two questions: (i) "In the next twelve months, do you think the economic situation in our country will get (1) worse, (2) stay about the same, or (3) get better?" (ii) "In the next twelve months, do you think unemployment in our country will (1) increase, (2) stay about the same, or (3) decrease?" *Personal economy outlook* is the average response to the following three questions: (i) "In the next five years, do you believe your standard of living will (1) decrease, (2) stay about the same, (3) or increase" (ii) "In the next twelve months, do you believe your standard of living will (1) decrease, (2) stay about the same, (3) or increase?" (iii) "In the next twelve months, compared to your current situation, do you believe you will have (1) less, (2) about the same amount of, or (3) more money at your disposal?" *General optimism* is the response to "Would you mainly consider yourself (1) a pessimist, (2) a realist, or (3) an optimist?" *Pension system outlook* is the response [1 (fully agree) through 5 (fully disagree)] to the claim "I believe that the statutory pension security will weaken to such an extent in the future that I, too, must privately save for my retirement." In the regressions labeled "Control variables included", age, gender, education level, home city size, employment and marital status, financial affluence, *Risk tolerance*, *Economic knowledge*, and *Self-assessed health* are controlled for. Below the estimates are z-statistics in parentheses. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% levels, respectively.

<i>Panel A: Y = Saving (0/1)</i>	(1)	(2)	(3)	(4)	(5)
Nat'l econ. outlook (1-3)	-0.033** (-2.36)			-0.017 (-1.16)	0.007 (0.46)
Personal econ. outlook (1-3)		-0.014 (-1.13)		-0.005 (-0.39)	-0.008 (-0.56)
General optimism (1-3)			-0.021* (-1.94)	-0.004 (-0.37)	-0.011 (-0.87)
Pension system outlook (1-5)				-0.077*** (-13.76)	-0.069*** (-10.72)
Control variables included	No	No	No	No	Yes
# obs.	5,502	5,500	5,515	5,404	4,356
Pseudo R ²	0.001	0.001	0.000	0.283	0.076
<i>Panel B: Y = Mutual funds (0/1)</i>	(1)	(2)	(3)	(4)	(5)
Nat'l econ. outlook (1-3)	0.017 (1.31)			0.022 (1.62)	0.043*** (2.99)
Personal econ. outlook (1-3)		0.003 (0.22)		0.001 (0.06)	-0.020 (-1.46)
General optimism (1-3)			-0.003 (-0.29)	0.002 (0.14)	-0.003 (-0.22)
Pension system outlook (1-5)				-0.025*** (-4.61)	-0.021*** (-3.49)
Control variables included	No	No	No	No	Yes
# obs.	5,502	5,500	5,515	5,404	4,356
Pseudo R ²	0.000	0.000	0.000	0.004	0.132

Continued.

Table 7, continued.

<i>Panel C: Y = Stocks (0/1)</i>	(1)	(2)	(3)	(4)	(5)
Nat'l econ. outlook (1-3)	0.023** (2.11)			0.023** (1.99)	0.029** (2.56)
Personal econ. outlook (1-3)		0.012 (1.18)		0.009 (0.87)	0.001 (0.12)
Optimism (1-3)			-0.003 (-0.32)	-0.005 (-0.51)	0.004 (0.42)
Pension system outlook (1-5)				-0.006 (-1.35)	-0.008 (-1.58)
Control variables included	No	No	No	No	Yes
# obs.	5,502	5,500	5,515	5,404	4,356
Pseudo R ²	0.000	0.001	0.000	0.002	0.267

Table 8. Effect of healthcare system outlook on financial outcomes

Average marginal effects (probit) on the probability of the outcome shown on each panel's top row: saving (Panel A), owning mutual fund shares (Panel B), or owning stocks (Panel C). *Healthcare system outlook* is the response [1 (fully agree) through 5 (fully disagree)] to the claim "Public services in Finland appear to be weakening to such an extent that, in the future, for example healthcare and medical fees will have to be personally paid for." In the regressions labeled "Control variables included", age, gender, education level, home city size, employment and marital status, financial affluence, *Risk tolerance*, *Economic knowledge*, and *Self-assessed health* are controlled for. Below the estimates are z-statistics in parentheses. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% levels, respectively.

<i>Panel A: Y = Saving (0/1)</i>	(1)	(2)
Healthcare outlook (1-5)	-0.016*** (-2.92)	-0.009 (-1.40)
Control variables included	No	Yes
# obs.	5,435	4,374
Pseudo R ²	0.001	0.055
<i>Panel B: Y = Mutual funds (0/1)</i>	(1)	(2)
Healthcare outlook (1-5)	-0.006 (-1.18)	-0.007 (-1.23)
Control variables included	No	Yes
# obs.	5,435	4,374
Pseudo R ²	0.0002	0.128
<i>Panel C: Y = Stocks (0/1)</i>	(1)	(2)
Healthcare outlook (1-5)	-0.012** (-2.55)	-0.008* (-1.73)
Control variables included	No	Yes
# obs.	5,435	4,374
Pseudo R ²	0.001	0.264

Essay 3: What drives the heterogeneity in portfolio choice? The role of institutional, traditional, and behavioral factors*

ABSTRACT We analyze stock market participation in 19 European countries over 2004-2013, jointly controlling for all relevant variables from prior literature. Previous work relies on a subset of these factors, and often lacks good risk aversion proxies. Our full model explains 30% of the variation in the participation decision. Institutional factors captured by country fixed effects contribute 9.5 percentage points; traditional individual-level factors, such as risk aversion and income, contribute 15 pp; recently identified factors, such as trust and health, contribute 5.5 pp. Most new factors offer little help explaining nonparticipation at the high end – among the wealthy and well-educated. We present evidence challenging and complementing existing interpretations of factors such as IQ, sociability, and trust. We suggest a hierarchical framework for thinking about effects in the high versus low end.

* Joint work with Markku Kaustia. We thank Petri Jylhä, Mikko Niemenmaa, Joni Kokkonen, Elias Rantapuska, as well as seminar participants at the 2nd Research in Behavioral Finance Conference in Amsterdam 2016, Aalto Finance lunch seminar and Bank of Finland Economics Seminar for comments. We also want to extend special thanks to Elina Oinonen for comments and assistance with the data. This paper uses data from SHARE Waves 1, 2, 4 and 5 (DOIs: 10.6103/SHARE.w1.500, 10.6103/SHARE.w2.500, 10.6103/SHARE.w4.500, 10.6103/SHARE.w5.500), see Börsch-Supan et al. (2013) for methodological details. The SHARE data collection has been primarily funded by the European Commission through the FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857) and FP7 (SHARE-PREP: N°211909, SHARE-LEAP: N°227822, SHARE M4: N°261982). Additional funding from the German Ministry of Education and Research, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

1. Introduction

Limited stock market participation has been the quintessential topic in the emerging field of household finance.²⁸ In the literature, several explanations have been offered for the low participation rates. Significant differences in stockholding propensity across countries, even between people of comparable wealth, suggest that country factors related to economic or cultural environment are important (Georgarakos and Pasini, 2011; Christelis, Georgarakos, and Haliassos, 2013). On the individual level, wealth, income, and education have for long been considered highly influential (e.g., Mankiw and Zeldes, 1991; Riley and Chow, 1992; Haliassos and Bertaut, 1995; Vissing-Jørgensen, 2002; Calvet and Sodini, 2014). Besides these traditional factors, more recent studies have uncovered an interesting set of novel factors that empirically explain stock market participation. These include social activity (Hong, Kubik, and Stein, 2004), interpersonal trust (Guiso, Sapienza, and Zingales, 2004; 2008), health (Rosen and Wu, 2004), general optimism (Puri and Robinson, 2007), political preferences (Kaustia and Torstila, 2010), cognitive skills (Christelis, Jappelli, and Padula, 2010; Grinblatt, Keloharju, and Linnainmaa, 2010), bequest motives (Georgarakos and Pasini, 2011), religiosity (Changwony, Campbell, and Tabner, 2015), and physique (Addoum, Korniotis, and Kumar, 2016).

In the current paper, we advance this literature by jointly estimating the effects of all such factors. Besides putting all the factors together, a key advantage of our study is the inclusion of a directly queried financial risk aversion measure. This type of a measure is particularly powerful in predicting actual financial risk-taking (Dohmen et al., 2011; Halko, Kaustia, and Alanko, 2012). As seen in Table 1 listing prior literature, most studies are forced to omit risk aversion altogether, or use crude proxies such as gender and wealth. This can lead to an omitted variable bias if the variable thought to affect stock market participation

²⁸ See Campbell (2006) for a review of literature in this field. An individual's stock market participation status has major implications on her wealth accumulation and consumption (Mehra and Prescott, 1985; Dynan and Maki, 2001; Cocco, Gomes, and Maenhout, 2005; Guvenen, 2006). Still, though obviously important, we do not mean to imply that investing in stocks is always the most important financial decision households make. Surely decisions related to, e.g., housing, as well as the liabilities-side, are also important. Data availability has likely been a factor in the number of studies conducted on stock market participation versus other aspects of household finance.

is also correlated with risk preference. With these data we are also able to shed light on the mechanism of influence for some of the key explanatory variables.

A second question we examine is the overall relative explanatory power of country factors, traditional individual-level determinants, and the new factors. This will help crystallize what the surge in household finance research since 2000 or so has brought in terms of understanding the stock market nonparticipation puzzle.

For data, we utilize all four main waves of the Survey of Health, Aging and Retirement in Europe (SHARE). It is a multidisciplinary survey targeted at individuals aged 50 and above, covering 20 European countries between years 2004 and 2013. Because of its comprehensive nature and broad geographical focus, SHARE data are extremely suitable for our research questions. SHARE also provides us with a directly queried risk attitude, included in the survey in the later waves. What we refer to as traditional factors in this study comprise gender, age, education, income, wealth, and risk aversion. The new factors we utilize are sociability (and its subcomponents), trust, political orientation, cognitive skills (and its subcomponents), health, religiosity, height, body mass index, optimism, and bequest motives.

We begin by investigating each new factor at a time, and find that they all significantly explain participation in these data. This constitutes an important out of sample test for the factors, particularly since we employ all key traditional factors as controls. Also in our baseline regression where all three groups of factors (country, traditional, new) are simultaneously controlled for, all but one of the new factors remain statistically significant with the predicted sign. Each of these factors thus brings additional information about why a person might not invest in stocks. The exception is height, suggested to positively associate with stock market participation by Addoum et al. (2016); its estimated coefficient is zero in the baseline regression.²⁹

²⁹ When Addoum et al. (2016) simultaneously include height as a teenager and current height in a specification, teenage height predicts participation while current height has no effect. When, in addition, risk aversion and other controls are added, also teenage height loses its predictive power in their analysis. This supports the interpretation that the effect of height works through risk aversion developed while growing up.

We report several new stylized facts about the role of the new factors:

- Sociability and cognitive skills are the most robust and economically significant variables, having effects on stockholding probability of 3.2 and 1.6 percentage points, respectively, associated with a one-standard-deviation increase. For comparison, the baseline frequency of participation is 27%.
- Breaking down sociability into its subcomponents, we find, in contrast to Hong et al. (2004), that activity in a religious organization does not predict participation. In fact, it is the only type of social activity that is not associated with participation in our data. On the other hand, the effects of social activities in categories like education or training, or in sports and social clubs, are remarkably strong given that we control for education, health, and body mass index. Prior literature emphasizes information about stocks as the mechanism for the effect of sociability. While not inconsistent with the information channel, our results suggest part of the effect may come from interactions with other positive determinants.
- Breaking down cognitive skills into their subcomponents, the most significant predictor of participation is recall ability, not numeracy as in Christelis et al. (2010) and Grinblatt et al. (2011). Neither of these studies controls for risk aversion. When we omit risk aversion, we too find a very strong effect for numeracy. The overall IQ variable thus seems, to a large extent, to be picking up the effect of risk aversion.³⁰ Growing evidence in psychology, on the other hand, associates working memory with positive life outcomes, and finds that this effect is largely separate from the effect of IQ (see, e.g., Packiam-Alloway and Alloway, 2010). That evidence is consistent with our results on the effect of recall ability.
- Interpersonal trust loses explanatory power when predicting *direct* participation in stocks (i.e., ignoring equity mutual funds and individual retirement accounts). This is inconsistent with Guiso et al. (2008) and Giannetti and Wang (2016), who argue that the likelihood to invest in stocks increases with the level of trust toward listed companies. On the

³⁰ Our result is also in line with Dohmen et al. (2010), who find that subjects with lower IQ test scores have higher experimentally elicited risk aversion.

other hand, our finding that trust predicts investment in managed equity funds suggests that trust toward financial advisors, another channel discussed in Guiso et al. (2008), does matter.

- Atella, Brunetti, and Maestas (2012) find that health status affects participation only in countries having no national healthcare system. Their group of countries with a national healthcare system, where no effect is found, is Denmark, Italy, Sweden, and Spain. We, on the other hand, find that the effect of health is strong in countries with high regulatory quality (including both Denmark and Sweden individually), but not present in countries of low regulatory quality (including both Spain and Italy individually). It thus seems that the effect reported in Atella et al. may be confounded with regulatory quality.
- General optimism has no significant impact on participation when the probability of leaving a bequest is controlled for. Puri and Robinson (2007) find a positive effect for optimism, but they do not control for the bequest motives.
- Compared to the dichotomous participation decision, the new factors are not very helpful in predicting the fraction of wealth held in stocks, at the intensive margin. Only political orientation has the predicted effect, with right-leaning individuals investing more in stocks.
- When we omit risk aversion in our intensive-margin analysis, sociability, cognitive skills, health, and height come out with significant effects in the expected direction. Much of the information in these factors is thus apparently captured by risk aversion. The same does not apply to traditional factors such as age, income, and wealth.

How well can we explain stock market participation overall? The baseline logit regression has an adjusted R-squared of 30%. In a Shapley decomposition of explanatory power, country fixed effects jointly account for roughly a third (9.5 percentage points). Of the individual-level factor groups, traditional factors contribute 15 pp., which is almost three times as much as the new factors (5.5 pp. in the baseline specification).

After much research on the topic, it is no surprise that one is facing decreasing returns when hunting new explanatory factors. We consolidate the findings from our analyses through an attempt at grouping the individual level factors in a

hierarchical taxonomy, inspired by and loosely modeled after Maslow's (1943) theory for the hierarchy of needs. For this purpose, we examine whether each factor becomes stronger or weaker when moving toward environments where participation is more common. We analyze this at the country level (grouping countries on regulation quality as measured by World Bank's worldwide governance indicators) and at the individual level (grouping individuals on wealth and education). Two of the factors we analyze always become stronger where baseline participation is higher: religiosity, which has a negative effect on participation, and political orientation, where right-leaning preferences have a positive effect. Political orientation also explains the share of wealth invested in stocks, and remains at least as strong for directly holding stocks. Based on these new results, as well as those of prior literature, we sketch a conceptual framework for the hierarchy of factors (Figure 1). Our idea here is that low-level factors (representing basic requirements for participation, such as wealth) need to be favorable before higher-level factors (information-related enablers, such as cognitive skill) can come to play. And, moving to settings where both such sets of factors are favorable, the highest level of self-actualizing considerations (values and attitudes) may help separate stock market participants from non-participants.

The rest of the paper is structured as follows. Section 2 reviews prior literature on risky asset holdings. Section 3 describes the data and the empirical variables, and Section 4 provides descriptive analyses. Section 5 presents regression results, first for the full sample and all factors, and then for various subsamples and focusing on selected factors individually. In Section 6, we assess the significance of the new factors as a group. Section 7 concludes.

2. Determinants of risky asset holdings

This section discusses the drivers of stock market participation. While our own empirical focus is mainly on the dichotomous participation decision, some earlier empirical papers only analyze the fraction of wealth allocated to equities, not making the distinction between the decision to participate and the conditional equity share. We discuss these papers even if evidence is not separately available for the participation decision. Although we occasionally refer to the underlying

theoretical motivations, the discussion is mostly driven by empirical findings. For comprehensive treatments of the theory, we recommend Guiso, Haliassos, and Jappelli (2003a), Campbell (2006), and Curcuru et al. (2010).

A. “Country factors” – The institutional and cultural environment

Macroeconomic factors should have an impact on the probability of participation among a country’s residents. There could also be a cultural channel whereby a culture of stock ownership in a country takes time to develop, and is likely promoted by a host of intertwined factors (Guiso, Haliassos, and Jappelli, 2003b). Also, investor protection and regulation are key in promoting household equity ownership (Giannetti and Koskinen, 2010; Pagano and Volpin, 2006). The various economic factors are, in turn, shaped by non-economic country characteristics, such as religion (Campante and Yanagizawa-Drott, 2015; Barro and McCleary, 2003; Stulz and Williamson, 2003).

Christelis et al. (2013) provide empirical evidence on the importance of country factors. Compared to Europe, stock market participation is more likely, and mortgages substantially higher, among U.S. households. As pointed out by Georgarakos and Pasini (2011) and others, differences in financial market participation are also substantial across countries within Europe. We use country fixed effects to capture all these effects.

B. “Traditional factors” – Individual-level determinants of the early literature

In the absence of participation constraints, everyone should invest a strictly positive amount in stocks (see, e.g., Merton, 1969; 1971). With a fixed participation cost, however, the combination of risk aversion and low wealth can lead to rational non-participation (Vissing-Jørgensen, 2002; 2004). Wealth empirically explains participation, as do measures of risk aversion (Haliassos and Bertaut, 1995; Bertaut, 1998).³¹ The average individual investor has decreasing relative risk aversion (Cohn et al., 1975; Calvet and Sodini, 2014), and the effect of wealth becomes stronger with high levels of wealth (Riley and

³¹ In theory, the likelihood of participation can also increase with risk aversion. Gomes and Michaelides (2005) show that this happens for plausible parameter values with uninsurable labor income risk and fixed entry costs.

Chow, 1992). However, investing in stocks is surprisingly uncommon even among wealthy households, suggesting that non-economic costs may also be important (Mankiw and Zeldes, 1991; Campbell, 2006; Curcuru, 2009).

Consistent with information costs, education has a strong positive effect on participation, even controlling for wealth and income (Haliassos and Bertaut, 1995). Cole, Paulson, and Shastry (2012) estimate that one additional year of schooling boosts the probability of financial market participation by seven to eight percent. Education can change individuals' behavior and decision making in several ways; through increasing financial literacy and cognitive skills, or affecting social networks, job opportunities, and beliefs and attitudes. Each of these channels can have a direct effect as well, as discussed in the following section.

Unhedgeable background risk—uncertain labor market income, entrepreneurial income, or fixed assets like real estate—can cause a need to reduce one's total risk by avoiding stocks (e.g. Heaton and Lucas, 2000a). Guiso, Jappelli, and Terlizzese (1996) find that the variability of wage income reduces stock holdings in Italy. In the U.S., the effect is statistically significant only for proprietary business income (Heaton and Lucas, 2000b). Frantonini (1998) finds that mortgage payments reduce risky asset holdings, and Kullmann and Siegel (2003) show that homeowners are more likely to participate in the stock market than renters.

Basic demographic variables are also relevant if they are, for instance, proxying for risk aversion or background risk. Pure age effects, that is, controlling for both cohort effects and time effects, are usually impossible to estimate (Poterba and Samwick, 2001). After addressing this issue to the best extent that their data allows, Ameriks and Zeldes (2004) find that the probability of stock market participation does to some degree decline with age. Men are more likely to invest in stocks and the gender difference is larger in single households (Jianakoplos and Bernasek, 1998; Sundén and Surette, 1998; Barber and Odean, 2001). However, Halko, Kaustia, and Alanko (2012) show that this effect vanishes after controlling for other factors in Finland, a country often considered the most gender equal in the world.

C. “New factors” – Behavioral and other recently identified determinants

Social interactions affects households’ investment decisions. Participation in retirement plans is influenced by the choices of co-workers (Madrian and Shea, 2001; Duflo and Saez, 2002). Hong et al. (2004) find that households interacting with their neighbors or attending church are more likely to invest in stocks. Changwony et al. (2015) and Georgarakos and Pasini (2011) present similar findings for other social activities. The evidence reported by Brown et al. (2008) and Kaustia and Knüpfer (2012) suggests that the effect of social interaction is causal.

The concept of social capital has been linked to stock market participation by Guiso et al. (2004). According to the authors, high social capital enhances the level of trust in a society, which in turn boosts financial development and increases household stock market participation. To measure social capital, researchers have overwhelmingly turned to survey evidence on generalized trust (see Sapienza et al., 2008). Guiso et al. (2008) find that trusting individuals are significantly more likely to hold stocks using the World Values Survey. The effect of trust remains equally strong for wealthier households. In addition to generalized trust, Guiso et al. (2008) show that trust particularly towards banks also predicts participation. Giannetti and Wang (2016) show that the incidence of corporate fraud in a U.S. state makes the inhabitants of that state invest less in stocks, also in the non-fraudulent firms. They explain this result by loss of trust toward the stock market among households.

Kaustia and Torstila (2010) propose that some people perceive the stock market as incongruent with their personal values. For them, investing in stocks would create a discrepancy between actions and values—cognitive dissonance—and so cause an additional mental participation cost. Accordingly, Kaustia and Torstila (2010) find a positive association between voting right-wing and investing in stocks. Changwony et al. (2015) find a similar result in the UK.

Frederick (2005) shows that individuals with high cognitive reflection test (CRT) scores are less loss averse compared to their peers with lower CRT scores. Benjamin, Brown, and Shapiro (2013) find that more cognitively able individuals are more risk neutral over small stakes and more patient over short

time horizons. Dohmen et al. (2010) study a random sample of 1,000 German adults and report that lower cognitive abilities are associated with greater risk aversion and impatience even controlling for education, income, and credit constraints. Higher cognitive abilities can thus affect stock market participation through risk preferences, in addition to lowering information costs. Christelis et al. (2010) find that cognitive abilities are strongly associated with equity ownership using the first wave of SHARE data. Grinblatt et al. (2010) find that IQ scores measured for young adults predict stock market participation later in life, and mathematical skill is the most influential subcomponent of IQ. Van Rooij, Lusardi, and Alessie (2007) show the same for a specific skill, namely scores on a financial literacy test. However, Cole et al. (2012) do not find evidence of financial literacy education affecting participation in a natural experiment.

Several studies have investigated the effect of health on financial portfolios. Rosen and Wu (2004) find that US households in poor health are less likely to hold risky assets. Edwards (2008) examines data from the Study of Assets and Health Dynamics among the Oldest Old (AHEAD), showing that retired individuals view their health status to be risky and try to hedge against it by decreasing their exposure to financial risk. Using data from the first wave of SHARE, Atella, Brunetti, and Maestas (2012) show that the negative effect of bad self-assessed health on the probability to hold stocks is only found in countries with no national healthcare system, while Bressan, Pace, and Pelizzon (2014) show that health measures other than self-assessments are irrelevant for portfolio choice. In sum, these studies suggest that self-assessments of health are more influential on financial decisions than objective measures, and that those in bad health are less likely to hold stocks.

The relationship between religiosity and stockholding has received a fair amount of attention, but the results are mixed. While going to church is positively associated with stock market participation (Hong et al., 2004), people who say religion makes a difference in their life have are likely to own stocks (Changwony et al., 2015). Differences between religions may also be relevant. Halek and Eisenhauer (2001) show Catholics and Jews to be more tolerant toward speculative risk-taking, and accordingly, Kumar, Page, and Spalt (2011)

find risk-seeking investment behavior to be more prevalent in regions where the Catholic-Protestant ratio is high.

Finally, an individual's physique has been connected to her financial decisions by Addoum et al. (2016). They show taller and less obese people are more likely to hold stocks.

3. Data

We employ data from all four main waves of the cross-national Survey of Health, Ageing and Retirement in Europe (SHARE).³² Waves 1, 2, 4, and 5 were primarily conducted in 2004, 2006, 2011, and 2013, respectively, and altogether more than 100,000 individuals from 20 countries have been interviewed.³³ SHARE widely covers different regions of Europe, collecting information on health, socio-economic status and social networks of individuals aged 50 and above and their spouses (who can be of any age). The main questionnaire is partly based on the Health and Retirement Study (HRS) and the English Longitudinal Study of Ageing (ELSA). All questions are standardized across countries.

The survey has largely held its form through the waves, allowing us to pool together information over time. Most of the questions (e.g., those related to cognitive abilities, health, social activities, employment status and future expectations) are posed separately to household members. However, it is possible for a household to appoint one household member as a “finance responsible” to answer questions related to assets and financial transfers on behalf of the entire household. We use the household-level figures.

To diminish data loss due to non-response, SHARE data have been completed using a method called multiple imputation. If a respondent has not reported her annual income, for instance, the imputation method generates five estimates based on her other characteristics, and the income and characteristics of other

³² Five waves have been collected in total, of which we utilize the first, second, fourth, and fifth. We exclude the third wave, collected in 2009, because it had a different format, focusing on early-life experiences.

³³ Our sample includes 19 of these countries. Responses from Ireland, collected in Wave 2, are not used because of a data conformity issue.

respondents.³⁴ For each wave of SHARE, the imputation module contains five sets of data, each representing a different draw from the distribution of missing values. The way we arrive at our final estimates using these datasets is described in Appendix I.

A. Variable definitions

The zero/one stock market participation variables we aim to explain are *Direct participation*, indicating whether a respondent owns stocks directly, and *Total participation*, including stockholdings also through mutual funds or IRAs on top of direct ones. We also analyze *Equity share*, which expresses the fraction of a respondent's aggregate financial assets accounted for by direct and indirect stockholdings. As in much of the existing participation literature, our main focus is in total participation.

The variable *Education* has six categories based on the International Standard Classification of Education 1997 (ISCED-97), facilitating comparison across countries. Financial affluence measures, *Total assets*, *Total liabilities*, and *Income*, are reported on the household level. Total assets include gross financial wealth (bank accounts, bonds, stocks, mutual funds, long-term savings) and real wealth (real estate, business, cars). Total liabilities include mortgages and any financial liabilities. Income is reported net of taxes, and includes revenues from employment, pension, and assets owned.³⁵

We measure *Risk aversion* with the following question, similar to the U.S.-based Survey of Consumer Finances (SCF; see, e.g., Haliassos and Bertaut, 1995, p. 1121). “Thinking about financial risk that you are willing to take, do you a) Take substantial financial risks expecting to earn substantial returns, b) Take above average financial risks expecting to earn above average returns, c) Take average financial risks expecting to earn average returns, and d) Not willing to take any financial risks.” We convert these answers to a four-point scale where 4 indicates maximum risk aversion (answer d) and 1 is least risk averse (answer a).

Sociability is a variable that counts the social activities a respondent reports to have engaged in during the previous year (Waves 4 and 5) or month (Waves 1

³⁴ A detailed description of the imputation procedure is given by Christelis (2011) and in the SHARE Wave 4 Release Guide 1.1.1, available at <http://www.share-project.org/>.

³⁵ The income figures from Wave 1 are reported in gross terms.

and 2), with the following options given: a) Voluntary or charity work, b) Attendance of an educational or training course, c) Participation in a sports, social or other kind of club, d) Taking part in the activities of a religious organization (church, synagogue, mosque, etc.), and e) Taking part in a political or community-related organization.

As in most previous research, we use the following question on interpersonal trust as our *Trust* measure: “Generally speaking, would you say that most people can be trusted or that you can’t be too careful in dealing with people?” Responses are given on a 0-10 scale, where zero means “one can’t be too careful” and ten means “most people can be trusted”.

The *Right-wing*-variable is based on the following question: “In politics people sometimes talk of ‘left’ and ‘right’. On a scale from zero to ten, where zero means left and ten means right, where would you place yourself?”

For *Cognitive skills*, we construct an index based on three different dimensions of cognitive ability measured by SHARE. The first one, numeracy, is based on four calculations: (1) 10% of 1,000, (2) half of 300, (3) 1.5 times 6,000, (4) the value of 2,000 euro after two years of compound interest of 10%.³⁶ The second one, fluency, is measured by the number of different animals a respondent can name in one minute, with a cap at 70.³⁷ The third component, recall, equals the number of words a respondent can remember from a list of ten after a short time. We create the index by averaging the three components after standardizing them into z-scores.

The measure of *Health* is a 1-5 scale based on (reversed) responses to the following question: “Would you say your health is (1) excellent, ..., (5) poor?”

Religiosity is measured by how often a respondent prays. Reported frequencies are coded onto a 0-5 scale, where zero means never and five means more than once a day. Compared to church attendance as used by Hong et al. (2004), this measure should be more descriptive of belief intensity and less so of social activity.

³⁶ If (1) is answered correctly, the interviewer jumps to (3). If (3) is again correctly responded to, (4) will be asked as the final question. (2) is only asked if (1) is answered incorrectly, and after that no further question is asked. For details on scoring, see Dewey and Prince (2005).

³⁷ Energetic finance researchers should try this test: can you make the 70 mark?

Finally, we use the *Body mass index (BMI)* and *Height*. The index is calculated as follows: $BMI = \text{Weight (kg)} / [\text{Height (m)}]^2$. Like Addoum et al. (2016), we use relative measures standardized by country, gender, age, and survey wave for these variables.

4. Descriptive analysis

A. Participation in the equity market

Figure 2 shows the wave-to-wave development of total and direct stock market participation rates in the ten countries that took part in all four waves. The figure is clearly highest in the Nordic countries of Sweden and Denmark, where total participation is around 60%. In comparison, in the Mediterranean countries of Spain and Italy, about 10% own any stocks. Typically about half of total participation comes from indirect stock investments.

Figure 2 also illustrates an increasing preference for indirect stockholdings and a decline of direct holdings. In all countries except the Netherlands and Sweden, total participation has tended to increase through the waves. At the same time, direct participation in many of these countries has declined, especially after the second wave in 2006. To get a rough idea of a potential relation between equity prices and participation over time, Figure 3 plots the cumulative returns of the Eurostoxx 50 index during the sample period together with the participation rates aggregated across countries covered in all waves. Changes in participation rates are congruent with changes in stock prices, except for the decline in direct participation between the 2011 and 2013 waves.

B. Characteristics of participants and non-participants

Table 2 summarizes respondent demographics by stock market participation status. Stock market participants are younger than non-participants, and those with indirect stockholdings the youngest group. This pattern can be due to pension savings indirectly allocated to stocks through mutual funds or IRAs that are gradually depleted or turned into safer assets after retirement.

Compared to non-stockholders, stock market participants are more often men, have more education, earn more, and have accumulated more wealth. All the

differences are greater when comparing non-stockholders to those who directly own stocks. Although quite striking in magnitude, the differences are in line with prior literature.

Table 3 turns to the psychological and physical attributes of the respondents. Risk aversion is lower, trust in others higher, political preferences more right-wing, religiosity lower, and scores in cognitive skills tests higher among stock investors. The median stockholder reports three social activities compared to one reported by the median non-stockholder, is taller both in absolute terms and proportionally to her weight, and considers herself to be in better health.

5. Regression results

A. Drivers of stock market participation

Table 4 presents our baseline analysis of drivers of stock market participation. It reports results from probit regressions where the dependent variable takes the value of one if an individual holds stocks either directly or through equity mutual funds (columns 1 through 5). To make coefficients comparable across regressors, the average marginal effect of a one-standard-deviation increase is reported for each non-dummy variable.³⁸ Squared terms are included for age and relative height, consistent with prior studies. They are not separately tabulated, however. Rather, we report the effect of an *additional* year of age, or centimeter of height, on participation probability. In the first column, we include only the traditional determinants for risky asset holdings: demographics and risk aversion, as well as country fixed effects. The second column deviates from the others in presentation format. Instead of a single regression, it summarizes the results of nine different regressions. In each regression, one of the new determinants at a time is added to the specification of column 1. Only the coefficient of the added determinant is displayed in column 2. So, for example, the coefficient of 0.023 for sociability is from a regression like column 1, except that also sociability is included. Column 3 presents our “baseline” specification, including all our variables of interest and the full set of controls. In columns 4

³⁸ For the only dummy regressor, *Male*, the coefficient gives the marginal effect of change from 0 to 1.

and 5, we drop the controls for risk aversion and country fixed effects, respectively, to see how omitting these key factors might affect coefficients. Finally, in column 6, the dependent variable is a direct participation dummy, while the explanatory variables are the same as in the baseline specification of column 3.

We cluster standard errors on the household level throughout the analyses. Estimated standard errors will thus not be biased downward due to correlation in responses among household members in a given wave, or among an individual's responses across waves. This is important because responses for some of the variables, considered relatively static through time, are not collected from a respondent in all waves. In such cases, we update missing values using information from other waves if available. Characteristics for which information has been updated across waves include gender, education, height, risk aversion, cognitive abilities, trust, political preferences, and religiosity. Obviously many of these factors are also very static, even if collected in each wave. To investigate any potential remaining effect on standard errors, we replicate the main analysis using a single cross-section only (Wave 5). The findings remain the same, although the smaller number of observations leads to slightly less precise estimates.

Controlling for country effects, the traditional factors all have anticipated effects on the probability of stock market participation, as seen in column 1. Adding each of the new factors to this specification on their own in column 2, we see that all of them behave as suggested by prior studies. We are thus able to replicate the most prominent findings of stock market participation studies in this large international sample.

Our baseline specification, with all factors simultaneously included, is presented in column 3. The big picture remains. While a number of the coefficients do decrease in both size and significance in this horse race, height is the only new factor that loses its predictive power altogether. However, as the body mass index describes a respondent's weight in proportion to her height, we still see that height plays a role through that channel. In sum, the findings in column 3 show that even in the presence of a comprehensive set of controls, each new factor provides an important piece of additional information.

As shown in Table 1, measures of risk aversion have been either indirectly derived or not available at all in most of the prior studies explaining participation with new factors. Column 4 drops the risk aversion control to examine any bias this might cause in other coefficients. Of the basic demographics, particularly being male, relatively young, and well-paid appear to be positively associated with risk tolerance, as the marginal effects attributed to these factors are inflated vis-à-vis column 3. Of the new factors, the same applies to trust, right-wing political orientation, health, and, to a slightly lesser extent, cognitive skills and the body mass index.

Participation studies have traditionally been conducted with national data sets. Databases like SHARE allow us to see whether the drivers of participation vary across different cultural and regulatory environments. In column 5, we take a first look at this issue by omitting country dummies. This alters a number of the estimates quite substantially. Women in some countries, for instance, are more likely to hold stocks than men in some others, reducing the gender effect on participation probability by almost three quarters. A similar pattern emerges with the difference in participation propensity brought upon by age, making age lose its explanatory power altogether. The coefficient of relative height even turns negative as individuals who are relatively short in some countries participate more than relatively tall individuals in others. Importantly, in countries where households have better access to debt, people are much more likely to hold stocks. This comes through as a positive effect of household liabilities on participation. Finally, the higher average levels of interpersonal trust, right-wing political values, cognitive test scores, and self-rated health, along with the lower level of religiosity, in countries where participation is more common make these factors stand out as more influential when country dummies are omitted.

Column 6 limits to directly held stocks only. Compared to other households in the sample, those with direct stockholdings are on average older, not younger. Most interestingly, individuals who are relatively trusting toward others are not more likely to make direct stock investments. This suggests that trust toward companies, as proposed by Guiso et al. (2008) and Giannetti and Wang (2016), plays little part, while trust plays a larger part in decisions involving the financial industry, such as fund managers or investment advisors.

Looking at Table 4 as a whole, the abundance of significance stars seems to suggest that quite a lot is known about the question of who invests in stocks. But how far do these models really take us in identifying stock market participation? The pseudo-R-squared is based on the likelihood of observing the actual data if a model is realistic. It shows how much the explanatory variables improve the model's ability to produce realistic estimates, compared to just regressing the dependent variable on a constant. The baseline specification, with 35 regressors,³⁹ reaches a pseudo-R-squared of 0.298, saying that its log-likelihood is about 0.70 times that of a model predicting participation with a constant only.⁴⁰ While this improvement appears substantial, it is not obvious what it implies in terms of absolute predictive power.

As a more intuitive measure of model performance, we turn to its *sensitivity*, expressing the probability that we correctly identify a participant. As seen in Table 4, this probability is about 50% at best. Strikingly, it is only improved by three percentage points, from 48% to 51%, through adding the full set of new factors into the model. In other words, when confronted with a stockholder, collecting extensive background information and using a probit model leads to an expected probability of identification equal to what is achieved by ignoring all information, and simply tossing a coin. While this might seem like a poor result at the outset, one must bear in mind that only about 30% of respondents do hold stocks. Of the 70% who do not, the baseline model correctly identifies about 92%. Probit models in general favor classification into the larger of the two groups (here non-participants), and a larger fraction of positive outcomes in the data leads to higher sensitivity.

B. Factor subcomponents and factors with incomplete data

Our data allows a more granular look into two of the variables most strongly associated with participation, namely sociability and cognitive skills. As explained above, the *Sociability*-variable counts the number of different activities a respondent has engaged in. Previous participation studies have been

³⁹ In addition to the 15 shown in Table 4, the squared terms of age and height, and 18 country dummies.

⁴⁰ The McFadden pseudo-R-squared used in our estimations is defined as follows: $\text{pseudo-R}^2 = 1 - (\log\text{-pseudo-likelihood of full model} / \log\text{-pseudo-likelihood of constant-only model})$. As likelihoods are between zero and one, their logarithms are negative, and a smaller log-likelihood means better fit.

explicit about the *type* of social activity, defining sociability as interaction with neighbors, going to church, or being active in social groups or organizations (Hong et al., 2004; Changwony et al., 2015). To see how various types of social activity associate with participation, in Table 5 we report results where the *Sociability*-variable is decomposed into different activities.

Four out of the five activities have significantly positive effect on participation. However, unlike Hong et al. (2004), we find that taking part in the activities of a religious organization, such as a church or synagogue, does not predict participation. The reason for this discrepancy in results is mainly not that we include a separate control for religiosity, but that we control for other types of sociability. In a regression where the indicator of religion-related activities is entered as the only measure of sociability, its coefficient is positive and significant.

Christelis et al. (2010) and Grinblatt et al. (2011) both find that numerical skills are the most important component of cognitive ability in predicting participation. Columns 2-4 in Table 5 break cognitive ability into its subcomponents as available in SHARE, that is, numeracy, fluency, and recall. As seen in the final column, we find both numeracy and fluency to have zero effects in the baseline specification. Recall ability is the only positive and significant component of the *Cognitive skills*-variable.

Our more comprehensive set of controls appears to again explain this discrepancy with earlier research: When we try to match the specifications of Grinblatt et al. (2011) (only controlling for gender, age, education, income, and wealth) and Christelis et al. (2010) (omitting risk aversion from our baseline specification), we, too, find numeracy to be the strongest predictor of participation.

In Table 6, we analyze two factors previously found to be important, but for which data is only available in some of the waves of SHARE. Puri and Robinson (2007) show optimistic individuals participate more.⁴¹ Ameriks et al. (2011) demonstrate the importance of bequest considerations for financial decisions later in life, and correspondingly, Christelis et al. (2010) and Georgarakos and

⁴¹ Puri and Robinson's (2007) measure of optimism is subjective life-expectancy minus actuarial life-expectancy. Dominitz and Manski (2007) show that individuals with more optimistic expectations of equity returns are more likely to participate.

Pasini (2011) show that those who plan to leave a bequest are more likely to own stocks. In Table 6, the *Optimist*-dummy indicates if a respondent says she “sometimes” or “often”, as opposed to “rarely” or “never”, feels that the future looks good for her. The *Plans bequest*-dummy indicates if a respondent considers her probability for leaving a bequest to be positive. When individually adding the dummies to our baseline specification in all available waves, the results are in line with prior studies. However, when both are simultaneously included, which limits the observations to Wave 2 only, the *Optimist*-dummy loses its significance. The estimated effects of other factors are not notably changed from the baseline in any of the specifications and are not reported.

C. Determinants of participation in different regulatory environments

So far, we have seen that participation rates vary substantially across Europe, and that there is an important country fixed effect even after controlling for a host of individual level factors. To examine how local economic conditions shape the attributes separating participants from non-participants, we rank countries according to their level of regulatory quality, as measured by the World Bank’s Worldwide Governance Indicators. The measure aims to capture governmental ability to “permit and promote private sector development” through policy, including components such as investment freedom and transparency of financial institutions. As investor protection and regulation are key in promoting household equity ownership (Pagano and Volpin, 2006; Giannetti and Koskinen, 2010), our ranking methodology appears suitable. The resulting country groups of high, medium, and low regulation quality are presented in Panel A of Table 7.

Panel B of Table 7 presents results from baseline regressions for each country group. We first note that participation increases monotonously with regulatory quality, being almost four times as high in top-ranked countries compared to bottom-ranked countries. Accordingly, as discussed above, our model’s ability to correctly identify a stockholder considerably improves when moving up in regulation quality. Most of the determinants remain significant in all three groups, but often they are stronger in countries with higher regulatory quality.

Interpersonal trust, political orientation, and self-assessed health do not predict participation in countries of low regulatory quality. The results for trust contrasts

the findings of Guiso et al. (2008), who find trust to predict stock ownership in both Italy (low regulatory quality) and the Netherlands (high regulatory quality). Kaustia and Torstila's (2011) and Changwony et al.'s (2015) findings of right-wing political preferences predicting participation come from countries of high regulatory quality, and appear not to generalize to countries of low regulatory quality.⁴²

Regarding health, Atella, Brunetti, and Maestas (2012) use SHARE data to show that it only affects participation in countries with no national healthcare system. Their group of countries with a national healthcare system, where no effect is found, consists of Denmark, Italy, Sweden, and Spain. However, Atella et al. (2012) show no analysis of the countries individually, leaving it ambiguous where the result comes from. In our sample, the effect of health is highly significant in both Denmark and Sweden, which rank in the top tertile of regulatory quality. We do find a zero effect in Spain, but in Italy the coefficient of health is again marginally significant (t-stat 1.75).⁴³ This goes against the explanation proposed by Atella et al. (2012).

D. Determinants of participation by wealth and education level

Wealth and education are highly significant predictors of stock market participation. Next, we use these variables to split the sample into three groups of households, and study the determinants of participation therein. To account for the varying levels of average wealth and education across countries, we make the groupings on the country level. For example, individuals in the top tertile of wealth in Poland go in the high wealth group although many of them would be in the bottom tertile of wealth in the full sample.

Table 8 shows that two of the key traditional factors, gender and education, lose their predictive power in some of the subsamples. In the low wealth group, men and women are equally likely to own stocks. Among those in their country's top tertiles of both wealth and education, having an additional year of education makes no difference for owning stocks. Of the new factors, interpersonal trust, self-assessed health, and the body mass index lose their significance in some of

⁴² Kaustia and Torstila's (2011) data come from Finland, whose regulatory quality score is highest in Europe at 1.90. Changwony et al.'s (2015) data are from the UK, whose score of 1.83 is still higher than Switzerland's, which is the top-ranking country in the SHARE sample.

⁴³ Individual country results are available by request.

the subsamples. Trust does not increase participation among those with high education combined with high wealth. Health does not distinguish participants from non-participants among the highly educated, while BMI is not a significant predictor of participation among those with relatively low wealth.

Perhaps the most interesting observation from Table 8 is that even among those who are both wealthy and highly educated, personal characteristics really matter. This issue is at the core of the stock market participation puzzle: why are those who are likely to know about the stock market and have enough wealth not participating? The gender gap remains large, men being four percentage points more likely to own stocks. Willingness to avoid financial risk is another significant reason to stay out, implying that even in this group, many are not convinced with the historically favorable long-term risk-return relationship of stocks. For many, political values appear to provide an argument against the stock market. And quite interestingly, even in this group that at the outset would appear financially sophisticated, cognitive skills are a highly significant factor. However, when we break down the cognitive skills index to its components, fluency, numeracy, and recall, none of them individually reaches significance in this subsample. Conditional on high socio-economic status, some overall ability is therefore more prevalent among stock market participants.

6. How significantly do the new factors increase our knowledge about participants?

One goal in this paper is to critically assess the extent to which the factors proposed in the relatively recent literature enhance our understanding of stock market participation. To this end, we compare their joint explanatory power to that of traditional and country factors.

A. Which new factors appear the most important?

Table 9 shows that the only new factors for which we estimate the predicted effect with statistical significance in all analyses are sociability, cognitive skills, and religiosity. Mainly, the consistently robust factors are also those with most economic significance in terms of effect size in the baseline specification. Looking at the estimated changes in stockholding probability resulting from a

one-standard-deviation increase in each factor, tabulated in Table 9, sociability ranks highest with an estimate of 2.4 percentage points. This corresponds to almost 10% of the sample propensity to hold stocks. The body mass index has the second largest effect magnitude, with a standard deviation's reduction estimated to lead to a jump of 2.3 pp. in participation probability. As seen above, being slender only predicts stockholding among the relatively wealthy, who on average weigh less relative to their height than the less affluent (from the highest to the lowest net wealth tertile, the average values of relative body mass index are -0.10, 0.02, and 0.08). Cognitive skill has the third largest effect size at 1.6 pp.

B. How important are the new factors as a group?

We next look at the contribution of the new factors as a group to the explanatory power of our regressions. We do this by decomposing the McFadden pseudo-R-squared from the regression by the Shapley method. It avoids the dilemma of deciding in which order the regressors should be added, something that would significantly affect the results. The Shapley method, in contrast, produces an additive decomposition.⁴⁴

Figure 4 presents the results of the Shapley decompositions of explanatory power. Traditional factors typically have more explanatory power as a group compared to country effects and new factors. In the baseline specification, traditional factors account for about half of the increase in log-likelihood compared to a constant-only model. Country factors account for roughly a third, and new factors about a fifth. Considering the fact that traditional factors are fewest in number, at seven in total compared to eight new factors and 19 country dummies, their relative influence seems particularly high. Only in two exceptional subsamples are country effects jointly more important: among those with high wealth, and among those with low wealth and low education.

One might expect that when we look at people from countries with similar regulatory environments, individual-level differences would mainly determine who is likely to invest in stocks. This is indeed what we find for countries with intermediate or low regulatory quality. Somewhat surprisingly, however, among

⁴⁴ For further details, see <https://ideas.repec.org/c/boc/bocode/s411401.html>.

countries where regulation quality is high, the effect of macro-level differences is substantial. The countries in this group are Denmark, Estonia, Germany, Netherlands, Sweden, and Switzerland. Out of the six countries, five are in the top seven of the sample in terms of participation. Even among them, there is substantial variation, since Sweden and Denmark are quite far above the rest. But the country that really brings variation into the group is Estonia. Its participation rate is around eight percent, among the lowest in the sample. The hefty economic reforms conducted since regaining independence from the Soviet Union in 1991 have placed Estonia in the top tertile with respect to regulation quality, but stock market participation still lags behind.

Table 10 tabulates the relative explanatory power of the three groups of factors. We use the values shown in Figure 4, and simply divide the new factors' pseudo-R-squared contribution with that of traditional factors. In the full sample baseline specification, this "explanatory power ratio" is slightly below 40 percent.

Level of education affects the explanatory power ratio between new and traditional factors. Among the little educated, the new factors contribute 43% of what traditional ones do. Among the highly educated, the fraction is 26%. This is one demonstration of the challenge in explaining participation in the high end of households.

C. Do the new factors help explain the fraction of wealth held in equities?

As our final set of tests, we look at an alternative dependent variable: the fraction of stockholders' wealth held in equities, or the *equity share*. We define the value of equity holdings as the value of directly held stocks, plus the value of equity's fraction in mutual fund and IRA holdings, estimated as follows. When a respondent says she owns mutual funds or IRAs, she is asked whether they include a) mostly stocks, b) half stocks, half bonds, or c) mostly bonds. In case a), we multiply the fund or IRA holding value by 4/5, and include the resulting amount into equity holdings. In cases b) and c), the respective coefficients are 1/2 and 1/5. The equity share is then found by dividing the value of equity holdings by the combined value of equities, bonds, mutual funds, IRAs, and bank accounts. Multiple imputations-based data are not available for the individual wealth categories, so we rely on self-reported values only.

The results presented in Table 11 show patterns quite different from the 0/1 results. In the full model (column 3), only political preference is significant among the new factors. A move from the center to the very right on the 0-10 scale leads to an increase in equity share of 2.5 percentage points. When dropping risk aversion (column 4), sociability, cognitive skills, and health become significant. This adds to the earlier findings suggesting that when risk aversion is not directly control for these factors may at least partially act as risk aversion proxies. A significant gender effect also appears in the absence of risk aversion control. When dropping all new factors (column 2), the coefficients for traditional factors change little. Finally, dropping country effects (column 1) affects coefficients of traditional factors much less than when analyzing the 0/1 participation decision.

7. Conclusion

We use the four main waves of SHARE, conducted between years 2004 and 2013, to analyze stock market participation jointly controlling for all relevant variables identified in prior empirical literature. Further, we use a directly queried measure of risk aversion that has been shown particularly powerful in explaining actual risk-taking, whereas previous work often lacks good risk aversion proxies.

We report a number of new stylized facts that affect the interpretation of the recently considered variables. Sociability, cognitive skill, and religiosity explain participation throughout the analyses. Breaking down sociability into its subcomponents shows that activity in a religious organization is not related to participation, while social activity related to education or sports is, on top of controlling for education and health. Breaking down cognitive skills into their subcomponents shows that recall ability has much more explanatory power than numeracy. This is inconsistent with earlier findings in participation studies—and likely due to their lack of controlling for risk aversion—but consistent with recent findings on the importance of working memory for life outcomes. Trust predicts participation in equity mutual funds, but not in directly held stocks. This is consistent with the view that the relevant channel is trust toward market intermediaries such as financial advisers, and inconsistent with the view that the

effect mechanism is based on trust in public corporations. Optimism has no impact on participation propensity if controlling for a bequest motive. Height loses its predictive power in the presence of other new variables.

Our full model regression explains 30% of the variation in the participation decision. Of this explanatory power, institutional factors captured by country fixed effects account for about a third, and traditional individual-level factors about 50%. Less than a fifth of the variation is explained by the recently identified factors. Non-participation is widespread even among the relatively wealthy and educated individuals, and our ability to explain it remains rather limited.

We find that two variables, political orientation and religiosity, gain in significance in subsamples where participation rates are relatively high: the well-educated and wealthy, and countries of high regulatory quality. Based partly on this result, and partly on prior research, we suggest a hierarchical model of participation drivers. In this model, similar in spirit to Maslow's (1943) hierarchy of needs, the low-level factors, such as wealth, have to be on a sufficient level before high-level, e.g., psychological, factors can come into play. In our view, further progress in explaining non-participation, particularly among the well-off, would likely benefit from a focus in the high end of the model. This calls for identifying more measures for personal values and attitudes relevant for investing in stocks.

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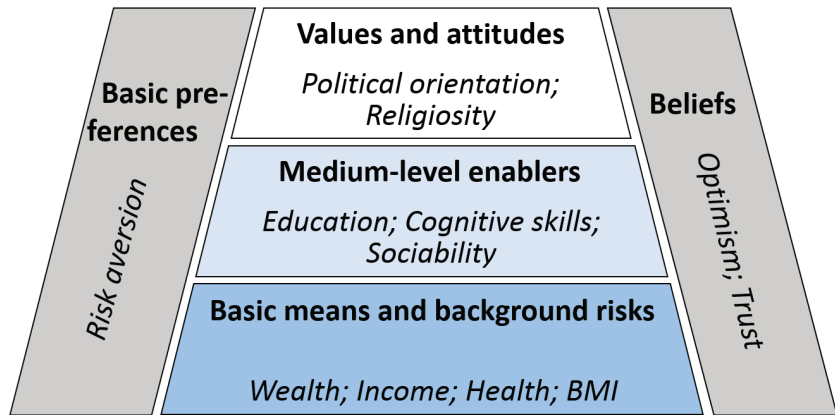


Figure 1. Conceptual hierarchical model of stock market participation drivers.

In the figure, boldface group headings describe the type of influence, while italicized concepts represent the empirical variables employed in this study, and serve as examples of how each type of influence can be measured.

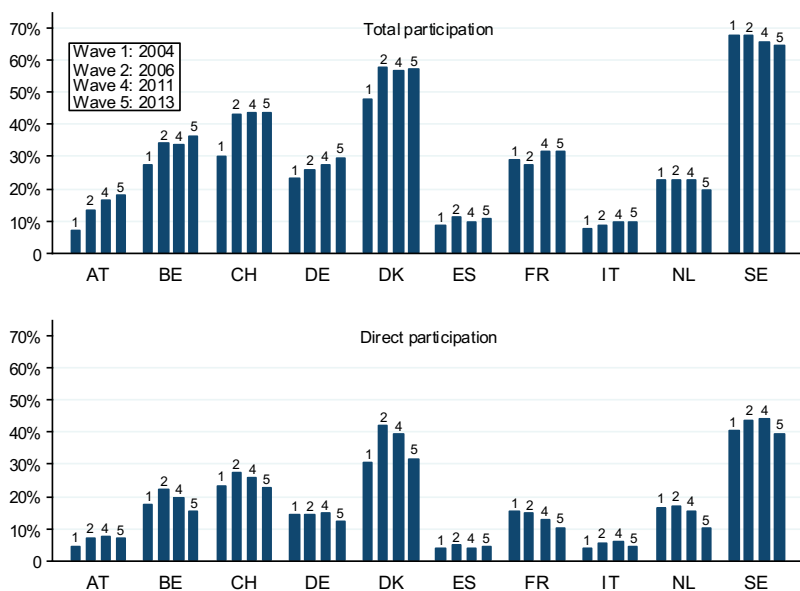


Figure 2. Total and direct stock market participation by country in the four waves

The figure shows the fraction of respondents who have invested in stocks either directly or indirectly through mutual funds or IRAs (total participation combines direct and indirect participation). Only countries with data available for all four main waves are included. *AT* is short for Austria, *BE* for Belgium, *CH* for Switzerland, *DE* for Germany, *DK* for Denmark, *ES* for Spain, *FR* for France, *IT* for Italy, *NL* for the Netherlands, and *SE* for Sweden.

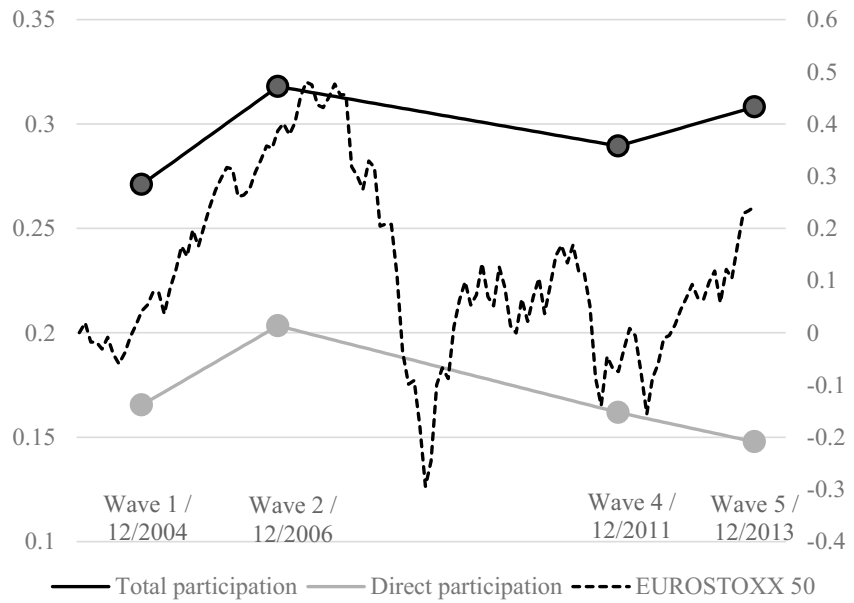


Figure 3. Participation in the individual survey waves and equity prices in Europe

The fraction of respondents who own stocks in each wave is shown on the left axis. Cumulative returns of the Eurostoxx 50 index, starting January 2004, are shown on the right axis. The index covers 50 blue-chip stocks from 12 Eurozone countries.

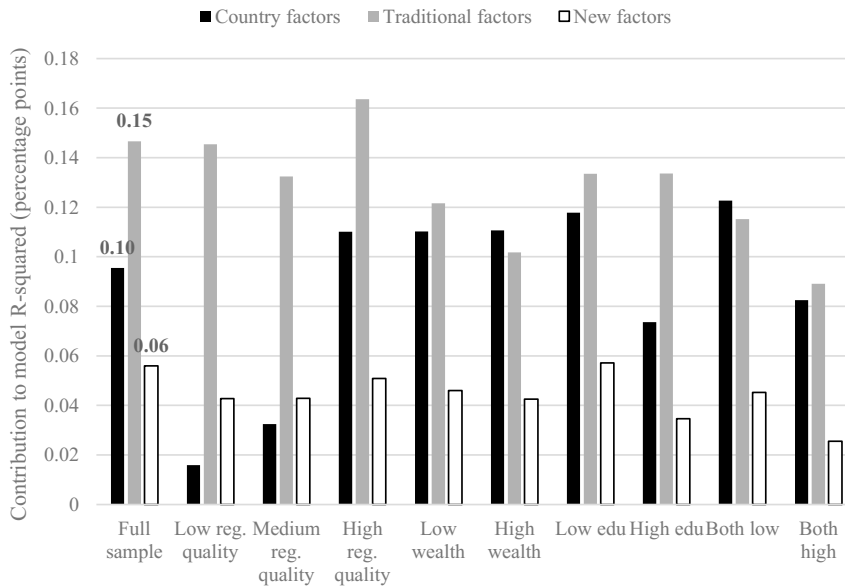


Figure 4. Relative explanatory power of different groups of factors

In the graph, the pseudo-R-squared of our main specification in all subsamples is divided into three parts via a Shapley decomposition. Each part represents the contribution to explanatory power of a group of variables. Absolute values are shown, not fractions: the sum of the three components equals the pseudo-R-squared of the regression. The first variable group is *Country factors*, including a dummy for each of the 19 countries (one omitted). The second group is *Traditional factors*, including gender, age, education, income, wealth, and risk aversion. The third group is *New factors*, including sociability, trust, political orientation, cognitive abilities, health, religiosity, height, and the body mass index.

Table 1. Summary of risk aversion measures used in previous studies on the new factors

Journal name abbreviations are: *EER* for European Economic Review; *JBF* for Journal of Banking and Finance; *JEEA* for Journal of the European Economic Association; *JF* for Journal of Finance; *JFE* for Journal of Financial Economics; *MS* for Management Science; *RoF* for Review of Finance. Data source abbreviations are: *BHPS* for British Household Panel Survey; *DHS* for Dutch National Bank household survey; *FCSD* for Finnish Central Securities Depository; *HRS* for Health and Retirement Study; *IRS* for Internal Revenue Service; *NLSY* for National Longitudinal Study of Youth; *PSID* for Panel Study of Income Dynamics; *SCF* for Survey of Consumer Finances; *SHARE* for Survey of Health and Retirement in Europe; *WVS* for World Values Survey.

Authors	Title	Journal, year	Data	Risk aversion proxy
Addoun, Kormiotis, Kumar	Stature, obesity, and portfolio choice	MS, forthc.	US: HRS 1992-2008 & NLSY 1992-2008; SHARE W1 (2004), W2 (2006); Netherlands: DHS 1993-2009	HRS: Measure based on income gambles like the one used by Hong et al. (2004), created by Kimball, Sahn, and Shapiro (2008). NLSY: Proxy based on three gambles SHARE & DHS: None; control for gender, education, wealth.
Giannetti, Wang	Corporate scandals and household stock market participation	JF, forthc.	US: PSID 1984-2009, combined with brokerage and fraud data	Dummy for below median risk tolerance based on income gamble questions in 1996 wave; included 1996 and onwards. Also control for wealth, age, education, ... Gender control unclear.
Changwony, Campbell, Tabner	Social engagement and stock market participation	RoF, 2015	UK: BHPS 1995, 2000, 2005	None; control for gender, education, wealth, health, having debt, self-employment, ...
Atella, Brunetti, Maestas	Household portfolio choices, health status, and health care systems: A cross-country analysis based on SHARE	JBF, 2012	SHARE W1 (2004)	None; control for gender, education, wealth, sociability, religiosity, cognitive skills, ...
Georgarakos, Pasini	Trust, sociability, and stock market participation	RoF, 2011	SHARE W1 (2004) added with trust data from WVS (W2 data used in online appendix)	None; control for gender, education, wealth, ...

Continued.

Table 1, continued.

Authors	Title	Journal, year	Data	Risk aversion proxy
Grinblatt, Keloharju, Linnainmaa	IQ and stock market participation	JF, 2011	Finland: Six data sets merged, holdings data from end-2000	None; control for gender, education, wealth, ...
Kaustia, Torstila	Stock market aversion? Political preferences and stock market participation	JFE, 2011	Finland: FCSD ownership data 1995-2002; Statistics Finland 1996, 2002; Survey data 2003, 2006, 2009	None; control for gender, education, wealth.
Christelis, Jappelli, Padula	Cognitive abilities and portfolio choice	EER, 2010	SHARE W1 (2004)	None; control for education, income, wealth, religiosity, ... Gender control unclear.
Brown, Ivkovic, Smith, Weisbenner	Neighbors matter: Causal community effects and stock market participation	JF, 2008	US: IRS panel data on tax returns 1987-1996	None; control for individual fixed effects, income, age.
Guiso, Sapienza, Zingales	Trusting the stock market	JF, 2008	Netherlands: DHS 2003; Italian bank customers	DHS: Risky gamble question. Also control for ambiguity aversion, optimism. Italy: Dummy based on claim: Risk is (1) an uncertain event from which one can profit, or (2) an uncertain event one should protect himself from.
Dominitz, Manski	Expected equity returns and portfolio choice: Evidence from the Health and Retirement Study	JEEA, 2007	US: HRS 2004	None; control for gender and marital status.

Continued.

Table 1, continued.

Authors	Title	Journal, year	Data	Risk aversion proxy
Puri, Robinson	Optimism and economic choice	JFE, 2007	US: SCF (all suitable waves since 1989, unclear which is the latest they use)	Question on willingness to take financial risk: "Take substantial risk for substantial reward", ..., "not willing to take any risk."
Hong, Kubik, Stein	Social interaction and stock-market participation	JF, 2004	US: HRS 1992	Dummy indicating if at least one household member would take a job that would double their income with a 50% chance and cut it by a third with a 50% chance.
Rosen, Wu	Portfolio choice and health status	JFE, 2004	US: HRS 1992, 1994, 1996, 1998	Dummy indicating if respondent would take a job that would double their income with a 50% chance and cut it in half with a 50% chance.

Table 2. Summary of demographics by participation status

For individuals who participated in more than one survey wave, only the latest observation is used. *ISCED-97* stands for the International Standard Classification of Education 1997, a 0-6 scale allowing international comparisons of education level. *Income* is annual, and both income and wealth are reported at the household level. *Financial wealth* includes bank accounts, bonds, stocks, mutual funds, and long-term savings, while *Total wealth* also includes real estate, business wealth, and cars. *Any stockholdings* means that respondent who own stocks in any form, either directly or indirectly, are included in the sample.

	Age	Male	Education (ISCED-97)	Income ('000 €)	Net wealth ('000 €)	
					Financial	Total
<u>No stockholdings</u>						
Mean	68.03	0.40	2.53	26.48	19.75	179.51
Median	67	0	3	15.80	2.43	95.34
Standard deviation	11.02	0.49	1.46	69.79	86.28	539.63
# observations	55,299	55,299	54,785	55,299	55,299	55,299
<u>Any stockholdings</u>						
Mean	64.46	0.53	3.46	55.12	120.33	420.18
Median	63	1	3	33.89	57.27	262.97
Standard deviation	9.72	0.50	1.41	102.19	224.00	633.69
# observations	16,182	16,182	16,023	16,182	16,182	16,182
<u>Direct stockholdings</u>						
Mean	65.66	0.58	3.57	61.86	150.98	506.26
Median	65	1	3	37.79	76.40	321.93
Standard deviation	9.93	0.49	1.41	118.02	259.45	721.90
# observations	7,679	7,679	7,588	7,679	7,679	7,679
<u>Full sample</u>						
Mean	66.47	0.44	2.74	34.15	45.57	249.59
Median	65	0	3	20.38	6.71	135.84
Standard deviation	10.74	0.50	1.49	80.81	143.29	593.36
# observations	107,894	107,894	106,277	107,894	107,894	107,894

Table 3. Summary of psychological and physical attributes by participation status

For individuals who participated in more than one survey wave, only the latest observation is used. *Risk aversion* is a 1-4 scale indicating whether a respondent is willing to a) take substantial financial risks expecting to earn substantial returns, b) take above average financial risks expecting to earn above average returns, c) take average financial risks expecting to earn average returns, or d) not take any financial risks. *Sociability* is a variable that counts the social activities a respondent reports to have engaged in during the previous year (Waves 4 and 5) or month (Waves 1 and 2). *Trust* equals the response, on a 0-10 scale, to “Generally speaking, would you say that most people can be trusted or that you can’t be too careful in dealing with people?”. *Right-wing* equals the response to “In politics people sometimes talk of ‘left’ and ‘right’”. On a scale from zero to ten, where zero means left and ten means right, where would you place yourself?”. *Cognitive abilities* is an index based on scores of numeracy, fluency, and recall tests, where the three scores are first demeaned and divided by their sample standard deviations, and then averaged. *Health* is a 1-5 scale based on “Would you say your health is (1) excellent, (5) poor?”. *Religiosity* is a 0-5 scale measuring the frequency of praying, where zero means never and five means more than once a day. *Height* is reported in centimeters, and *BMI* is calculated as Weight (kg) / [Height (m)]²; both are standardized relative to country and gender. *Any stockholdings* means that respondent who own stocks in any form, either directly or indirectly, are included in the sample.

	Risk avers. (1-4)	Sociability (0-5)	Trust (0-10)	Right-wing (0-10)	Cognitive skills	Health (1-5)	Religiosity (0-5)	Height (cm)	BMI
<u>No stockholdings</u>									
Mean	3.82	0.51	5.52	4.99	-0.12	2.68	1.91	166.81	27.14
Median	4	0	5	5	-0.12	3	1	166	26.48
Standard deviation	0.47	0.80	2.46	2.28	0.60	1.08	1.92	9.03	4.77
# observations	49,170	54,215	49,503	43,344	54,792	55,299	49,085	55,091	54,958
<u>Any stockholdings</u>									
Mean	3.36	1.02	6.33	5.27	0.18	3.28	1.26	170.84	26.31
Median	3	1	7	5	0.18	3	0	170	25.71
Standard deviation	0.72	1.02	2.24	2.24	0.55	1.06	1.68	9.28	4.24
# observations	14,909	16,065	14,987	14,298	16,138	16,182	14,770	16,164	16,144
<u>Direct stockholdings</u>									
Mean	3.23	1.06	6.44	5.43	0.22	3.35	1.29	171.54	26.04
Median	3	1	7	5	0.22	3	0	172	25.51
Standard deviation	0.76	1.02	2.23	2.23	0.57	1.06	1.68	9.15	4.03
# observations	6,919	7,626	6,969	6,657	7,651	7,679	6,864	7,667	7,655

Continued.

Table 3, continued.

	Risk avers. (1-4)	Sociability (0-5)	Trust (0-10)	Right-wing (0-10)	Cognitive skills	Health (1-5)	Religiosity (0-5)	Height (cm)	BMI
<u>Full sample</u>									
Mean	3.71	0.61	5.72	5.07	-0.04	2.82	1.72	167.96	26.88
Median	4	0	6	5	-0.03	3	1	168	26.23
Standard deviation	0.57	0.87	2.42	2.28	0.60	1.10	1.87	9.15	4.62
# observations	90,729	105,229	96,157	86,026	106,681	107,809	95,313	107,376	107,071

Table 4. Determinants of stock market participation

Average marginal effects on the probability of stockholding of a one-standard-deviation change in an explanatory variable (zero-to-one for dummies), obtained through probit regressions. *Any holdings* means that a respondent holds stocks either directly or indirectly, *Direct holdings* means that stock are owned directly. Column 2 summarizes results from nine separate regressions. Each of them is like the one presented in column 1, except that one of the nine new factors has been added as an explanatory variable. This is done with each new factor, one at a time. In column 2, the coefficient of the new factor is shown, while the rest of the output is omitted. *Education* has six categories based on the International Standard Classification of Education 1997 (ISCED-97). *Income* (annual, net) and wealth measures are on the household level, in euro. *Total assets* include gross financial wealth (bank accounts, bonds, stocks, mutual funds, long-term savings) and real wealth (real estate, business, cars). *Total liabilities* include mortgages and any financial liabilities. *Risk aversion* is a 1-4 scale indicating whether a respondent is willing to a) take substantial financial risks expecting to earn substantial returns, b) take above average financial risks expecting to earn above average returns, c) take average financial risks expecting to earn average returns, or d) not take any financial risks. *Sociability* is a variable that counts the social activities a respondent reports to have engaged in during the previous year (Waves 4 and 5) or month (Waves 1 and 2). *Trust* equals the response, on a 0-10 scale, to “Generally speaking, would you say that most people can be trusted or that you can’t be too careful in dealing with people?”. *Right-wing* equals the response to “In politics people sometimes talk of ‘left’ and ‘right’. On a scale from zero to ten, where zero means left and ten means right, where would you place yourself?”. *Cognitive abilities* is an index based on scores of numeracy, fluency, and recall tests, where the three scores are first demeaned and divided by their sample standard deviations, and then averaged. *Health* is a 1-5 scale based on “Would you say your health is (1) excellent, ..., (5) poor?”. *Religiosity* is a 0-5 scale measuring the frequency of praying, where zero means never and five means more than once a day. *Height* is reported in centimeters, and *BMI* is calculated as $\text{Weight (kg)} / [\text{Height (m)}]^2$; both are standardized relative to country, gender, age, and survey wave. Standard errors are clustered by household, and t-statistics shown in parentheses below the marginal effects. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent var. (0/1):	Any holdings					Direct holdings
	(1)	(2)	(3)	(4)	(5)	(6)
Male (0/1)	0.025*** (10.61)		0.021*** (7.79)	0.034*** (12.76)	0.006** (2.10)	0.012*** (5.55)
Age (years)	-0.032*** (-19.61)		-0.021*** (-14.76)	-0.032*** (-17.43)	0.000 (0.91)	0.011*** (4.98)
Education (ISCED)	0.042*** (31.86)		0.031*** (20.35)	0.034*** (22.26)	0.027*** (16.57)	0.018*** (13.25)
Ln(Income (€))	0.025*** (15.95)		0.021*** (13.19)	0.029*** (17.09)	0.052*** (28.20)	0.015*** (10.60)
Ln(Total assets (€))	0.122*** (69.87)		0.120*** (62.16)	0.126*** (63.16)	0.110*** (55.40)	0.094*** (43.43)
Ln(Total liab. (€))	-0.019*** (-13.97)		-0.019*** (-14.37)	-0.019*** (-14.05)	0.005** (2.52)	-0.019*** (-14.15)
Risk aversion (1-4)	-0.046*** (-46.45)		-0.045*** (-42.40)		-0.055*** (-50.29)	-0.032*** (-39.27)

Continued.

Table 4, continued.

Dependent var. (0/1):	Any holdings					Direct holdings
	(1)	(2)	(3)	(4)	(5)	(6)
Sociability (0-5)		0.023*** (22.21)	0.023*** (20.02)	0.024*** (21.15)	0.03*** (25.02)	0.011*** (12.27)
Trust (0-10)		0.01*** (8.7)	0.007*** (5.85)	0.01*** (6.52)	0.019*** (14.14)	0.002 (1.17)
Right-wing (0-10)		0.007*** (4.48)	0.007*** (5.8)	0.011*** (7.77)	0.011*** (8.64)	0.007*** (6.74)
Cognitive skills		0.018*** (14.39)	0.016*** (11.37)	0.02*** (13.94)	0.028*** (19.14)	0.015*** (12.24)
Health (1-5)		0.013*** (10.42)	0.008*** (5.66)	0.012*** (8.48)	0.019*** (12.78)	0.003*** (2.67)
Religiosity (0-5)		-0.007*** (-6.05)	-0.013*** (-8.93)	-0.013*** (-8.79)	-0.037*** (-25.09)	-0.007*** (-5.75)
Height (relative)		0.027** (2.52)	0.000 (0.36)	0.018 (1.39)	-0.027** (-2.28)	0.000 (-0.07)
BMI (relative)		-0.032*** (-5.72)	-0.023*** (-3.82)	-0.028*** (-3.94)	-0.014* (-1.75)	-0.023*** (-3.87)
Country dummies	Yes	Yes	Yes	Yes	No	Yes
Pseudo R ²	0.297		0.298	0.281	0.232	0.28
P($\hat{y} > 0.5 \mid y = 1$)	48.1 %		50.8 %	49.1 %	42.7 %	19.2 %
P($\hat{y} \leq 0.5 \mid y = 0$)	93.1 %		92.1 %	91.8 %	92.1 %	98.8 %
N	118,106		104,610	106,113	104,610	103,836

Table 5. Breakdown of *Sociability* and *Cognitive skills* into subcomponents

Average marginal effects on the probability of stockholding of a one-standard-deviation change in an explanatory variable (zero-to-one for dummies), obtained through probit regressions. *Any holdings* means that a respondent holds stocks either directly or indirectly. The indicators for different types of social activity show if a respondent engaged in an activity in the year (Waves 4 and 5) or month (Waves 1 and 2) preceding the interview. In the survey, the exact wordings describing the activities were (1) Taken part in a political or community-related organization; (2) Taken part in activities of a religious organization (church, synagogue, mosque etc.); (3) Done voluntary or charity work; (4) Attended an educational or training course; and (5) Gone to a sport, social, or other kind of club. *Fluency (0-10)*, *Numeracy (0-9)*, and *Recall (0-10)* are standardized scores from tests measuring verbal ability, numerical ability, and memory, respectively. GKL 2011 is short for Grinblatt, Keloharju, and Linnainmaa, 2011, and CJP 2010 is short for Christelis, Jappelli, and Padula, 2010. Standard errors are clustered by household, and t-statistics shown in parentheses below the marginal effects. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent var. (0/1): Any holdings				
Type of social activity (0/1):				
- Political organization	0.011**			
	(2.32)			
- Religious organization	0.004			
	(0.95)			
- Voluntary or charity work	0.020***			
	(6.13)			
- Education or training	0.040***			
	(11.40)			
- Sports or social club	0.038***			
	(14.28)			
Numeracy (0-9)	0.013***	0.010***	0.001	
	(8.52)	(6.91)	(0.95)	
Fluency (0-10)	0.009***	0.007***	0.001	
	(6.17)	(5.00)	(0.30)	
Recall (0-10)	-0.001	0.001	0.003**	
	(-0.75)	(1.50)	(2.55)	
Other controls as in...	Baseline	GKL 2011 (Demographics only)	CJP 2010 (Risk aversion omitted)	Baseline
Country dummies	Yes	Yes	Yes	Yes
Pseudo R ²	0.299	0.272	0.280	0.297
N	104,787	104,610	104,610	104,610

Table 6. Factors with incomplete data: Optimism and bequest motive

Average marginal effects on the probability of stockholding of zero-to-one changes in the two explanatory variables of interest, obtained through probit regressions. *Any holdings* means that a respondent holds stocks either directly or indirectly. *Optimist (0/1)* indicates if a respondent says she “sometimes” or “often”, as opposed to “rarely” or “never”, feels that the future looks good for her. *Plans bequest (0/1)* indicates if a respondent considers her probability for leaving a bequest to be positive. In all three specifications, control variables include the full baseline specification, shown in column 3 of Table 4. Standard errors are clustered by household, and t-statistics shown in parentheses below the marginal effects. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent var. (0/1): Any holdings		
Optimist (0/1)	0.015*** (4.42)		0.008 (1.47)
Plans bequest (0/1)		0.044*** (5.40)	0.032*** (3.53)
Data from waves...	2, 4, 5	1, 2	2
Country dummies	Yes	Yes	Yes
Pseudo R ²	0.300	0.324	0.333
N	92,295	54,224	41,952

Table 7. Determinants of stock market participation by country regulation quality

Panel A shows how the sample countries score on regulatory quality according to a measure provided by the World Bank's Worldwide Governance Indicators. The scores are used to divide the countries into tertiles. Panel B shows average marginal effects on the probability of direct or indirect stockholding of a one-standard-deviation change in an explanatory variable (zero-to-one for dummies), obtained through probit regressions in each tertile of countries. *Education* has six categories based on the International Standard Classification of Education 1997 (ISCED-97). *Income* (annual, net) and wealth measures are on the household level, in euro. *Total assets* include gross financial wealth (bank accounts, bonds, stocks, mutual funds, long-term savings) and real wealth (real estate, business, cars). *Total liabilities* include mortgages and any financial liabilities. *Risk aversion* is a 1-4 scale indicating whether a respondent is willing to a) take substantial financial risks expecting to earn substantial returns, b) take above average financial risks expecting to earn above average returns, c) take average financial risks expecting to earn average returns, or d) not take any financial risks. *Sociability* is a variable that counts the social activities a respondent reports to have engaged in during the previous year (Waves 4 and 5) or month (Waves 1 and 2). *Trust* equals the response, on a 0-10 scale, to "Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?". *Right-wing* equals the response to "In politics people sometimes talk of 'left' and 'right'. On a scale from zero to ten, where zero means left and ten means right, where would you place yourself?". *Cognitive abilities* is an index based on scores of numeracy, fluency, and recall tests, where the three scores are first demeaned and divided by their sample standard deviations, and then averaged. *Health* is a 1-5 scale based on "Would you say your health is (1) excellent, ..., (5) poor?". *Religiosity* is a 0-5 scale measuring the frequency of praying, where zero means never and five means more than once a day. *Height* is reported in centimeters, and *BMI* is calculated as $\text{Weight (kg)} / [\text{Height (m)}]^2$; both are standardized relative to country, gender, age, and survey wave. Standard errors are clustered by household, and t-statistics shown in parentheses below the marginal effects. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Regulatory quality scores from World Bank's Worldwide Governance Indicators

Top tertile <i>Country (score)</i>	Middle tertile <i>Country (score)</i>	Bottom tertile <i>Country (score)</i>
Switzerland (1.82)	Luxembourg (1.65)	Spain (0.78)
Sweden (1.80)	Austria (1.49)	Hungary (0.77)
Netherlands (1.78)	Israel (1.21)	Portugal (0.77)
Denmark (1.72)	Belgium (1.17)	Italy (0.66)
Germany (1.70)	France (1.09)	Slovenia (0.66)
Estonia (1.67)	Poland (1.06)	Greece (0.34)
	Czech Republic (1.02)	

Continued.

Table 7, continued.

<i>Panel B: Determinants of participation in regulatory quality tertiles</i>			
	Top tertile	Middle tertile	Bottom tertile
Participation rate	37.6 %	25.7 %	10.0 %
Male (0/1)	0.020*** (4.41)	0.021*** (4.84)	0.021*** (5.02)
Age (years)	-0.032*** (-10.94)	-0.021*** (-8.67)	-0.021*** (-6.29)
Education (ISCED)	0.028*** (9.89)	0.034*** (13.98)	0.028*** (12.18)
Ln(Income (€))	0.007*** (2.71)	0.032*** (7.21)	0.012*** (4.75)
Ln(Total assets (€))	0.14*** (45.00)	0.112*** (33.93)	0.075*** (16.2)
Ln(Total liab. (€))	-0.023*** (-10.99)	-0.023*** (-8.04)	-0.009*** (-4.66)
Risk aversion (1-4)	-0.055*** (-30.08)	-0.046*** (-25.78)	-0.028*** (-16.75)
Sociability (0-5)	0.023*** (11.55)	0.027*** (14.33)	0.017*** (8.39)
Trust (0-10)	0.010*** (4.00)	0.010*** (4.81)	0.000 (0.10)
Right-wing (0-10)	0.014*** (5.70)	0.009*** (3.70)	-0.002 (-1.04)
Cognitive skills	0.018*** (7.67)	0.016*** (6.83)	0.011*** (5.07)
Health (1-5)	0.010*** (4.07)	0.009*** (3.75)	0.003 (1.58)
Religiosity (0-5)	-0.015*** (-5.72)	-0.015*** (-5.61)	-0.007*** (-3.12)
Height (relative)	-0.018 (-1.07)	0.018 (0.95)	0.027 (1.33)
BMI (relative)	-0.018* (-1.82)	-0.028** (-2.53)	-0.028*** (-2.77)
Country dummies	Yes	Yes	Yes
Pseudo R ²	0.325	0.208	0.204
P($\hat{y} > 0.5 \mid y = 1$)	67.7 %	34.7 %	8.7 %
N	41,036	40,904	22,670

Table 8. Determinants of stock market participation by wealth and education

Average marginal effects on the probability of direct or indirect stockholding of a one-standard-deviation change in an explanatory variable (zero-to-one for dummies), obtained through probit regressions. The sample is divided into tertiles based on *Net wealth* (financial + real wealth – mortgages and financial liabilities) and *Education* (six categories based on the International Standard Classification of Education 1997 (ISCED-97)). The divisions are made on the country level: *Low* means belonging to the bottom tertile of one's country, *High* means the top tertile. *Income* (annual, net) and wealth measures are on the household level, in euro. *Total assets* include gross financial wealth (bank accounts, bonds, stocks, mutual funds, long-term savings) and real wealth (real estate, business, cars). *Total liabilities* include mortgages and any financial liabilities. *Risk aversion* is a 1-4 scale indicating whether a respondent is willing to a) take substantial financial risks expecting to earn substantial returns, b) take above average financial risks expecting to earn above average returns, c) take average financial risks expecting to earn average returns, or d) not take any financial risks. *Sociability* is a variable that counts the social activities a respondent reports to have engaged in during the previous year (Waves 4 and 5) or month (Waves 1 and 2). *Trust* equals the response, on a 0-10 scale, to "Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?". *Right-wing* equals the response to "In politics people sometimes talk of 'left' and 'right'. On a scale from zero to ten, where zero means left and ten means right, where would you place yourself?". *Cognitive abilities* is an index based on scores of numeracy, fluency, and recall tests, where the three scores are first demeaned and divided by their sample standard deviations, and then averaged. *Health* is a 1-5 scale based on "Would you say your health is (1) excellent, ..., (5) poor?". *Religiosity* is a 0-5 scale measuring the frequency of praying, where zero means never and five means more than once a day. *Height* is reported in centimeters, and *BMI* is calculated as $\text{Weight (kg)} / [\text{Height (m)}]^2$; both are standardized relative to country, gender, age, and survey wave. Standard errors are clustered by household, and t-statistics shown in parentheses below the marginal effects. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% levels, respectively.

	Net wealth		Education		Both low	Both high
	Low	High	Low	High		
Participation rate	13.0 %	42.4 %	19.3 %	38.8 %	10.4 %	50.9 %
Male (0/1)	0.002 (0.61)	0.035*** (6.21)	0.010*** (2.87)	0.038*** (6.28)	0.004 (0.83)	0.042*** (4.44)
Age (years)	-0.021*** (-9.23)	-0.032*** (-6.95)	-0.021*** (-11.26)	-0.032*** (-7.75)	-0.021*** (-7.18)	-0.032*** (-4.20)
Education (ISCED)	0.018*** (8.35)	0.039*** (13.34)	0.043*** (9.55)	0.022** (2.38)	0.021*** (3.53)	0.018 (1.34)
Ln(Income (€))	0.007*** (3.90)	0.032*** (7.18)	0.015*** (6.71)	0.021*** (4.80)	0.007*** (3.32)	0.033*** (4.16)
Ln(Total assets (€))	0.073*** (32.29)	0.126*** (13.95)	0.092*** (39.93)	0.157*** (32.27)	0.063*** (23.74)	0.175*** (11.14)
Ln(Total liab. (€))	-0.019*** (-8.63)	-0.023*** (-8.16)	-0.019*** (-8.94)	-0.028*** (-8.54)	-0.019*** (-6.57)	-0.028*** (-6.22)
Risk aversion (1-4)	-0.021*** (-14.12)	-0.063*** (-28.87)	-0.034*** (-23.83)	-0.065*** (-27.98)	-0.016*** (-8.73)	-0.072*** (-19.98)

Continued.

Table 8, continued.

	Net wealth		Education		Both low	Both high
	Low	High	Low	High		
Sociability (0-5)	0.017*** (9.57)	0.027*** (12.17)	0.023*** (14.10)	0.028*** (11.96)	0.017*** (7.37)	0.030*** (8.20)
Trust (0-10)	0.005*** (2.90)	0.010*** (3.09)	0.010*** (5.50)	0.007** (2.19)	0.005** (2.29)	0.005 (1.02)
Right-wing (0-10)	0.005*** (3.22)	0.009*** (3.51)	0.005*** (3.31)	0.014*** (4.52)	0.005** (2.31)	0.018*** (3.76)
Cognitive skills	0.008*** (4.19)	0.022*** (7.11)	0.017*** (9.48)	0.016*** (4.93)	0.011*** (4.67)	0.020*** (3.94)
Health (1-5)	0.009*** (4.45)	0.006* (1.90)	0.009*** (5.06)	0.002 (0.71)	0.008*** (3.61)	-0.002 (-0.54)
Religiosity (0-5)	-0.009*** (-4.26)	-0.015*** (-4.59)	-0.013*** (-7.24)	-0.019*** (-5.40)	-0.007*** (-3.06)	-0.013*** (-2.59)
Height (relative)	-0.027 (-1.43)	0.037 (1.39)	0.000 (-0.17)	0.009 (0.47)	-0.046** (-2.41)	0.000 (-0.07)
BMI (relative)	-0.009 (-0.96)	-0.055*** (-4.31)	-0.018** (-2.23)	-0.065*** (-4.24)	-0.009 (-0.93)	-0.079*** (-3.36)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R ²	0.278	0.255	0.308	0.242	0.283	0.197
P($\hat{y} > 0.5$ $y = 1$)	25.1 %	65.2 %	41.8 %	59.9 %	21.0 %	71.9 %
N	35,624	34,822	54,173	25,671	22,342	12,608

Table 9. Summary of factor explanatory power through specifications

Specifications where a variable was estimated to have a significant effect as predicted by prior literature are marked with an “X”. In the next-to-last column, a variable whose estimate had the predicted sign in all specifications, even if not always statistically significant, is marked. In the final column, the percentage-point change in stockholding probability resulting from a one-standard-deviation increase in an explanatory variable, as estimated in our baseline specification in column (3) of Table 4, is shown. *Sociability* is a variable that counts the social activities a respondent reports to have engaged in during the previous year (Waves 4 and 5) or month (Waves 1 and 2). *Trust* equals the response, on a 0-10 scale, to “Generally speaking, would you say that most people can be trusted or that you can’t be too careful in dealing with people?”. *Right-wing* equals the response to “In politics people sometimes talk of ‘left’ and ‘right’. On a scale from zero to ten, where zero means left and ten means right, where would you place yourself?”. *Cognitive abilities* is an index based on scores of numeracy, fluency, and recall tests, where the three scores are first demeaned and divided by their sample standard deviations, and then averaged. *Health* is a 1-5 scale based on “Would you say your health is (1) excellent, ..., (5) poor?”. *Religiosity* is a 0-5 scale measuring the frequency of praying, where zero means never and five means more than once a day. *Height* is reported in centimeters, and *BMI* is calculated as $\text{Weight (kg)} / [\text{Height (m)}]^2$; both are standardized relative to country, gender, age, and survey wave.

	Predicted, significant effect					Pred. sign	Effect size (p.p.)
	Baseline	Direct partic.	All reg. environments	All wealth levels	All educ. levels		
Sociability	X	X	X	X	X	X	2.35
Trust	X			X	X	X	0.73
Right-wing	X	X		X	X		0.69
Cognitive skills	X	X	X	X	X	X	1.57
Health	X	X		X			0.77
Religiosity	X	X	X	X	X	X	-1.31
Height							0.00
Body mass index	X	X	X		X	X	-2.31

Table 10. “Explanatory power ratio”: new factors over traditional factors

The table shows the fraction of the explanatory power of *Traditional factors* accounted for by the explanatory power of *New factors* in our main specification in all subsamples. The explanatory power of each group is retrieved via a Shapley decomposition of the pseudo- R^2 , and the values are shown in Figure 4. *Traditional factors* include gender, age, education, income, wealth, and risk aversion, while *New factors* include sociability, trust, political orientation, cognitive abilities, health, religiosity, height, and the body mass index.

Full sample	Regulation quality			Wealth		Education		Both low	Both high
	Low	Medium	High	Low	High	Low	High		
0.382	0.294	0.324	0.311	0.378	0.418	0.428	0.259	0.393	0.287

Table 11. Determinants of equity's share in financial assets

The output of OLS regressions explaining the equity share, defined as the value of equity holdings divided by total financial assets, conditional on owning stocks. Equity holdings include directly held stocks and the equity fraction of mutual fund and IRA holdings. Total financial assets include equities, bonds, mutual funds, IRAs, and bank accounts. Values in euro as reported by respondents. *Education* has six categories based on the International Standard Classification of Education 1997 (ISCED-97). *Income* (annual, net) and wealth measures are on the household level, in euro. *Total assets* include gross financial wealth (bank accounts, bonds, stocks, mutual funds, long-term savings) and real wealth (real estate, business, cars). *Total liabilities* include mortgages and any financial liabilities. *Risk aversion* is a 1-4 scale indicating whether a respondent is willing to a) take substantial financial risks expecting to earn substantial returns, b) take above average financial risks expecting to earn above average returns, c) take average financial risks expecting to earn average returns, or d) not take any financial risks. *Sociability* is a variable that counts the social activities a respondent reports to have engaged in during the previous year (Waves 4 and 5) or month (Waves 1 and 2). *Trust* equals the response, on a 0-10 scale, to "Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?". *Right-wing* equals the response to "In politics people sometimes talk of 'left' and 'right'. On a scale from zero to ten, where zero means left and ten means right, where would you place yourself?". *Cognitive abilities* is an index based on scores of numeracy, fluency, and recall tests, where the three scores are first demeaned and divided by their sample standard deviations, and then averaged. *Health* is a 1-5 scale based on "Would you say your health is (1) excellent, ..., (5) poor?". *Religiosity* is a 0-5 scale measuring the frequency of praying, where zero means never and five means more than once a day. *Height* is reported in centimeters, and *BMI* is calculated as $\text{Weight (kg)} / [\text{Height (m)}]^2$; both are standardized relative to country, gender, age, and survey wave. Standard errors are clustered by household, and t-statistics shown in parentheses below the marginal effects. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
Male (0/1)	-0.001 (-0.19)	0.001 (0.32)	0.001 (0.18)	0.013*** (2.90)
Age (years)	-0.010*** (-3.60)	-0.011*** (-3.94)	-0.013*** (-4.34)	-0.014*** (-4.56)
Age ² (/ 1,000)	0.083*** (3.89)	0.090*** (4.25)	0.102*** (4.58)	0.105*** (4.67)
Education (ISCED)	-0.003* (-1.80)	-0.003** (-1.98)	-0.003 (-1.59)	-0.001 (-0.60)
Ln(Income (€))	-0.011*** (-5.50)	-0.009*** (-4.46)	-0.01 *** (-4.70)	-0.003 (-1.36)
Ln(Total assets (€))	0.004** (2.18)	0.007*** (3.56)	0.008*** (3.50)	0.011*** (4.81)
Ln(Total liab. (€))	0.002*** (5.71)	0.003*** (5.89)	0.003*** (5.96)	0.003*** (5.92)
Risk aversion (1-4)	-0.061*** (-21.83)	-0.059*** (-20.68)	-0.058*** (-20.06)	

Continued.

Table 11, continued.

	(1)	(2)	(3)	(4)
Sociability (0-8)			-0.002 (-0.79)	0.003*** (5.92)
Trust (0-10)			-0.002* (-1.74)	-0.001 (-0.39)
Right-wing (0-10)			0.005*** (4.59)	-0.002 (-1.54)
Cognitive skills			0.006 (1.45)	0.006*** (5.86)
Health (1-5)			0.001 (0.63)	0.012*** (3.11)
Religiosity (0-5)			0.003* (1.75)	0.004* (1.75)
Height (relative)			0.001 (0.42)	0.002 (1.48)
Height ²			0.001 (0.50)	0.002 (0.79)
BMI (relative)			0.001 (0.32)	0.001 (0.63)
Constant	0.967*** (10.08)	0.981*** (10.19)	1.018*** (10.07)	0.722*** (7.12)
Country dummies	No	Yes	Yes	Yes
R ²	0.035	0.050	0.054	0.029
N	19,799	19,799	19,040	19,244

Appendix I. Obtaining estimates using the five imputed datasets

The discussion here is adapted from SHARE release guide 2-6-0 (pp. 24-25). The calculation of the magnitudes of interest in the context of multiple imputation can be performed as follows: let $m=1, \dots, M$ index the imputation draw (with M in our case equal to 5) and let $\hat{\beta}_m$ be our estimate of interest (e.g. sample median, regression coefficient etc.) from the m^{th} imputed dataset. Then the estimate using all M imputed datasets is simply the average of the M separate estimates, i.e.,

$$\bar{\beta}_M = \frac{1}{M} \sum_{m=1}^M \hat{\beta}_m.$$

The variance of this estimate consists of two parts. Let V_m be the variance estimated from the m^{th} imputed dataset. Then the first magnitude one needs to compute is the average of all M variances, which constitutes the within-imputation variance, i.e.,

$$WV_M = \frac{1}{M} \sum_{m=1}^M V_m.$$

The second quantity one needs is the between-imputation variance, which is given by

$$BV_M = \frac{1}{M-1} \sum_{m=1}^M (\hat{\beta}_m - \bar{\beta}_M)^2.$$

Finally, the total variance of the estimate is equal to

$$V_M = WV_M + \frac{M+1}{M} BV_M.$$

As Little and Rubin (2002) point out, the second term in the above equation represents the share of the total variance due to missing values. One can perform a usual single variable t-test of significance employing the following formula to compute the degrees of freedom n equal to:

$$n = (M-1) \left(1 + \frac{1}{M+1} \frac{WV_M}{BV_M} \right)^2.$$

Essay 4: Shiny, happy people holding shares? Exploring links between subjective well-being and stock market participation*

ABSTRACT In contrast to the economics of happiness literature focusing on the link between income and reported life satisfaction, we explore the relation between life satisfaction and holding stocks. We find that stock market participation explains happiness over and above other measures of financial affluence. Changes in individual participation status and happiness over time provide some evidence consistent with a causal relation. This is in line with specific characteristics of a stock investment that make it plausible for a person to feel more satisfied with herself after allocating some of her wealth into stocks. A potential channel that we study and find evidence for is increased social utility.

* Joint work with Markku Kaustia.

1. Introduction

Economics of happiness research studies the link between income and reported life satisfaction. The seminal finding in this literature is the Easterlin paradox (Easterlin, 1974), stating that although income is positively associated with life satisfaction in the cross-section, growth in average income does not appear to increase satisfaction over time. Of the recent studies, some still find the paradox to hold, at least once a certain threshold, or “satiation point”, of economic prosperity has been reached (Clark et al., 2008; Di Tella and MacCulloch, 2008; Di Tella et al., 2010). Others refute it (Stevenson and Wolfers, 2008; 2013; Kahneman and Deaton, 2010), saying that income growth does lead to greater life satisfaction, and that no satiation point is empirically found.

This paper takes a household finance approach to the economics of happiness. Specifically, we explore the relation between life satisfaction and an alternative indicator of financial affluence: holding stocks. To an extent, focusing on stock ownership should be equivalent to focusing on income, as high-earning individuals are immensely more likely to hold stocks.⁴⁵ However, also the characteristics *besides affluence* that stock market participation research has shown to make an individual a likely stockholder (e.g., being sociable, trusting toward others, and politically right-wing oriented) are associated with overall life-satisfaction. To give a household finance based motivation for our interest in this relation, Table 1 shows the univariate correlations of 14 established participation determinants with reported life-satisfaction and stock ownership. They are all of the same sign, and their magnitudes often in the same ballpark.

Furthermore, certain characteristics of a stock investment make it plausible that a person would feel more satisfied with herself after allocating some of her wealth into stocks. First, according to Myers and Diener (1995), feeling a sense of community with others can enhance well-being, as it helps people define their personal identity. “Firm part-owners” might well become such a community. Hong et al. (2004) hypothesize that people derive satisfaction from discussing their investments with other stockholders.⁴⁶ Kumar and Gilovich (2015) show

⁴⁵ See, e.g., page 510 in the Survey of Consumer Finances Chartbook, issued by the U.S. Federal Reserve Board of Governors in September 2014, available at <http://www.federalreserve.gov/econresdata/scf/files/BulletinCharts.pdf>.

⁴⁶ The social communities Hong et al. (2004) use in their empirical tests are neighbors and church-goers.

that, compared to talking about their possessions, people get more pleasure out of talking about their experiences. Stocks, with their salient media coverage and the associated ups and downs, should provide more experiences to talk about than most other forms of saving. Channels through which participation in the stock market could increase life satisfaction therefore include an investor's sense of community with other stockholders, the resulting self-identification as "firm part-owner", and the enjoyment of sharing experiences with others.

Second, having goals and actively pursuing them is a significant predictor of subjective well-being (Emmons, 1986; Diener and Fujita, 1995). Similarly, people who feel they have control over their lives (Myers and Diener, 1995) and engage in long-term planning (Elder and Rudolph, 1999) tend to be more satisfied. Households often make stock investments for the long term, especially when they enter the market for the first time.⁴⁷ Participating in the stock market is also a reasonable way to pursue the goal of increased financial well-being in retirement. People with a propensity to plan for the future accumulate more financial wealth, including stocks (Ameriks et al., 2003; Lusardi and Mitchell, 2007). It seems plausible that an individual sees entering the stock market as taking a step toward her financial goals, a concrete action to influence her future finances. This, in turn, may lead to greater life satisfaction.

We investigate the links between life satisfaction and stock market participation using waves 1, 2, 4, and 5 of the Survey of Health, Aging and Retirement in Europe (SHARE). This multidisciplinary survey on health, socio-economic status, and social networks, targeted at individuals aged 50 and above, covers 20 European countries between years 2004 and 2013. To measure subjective life satisfaction, we use the standard survey question used in most economics of happiness studies: "On a scale from 0 to 10, where 0 means completely dissatisfied and 10 means completely satisfied, how satisfied are you with your life?"

Our results show that stock market participation significantly predicts high reported life satisfaction, over and above other financial affluence measures and

⁴⁷ In data covering all trades of publicly listed stocks in Finland, Lehtinen (2016, see Appendix A) shows that almost two thirds of actively acquired stock investments are held for at least five years among first-time investors. Holding periods are even longer when investors passively receive stocks, e.g., through inheritance.

demographic factors. This applies to both country-level averages and individuals. Furthermore, between consecutive survey waves, reported happiness develops more positively among those who enter the stock market. This finding is consistent with a causal relation between stock ownership and happiness. It is not very strong, however, and the direction of a potential causality cannot be inferred.

Of the potential explanations for stock ownership to increase happiness discussed above, we are able to investigate the one where an individual gains social utility from holding stocks. Assuming that marginal utility from participating in social groups is diminishing in their number, an individual with fewer other social communities should derive more social utility from being or becoming a stockholder. Our results are consistent with this idea: an individual with no or only one other social community is significantly happier if she holds stocks, while there is no happiness difference between participants and non-participants among those with many social communities.

We also find evidence that appears to be in line with the existence of a “satiation point” in wealth. First, those who own stocks report similar levels of happiness even when differences in affluence are substantial. This is consistent with stockholders typically being above some satiation point. Second, owning stocks influences life satisfaction most among those with least income and wealth. Here, we hypothesize that owning stocks could serve as a signal of affluence between individuals. If it is considered desirable to “seem rich”, then the additional satisfaction from exhibiting this particular signal should be highest among those with few other ways to signal affluence, i.e., those below some satiation point.

Finally, *changes* in personal wealth are especially strongly associated with changes in happiness among stock market participants. Changes in equity wealth, in particular, do not drive the result, so an explanation based on the greater observability of equity wealth fluctuations is not supported. While we cannot pinpoint any alternative explanation, it is possible that the accumulation of wealth is generally more important for life satisfaction among those who end up owning stocks.

The paper proceeds as follows. In the next section, we give descriptive illustrations of the way subjective happiness and stock ownership are related in the SHARE data. In Section 3, we provide regression results, first for the full sample in both the cross-section and time series, and finally for subsamples based on the number of social communities. Section 4 concludes.

2. Descriptive evidence on the relation between happiness and stock market participation

To assess how happiness may be related to stock ownership, we begin by plotting, in the top panel of Figure 1, the response distributions of both participants and non-participants from the question we use for measuring subjective well-being: “On a scale from 0 to 10, where 0 means completely dissatisfied and 10 means completely satisfied, how satisfied are you with your life?” Then, in each of the 0-10 response categories, we separately plot the participation rate in the bottom panel.

The top panel shows that the average and median responses are more positive among those who own stocks. Correspondingly, the category-by-category participation rates in the bottom panel show a consistent, increasing pattern until response category nine, and then a slight drop for the maximum category of 10.⁴⁸

Figure 2 depicts, wave by wave, country-level life satisfaction and stock market participation. Typically, countries of high participation tend to have high average happiness levels. As in the previous figure, however, the effect of affluence is not controlled for: it may be that average affluence is driving the levels of both participation and happiness within a country.

On a side note, Figure 2 establishes a stylized fact about life satisfaction related to the Easterlin paradox: it is quite stable within countries over the sample period of 2004-2013. Although there are exceptions (most notably Austria), the ranking of countries on the satisfaction scale remains largely unchanged from wave to wave. This is consistent with Clark et al. (2008), who illustrate the intertemporal stability of country-level life satisfaction, both in absolute terms and relative to other countries, using 30-year time-series from five European countries. Also in

⁴⁸ The pattern is the same also for income and wealth.

stock ownership, few substantial within-country changes are seen in the sample period, although in a longer time frame participation can fluctuate substantially. In the U.S., for instance, the percentage of families holding stocks grew from about 30% in the late eighties to about 50% in the late nineties.⁴⁹

As mentioned, the plots in Figures 1 and 2 do not account for the confounding effect of general financial affluence. This is also the case in graph (1) of Figure 3, where we plot the sample countries so that average life satisfaction is on the y-axis, and the stock market participation rate on the x-axis. A linear regression gives a remarkably good fit, with an R-squared of 0.63. When we, for comparison, replace stock market participation with average income in graph (4), the plot looks very similar. The relation between life-satisfaction and income in these data is in line with prior studies.⁵⁰

Graphs (2) and (3) of Figure 3 tentatively assess the extent to which general affluence drives the seeming relation between participation and happiness. For graph (2), we take the full-sample variation in happiness *not explained* by income and wealth in a linear regression, and then plot the country-averages of this residual against country participation rates. In other words, we only look at “excess” happiness, unrelated to affluence. Still, a clearly increasing pattern remains. Finally, in graph (3), we further replace country participation rates with participation not explained by differences in income and wealth in a full-sample probit. That is, we plot “excess” happiness against “excess” participation rates. While the fit of the regression line visibly deteriorates, we importantly see that participation and happiness exhibit a country-level correlation *beyond* what is explained by differences in income and wealth.

Of course, as noted by Frey and Stutzer (2002), a number of factors besides average income or wealth separate rich and poor countries from each other, and they may also be important for happiness. For example, affluent countries typically have more stable and democratic political institutions, along with more economic freedom, than poor ones (Frey and Stutzer, 2002). Similar factors have been found key for promoting widespread participation in the stock market

⁴⁹ See page 507 in the SCF Chartbook

(<http://www.federalreserve.gov/econresdata/scf/files/BulletinCharts.pdf>).

⁵⁰ Typically, log-income would be used, and the relation in graph (4) would be much closer to linear. Euro income figures, which result in the concave pattern, are now used to make graphs (1) and (4) comparable.

(Guiso et al., 2003; Pagano and Volpin, 2006; Giannetti and Koskinen, 2010), and likely also influence the life satisfaction of citizens.

3. Results

A. Does participation predict happiness in the cross-section?

To find out whether stock ownership, in itself, may lead to changes in happiness, we first want to add more controls into our analysis. This is done in the following section. Table 2 presents regression results on the association between stock market participation and life satisfaction when both affluence-related and demographic factors are held constant. Also in this framework, stock market participants do seem more satisfied with their lives. This supports the hypothesis that owning stocks as such is associated with life-satisfaction. Still, omitted factors may confound this result.

In columns (5) and (6) of Table 2, we investigate, in our context, the “satiation point” hypothesis. We divide respondents into five brackets based on income and wealth to assess whether results differ between respondents of different affluence levels. First, in column (5), we see that beyond a point, more income seems to cease bringing more happiness, consistent with, e.g., Clark et al. (2008). The coefficient for being in the highest bracket is actually slightly below that of the second-highest. With wealth, there is no such pattern. Although the jump in life satisfaction is largest when moving from the lowest to the second-lowest wealth bracket, a monotonously increasing pattern continues throughout the wealth distribution. The results support a story where a satiation point, beyond which affluence no longer positively associates with happiness, may exist for income, but not for wealth.

Column (6) of Table 2 separately looks at participants and non-participants in the different income and wealth brackets. Interestingly, the life satisfaction of those who own stocks appears less sensitive to their levels of income and wealth. While the main effect of stock ownership becomes significantly larger in this analysis, the additional impact of more income or wealth is smaller among participants.

In unreported analyses, we separately run the regressions in subsamples of respondents with different levels of income and wealth. We find that owning stocks influences life satisfaction most among those with least income and wealth. When we use three income and wealth brackets (bottom 30%, middle 40%, top 30%), for instance, the coefficient of the *Stock*-dummy in the bottom bracket is about 1.5-2 times that of the middle and top brackets.⁵¹

The findings in column (6) and the unreported analyses also appear consistent with a satiation point-hypothesis. First, stock ownership may be indicative of an affluence level beyond which happiness is only weakly influenced by finances. This could explain why the additional impact of more income or wealth is smaller among participants. Second, individuals may derive pleasure from exhibiting signals of affluence, or “seeming rich” (see, e.g., Bagwell and Bernheim, 1996). Stock ownership may be considered such a signal. When the level of wealth is truly high (i.e., above some satiation point), it can be signaled in many other ways as well, and the additional satisfaction from exhibiting this particular signal may decrease. This could explain why owning stocks influences life satisfaction most among those with least income and wealth.

B. Changes over time in life satisfaction and stock market participation

So far, we have focused on cross-sectional associations between participation status and levels of happiness. Next, we utilize transitions from wave to wave to further see whether *changes* in stock market participation status are associated with changes in life satisfaction. This analysis can be informative regarding any potential causality between happiness and stock market participation. In Table 3, we regress respondents’ wave-to-wave differences (first differences) in reported life satisfaction on differences in the participation dummy and other regressors. Time-invariant regressors (gender, education, home country) or those whose change is the same for all respondents (age) are therefore dropped. First-differencing also eliminates any constant, unobserved heterogeneity among respondents that might confound interpretation.

⁵¹ In an ordered probit model, the *Stock*-dummy gets coefficients of 0.048 (t-stat 2.47), 0.028 (2.03), and 0.032 (2.19) in the bottom, middle, and top income brackets, respectively. In an OLS model, the respective coefficients are 0.091 (2.73), 0.042 (2.13), and 0.043 (2.44). In both models, the control variables include the full battery used in Table 2.

The unbalanced panel regressions reported in Table 3 show that, compared to individuals who stayed out of the stock market, those who entered had a significantly more positive life satisfaction development between waves. Though in column (1), where general trends between waves are not controlled for, even market entrants' life satisfaction decreased on average. Column (2) accounts for time trends. Compared to the increase in average happiness of 0.16 among non-participants, the increase among entrants was larger by 0.06, or about 38%. Compared to non-participants, those who exited or stayed in the market also experienced slightly larger increases in satisfaction, although statistically insignificant. Growth in overall wealth was also significant in predicting increases in life satisfaction. The coefficients indicate that a very substantial increase in wealth is required before its impact on reported happiness is equal to that of becoming a stock market participant. The average value of $\ln(\text{Total assets (€)})$ is 11.96, corresponding to 156,000 euro. A unit increase to 12.96, estimated to increase reported life satisfaction by 0.17, would imply a jump in total assets to 425,000 euro. A unit decrease would imply a drop in total assets to 58,000 euro.

In columns (3) and (4), we analyze participants (enter, exit, or stay in the market) only. There are no differences in happiness development among the groups. Interestingly, however, we find that the association between wealth and happiness changes is driven by this subsample. We saw before that the *level* of financial affluence is *less* strongly associated with happiness among stockholders, which, at first, appears contradictory. Together, the findings are consistent with the existence of a satiation point in affluence, above which most stockholders are. Two such individuals would be almost equally happy even if their wealth differs substantially. Nonetheless, changes in personal wealth appear particularly important for their happiness.

The salience of changes in equity value may explain why stockholders' life satisfaction appears especially sensitive to wealth changes. We investigate this hypothesis by studying the effect of equity wealth changes in particular, but find no support for this idea. This calls for another explanation for the strong relation between wealth and happiness changes among stock market participants. One hypothesis is that the accumulation of wealth is generally more important for life

satisfaction among those who own stocks, perhaps due to more materialistic values.

Overall, the results on contemporaneous changes are consistent with a causal relation between life-satisfaction and stock market participation. The findings are not statistically very strong, however, and do not allow inference as to the direction of causality. On the one hand, more happiness may result from owning stocks through the sense of identity or future-preparedness it provides. On the other hand, an individual who feels she can influence her future – something shown to be associated with happiness – may be more inclined to postpone consumption in order to purchase stocks.

C. An investigation of the social community channel

Stock market participants appear more satisfied with their lives than non-participants, controlling for income, wealth, and demographics. But why is this the case? We have hypothesized that people derive satisfaction from owning stocks because it enables them to identify themselves as part of a community, and to share experiences they would not get by keeping their money on a bank account. We explore this hypothesis in Table 4 by studying subsamples that differ in the number of *other* social communities they engage in. These communities can be charity, political, or religious organizations, sports or other clubs, or educational groups. Assuming that marginal utility from participating in social groups is diminishing in their number, an individual with fewer other social communities should derive more utility from being or becoming a stockholder.

The findings in Table 4 support the idea that stock ownership increases subjective well-being due to the social utility it brings. Individuals with no or few other communities to socialize with report to be significantly happier if they own stocks, while people with a number of other social activities appear to derive no additional satisfaction from stock ownership.

A concern regarding the analysis in Table 4 may be that the subsamples systematically differ on a dimension other than sociability, and that this drives the results. Furthermore, the considerably smaller sample size might contribute to the lower precision of the estimates among the most socially active. To assess

the validity of these concerns, we run an unreported analysis where subsamples are based on wealth instead. Also in this division, the sample sizes vary substantially, between 28,000 and 58,000. Stock ownership is highly significant in all wealth groups, also in those with fewer observations. This gives confidence in our interpretation that the result in Table 4 is not spurious, and that the number of social communities actually matters.

4. Conclusion

We provide first evidence that certain *types* of wealth are particularly influential for happiness. Specifically, we show that stock market participation significantly predicts high reported life satisfaction, over and above other financial affluence measures and demographic factors. In the SHARE survey data that we use, this applies to both country-level averages and individuals. Within-individual changes in participation status and reported life satisfaction over time, observed between consecutive survey waves, are consistent with a causal relation between stock ownership and happiness. This result is not very strong, however, and the direction of a potential causality cannot be established.

Of channels that could plausibly explain why life satisfaction is higher among participants, we explore one where an individual gains social utility from holding stocks. More than many other types of financial assets, stocks, with their observable ups and downs, provide experiences to share with others, along with a feeling of belonging to a community of “firm part-owners”. Assuming that marginal utility from participating in social groups is diminishing in their number, an individual with fewer other social communities should derive more social utility from being or becoming a stockholder. Our results are consistent with this idea: individuals with zero or one other social communities are especially satisfied if they hold stocks.

Our study provides several insights to the economics of happiness literature, where it is debated whether a “satiation point” of income or wealth exists. Above this point, happiness would no longer be associated with affluence. First, we find that the positive marginal effects of income and wealth on happiness are smaller among stock market participants. This is consistent with stockholders typically being above some satiation point. Second, owning stocks influences life

satisfaction most among those with least income and wealth, which suggests that owning stocks could also serve as a signal of affluence between individuals. If satisfaction is derived from “seeming rich”, then the additional satisfaction from exhibiting this particular signal should be highest among those below some satiation point.

We also find that, among stock market participants, changes in personal wealth are particularly strongly associated with changes in happiness. This result is not driven by changes in equity wealth. One hypothesis is that the accumulation of wealth is generally more important for life satisfaction among those who end up owning stocks. Further exploring this hypothesis is important for the household finance literature, where potential differences in personal values between participants and non-participants is a growing research area (see, e.g., Kaustia and Luotonen, 2016). In general, merging traditional economics of happiness with household finance appears promising in advancing the debate around the Easterlin paradox.

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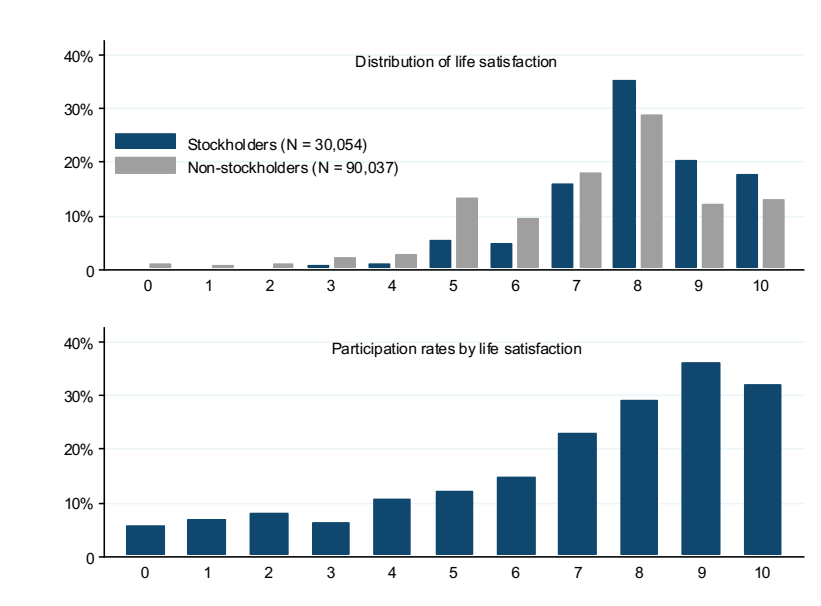


Figure 1. Life satisfaction of participants and non-participants

Top panel: distribution of life satisfaction among stockholders (blue) and non-stockholders (grey). Bottom panel: fraction participating in the stock market in each category of life satisfaction. *Life satisfaction* equals the response to “On a scale from 0 to 10, where 0 means completely dissatisfied and 10 means completely satisfied, how satisfied are you with your life?”. Individuals with direct or indirect holdings are classified as stockholders.

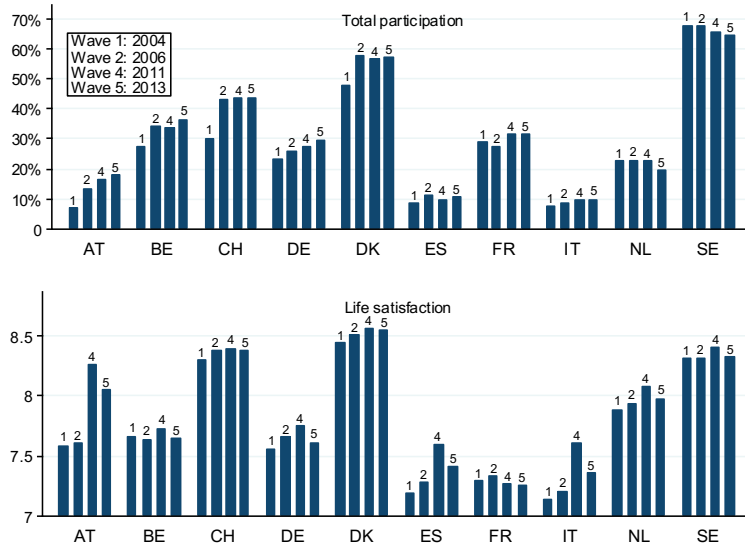


Figure 2. Participation rate and average life satisfaction in sample countries over time

Only countries that participated in all waves are included. Participation is defined as direct or indirect stock ownership. *Life satisfaction* equals the response to “On a scale from 0 to 10, where 0 means completely dissatisfied and 10 means completely satisfied, how satisfied are you with your life?”. *AT* is short for Austria, *BE* for Belgium, *CH* for Switzerland, *DE* for Germany, *DK* for Denmark, *ES* for Spain, *FR* for France, *IT* for Italy, *NL* for the Netherlands, and *SE* for Sweden.

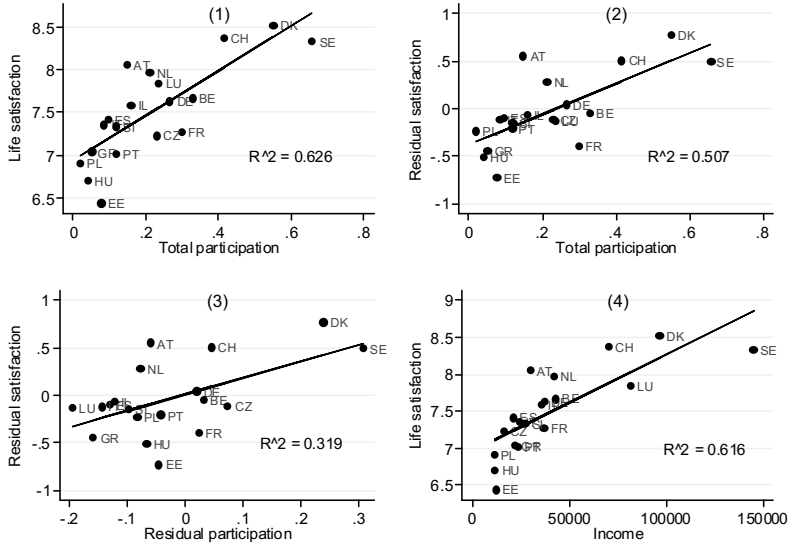


Figure 3. Country-level plot of life satisfaction against participation rate and income

Only countries that participated in all waves are included. In graph (1), country averages of reported life satisfaction are on the vertical axis, and country participation rates on the horizontal axis. In graph (2), we first run the OLS regression $Life\ satisfaction = a + b_1 * Income + b_2 * Total\ assets + e$ in the full sample. Then, country averages of e are plotted on the vertical axis, with average participation still on the horizontal axis. In graph (3), vertical axis values are as in graph (2), and horizontal axis values are country average e 's from the full-sample probit regression $Stock\ (0/1) = a + b_1 * Income + b_2 * Total\ assets + e$. In graph (4), country averages of reported life-satisfaction are on the vertical axis, and country averages of reported annual household income (in euro) on the horizontal axis. *Life satisfaction* equals the response to "On a scale from 0 to 10, where 0 means completely dissatisfied and 10 means completely satisfied, how satisfied are you with your life?". *Stock* is an indicator for either direct or indirect stockholdings. *Income* (annual, net) and *Total assets* are on the household level, in euro, and have been adjusted by first taking a natural logarithm and then winsorizing. Total assets include gross financial wealth (bank accounts, bonds, stocks, mutual funds, long-term savings) and real wealth (real estate, business, cars).

Table 1. Univariate correlations

Life satisfaction equals the response to “On a scale from 0 to 10, where 0 means completely dissatisfied and 10 means completely satisfied, how satisfied are you with your life?”. *Stock* is an indicator for either direct or indirect stockholdings. *Income* (annual, net) and *Total assets* are on the household level, in euro, and have been adjusted by first taking a natural logarithm and then winsorizing. Total assets include gross financial wealth (bank accounts, bonds, stocks, mutual funds, long-term savings) and real wealth (real estate, business, cars). *Risk aversion* is a 1-4 scale indicating whether a respondent is willing to a) take substantial financial risks expecting to earn substantial returns, b) take above average financial risks expecting to earn above average returns, c) take average financial risks expecting to earn average returns, or d) not take any financial risks. *Education* has six categories based on the International Standard Classification of Education 1997 (ISCED-97). *Sociability* is a variable that counts the social activities a respondent reports to have engaged in during the previous year (Waves 4 and 5) or month (Waves 1 and 2). *Trust* equals the response, on a 0-10 scale, to “Generally speaking, would you say that most people can be trusted or that you can’t be too careful in dealing with people?”. *Right-wing* equals the response to “In politics people sometimes talk of ‘left’ and ‘right’. On a scale from zero to ten, where zero means left and ten means right, where would you place yourself?”. *Cognitive skills* is an index based on scores of numeracy, fluency, and recall tests, where the three scores are first demeaned and divided by their sample standard deviations, and then averaged. *Health* is a 1-5 scale based on “Would you say your health is (1) excellent, ..., (5) poor?”. *Religiosity* is a 0-5 scale measuring the frequency of praying, where zero means never and five means more than once a day. *Height* is reported in centimeters, and *BMI* is calculated as $\text{Weight (kg)} / [\text{Height (m)}]^2$; both are standardized relative to country, gender, age, and survey wave. All the correlations are significant at the 1% level.

	Life satisfaction (0-10)	Stock (0/1)
Stock (0/1)	0.181	1
Total assets (€)	0.220	0.315
Income (€)	0.223	0.289
Risk aversion (1-4)	-0.105	-0.316
Male (0/1)	0.039	0.117
Age (years)	-0.055	-0.144
Education (ISCED)	0.139	0.261
Sociability (0-8)	0.183	0.233
Trust (0-10)	0.203	0.137
Right-wing (0-10)	0.061	0.052
Cognitive skills	0.119	0.239
Health (1-5)	0.385	0.230
Religiosity (0-5)	-0.018	-0.146
Height (cm)	0.099	0.189
Body mass index	-0.075	-0.081

Table 2. Does participation explain happiness over other wealth measures and demographics?

Output from ordered probit regressions where the dependent variable, *Life satisfaction*, equals the response to “On a scale from 0 to 10, where 0 means completely dissatisfied and 10 means completely satisfied, how satisfied are you with your life?”. *Stock* is an indicator for either direct or indirect stockholdings. *Income* (annual, net) and wealth measures are on the household level, in euro. *Total assets* include gross financial wealth (bank accounts, bonds, stocks, mutual funds, long-term savings) and real wealth (real estate, business, cars). *Total liabilities* include mortgages and any financial liabilities. *Education* has six categories based on the International Standard Classification of Education 1997 (ISCED-97). The income groups are done roughly by the following percentiles: bottom 10% (N=14,073, income<6,200€); 11th-25th percentile (N=20,158, income from 6,200 to 11,900€); 26th-75th percentile (N=57,793, income from 11,900 to 40,200€); 76th-90th percentile (N=16,187, income from 40,200 to 73,500€); and top 10% (N=10,879, income>73,500€). Similarly, the wealth groups are: bottom 10% (N=13,765, net wealth<3,000€); 11th-25th percentile (N=19,259, net wealth from 3,000 to 42,000€); 26th-75th percentile (N=58,440, net wealth from 42,000 to 304,000€); 76th-90th percentile (N=16,617, net wealth from 304,000 to 566,000€); and top 10% (N=11,009, net wealth>566,000€). Standard errors are clustered by household, and t-statistics shown in parentheses below the coefficients. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% levels, respectively.

	Life satisfaction (0-10), ordered probit					
	(1)	(2)	(3)	(4)	(5)	(6)
Stock (0/1)	0.432*** (56.01)	0.233*** (28.58)	0.209*** (25.21)	0.094*** (11.05)	0.086*** (10.01)	0.32*** (4.37)
Ln(Income (€))		0.121*** (41.34)	0.117*** (39.13)	0.063*** (19.98)		
Ln(Total assets (€))		0.062*** (30.68)	0.059*** (28.63)	0.073*** (33.6)		
Ln(Total liab. (€))		0.003*** (3.31)	0.004*** (4.99)	-0.012*** (-13.75)		
Male (0/1)			0.029*** (3.87)	0.025*** (3.35)	0.014* (1.82)	0.014* (1.87)
Age (years)			0.018*** (4.27)	0.01** (2.36)	0.016*** (3.75)	0.016*** (3.82)
Age ² (/ 1,000)			-0.098*** (-3.19)	-0.063** (-2.07)	-0.092*** (-2.98)	-0.094*** (-3.04)
Education (ISCED)			0.046*** (16.96)	0.046*** (15.71)	0.04*** (13.37)	0.039*** (13.31)
Income group:						
- 2					0.027** (2.03)	0.033** (2.31)
- 3					0.214*** (15.83)	0.22*** (16.3)
- 4					0.349*** (21.44)	0.373*** (19.31)
- Highest					0.336*** (16.79)	0.355*** (15.53)

Continued.

Table 2, continued.

	Life satisfaction (0-10), oprobit					
	(1)	(2)	(3)	(4)	(5)	(6)
Stock=1 x Income group:						
- 2						-0.082* (-1.75)
- 3						-0.104** (-2.47)
- 4						-0.145*** (-3.47)
- Highest						-0.13*** (-2.76)
Wealth group:						
- 2					0.207*** (13.16)	0.211*** (12.56)
- 3					0.318*** (23.45)	0.316*** (22.89)
- 4					0.44*** (27.8)	0.462*** (26.7)
- Highest					0.509*** (23.95)	0.527*** (19.52)
Stock=1 x Wealth group:						
- 2						-0.14** (-2.11)
- 3						-0.1* (-1.84)
- 4						-0.17*** (-2.86)
- Highest						-0.15** (-2.39)
Country dummies	No	No	No	Yes	Yes	Yes
Pseudo R ²	0.008	0.021	0.023	0.039	0.04	0.04
N	120,091	120,090	119,089	119,089	119,090	119,090

Table 3. Simultaneous changes in participation status and happiness

Output from OLS regressions where the dependent variable, Δ *Life satisfaction*, is the change in a respondent's life satisfaction between consecutive survey waves. In each wave, life satisfaction equals the response to "On a scale from 0 to 10, where 0 means completely dissatisfied and 10 means completely satisfied, how satisfied are you with your life?". *Enter market* indicates if a respondent was not a stock market participant in one survey wave, but was a participant in the following wave. *Exit market* indicates the opposite pattern, and *Stay in market* indicates participation in two consecutive waves. In the *Participants only* -sample, only respondents who either entered, exited, or stayed in the market between consecutive waves are included. *Income* (annual, net) and *Total assets* are on the household level, in euro. Total assets include gross financial wealth (bank accounts, bonds, stocks, mutual funds, long-term savings) and real wealth (real estate, business, cars). The *Trend*-dummies account for the change in sample average life satisfaction between waves. Data is only available for two wave-to-wave transitions (from wave 2 to 4, and wave 4 to 5), and one of the trend dummies will be the omitted category. Therefore only one coefficient, reflecting the trend between waves 4 and 5, is displayed. Below the coefficients in parentheses, t-statistics based on robust standard errors are shown. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% levels, respectively.

	Δ Life satisfaction			
	Full sample		Participants only	
	(1)	(2)	(3)	(4)
Enter market (N =2,701)	0.070** (2.13)	0.059* (1.79)	0.01 (0.28)	0.014 (0.40)
Exit market (N = 3,156)	0.044 (1.41)	0.039 (1.25)	0.01 (0.31)	0.017 (0.51)
Stay in market (N = 5,851)	0.046** (2.11)	0.026 (1.18)		
$\Delta \ln(\text{Income (€)})$	0.008 (0.90)	0.008 (0.87)	-0.008 (-0.50)	-0.01 (-0.68)
$\Delta \ln(\text{Total assets (€)})$	0.008 (0.92)	0.017** (1.99)	0.060*** (3.64)	0.065*** (3.91)
Trend ($\overline{LS}_{W5} - \overline{LS}_{W4}$)		-0.356*** (-16.51)		-0.152*** (-5.38)
Constant	-0.089*** (-6.45)	0.162*** (7.87)	-0.043** (-2.56)	0.055** (2.20)
R ²	0.0003	0.008	0.002	0.004
N	32,608	32,608	11,708	11,708

Table 4. Participation status and happiness in subsamples based on sociability

Output from ordered probit regressions where the dependent variable, *Life satisfaction*, equals the response to “On a scale from 0 to 10, where 0 means completely dissatisfied and 10 means completely satisfied, how satisfied are you with your life?”. *Number of other social communities* is taken from a question that asks respondents to choose from a list the social activities they engaged in during the previous year (Waves 4 and 5) or month (Waves 1 and 2). The list includes a) Voluntary or charity work, b) Attendance of an educational or training course, c) Participation in a sports, social or other kind of club, d) Taking part in the activities of a religious organization (church, synagogue, mosque, etc.), and e) Taking part in a political or community-related organization. *Stock* is an indicator for either direct or indirect stockholdings. *Income* (annual, net) and wealth measures are on the household level, in euro. *Total assets* include gross financial wealth (bank accounts, bonds, stocks, mutual funds, long-term savings) and real wealth (real estate, business, cars). *Total liabilities* include mortgages and any financial liabilities. *Education* has six categories based on the International Standard Classification of Education 1997 (ISCED-97). Standard errors are clustered by household, and t-statistics shown in parentheses below the coefficients. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% levels, respectively.

	Number of other social communities:		
	None	At least one	At least two
Participation rate	16.8%	35.1%	41.4%
Stock (0/1)	0.107*** (8.61)	0.051*** (4.46)	0.017 (0.96)
Ln(Income (€))	0.057*** (16.05)	0.07*** (12.39)	0.074*** (7.37)
Ln(Total assets (€))	0.064*** (24.96)	0.081*** (22.65)	0.091*** (15.18)
Ln(Total liab. (€))	-0.014*** (-11.49)	-0.01*** (-8.77)	-0.009*** (-5.04)
Male (0/1)	0.03*** (3.11)	0.021* (1.94)	0.018 (1.04)
Age (years)	0.003 (0.56)	0.008 (1.29)	0.034*** (3.47)
Age ² (/ 1,000)	0.02 (-0.52)	0.034 (-0.7)	0.221*** (-3.01)
Education (ISCED)	0.042*** (10.97)	0.031*** (7.54)	0.027*** (4.19)
Country dummies	Yes	Yes	Yes
Pseudo R ²	0.03	0.04	0.041
N	65,763	53,327	20,981



ISBN 978-952-60-7100-8 (printed)
ISBN 978-952-60-7095-7 (pdf)
ISSN-L 1799-4934
ISSN 1799-4934 (printed)
ISSN 1799-4942 (pdf)

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