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Dispositional optimism and stock investments *

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Abstract

This paper analyses the relationship between dispositional optimism and stock investments. Data are drawn from the second wave of the Survey of Health, Ageing and Retirement in Europe. Dispositional optimism is found to be a relevant predictor of the ownership of stocks as well as of the share of gross financial wealth invested in this asset. The role of dispositional optimism is found to be stronger for risk tolerant agents and its relationship with the share of wealth invested in stocks varies with agents' trust.

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1 Introduction

Population ageing and increasing longevity imply that individuals must make careful and skilful use of financial resources, which should support their consumption over a much longer retirement period than a few decades ago. However, in Europe surprisingly large fraction of elderly households hold suboptimal portfolios and make a limited use of financial markets, which results in financial hardship in late life (Angelini et al., 2009).

In this paper we use data from the second wave of the Survey of Health, Ageing and Retirement in Europe (SHARE) to investigate how portfolio decisions of older Europeans are affected by dispositional optimism, defined as having generalized positive expectations regarding future events (Scheier and Carver, 1985). Optimism is a potential source of overconfidence, which has been shown to lead to inefficient financial decisions (Odean, 1998). Overly optimistic economic agents might overstate their knowledge of financial markets and underestimate the volatility of their investments, making them more likely to trade often and to include riskier assets in their portfolios, *ceteris paribus*. Barber and Odean (2000) show that there is a negative relationship between the frequency of trading of households and the net returns from their stocks. High frequency trading is associated with a net annualized return of 11.4 percent, 6.5 basis points lower than market returns and 7.1 basis points lower than the net returns earned by households that trade infrequently. As Puri and Robinson (2007) argue, dispositional optimism induces individuals to overestimate the probability that favourable events occur and the probability that unfavourable events do not take place. On the one hand, this bias in beliefs creation may disincentivize investments in financial education since, everything else constant, individuals are more likely to be (too) confident of their financial knowledge to make informed decisions. On the other hand, even if agents are endowed with appropriate levels of financial literacy to manage financial investments, this bias might lead agents to misuse their financial knowledge and to undertake suboptimal financial behaviours by underreacting to highly relevant information and place too much attention

on anecdotal and less relevant information (Odean, 1998)[1].

In addition, dispositional optimism can decrease the perceived participation costs of stock-holding (see Guiso et al. 2003) by lowering the disutility coming from investing time in financial literacy or in tracking portfolio performance over time on a regular basis. Also, lack of transparency about financial product characteristics or inadequate skills in evaluating the costs of managing financial portfolios (e.g trading costs or management fees) might lead optimistic individuals to develop too favourable forecasts of these costs. Everything else constant, more optimistic individuals might find the costs of stock investments lower and be more likely to invest their wealth in this asset.

From an empirical point of view, one of the key issues is how to measure dispositional optimism in the population. Puri and Robinson (2007) draw data from the US Survey of Consumer Finances to develop a novel indicator of dispositional optimism based on the difference between self-reported life-expectancy and that implied by actuarial life-tables. They use this index of life-expectancy miscalibration to investigate the relationship between optimism and a wide range of economic outcomes, including investment behaviour. They find that optimism is significantly and positively related to the participation in the equity market and the amount of wealth invested in stocks.

One limitation of their approach is that they do not explicitly control for cognitive skills. Individuals endowed with higher cognitive skills might be better able to estimate their survival probability. Then, some of the sample variability in the life-expectancy miscalibration index might be due to heterogeneity in cognitive functioning rather than to expectations regarding the future. At the same time, cognitive skills are also related to financial market participation. Christelis et al. (2010) find that cognitive abilities have a positive and significant effect on the probability of investing in information-intensive assets, such as stocks, which have a higher degree of sophistication and whose proper use

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[1]The effect of dispositional optimism on household finance is by no means always negative. Borrowing from the psychological and medical literature surveyed in Puri and Robinson (2007), optimism might make agents more willing to develop habits and decisions that make desired outcomes more likely to take place. This impact on behaviour can be explained by the fact that optimistic agents overrate the importance of their actions to achieve their desired outcomes.

requires higher abilities to process contextual information related to financial markets. Therefore, not controlling for cognitive functioning might lead to biased results.

In this paper we study the relationship between optimism and financial behaviour by focusing on the ownership and the share of financial of wealth invested in stocks. We use the same approach as in Puri and Robinson (2007) to measure optimism but explicitly controlling for cognitive skills using the indicators described by Christelis et al. (2010). Further, we take advantage of the second wave of SHARE data to control for three additional personality traits that have been proved to be relevant predictors of financial behaviour: trust, social interactions, and risk aversion (see Campbell 2006, Guiso et al. 2008 and Hong et al. 2004). Our approach is then suited to disentangle the role played in shaping financial decisions by having positive expectations about the future (dispositional optimism) from those played by the trust of investors about the reliability and the fairness of financial markets, their propensity to establish social interactions with other people and their willingness to take financial risks. Finally, we also analyze to what extent the role of dispositional optimism varies with the levels of trust, social interactions and risk aversion of agents in order to describe the interaction of optimism with other relevant personality traits and provide an empirical assessment of its degree of complementarity or substitutability with them. Our analysis provides support to the development of theoretical models which incorporates behavioural and personality factors to explain the patterns in household investment behaviour found in the data.

The rest of the paper is organised as follows. Section 2 presents the data and the definition of the main variables of interest in our analysis. Section 3 explains the empirical strategy adopted and our findings. Finally, Section 4 concludes.

2   Data

In this paper we use data from the second wave of the Survey of Health, Ageing and Retirement in Europe (SHARE)[2]. SHARE collects extensive information on current de-

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[2]See Börsch-Supan et al. (2013, 2008, 2005).

mographics, health, employment, income, assets, social activities and expectations of individuals aged 50 and over living in several European countries, ranging from Scandinavia to the Mediterranean. Descriptive statistics of all the variables included in our empirical analysis are presented in Table 1.

Our empirical analysis crucially depends on the availability of complete information on the economic resources available to households. As common in household surveys, information on wealth is often missing. Excluding observations with missing values from the analysis would reduce the sample size and, most importantly, might introduce sample selectivity issues, leading to biased results. In SHARE missing data are imputed using multiple imputation techniques. For each missing observation, five imputations are produced in order to reflect the stochastic nature of the imputation process. This approach is then aimed at providing (some points of) the distribution of the missing value instead of deriving a single prediction for it (see Christelis, 2008, 2011, for details about the imputation procedure). In our estimation we take into account the variability associated with the imputation process by following Little and Rubin (1987), who explicitly control for the variance of the estimates both within and between each set of imputation.

[TABLE 1 ABOUT HERE]

2.1   Financial market participation

We analyze financial market participation by looking at the ownership of stocks. We use both direct and total ownership, where the latter also includes ownership of stocks through mutual funds and individual retirement accounts[3].

Our sample includes 17,455 observations. For each household we selected the financial respondent, who is the person in charge of answering the financial and asset questions on behalf of the household.

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[3]In SHARE respondents who declare to have money in mutual funds or managed investment accounts are asked whether these are mostly stocks, mostly bonds or half stocks and half bonds. In the definition of total ownership we include mutual funds and individual retirement accounts which are either mostly stocks or half stocks and half bonds.

In our sample, 18% of households hold stocks directly, but this percentage increases to 30% when we also consider the indirect ownership of stocks through retirement accounts or mutual funds. This large difference in the proportion of direct and indirect stock owners suggests that financial intermediaries managing retirement accounts and mutual funds act as important channels of diffusion of the stock ownership by making investors more aware of the opportunities provided by risky financial markets and providing them with support to deal with the sophistication of these products.

Figure 1 shows that households own stocks both directly and indirectly much more frequently in Sweden, Denmark, Belgium and Switzerland, where financial markets and institutions are more developed. In Austria, the Southern countries (Italy, Spain and Portugal) and Eastern Europe, financial market participation is less widespread although in Poland indirect stock ownership is relatively high, probably due to individual retirement accounts.

[FIGURE 1 ABOUT HERE]

We also compute the share of (gross) financial wealth invested in stocks. Our measure of gross financial wealth is equal to the amount of wealth invested in bank accounts, government and corporate bonds, stocks, mutual funds, individual retirement accounts, contractual savings for housing and life insurance policies[4].

If we restrict our attention to the households who own stocks (directly or indirectly via mutual funds or individual retirement accounts), the average share of their gross financial wealth invested in this asset is 30%. If we consider all the households in the sample, the average share falls to 11%. Considering direct investments in stocks leads to similar results. The average share of financial wealth invested in stocks is 26% for stock owners and 5% in the overall sample.

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[4]The share of gross financial wealth invested in stocks and bonds cannot be defined for households whose gross financial wealth is 0. This leads to the exclusion from the sample of about 2,100 households.

2.2 Cognitive skills

The SHARE questionnaire includes an entire section devoted to the measurement of cognitive abilities. In line with Christelis et al. (2010), we use three indicators that are likely to influence financial investments: numeracy, planning and executive function (fluency) and memory (recall). The definition of the cognitive ability indicators used in our analysis is carefully explained by Christelis et al. (2010).

The indicator of numeracy is based on the answers to four questions in which respondents have to perform simple calculations, such as finding the 10 percent of a number. The numeracy indicator ranges from 1 to 5. The sample average is 3.48. For fluency, the respondent has one minute to name as many different animals as she can think of. The fluency score is equal to the total number of animals mentioned. Any member of the animal kingdom, real or mythical is scored correct, except repetitions and proper nouns. On average, our respondents named 20 animals. Finally, memory is measured through a recall test. The interviewer reads a list of 10 words and the respondent has up to one minute to tell as many words as she can recall.[5] On average, respondents were able to recall 4 words.

2.3 Trust

To make sure that our measure of optimism is not just a proxy for trust, we also include a control for trust in our regressions. More optimistic individuals might be more likely to trust other people since they have more positive expectations about other people's behaviour and respect of social norms. At the same time, Guiso et al. (2008) have provided evidence of a strong association between trust and financial market participation. To measure trust we use a question asked in the second wave of SHARE:

Generally speaking, would you say that most people can be trusted or that you can't bee too careful in dealing with people?

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[5]The list includes the following words: butter, arm, letter, queen, tickets, grass, corner, stone, book, stick.

The wording of the question is the same as in the World Values Survey questionnaire and as used by Guiso et al. (2008). The only difference is that in SHARE respondents have to answer on a scale that goes from 0 to 10, where 0 means you can't be too careful and 10 means that most people can be trusted, while in the World Values Survey the answer can only be yes or no. The average level of trust of SHARE respondents is 5.71. About 6% of respondents declare a level of trust equal to 0 and a further 6% selects the highest level on the trust scale.

2.4 Social interaction

The SHARE questionnaire asks respondents whether they have been involved in social activities in the last months. The question text is reported below.

Have you done any of these activities in the last month?

The available answering categories are: 1. Done voluntary or charity work; 2. Cared for a sick or disabled adult; 3. Provided help to friends or neighbors; 4. Attended an educational or training course; 5. Gone to a sport, social or other kind of club; 6. Taken part in activities of a religious organization (church, synagogue, mosque etc.); 7. Taken part in a political or community-related organization. Respondents can select more than one activity. Overall, almost 51% of respondents in our sample have been involved in at least one of these activities in the last month. The most selected actitivities are voluntary or charity work (15%), the provision of help to friends or neighbours (20%) and the attendance of a club (23%).

2.5 Risk aversion

As an indicator for risk tolerance, we use the self-reported answer to a question on portfolio allocation between riskless and risky assets. The question reads as follows:

Which of the following statements comes closest to the amount of financial risk that you are willing to take when you save or make investments?

The available options are: 1. Take substantial financial risks expecting to earn substantial returns; 2. Take above average financial risks expecting to earn above average returns; 3. Take average financial risks expecting to earn average returns; 4. Not willing to take any financial risks. As about 75% percent of the answers are concentrated in option 4, the variable that we include in the specification is a dummy equal to 1 if the individual declares not to be willing to take any financial risk.

2.6   Dispositional optimism

Following Puri and Robinson (2007), we measure dispositional optimism as the difference between self-assessed and actuarial survival probabilities. We elicit respondents' self-assessed survival probabilities from the question:

What are the chances that you will live to be age T or more?

The target age T depends on the age of the respondent at the time of the interview. It is equal to 75 for respondents aged 50-65, to 80 for those aged 66-70, to 85 for those aged 71-75, to 90 for those aged 76-80, to 95 for those aged 81-85, to 100 for those aged 86-95, to 105 for those aged 96-100, and to 110 for those aged 101-105. We then follow Peracchi and Perotti (2010) and use the information available in the Human Mortality Database (see http://www.mortality.org) by gender, country and year of birth to compute actuarial probabilities of survival to the same target age T. Our measure of dispositional optimism is equal to the difference between the self-assessed probability of survival and that obtained from the actuarial life tables,

$$\text{Optimism}_i = \text{Subjective\_survival}_i - \text{Actuarial\_survival}_i$$

Figure 2 reports the cumulative distribution function of the dispositional optimism indicator in our sample. The indicator has been standardized to lie between 0 and 1. This standardization is needed to define clear benchmarks to indicate the most pessimistic and most optimistic individuals in our sample. Indeed, our indicator takes on value 0 for the

most pessimistic respondents in the sample and 1 for the most optimistic ones. The figure shows that the first quartile is 0.37, the median is 0.48 and the third quartile is 0.58.

[FIGURE 2 ABOUT HERE]

The left panel of Figure 3 shows that the correlation between our indicators of dispositional optimism and risk aversion is negative. At a pure descriptive level, individuals who are not willing to take any financial risks are also more pessimistic about their probability of survival. This evidence suggests that the unwillingness to take financial risks is correlated with a more general pessimistic disposition towards evaluating uncertain events. Viceversa, the relationship between trust and optimism is positive (see the central panel) and the R-squared of the regression interpolating the points in the graph reveals a much stronger link than in the risk aversion case. The right panel reports the raw correlation between dispositional optimism and our measure of social interaction, which turns out to be positive.

[FIGURE 3 ABOUT HERE]

Differences between subjective and actuarial survival probabilities might be unrelated with optimism but just be due to the fact that individuals have more accurate information about their longevity than demographers (Perozek, 2008). For instance, individuals might be better informed about their health status, life-style, economic resources devoted to health care and the presence of genetic diseases among family members. For this reason, Puri and Robinson (2007) conduct an extensive series of tests to validate life expectancy miscalibration as a measure of optimisim, showing that it correlates both with positive expectations about future economic conditions and with psychometric tests of optimism. In what follows, we also carry out several tests to validate our measure of dispositional optimism within our sample by comparing it with other outcomes arguably related to a positive attitude towards life. In the SHARE data, we have information on

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respondents' expectations about their future standards of living. As long as overestimating their own probability of survival reflects higher levels of dispositional optimism, we expect a positive correlation between the two, *ceteris paribus*.

[TABLE 2 ABOUT HERE]

SHARE respondents are asked to assess the chances (on a scale from 0 to 100) that in the next five years their standard of living will improve. The sample average is around 27. We estimate an OLS regression of this outcome on our measure of dispositional optimism and the whole set of covariates that will be used in our main analysis. They include country of residence, gender, a second order polynomial of age, household size, number of children, education, employment status, household income, wealth, health, parental longevity, cognitive abilities indicators, risk preferences and trust. The results are shown in column 1 of Table 2. The coefficient on the dispositional optimism indicator is positive and statistically significant (p-value=0.000). This result suggests a strong correlation between these two indicators in the expected direction. Everything else constant, the higher the dispositional optimism, the higher the probability that individuals think that their standard of living will improve in the future. Moving from extreme pessimism to extreme optimism improves the chances of living better by 39 percentage points. A similar question asks respondents to rate the chances that in the next five years their standard of living will get worse. On average our respondents believe that the chances that things will get worse in the future amount to 38%. Consistently with our previous results, the OLS regression of this outcome on the dispositional optimism indicator shows that the coefficient is negative and statistically significant (see column 2 of Table 2). Individuals are less prone to think that their standard of living will get worse if they are more optimistic. On average, the self-assessed probability of experiencing a deterioration of the standard of living for extremely pessimistic individuals is 18 percentage points higher than the one of their extremly optimistic counterparts.

We also look at the correlation between dispositional optimism and self-assessed health. In our sample 65% of respondents declare that their health is good, very good or

excellent. Crucially, our specification controls for more objective health indicators based on limitations with (instrumental) activities of daily living. Our hypothesis is that, conditional on objective health indicators and socioeconomic status, higher dispositional optimism makes individuals more likely to rate their health status as good or even better. Our results show that the correlation between our indicator of optimism and self-reported health is actually positive and significant (see column 3). The magnitude of the coefficient is remarkably sizebale since it shows that everything else constant, extremely optimistic individuals are 54 percentage points more likely than extremely pessimistic individuals to define their health as at least good.

Finally, we analyze the correlation between our indicator of optimism based on survival probability miscalibration and the Life Orientation Test (LOT) implemented in the second wave of SHARE. LOT has been introduced and validated by Scheier and Carver (1985) and Scheier et al. (1994) as an indicator of dispositional optimism. In LOT respondents are asked to rate their agreement with a set of sentences designed to measure their positive attitude towards life according to a numerical scale. The value of the LOT score for each respondent comes from the summation of her so-coded answers[6]. The fourth column of Table 2 shows that on average the LOT score of respondents with the highest level of optimism based on survival probability miscalibration is 5 points higher than the one of respondents with the lowest level of optimism as measured by miscalibration. This variation is statistically significant and sizeable since it amounts to about one third of the sample average of the LOT score (17.65). Unfortunately the LOT questions in SHARE are included in a paper-and-pencil section of the questionnaire that has been filled in by only about one fourth of respondents. Therefore, using this measure of optimism in our main analysis would imply a strong sample selection problem.

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[6]The sentences proposed in LOT are "I pursue my goals with lots of energy", "In uncertain times, I usually expect the best", "I'm always optimistic about my future", "I hardly ever expect things to go my way", "I still find ways to solve a problem if others have given up", "I rarely count on good things happening to me", "Given my previous experiences I feel well prepared for my future". For each sentence, positive attitudes of respondents are coded on a scale ranging from 0 (lowest optimism) to 4 (highest optimism).

3 Results

3.1 Stock market participation

Our estimating equation is

$$y_i = \beta_0 + \beta_1 Optimism_i + \gamma_1 X_i + u_i$$

The stock market participation y_i takes on value 1 if individual i lives in a household owning stocks and 0 otherwise. Stock market participation depends on a constant term, our indicator of dispositional optimism, a vector X_i including individual and household characteristics and an error term u_i. The variables included in the vector X_i are country of residence, gender, a second order polynomial of age, household size, number of children, education, employment status, household income, wealth, health, parental longevity, cognitive ability indicators, trust, social interaction and risk preferences. The model is estimated by ordinary least squares. Standard errors are adjusted to take into account arbitrary heteroskedasticity. SHARE provides 5 sets of multiply-imputed data for some of the key-variables considered in our analysis, such the ownership of stocks, financial wealth items and risk preferences. All the results of the regression analyses in this paper come from the combination of multiply-imputed datasets according to Little and Rubin (1987).

Table 3 reports the results for direct stock market participation. The first column considers a parsimonious specification that only controls for the country of residence and basic demographics, namely gender, age, household size and the number of children. As expected, the likelihood of holding stocks is highest in Scandinavian countries and lowest in Mediterranean and Eastern countries. It is lower for females and its relationship with age is hump-shaped. Finally, it increases with the number of household members and decreases with the number of children. This latter effect might suggest that individuals prefer not to invest their resources in risky assets if they plan to leave an inheritance. The optimism coefficient is positive and significant. Everything else constant, the difference

in the probability of holding stocks between those with the lowest level of our dispositional optimism indicator and those with the highest one is 9.53 percentage points. The magnitude of this effect decreases substantially when we add socio-economic controls in column 2 but the optimism coefficient remains statistically significant.

As discussed earlier, one potential criticism against our optimism measure is that the miscalibration in the probability of survival might just reflect the fact that individuals have more information about their health and genetics than the demographers do when computing the life tables. To address this issue, in column 3 we augment our model with two objective measures of health, namely limitations with activities of daily living and limitations with instrumental activities of daily living, and information on parental longevity, that is whether the mother and the father of the respondent are still alive or not at the time of the interview. The results show that, even controlling for health and genetic factors, optimism still plays a significant role in explaining stock market participation. The coefficient on the activity of daily living parameter is negative and statistically significant, while the coefficients on parental longevity indicators are not significant.

Further, the effect of survival probability miscalibration might be explained by the fact that the accuracy of respondents' assessments concerning their survival probability might depend on the level of their cognitive abilities, which have also been shown to be relevant determinants of stock market participation (Christelis et al. (2010)). In the fourth column of Table 3 we report the results obtained when a set of cognitive ability indicators is included in the specification. All the three indicators are statistically significant and suggest that individuals with higher cognitive abilities are more likely to hold stocks. However, the coefficient on the dispositional optimism indicator remains positive and significant.

Next, we include in our specification three further explanatory variables describing personality traits: trust, social interaction and risk aversion. The first indicator measures the level of trust in other people: respondents who have less trust in institutions might

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be less likely to establish contact or ask services from them and therefore to participate in the financial markets. The social interaction indicator measures the involvement of respondents in social activities during the last month. As pointed out by Hong et al. (2004), individuals involved in social interactions might be more likely to be informed about the state of financial markets by talking about it with their peers. The third indicator is needed to assess whether the correlation captured by the parameter on the miscalibration term is due to a generic positive attitude of individuals towards risk in uncertain contexts. The results in column 5 show that the inclusion of risk aversion, trust and social interaction indicators in the specification leads the parameter on the optimism term to become not significant. This finding suggests that the effect of optimism found earlier was actually capturing the effect of other personality traits correlated with it, whose importance in explaining stock market participation decisions has been already documented in the literature. While the level of trust does not seem to matter, risk aversion and social interactions both have a significant effect on stock ownership with the expected sign.

Finally, we test whether the relationship between dispositional optimism and stock-holding is affected by the degree of trust, social interaction and risk aversion. To do this, we add to our specification interaction terms between dispositional optimism and the other personality traits (column 6). While the role of optimism in explaining stock ownership does not seem to vary with the level of trust and social activities, interaction between optimism and risk aversion turns out to be statistically significant. For those who are willing to take financial risks, the difference in the probability of holding stocks between extremely optimistic and extremely pessimistic individuals is equal to 13.90 percentage points. On the contrary, for those who are risk averse the relationship between optimism and stock-holding is not significant[7].

[TABLE 3 ABOUT HERE]

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[7]If the analysis is replicated by using a probit model, we find consistent results. The gradient in the likelihood of holding stocks between those with the highest level of optimism and those with the lowest is statistically significant and it is equal to 7.13 percentage points for risk tolerant investors. Instead, it is not significant for risk averse investors.

In Table 4 we replicate the same analysis for total stock-ownership, which also include indirect holding of stocks through mutual funds and individual retirement accounts. Interestingly, when we use this broader definition, the effect of optimism is positive and statistically significant in all specifications, even when controlling for risk aversion, trust and social interactions. Indeed, column 5 of Table 4 shows that moving from the lowest to the highest level of optimism is associated with an increase in total stock-holding by 4.97 percentage points. This effect is economically significant if compared to those induced by changes in other key determinants of stock-ownership. It is more than half of the one associated with moving from low education to high education (7.62 percentage points) and higher than the one induced by moving from the lowest to the highest level of our numeracy skills indicator (3.24 percentage points). An immediate implication of these comparisons is that the detrimental effect on stock ownership exerted by moving from the highest to the lowest level of dispositional optimism can be offset by investments in education and numeracy skills, which are outcomes easier to target for policy makers. Moreover, trust has now a positive and significant effect on the total holding of stocks. This result is in line with the hypothesis that individuals with a higher level of trust in financial institutions are more likely to use the services offered by financial intermediaries and include stocks in their portfolios. Arguably, this effect has not been found when looking at the direct holding of stocks due to the degree of sophistication of these products that might discourage individuals from entering risky market without the support of intermediaries. The results also confirm the important role of risk aversion and social interactions for stock market participation. Adding the full set of interaction terms confirms that the relationship between stock-holding and optimism is mostly driven by risk tolerant investors; for this group the difference in the probability of holding stocks between extreme optimists and extreme pessimists is about 13.13 percentage points[8].

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[8]Again, we replicated the analysis by using a probit model and found substantial support of our results. Stock holding is found to increase by 11.74 percentage points as a response to a discrete change in the optimism indicator for risk tolerant investors. For risk averse individuals this variation is not significant.

[TABLE 4 ABOUT HERE]

3.2 Share of financial wealth invested in stocks

We now focus on the relationship between dispositional optimism and how much house-holds invest in stocks by estimating standard Tobit models via maximum likelihood. As before, we analyze the share of wealth invested in direct and total stock holding separately. Our estimating equation is:

$$y_i = \max(0, \beta_0 + \beta_1 Optimism_i + \gamma_1 X_i + u_i)$$

where y_i is the observed share of financial wealth invested in stocks by the household of individual i, the control factors X_i included in the right-hand-side of the equation are the same as those used in the previous subsection and u_i is stochastic component following a normal distribution with zero mean and unknown variance σ^2. The parameters in the Tobit specification make it possible to assess the effect of the explanatory variables on the average share of financial wealth invested in stocks by stock owners, $E[y|x, y > 0]$, and by all agents in the sample, $E[y|x]$.

Table 5 summarizes the results of the analysis for the share of wealth invested in direct stock holding. In line with our results on stock-ownership, once we control for risk aversion, trust and social interactions, the optimism coefficient loses its significance. In addition, the relationship between the share of financial wealth devoted to direct stock holding and optimism appears to be statistically negligible independently of the level of risk aversion, trust and social interaction of agents[9]. Table 6 reports the results for the share of wealth invested in direct and indirect stock holding. The pattern previously found for the total ownership of stocks is confirmed. If we look at the most parsimonious specification, the response of stock owners to a discrete change in our optimism indicator

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[9]We computed the response of the outcome of interest to changes in dispositional optimism for alternative profiles of investors defined according to trust, social interaction and risk aversion. None of these variations is significant.

is to increase the share of financial wealth held in stocks by 5.12 percentage points (6.06 percentage points if we consider all investors). In the specification with the full set of control variables, the coefficient on dispositional optimism is still significant. The share of financial wealth invested in stocks by extremely pessimistic stock-owners is on average 1.69 percentage points lower than the one held by their extremely optimistic counterparts. If we look at the variation induced in the share of wealth held in stocks by all agents, this is equal to 1.94 points. As in the ownership case, these effects are not only statistically but also economically significant if compared to those associated with moving from the lowest to the highest levels of education and numeracy. If we focus on stock-owners, the variation in the share of wealth invested in stocks induced by moving from extreme pessimism to extreme optimism is more than two thirds than the differential between low and high educated individuals (2.45 percentage points) and equivalent to the differential between individuals with the lowest and the highest levels of our numeracy indicator (1.76 percentage points)[10]. It is worth noting that consistently with the results for participation discussed in the previous section, trust is found to be a relevant predictor only when the total investment in stocks are considered. Risk aversion and social interactions remain important determinants of stock market investment.

If we include interaction terms in our model, we can predict the response of the share of financial wealth invested in stocks to variations in optimism for different profiles of stock-owners defined according to the personality traits considered in our models. We consider eight profiles of stock owners defined by combining the lowest and the highest achievable levels of our indicators for trust, social interaction and risk aversion. We find that, regardless of the degree of social interaction, risk tolerant stock owners, who do not trust others and move from extreme pessimism to extreme optimism, increase by about 9 percentage points the share of financial wealth invested in stocks. For risk averse stock-owners with no trust in other people and no social interactions, the same change in

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[10]Looking at the share of wealth invested in stock by all agents provides similar results. The differential between low and high education individuals amount to 2.83 percentage points, the one between agents with low and high numeracy levels is 2.01 percentage points.

optimism is associated with an increase by 3 percentage points. This effect is marginally significant. For all other groups, we do not find a significant effect of optimism on the share of wealth invested in stocks.[11]

4   Conclusions

We draw data from the second wave of SHARE to analyze the relationship between dispositional optimism and stock market participation in twelve European countries. Following Puri and Robinson (2007), we develop an indicator of dispositional optimism based on the miscalibration between subjective and objective survival probabilities. We separately analyze direct and total stock market participation, which also include stocks held in mutual funds and individual retirement accounts, at both the extensive and the intensive margin.

We estimated the relationship between dispositional optimism and financial investments in stocks controlling not only for a rich set of demographic and socio-economic characteristics but also for cognitive skills and personality traits, namely risk aversion, trust and social interactions. If we focus on the ownership of stocks, we find that dispositional optimism mainly matters for risk tolerant agents, for whom being extremely optimistic rather than extremely pessimistic is associated with a statistically and economically significant increase in the probability of holding stocks of about 13 and 14 percentage points for direct and total ownership respectively. However, for risk averse agents dispositional optimism plays a negligible role on financial behaviour. If we look at the share of wealth invested in stocks, optimism plays a role only when we consider the total investment in stocks and its effects varies with the degree of risk aversion and trust. In particular, for risk tolerant investors with no trust in other people, being extremely optimistic rather than extremely pessimistic is associated with an increase of

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[11]We obtain similar results when looking at the share of wealth invested in stocks by all investors, which increases by about 11 percentage points for not trusting risk tolerant stock owners regardless of having social interactions or not. Instead, it increases by 2.95 percentage points for risk averse investors without trust and social interactions. This latter variation is again marginally significant.

about 11 percentage points in the total share of wealth that they invest in stocks. These empirical findings provide support for the development and the calibration of theoretical models of financial behaviour that incorporate standard economic determinants with the behavioural characteristic of agents. Pessimistic individuals might develop unattractive beliefs of the actual costs of trading and managing stocks and decide not to participate in the market, even if they are not risk averse. However, our results suggest that investing in their education and numeracy might offset the impact of their negative attitude towards life and lower barriers to financial market participation.

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A Figures

Figure 1: Direct and total stock market participation by country
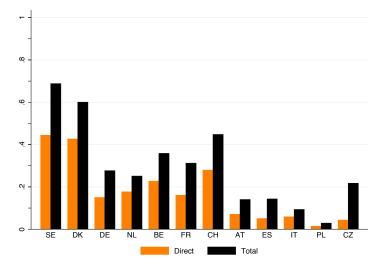

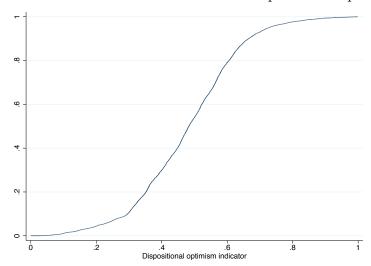Figure 2: Cumulative distribution function of the dispositional optimism indicator

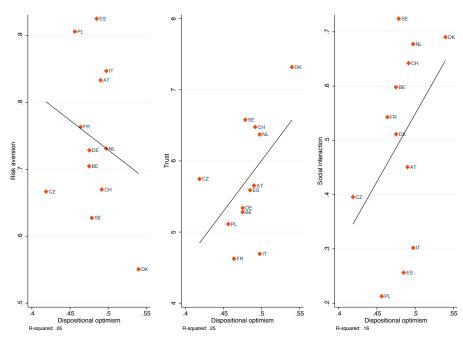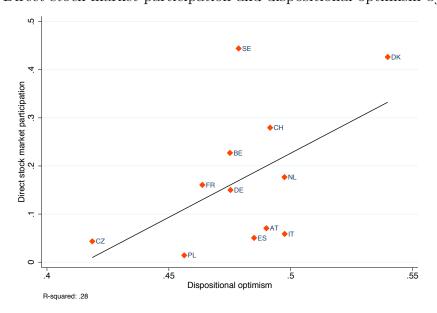Figure 3: Risk aversion, trust and dispositional optimism

Figure 4: Direct stock market participation and dispositional optimism by country

B Tables

Table 1: Summary statistics of the variables used in the regressions

Variable	Definition	Mean	Std. Dev.
direct stock own.	Direct stock ownership	.184	.393
total stock own.	Total stock ownership	.307	.465
share of direct stock own.	Direct stock ownership	.055	.162
share of total stock own.	Total stock ownership	.106	.207
living better	Chances of living better 5 years from now	26.777	28.667
living worse	Chances of living worse 5 years from now	38.282	32.137
good health	Excellent, very good or good health	.651	.477
optimism	Survival probability miscalibration	.48	.155
lot	Life Orientation Test	17.652	4.158
SE	Living in Sweden	.1	.3
DK	Living in Denmark	.089	.285
NL	Living in The Netherlands	.093	.291
BE	Living in Belgium	.11	.313
FR	Living in France	.088	.283
CH	Living in Switzerland	.056	.23
AT	Living in Austria	.048	.215
ES	Living in Spain	.06	.237
IT	Living in Italy	.096	.295
PL	Living in Poland	.086	.281
CZ	Living in Czech Republic	.085	.278
female	The respondent is female	.534	.499
age	Age	64.468	10.059
age2	Age squared	4257.335	1347.748
hhsize	Number of household members	2.122	1.086
number of children	Number of children	2.166	1.405
medium education	Medium education (ISCED=3)	.312	.468
high education	High education (ISCED=4,5,6)	.237	.429
employed	The respondent is employed	.291	.454
retired	The respondent is retired	.529	.499
hh income	IHS transf. of household income	10.541	1.346
hh financial wealth	IHS transf. of household wealth	7.792	7.58
adl	Limited with activities of daily living	.097	.296
iadl	Limited with instrumental adl	.07	.254
mother dead	Mother is dead	.763	.425
father dead	Father is dead	.905	.293
numeracy	Results of the numeracy test	3.482	1.104
fluency	Results of the verbal fluency test	19.825	7.532
recall	Results of the recall test	3.634	1.994
trust	Level of trust in other people	5.713	2.529
social interaction	Taken part in social activities last month	.51	.5
risk aversion	No willingness to take any financial risk	.738	.441

Table 2: Validation of the dispositional optimism indicator

	living better	living worse	good health	lot
optimism	39.398***	-17.813***	0.538***	5.693***
	(1.472)	(1.799)	(0.024)	(0.439)
SE	12.573***	-12.454***	0.047***	0.250
	(0.958)	(1.224)	(0.015)	(0.310)
DK	9.034***	-21.405***	0.049***	-0.008
	(1.051)	(1.205)	(0.015)	(0.339)
NL	9.533***	-7.265***	0.041***	-0.601**
	(0.977)	(1.238)	(0.015)	(0.276)
BE	3.909***	-9.808***	0.121***	-0.663
	(0.877)	(1.200)	(0.014)	(0.531)
FR	-0.636	5.859***	0.064***	-0.893***
	(0.890)	(1.292)	(0.015)	(0.279)
CH	6.290***	-13.660***	0.143***	1.292***
	(1.101)	(1.343)	(0.016)	(0.266)
AT	6.465***	-5.299***	0.100***	0.981
	(1.071)	(1.435)	(0.018)	(0.664)
ES	17.636***	-5.775***	0.046**	0.742
	(1.101)	(1.386)	(0.019)	(0.452)
IT	14.997***	-7.552***	0.032**	0.107
	(0.967)	(1.225)	(0.016)	(0.299)
PL	8.467***	-3.938***	-0.089***	-0.979***
	(0.989)	(1.258)	(0.017)	(0.273)
CZ	8.984***	-0.507	-0.022	-0.880***
	(0.941)	(1.273)	(0.016)	(0.255)
female	-0.017	-1.036**	0.034***	0.254*
	(0.442)	(0.520)	(0.007)	(0.130)
age	-2.116***	2.440***	0.004	0.039
	(0.295)	(0.316)	(0.005)	(0.074)
age2	0.010***	-0.018***	-0.000**	-0.001
	(0.002)	(0.002)	(0.000)	(0.001)
hhsize	0.960***	-0.427*	0.003	0.141***
	(0.218)	(0.241)	(0.003)	(0.053)
number of children	-0.061	-0.287	-0.000	0.098**
	(0.143)	(0.178)	(0.002)	(0.047)
medium education	-0.768	0.598	0.012	-0.056
	(0.516)	(0.611)	(0.009)	(0.148)
high education	0.394	0.156	0.043***	0.500***
	(0.603)	(0.707)	(0.009)	(0.177)
employed	0.062	2.472***	0.141***	0.419**
	(0.733)	(0.813)	(0.011)	(0.198)
retired	-1.352**	-2.292***	0.054***	0.452**
	(0.630)	(0.754)	(0.011)	(0.203)
hh income	0.121	-0.362*	0.006**	0.162**
	(0.171)	(0.209)	(0.003)	(0.076)
hh financial wealth	-0.049	-0.168***	0.002***	0.041***
	(0.041)	(0.042)	(0.001)	(0.010)
adl	-0.752	2.455***	-0.253***	-0.596**
	(0.716)	(0.944)	(0.013)	(0.246)
iadl	-1.566**	2.632**	-0.180***	-1.462***
	(0.794)	(1.131)	(0.014)	(0.320)
mother dead	-0.907	0.620	-0.027***	-0.027
	(0.594)	(0.639)	(0.008)	(0.150)
father dead	0.229	-0.798	-0.009	0.383**
	(0.817)	(0.856)	(0.011)	(0.195)
numeracy	-0.159	0.542**	0.023***	0.195***
	(0.225)	(0.262)	(0.004)	(0.066)
fluency	0.004	-0.035	0.002***	0.021**
	(0.034)	(0.040)	(0.001)	(0.009)
recall	0.244*	0.142	0.010***	0.119***
	(0.125)	(0.145)	(0.002)	(0.035)
trust	0.366***	-0.512***	0.009***	0.125***
	(0.086)	(0.104)	(0.001)	(0.026)
social interaction	-0.667	-0.445	0.049***	0.379***
	(0.447)	(0.523)	(0.007)	(0.125)
risk aversion	-2.659***	0.907	-0.031***	-0.212
	(0.517)	(0.588)	(0.008)	(0.133)
Constant	92.936***	-20.548*	0.024	10.134***
	(10.187)	(10.984)	(0.157)	(2.599)
Number of observations	17455	17455	17455	4220

Note: Linear regression models estimated by OLS and based on 5 sets of multiply-imputed data combined according to Little and Rubin (1987). *** p<0.01, ** p<0.05, * p<0.1

Table 3: Direct stock market participation

	(1)	(2)	(3)	(4)	(5)	(6)
optimism	0.095***	0.048***	0.046**	0.040**	0.022	0.113*
	(0.019)	(0.018)	(0.018)	(0.018)	(0.018)	(0.060)
SE	0.302***	0.319***	0.319***	0.310***	0.279***	0.280***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.014)	(0.014)
DK	0.278***	0.269***	0.268***	0.267***	0.227***	0.226***
	(0.016)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
NL	0.028**	0.032**	0.031**	0.028**	0.023*	0.024*
	(0.013)	(0.013)	(0.013)	(0.013)	(0.012)	(0.012)
BE	0.081***	0.088***	0.088***	0.092***	0.079***	0.080***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.012)	(0.012)
FR	0.017	0.040***	0.040***	0.045***	0.044***	0.044***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.012)	(0.012)
CH	0.133***	0.125***	0.125***	0.123***	0.109***	0.110***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.016)	(0.016)
AT	-0.068***	-0.046***	-0.046***	-0.048***	-0.037***	-0.037***
	(0.013)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
ES	-0.098***	-0.026**	-0.027**	-0.004	0.011	0.012
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
IT	-0.099***	-0.025**	-0.026**	-0.010	-0.006	-0.005
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
PL	-0.143***	-0.033***	-0.032***	-0.014	-0.003	-0.003
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
CZ	-0.098***	-0.033***	-0.033***	-0.032***	-0.062***	-0.061***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
female	-0.043***	-0.029***	-0.029***	-0.027***	-0.011*	-0.010*
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
age	0.021***	0.019***	0.018***	0.017***	0.014***	0.014***
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
age2	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
hhsize	0.018***	0.012***	0.012***	0.012***	0.013***	0.013***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
number of children	-0.011***	-0.004**	-0.004**	-0.004**	-0.003**	-0.004**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
medium education		0.041***	0.041***	0.031***	0.021***	0.021***
		(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
high education		0.111***	0.111***	0.093***	0.062***	0.062***
		(0.008)	(0.008)	(0.009)	(0.008)	(0.008)
employed		-0.002	-0.002	-0.007	-0.016*	-0.016*
		(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
retired		-0.011	-0.012	-0.014*	-0.011	-0.011
		(0.008)	(0.008)	(0.008)	(0.007)	(0.007)
hh income		0.023***	0.023***	0.022***	0.017***	0.017***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
hh financial wealth		0.010***	0.010***	0.010***	0.008***	0.008***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
adl			-0.019**	-0.015*	-0.013	-0.014
			(0.009)	(0.009)	(0.008)	(0.008)
iadl			0.003	0.013	0.009	0.008
			(0.010)	(0.010)	(0.010)	(0.010)
mother dead			0.007	0.008	0.011	0.011
			(0.008)	(0.008)	(0.008)	(0.008)
father dead			0.001	0.002	0.004	0.004
			(0.011)	(0.011)	(0.011)	(0.011)
numeracy				0.014***	0.006**	0.007**
				(0.003)	(0.003)	(0.003)
fluency				0.002***	0.001***	0.001***
				(0.000)	(0.000)	(0.000)
recall				0.003*	0.003*	0.003*
				(0.002)	(0.002)	(0.002)
trust					0.001	0.001
					(0.001)	(0.003)
social interaction=1					0.024***	0.005
					(0.006)	(0.017)
risk aversion=1					-0.214***	-0.144***
					(0.008)	(0.025)
optimism × trust						0.001
						(0.006)
social interaction=1 × optimism						0.040
						(0.034)
risk aversion=1 × optimism						-0.146***
						(0.050)
Constant	-0.504***	-0.859***	-0.820***	-0.875***	-0.564***	-0.596***
	(0.111)	(0.126)	(0.129)	(0.129)	(0.124)	(0.126)
Number of observations	17455	17455	17455	17455	17455	17455

Note: Linear regression models estimated by OLS and based on 5 sets of multiply-imputed data combined according to Little and Rubin (1987). *** p<0.01, ** p<0.05, * p<0.1

Table 4: Direct and indirect stock market participation

	(1)	(2)	(3)	(4)	(5)	(6)
optimism	0.163***	0.087***	0.083***	0.073***	0.050**	0.163**
	(0.022)	(0.021)	(0.021)	(0.021)	(0.020)	(0.064)
SE	0.423***	0.440***	0.439***	0.426***	0.386***	0.386***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
DK	0.317***	0.300***	0.300***	0.298***	0.246***	0.246***
	(0.017)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
NL	-0.031**	-0.028*	-0.029*	-0.032**	-0.042***	-0.041***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.014)	(0.014)
BE	0.085***	0.094***	0.094***	0.099***	0.082***	0.083***
	(0.016)	(0.015)	(0.015)	(0.015)	(0.014)	(0.014)
FR	0.040**	0.071***	0.071***	0.079***	0.077***	0.077***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.015)	(0.015)
CH	0.171***	0.153***	0.152***	0.150***	0.131***	0.131***
	(0.019)	(0.018)	(0.019)	(0.018)	(0.018)	(0.018)
AT	-0.113***	-0.078***	-0.078***	-0.081***	-0.068***	-0.068***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.015)	(0.015)
ES	-0.126***	-0.027*	-0.028*	0.005	0.023	0.024
	(0.016)	(0.016)	(0.016)	(0.016)	(0.015)	(0.015)
IT	-0.190***	-0.085***	-0.085***	-0.061***	-0.056***	-0.055***
	(0.013)	(0.014)	(0.014)	(0.014)	(0.013)	(0.013)
PL	-0.256***	-0.094***	-0.091***	-0.065***	-0.051***	-0.051***
	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
CZ	-0.051***	0.039***	0.039***	0.042***	0.005	0.006
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
female	-0.064***	-0.040***	-0.040***	-0.039***	-0.020***	-0.020***
	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
age	0.013***	0.019***	0.017***	0.015***	0.012***	0.011***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
age2	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
hhsize	0.017***	0.009***	0.009***	0.009***	0.010***	0.010***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
number of children	-0.014***	-0.005**	-0.005**	-0.005**	-0.004*	-0.004*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
medium education		0.054***	0.053***	0.038***	0.025***	0.025***
		(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
high education		0.143***	0.142***	0.115***	0.076***	0.076***
		(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
employed		0.053***	0.053***	0.046***	0.034***	0.034***
		(0.011)	(0.011)	(0.011)	(0.010)	(0.010)
retired		-0.014*	-0.015*	-0.018**	-0.014*	-0.014*
		(0.009)	(0.009)	(0.009)	(0.008)	(0.008)
hh income		0.029***	0.029***	0.027***	0.021***	0.021***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
hh financial wealth		0.015***	0.015***	0.015***	0.013***	0.013***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
adl			-0.015	-0.009	-0.007	-0.007
			(0.010)	(0.010)	(0.010)	(0.010)
iadl			-0.013	0.002	-0.003	-0.003
			(0.011)	(0.011)	(0.011)	(0.011)
mother dead			0.002	0.004	0.007	0.007
			(0.009)	(0.009)	(0.009)	(0.009)
father dead			0.002	0.004	0.007	0.007
			(0.012)	(0.012)	(0.012)	(0.012)
numeracy				0.017***	0.008**	0.008***
				(0.003)	(0.003)	(0.003)
fluency				0.003***	0.002***	0.002***
				(0.001)	(0.000)	(0.000)
recall				0.005***	0.005***	0.005***
				(0.002)	(0.002)	(0.002)
trust					0.003**	0.006*
					(0.001)	(0.003)
social interaction=1					0.038***	0.035*
					(0.006)	(0.019)
risk aversion=1					-0.257***	-0.205***
					(0.008)	(0.026)
optimism × trust						-0.006
						(0.007)
social interaction=1 × optimism						0.006
						(0.038)
risk aversion=1 × optimism						-0.106**
						(0.051)
Constant	0.024	-0.758***	-0.712***	-0.789***	-0.408***	-0.454***
	(0.127)	(0.140)	(0.144)	(0.143)	(0.139)	(0.141)
Number of observations	17455	17455	17455	17455	17455	17455

Note: Linear regression models estimated by OLS and based on 5 sets of multiply-imputed data combined according to Little and Rubin (1987). *** p<0.01, ** p<0.05, * p<0.1

Table 5: Share of gross financial wealth invested in direct stock ownership

	(1)	(2)	(3)	(4)	(5)	(6)
optimism	0.169***	0.108***	0.100**	0.090**	0.057	0.147
	(0.041)	(0.041)	(0.041)	(0.041)	(0.040)	(0.113)
SE	0.354***	0.397***	0.396***	0.384***	0.337***	0.337***
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
DK	0.324***	0.323***	0.322***	0.323***	0.277***	0.277***
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
NL	0.060**	0.069***	0.067***	0.067***	0.057**	0.057**
	(0.024)	(0.025)	(0.025)	(0.025)	(0.024)	(0.024)
BE	0.139***	0.166***	0.167***	0.177***	0.150***	0.150***
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
FR	0.020	0.060**	0.060**	0.072***	0.073***	0.073***
	(0.025)	(0.025)	(0.025)	(0.026)	(0.025)	(0.025)
CH	0.201***	0.188***	0.186***	0.187***	0.171***	0.171***
	(0.026)	(0.026)	(0.026)	(0.026)	(0.025)	(0.025)
AT	-0.164***	-0.128***	-0.127***	-0.130***	-0.109***	-0.109***
	(0.035)	(0.035)	(0.035)	(0.035)	(0.034)	(0.034)
ES	-0.251***	-0.110***	-0.111***	-0.063*	-0.025	-0.025
	(0.037)	(0.037)	(0.037)	(0.037)	(0.036)	(0.036)
IT	-0.211***	-0.099***	-0.100***	-0.067**	-0.060**	-0.060**
	(0.030)	(0.031)	(0.031)	(0.031)	(0.030)	(0.030)
PL	-0.416***	-0.241***	-0.236***	-0.200***	-0.170***	-0.171***
	(0.046)	(0.047)	(0.047)	(0.046)	(0.045)	(0.045)
CZ	-0.275***	-0.155***	-0.157***	-0.155***	-0.198***	-0.198***
	(0.034)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)
female	-0.079***	-0.048***	-0.048***	-0.044***	-0.014	-0.014
	(0.012)	(0.011)	(0.011)	(0.012)	(0.012)	(0.012)
age	0.047***	0.035***	0.030***	0.028***	0.024***	0.024***
	(0.007)	(0.007)	(0.008)	(0.008)	(0.007)	(0.007)
age2	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
hhsize	0.037***	0.014*	0.014*	0.014*	0.019***	0.019***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
number of children	-0.024***	-0.016***	-0.016***	-0.017***	-0.016***	-0.016***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
medium education		0.091***	0.089***	0.073***	0.054***	0.054***
		(0.014)	(0.014)	(0.015)	(0.014)	(0.014)
high education		0.165***	0.163***	0.131***	0.086***	0.085***
		(0.014)	(0.014)	(0.015)	(0.015)	(0.015)
employed		-0.031	-0.034*	-0.040**	-0.046**	-0.046**
		(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
retired		0.006	0.003	0.000	0.005	0.005
		(0.019)	(0.019)	(0.019)	(0.018)	(0.018)
hh income		0.101***	0.100***	0.095***	0.073***	0.073***
		(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
hh financial wealth		0.019***	0.019***	0.018***	0.014***	0.014***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
adl			-0.052**	-0.043*	-0.043*	-0.043*
			(0.024)	(0.024)	(0.024)	(0.024)
iadl			-0.033	-0.013	-0.014	-0.014
			(0.031)	(0.031)	(0.030)	(0.030)
mother dead			0.011	0.013	0.017	0.017
			(0.015)	(0.015)	(0.014)	(0.014)
father dead			0.001	0.003	0.005	0.005
			(0.019)	(0.019)	(0.019)	(0.019)
numeracy				0.026***	0.012**	0.012**
				(0.006)	(0.006)	(0.006)
fluency				0.004***	0.004***	0.004***
				(0.001)	(0.001)	(0.001)
recall				0.005	0.005	0.005
				(0.003)	(0.003)	(0.003)
trust					0.001	0.006
					(0.002)	(0.007)
social interaction=1					0.041***	0.048
					(0.011)	(0.039)
risk aversion=1					-0.286***	-0.265***
					(0.011)	(0.039)
optimism × trust						-0.010
						(0.014)
social interaction=1 × optimism						-0.014
						(0.076)
risk aversion=1 × optimism						-0.042
						(0.076)
Constant	-1.987***	-2.951***	-2.806***	-2.912***	-2.306***	-2.348***
	(0.235)	(0.265)	(0.275)	(0.275)	(0.270)	(0.273)
sigma						
Constant	0.460***	0.442***	0.442***	0.441***	0.422***	0.422***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)
Number of observations	15362	15362	15362	15362	15362	15362

Note: Tobit regression models estimated by maximum likelihood and based on 5 sets of multiply-imputed data combined according to Little and Rubin (1987). *** p<0.01, ** p<0.05, * p<0.1

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Table 6: Share of gross financial wealth invested in direct and indirect stock ownership

	(1)	(2)	(3)	(4)	(5)	(6)
optimism	0.175***	0.111***	0.103***	0.092***	0.057*	0.236***
	(0.031)	(0.030)	(0.031)	(0.031)	(0.030)	(0.083)
SE	0.416***	0.447***	0.446***	0.433***	0.388***	0.388***
	(0.017)	(0.018)	(0.018)	(0.017)	(0.017)	(0.017)
DK	0.308***	0.294***	0.294***	0.294***	0.245***	0.246***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.017)	(0.017)
NL	-0.010	-0.000	-0.002	-0.003	-0.014	-0.013
	(0.019)	(0.019)	(0.019)	(0.019)	(0.018)	(0.018)
BE	0.113***	0.134***	0.136***	0.145***	0.122***	0.122***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.018)	(0.018)
FR	0.056***	0.095***	0.095***	0.108***	0.108***	0.108***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.018)	(0.018)
CH	0.178***	0.159***	0.157***	0.157***	0.138***	0.139***
	(0.020)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
AT	-0.155***	-0.125***	-0.124***	-0.128***	-0.111***	-0.111***
	(0.025)	(0.025)	(0.025)	(0.025)	(0.024)	(0.024)
ES	-0.135***	-0.011	-0.012	0.034	0.064***	0.064***
	(0.025)	(0.024)	(0.024)	(0.024)	(0.023)	(0.023)
IT	-0.241***	-0.143***	-0.144***	-0.113***	-0.105***	-0.104***
	(0.022)	(0.023)	(0.023)	(0.023)	(0.022)	(0.022)
PL	-0.420***	-0.289***	-0.284***	-0.251***	-0.221***	-0.221***
	(0.033)	(0.033)	(0.033)	(0.033)	(0.032)	(0.032)
CZ	-0.023	0.067***	0.065***	0.067***	0.020	0.021
	(0.021)	(0.021)	(0.021)	(0.021)	(0.020)	(0.020)
female	-0.078***	-0.049***	-0.049***	-0.046***	-0.021**	-0.020**
	(0.009)	(0.009)	(0.008)	(0.009)	(0.008)	(0.008)
age	0.030***	0.027***	0.022***	0.020***	0.015***	0.015***
	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)
age2	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
hhsize	0.020***	0.002	0.002	0.003	0.006	0.006
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
number of children	-0.020***	-0.012***	-0.012***	-0.013***	-0.012***	-0.012***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
medium education		0.087***	0.085***	0.068***	0.051***	0.051***
		(0.010)	(0.010)	(0.011)	(0.010)	(0.010)
high education		0.159***	0.157***	0.124***	0.083***	0.083***
		(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
employed		0.024*	0.019	0.014	0.008	0.007
		(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
retired		0.004	0.001	-0.003	0.002	0.001
		(0.014)	(0.014)	(0.014)	(0.013)	(0.013)
hh income		0.070***	0.070***	0.066***	0.050***	0.049***
		(0.006)	(0.006)	(0.006)	(0.005)	(0.005)
hh financial wealth		0.017***	0.017***	0.016***	0.013***	0.013***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
adl			-0.044**	-0.035*	-0.032*	-0.032*
			(0.018)	(0.018)	(0.017)	(0.017)
iadl			-0.063***	-0.043*	-0.045*	-0.045**
			(0.024)	(0.024)	(0.023)	(0.023)
mother dead			0.002	0.004	0.008	0.008
			(0.011)	(0.011)	(0.010)	(0.010)
father dead			0.013	0.016	0.019	0.018
			(0.014)	(0.014)	(0.013)	(0.013)
numeracy				0.027***	0.015***	0.015***
				(0.005)	(0.004)	(0.004)
fluency				0.004***	0.003***	0.003***
				(0.001)	(0.001)	(0.001)
recall				0.006***	0.006***	0.006***
				(0.002)	(0.002)	(0.002)
trust					0.003*	0.012**
					(0.002)	(0.005)
social interaction=1					0.033***	0.031
					(0.008)	(0.028)
risk aversion=1					-0.253***	-0.198***
					(0.008)	(0.028)
optimism × trust						-0.018*
						(0.010)
social interaction=1 × optimism						0.004
						(0.054)
risk aversion=1 × optimism						-0.114**
						(0.056)
Constant	-1.019***	-1.999***	-1.840***	-1.949***	-1.419***	-1.497***
	(0.175)	(0.191)	(0.200)	(0.199)	(0.193)	(0.195)
sigma						
Constant	0.402***	0.383***	0.382***	0.380***	0.361***	0.361***
	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)
Number of observations	15362	15362	15362	15362	15362	15362

Note: Tobit regression models estimated by maximum likelihood and based on 5 sets of multiply-imputed data combined according to Little and Rubin (1987). *** p<0.01, ** p<0.05, * p<0.1