Financial Literacy, Retirement Planning, and Household Wealth

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Abstract

There is ample empirical evidence documenting widespread financial illiteracy and limited pension knowledge. At the same time, the net worth distribution is heavily dispersed and many workers arrive on the verge of retirement with little or no personal wealth. This paper is the first to investigate the relation between financial sophistication and household net worth relying on specific measures of financial knowledge and skills rather than crude proxies. For this purpose, we have designed a new module for the Dutch DNB Household Survey. Our findings provide evidence of a statistically and economically significant positive effect of financial sophistication on net worth. Moreover, we highlight and document empirical evidence of two channels by which financial sophistication facilitates wealth accumulation. First, financial skills increase the likelihood to invest in the stock market thereby opening the possibility to benefit form the equity premium and improving the opportunities for risk diversification. Second, financial sophistication boosts retirement planning behavior by households, thereby providing an important channel for the development of savings plans and creating instruments for self-control. In addition, our results suggest that respondents who are relatively confident on their own financial skills have a higher propensity to plan. To take into account that wealth, portfolio management and planning activities might exert an independent effect on financial literacy, we employ instrumental variable regression techniques using information on economics education.

Key words: Financial Education, Savings and Wealth Accumulation, Retirement Planning, Knowledge of Finance and Economics, Overconfidence, Stock Market Participation
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1. Introduction

Households hold very different amounts of savings. Heterogeneity in lifetime earnings, the willingness to leave bequests, motives for precautionary or other savings, and cross sectional variability in time preferences, expectations, health, longevity, inheritances and other income shocks contribute to the dispersion in wealth holdings and have been researched extensively.[1] The relation between wealth accumulation and financial capabilities has received much less attention, mainly because information on the level of financial sophistication is usually unavailable. Recently, however, there has been a boost in research on the measurement of financial literacy and its effects on household behavior (e.g. Van Rooij, Lusardi and Alessie, 2007; Lusardi and Mitchell, 2007a, 2007b, 2008; Agnew, Szykman, Utkus and Young, 2007; Kimball and Shumway, 2006). This paper reports the results of a newly designed survey with an extensive set of questions to measure basic and more advanced financial skills and to the best of our knowledge it contains the first study of its impact on net worth.

The relation between financial sophistication and savings behavior is important as individuals are increasingly asked to take private responsibility for their financial well-being. Given the evidence on widespread financial illiteracy and limited pension knowledge, there is an obvious policy interest in the question whether financial education affects savings behavior and what type of education programs is most effective. The empirical evidence on the effect of financial education and the provision of information on savings behavior is mixed (Lusardi, 2004). Moreover, even if studies find a significant impact of financial education on savings, the outcomes generally do not provide much information on the channel underlying this effect. Studies on the impact of retirement seminars on savings for example are typically not able to disentangle the effect of an increase in financial skills, if any, from behavioral effects due to the provision of information, retirement seminars being an integral part of a more comprehensive initiative to increase financial awareness, or the importance of peer and community effects in raising savings (Duflo and Saez, 2003). We investigate whether household financial sophistication by itself has an impact on wealth accumulation and ask ourselves what underlying channels could be at work here.

The main contributions of this paper are the following. We provide evidence of an independent and positive effect of financial sophistication on wealth accumulation over and

[1] See the references in the next section.

above the effect of other determinants such as income, age, education, family composition, risk tolerance, patience, the attitude towards saving, and basic cognitive ability. We identify and highlight two channels by which financial literacy facilitates wealth accumulation. First, a high level of financial skills lowers economic and psychological barriers to invest in the stock market (Bertaut and Haliassos, 1995; Vissing-Jorgenson, 2004). We show that financial sophistication indeed fosters stock market participation and thereby provides households with the opportunity to benefit from the equity premium on stock investments. Second, we find that financial sophistication boosts retirement planning behavior by households, thereby providing an important mechanism for wealth accumulation (Ameriks, Caplin, and Leahy, 2003; Mitchell and Lusardi, 2007b). In addition, our empirical results suggest that respondents who are relatively confident about their own financial skills have a higher propensity to plan. The intuition behind the retirement planning channel is that a high level of financial knowledge and skills reduces planning costs, i.e. the economic and psychological barriers to acquire information, do the calculations and develop a plan. Our data show that once households start doing calculations on their savings needs for retirement, they often follow through setting up a retirement plan and are in general also successful in sticking to their plan.

Our findings have important policy implications. We show that financial illiteracy is widespread and that the lack of financial sophistication has important consequences for wealth holdings. This suggests that the skills to take financial decisions often fall short of what is necessary for the kind of choices that many individuals nowadays are expected to make in a world with a vast and growing supply of complicated financial products which have become accessible to a large public by now. The implication is that there is an important role for financial education as by effectively boosting financial sophistication households become better equipped to manage their own savings. One reason why this is important is that many households enter retirement with very little wealth (Venti and Wise, 1998, 2000; Lusardi, 1999, 2003). This has profound implications not only for personal welfare but also for public policy, as low savings households lack a buffer to deal with negative shocks and are more likely to become dependent on state benefits. In addition, financial education initiatives might help reducing the dispersion in wealth; a dispersion that is much higher than the often debated inequality in income (Cagetti and De Nardi, 2006) and which seems to be growing along with the de facto opening of the stock markets to a wider audience (Bilias, Georgarakos and Haliassos, 2007).

This paper is organized as follows. In Section 2 we review the current literature on wealth accumulation in relation to financial sophistication. In Section 3 we present data and descriptive statistics, and explain how the measures of financial ability and sophistication are constructed. In Section 4, we report the results of wealth regressions including measures of financial ability and sophistication. In Section 5, we present several extensions and discuss the robustness of the results. In section 6, we consider two channels by which financial skills exert an effect on wealth accumulation: stock market participation and retirement planning activities. In addition, we examine the economic relevance of being financially sophisticated. In Section 7, we conclude with some remarks on implications for policy and areas for future research.

2. Literature

The simplest version of the life cycle consumption model without bequests and uncertainty predicts that households accumulate savings during their working career to finance retirement and decumulate their wealth thereafter (Modigliani and Miller, 1954). This type of savings behavior enables households to smooth their marginal utility of consumption over the life cycle. However, there are many reasons why household consumption and wealth follow different patterns and the standard model can quite easily be adjusted to cope with many of them (Browning and Lusardi, 1996; Cagetti and De Nardi, 2006).

A large variety of empirical research sheds light on the observed patterns in wealth dispersion and portfolio choice. Studies have highlighted among others the role of precautionary saving motives (Hubbard, Skinner and Zeldes, 1995), longevity and bequests (Hurd, 1989), different economic opportunities across cohorts (Kapteyn, Alessie and Lusardi, 2005), self-control (Laibson, 1997; Benartzi and Thaler, 2004; Ameriks, Caplin, Leahy and Tyler, 2007), correlations across generations (Charles and Hurst, 2003), unexpected events (Venti and Wise, 2000; Lusardi, 2003), background income risk (Heaton and Lucas, 2000; Guiso, Jappelli, Terlizzese, 1996), and health (Rosen and Wu, 2004). To the best of our knowledge, none of these studies focus on the role of financial capabilities in accumulating savings, while more financially sophisticated individuals are likely to perceive lower barriers for gathering and processing information and are thus better equipped to manage their savings portfolio. Somewhat related is the work by Chan and Stevens (2008) who show that many households base their pension and

retirement savings decisions upon the limited and sometimes incorrect pension knowledge they have.[2]

Bernheim (1995, 1998) was among the first to stress that policymakers and researchers might have overlooked the importance of financial literacy for personal savings. Since then many studies emphasize the role of financial sophistication but, in absence of specific literacy measures, resort to crude proxies for financial skills, such as income, wealth or education (Calvet, Campbell and Sodini, 2007; Vissing-Jorgenson, 2004). The disadvantage of these proxies is that there is no way to disentangle the effect of financial ability from the effect of the proxy variable. By using education as a measure of financial sophistication one is not able to separate the independent effect of financial skills from the impact of the education level as such, which in addition in many regression specifications also serves as a proxy for lifetime income.

More recently, researchers have increased effort in developing specific measures of financial ability and knowledge (Hilgert and Hogarth, 2003; Lusardi and Mitchell, 2006) and have started investigating its relation to economic decisions and portfolio choice. Hilgert, Hogarth, and Beverly (2003) explore the relation between literacy and money management, while Lusardi and Mitchell (2006) consider the associations with retirement planning. More recently Van Rooij, Lusardi and Alessie (2007) and Christelis, Jappelli and Padula (2007) have studied the link between the decision to invest in stocks and specific measures of financial sophistication and basic cognitive abilities.

Several authors have stressed that the welfare costs of financial mistakes are not negligible (Campbell, 2006; Calvet, Campbell and Sodini, 2007; Cocco, Gomes and Maenhout, 2005). Nevertheless, an increasing amount of studies documents the prevalence of financial mistakes. Agarwal, Driscoll, Gabaix and Laibson (2007)) provide evidence on financial mistakes in the loan market with many households paying too much in terms of fees or interest rates on credit card debt, home equity loans and mortgages. Calvet, Campbell and Sodini (2007) show that in Sweden – a country that is claimed to have efficient investors – many households hold underdiversified portfolios or do not participate in financial markets at all.

The amount of financial mistakes might not come as a surprise given the body of evidence on limited financial literacy among households. This evidence is robust in different

[2] Many authors have documented that households are rather ill-informed about their Social Security benefits and company pensions. See Gustman and Steinmeier (2004) and Van Els, Van den End and Van Rooij (2004) for evidence for the US and the Netherlands, respectively.

settings and across different countries of which many have reacted by setting up financial education programs (OECD, 2005). While the large variation in the initiatives to enhance awareness and financial sophistication creates many possibilities to learn in the near future about how to effectively design and implement education programs, these evaluations have been limited so far (Smith and Stewart, 2008).

The impact of financial education on savings behavior has been investigated almost exclusively in the context of retirement seminars offered by US firms. An important exception is the work by Bernheim, Garrett, and Maki (2001) who document positive effects of financial education during high school on long term savings employing the variability in state mandates on the teaching of topics related to household financial decisions. Bernheim and Garrett (2003), Lusardi (2004) and Clark, D'Ambrosio, McDermed and Sawant (2006) have documented positive effects of retirement seminars in the workplace, especially when it regards the intentions to change savings behavior. Overall, however, the evidence is mixed as other studies were not able to come up with significant, lasting effects (Duflo and Saez, 2003, 2004).

Moreover, as the attendance in retirement seminar is voluntary it is not to be excluded that participants form a selected group that is already more intrinsically motivated to remedy insufficient pension savings. In addition, any beneficial effect of retirement seminars could also be the direct result of the provision of information on the need for retirement savings, rather than of an increase in financial sophistication. This is especially likely as retirement seminars typically take one or at most a few hours. Interestingly, Mandell (2008) does not find a literacy enhancing effect of more intensive courses at high school devoted to teaching personal finance and money management on test scores for financial literacy. This suggests that the effect of financial education on savings could also work via other channels than raising financial knowledge and ability. The impact of financial education on savings in these studies might for example work more indirectly through an effect on individual characteristics and the appetite for saving. In this paper, we do not evaluate financial education programs but focus directly on the role of actual financial knowledge and capabilities in wealth accumulation and disentangle its effects from other personal traits including risk tolerance, patience, and other preferences related to tastes for saving.

3. Data

We have devised a special module for the annual DNB Household Survey (DHS) including an elaborate set of questions on financial ability and knowledge as well as a section on retirement planning activities. The questions have been answered by the household panel run by CentERdata; a survey agency at Tilburg University specialized in internet surveys and experiments on response behavior in a web-based environment.[3] It is important to note that - even though the Netherlands has an internet penetration of about 80% - the selection of panel members is not dependent on the use and availability of internet. Households without a computer or an internet connection are provided with the necessary equipment (e.g. a set-top box to participate through their television connection). Attrition is dealt with by biannual refreshment samples that are drawn in view of keeping the panel representative of the Dutch population of 16 years and older (persons staying in hospitals, specialized care institutions or prisons are not included).[4]

The questionnaire was held among those persons within the household who are in charge of household finances. It was fielded in 2005 from September 23 until September 27 and repeated a week thereafter for those households that had not responded yet. The response rate equaled 74.4% (1508 out of 2028 households). The DHS contains an extensive set of information on income and work, health, household debt and assets, and an extensive set of psychological questions on attitudes with respect to saving and portfolio investments. We merge our module on financial literacy with the data in DHS 2005 on net worth for those households for which we have information on all of their assets and debts. Because wealth regressions might be sensitive to outliers we trim the net worth variable by excluding the top and bottom 1% of observations which are most suspicious to measurement error.

After these steps, our reduced sample consists of 1091 households. The average age of the respondents equals 50.8 (ranging from 22 to 90 years); 53.1% of the respondents are male; 56.7% are married or living together with a partner, about one third have children living at home and 20.4% of the respondents is retired. Comparison of these characteristics with the full sample shows that especially elderly respondents report their asset and debt position more frequently, but overall the composition of the sample remains fairly unchanged. The upper part of Table 1

[3] For more information, we refer to http://www.uvt.nl/centerdata/en.
[4] In addition, we will use household weights to calculate descriptive statistics to ensure representativeness of the population.

reports the median, mean and standard deviation of household net worth. Household wealth includes all kind of savings and investments accounts, housing wealth, other real estate, and durable goods, net of mortgages and other financial debt. It is clear that its distribution is skewed and that there is a lot of dispersion in net worth also after the substantial reduction due to the trimming process.

3.1. The measurement of literacy[5]

The module that we have inserted in the DNB Household Survey contains two sets of questions to assess financial literacy. These questions were designed using similar modules in the US Health and Retirement Survey (HRS) and a variety of other surveys on financial literacy. However, a few questions are unique to our module on literacy.[6] Households are instructed to answer the questions without consulting additional information or using a calculator.[7]

The first set of questions relates to basic financial literacy. Box 1 reports the exact wording of these questions, that measure the ability to perform simple calculations (the first question), the understanding of how compound interest works (second question), and the effect of inflation (third question). We also designed questions to assess the knowledge of time discounting (fourth question) and whether respondents suffer from money illusion (fifth question). These concepts lie at the basis of basic financial transactions, financial planning, and day-to-day financial decision-making. Responses to these questions are reported in Table 2A. Note that, while many respondents answer each individual question correctly, the proportion of respondents who answered all five questions correctly is only 40.2% (Table 2B). Thus, while many respondents display knowledge of a few financial concepts, basic financial literacy is not widespread.

The second set of questions is directed at the measurement of more advanced financial knowledge to be able to classify respondents according to different levels of sophistication. Box 2 reports the exact wording.[8] Clearly, these are much more complex questions than the ones in

[5] See Van Rooij, Lusardi and Alessie (2007) for an elaborate description of the measurement of financial literacy and its relation to demographics.

[6] For an analysis of the module on financial literacy in the 2004 HRS, see Lusardi and Mitchell (2006). For a review of financial literacy surveys across countries, see Lusardi and Mitchell (2007c).

[7] This facilitates the comparison with other surveys, which are normally done via telephone. Moreover, this procedure better enables researchers to assess what respondents know.

[8] Because we could not perform a pilot study to assess how respondents perform on these questions and how well they understood them, we use the wording of questions from other existing surveys (with some modifications to

the previous set. The purpose of these questions is to measure financial skills related to investment and portfolio choice. Specifically, these questions were devised to assess knowledge of financial assets, such as stocks, bonds and mutual funds as well as the trade-off between risk and return. Moreover, we attempt to measure whether respondents understand the concept of risk diversification, the function of the stock market, and the relationship between bond prices and interest rates.

Box 1. Basic Literacy Questions

1) Numeracy
Suppose you had €100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow? (i) More than €102; (ii) Exactly €102; (iii) Less than €102; (iv) Do not know; (v) Refusal.

2) Interest compounding
Suppose you had €100 in a savings account and the interest rate is 20% per year and you never withdraw money or interest payments. After 5 years, how much would you have on this account in total? (i) More than €200; (ii) Exactly €200; (iii) Less than €200; (iv) Do not know; (v) Refusal.

3) Inflation
Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account? (i) More than today; (ii) Exactly the same; (iii) Less than today; (iv) Do not know; (v) Refusal.

4) Time value of money
Assume a friend inherits €10,000 today and his sibling inherits €10,000 3 years from now. Who is richer because of the inheritance? (i) My friend; (ii) His sibling; (iii) They are equally rich; (iv) Do not know; (v) Refusal.

5) Money illusion
Suppose that in the year 2010, your income has doubled and prices of all goods have doubled too. In 2010, how much will you be able to buy with your income? (i) More than today; (ii) The same; (iii) Less than today; (iv) Do not know; (v) Refusal.

reflect the characteristics of the Dutch financial system and the behavior of Dutch financial markets). Specifically, we took question 6 from the National Council of Economic Education Survey, questions 7 and 9 from the NASD Investor Knowledge Quiz, question 15 from the 2004 Health and Retirement Study module on financial literacy, questions 8, 10, 11, 12, 13, 14 and 16 from the Survey of Financial Literacy in Washington State, the Survey of Consumers, and the John Hancock Financial Services Defined Contribution Plan Survey. We took the questions that best reflect financial sophistication related to financial instruments and the working of the stock market.

Table 3A documents responses to these advanced literacy questions. The pattern of answers is much different than in the previous set of questions. The proportion of correct answers on each question is much lower. For example, less than 50% of respondents know that a stock mutual fund is safer than a company stock. Note that not only does a sizable proportion of respondents answer these questions incorrectly, but many respondents also state they do not know the answers to these questions at all. For example, while 30% of respondents are incorrect about which asset (among savings accounts, bonds and stocks) gives the highest return over a long time period, 22% do not know the answer to this question. Table 3B shows that only a tiny fraction of respondents (5%) is able to answer all eleven advanced literacy questions correctly, while the fraction of incorrect or 'do not know' responses on several questions is sizable. These are important findings; most life cycle models assume that consumers are well informed and have the skills to take financial decisions which optimize their expected lifetime utility. Instead, the findings in Tables 1A, 1B, 2A, and 2B show that financial literacy should not be taken for granted. These findings echo the results found in US surveys, such as the Health and Retirement Study and the Survey of Consumers (see Lusardi and Mitchell (2007c) for a review).

We summarize all of the information about financial literacy resulting from our two sets of questions into a financial literacy index. First, we combine the available information by performing a factor analysis on the sixteen questions in the financial literacy module. Consistent with the way we have devised the financial literacy questions, the factor analysis indicates there are two main factors with different loading on two types of questions: The simple literacy questions (first 5 questions) and the more advanced literacy questions (remaining 11 questions). We decided therefore to split the set of questions into two groups and perform a factor analysis on the two sets separately. In this way, we can construct two types of literacy indices: a first literacy index potentially related to basic knowledge (note that there are no questions in this set about the stock market or about stocks and bonds) and a second index measuring more advanced financial knowledge as well as knowledge related to stocks, the stock market and other financial instruments. In constructing the indices, we explicitly take into account the differences between 'incorrect' answers and 'do not know' answers (see appendix A). As already reported in Lusardi and Mitchell (2006), it is important to exploit this information to differentiate between degrees of financial knowledge. Details about the factor analysis and descriptive statistics on the relation

between literacy and age, gender and education are provided by Van Rooij, Lusardi and Alessie (2007).

Box 2. Advanced Literacy Questions

6) *Which of the following statements describes the main function of the stock market?* (i) The stock market helps to predict stock earnings; (ii) The stock market results in an increase in the price of stocks; (iii)The stock market brings people who want to buy stocks together with those who want to sell stocks; (iv) None of the above; (v) Do not know; (vi) Refusal.

7) *Which of the following statements is correct? If somebody buys the stock of firm B in the stock market:* (i) He owns a part of firm B; (ii) He has lent money to firm B; (iii) He is liable for firm B's debts; (iv) None of the above; (v) Do not know; (vi) Refusal.

8) *Which of the following statements is correct?* (i) Once one invests in a mutual fund, one cannot withdraw the money in the first year; (ii) Mutual funds can invest in several assets, for example invest in both stocks and bonds; (iii) Mutual funds pay a guaranteed rate of return which depends on their past performance; (iv) None of the above; (v) Do not know; (vi) Refusal.

9) *Which of the following statements is correct? If somebody buys a bond of firm B*: (i) He owns a part of firm B; (ii) He has lent money to firm B; (iii) He is liable for firm B's debts; (iv) None of the above; (v) Do not know; (vi) Refusal.

10) *Considering a long time period (for example 10 or 20 years), which asset normally gives the highest return*? (i) Savings accounts; (ii) Bonds; (iii) Stocks; (iv) Do not know; (vi) Refusal.

11*) Normally, which asset displays the highest fluctuations over time*? (i) Savings accounts; (ii) Bonds; (iii) Stocks; (iv) Do not know; (v) Refusal.

12) *When an investor spreads his money among different assets, does the risk of losing money:* (i) Increase; (ii) Decrease; (iii) Stay the same; (iv) Do not know; (v) Refusal.

13) *If you buy a 10-year bond, it means you cannot sell it after 5 years without incurring a major penalty*. *True or false*? (i) True; (ii) False); (iii) Do not know; (iv) Refusal.

(14) *Stocks are normally riskier than bonds*. True or false? (i) True; (ii) False; (iii) Do not know; (iv) Refusal.

(15) *Buying a company stock usually provides a safer return than a stock mutual fund. True or false?* (i) True; (ii) False; (iii) Do not know; (iv) Refusal.

(16) *If the interest rate falls, what should happen to bond prices*? (i) Rise; (ii) Fall; (iii) Stay the same; (iv) None of the above; (v) Do not know; (vi) Refusal.

3.2 Wealth and literacy

This paper aims at exploring a new potential explanation contributing to the heterogeneity in wealth holdings, i.e. the role of the apparent widespread differences in financial literacy. First, we look at the bivariate relationship. The middle and bottom part of Table 1 documents a strong increase in median net worth with basic and advanced literacy. The median net worth position of the top quartile of financially sophisticated individuals amounts to €185900 which is the quadruple of the median net worth position in the bottom advanced literacy quartile (€46700). Also the differences in wealth position across basic literacy quartiles are large - although somewhat smaller than for advanced literacy. These simple correlations suggest a strong, non-linear gradient between literacy and net worth.

Table 4 shows a similar pattern for several asset categories. Home ownership and investments in stocks, mutual funds and bonds are much more common among those who score high on the literacy scales. Nevertheless there are obvious differences between asset classes. While home ownership is also not uncommon among the most illiterate households, investments in individual stocks or bonds are almost absent within this subgroup. This evidence suggests that more literate households have more diversified portfolios or at least spread their wealth over a richer class of assets.

4. Wealth regressions

To further investigate the relation between wealth accumulation and financial sophistication, we start with a basic multivariate regression for total net worth and extend this specification by successively including additional information. Table 5 reports the results. First, we run an OLS regression of total net worth on our measure for basic financial skills and cognitive abilities. Other control variables include gender, age and education level of the respondent, household composition (marital status and the number of children within the household), household net disposable income, and a dummy for whether the respondent is retired. We have also included a dummy for being self-employed as entrepreneurs differ in many aspects from others and might behave accordingly (Hurst and Lusardi, 2004).

Age and income appear to be strongly significant (Table 5, column 1). Total net worth is increasing in age, especially for those respondents who are in the middle of their working career,

but also at the older ages.[9] Of course, based on a cross-section, we cannot disentangle age and cohort effects. Nevertheless, while it may be surprising that households hardly decumulate wealth after retirement this finding is conform earlier evidence based on panel data for the Netherlands (Kapteyn, Alessie and Lusardi, 2005; Alessie, Lusardi and Kapteyn, 1999). To capture complex, possibly non-linear effects of income on wealth accumulation, we have included a polynomial for the natural logarithm of net disposable household income with a linear, quadratic and cubic term. A one percent increase in household income – measured at mean levels of the control variables – is associated with an increase in total net worth by somewhat more than €1400.

Most interesting is the positive and significant effect of basic cognitive financial ability on total net worth. A unit increase in basic literacy goes together with about €12000 more wealth (the basic literacy measure itself has a zero mean and a standard deviation of one). Individuals with better cognitive abilities seem to be more likely to accumulate savings. Nevertheless, it is not immediately clear whether this is the result of better financial decisions because of the ability to collect and process information at low cost and effort or runs through its association to personal characteristics like risk aversion, time preference or overconfidence (see for example Christelis, Jappelli and Padula, 2007, for a discussion).

First, we examine the role of confidence in financial skills in relation to actual financial knowledge. In addition to financial ability, self-knowledge or misperceptions of one's own ability might assert an independent effect on financial outcomes. Persons who are overly modest about their financial skills might refrain from financial innovations and forego potential financial benefits. Insofar high confidence in one's personal skills leads to less conservative portfolio management it could have a positive impact on net worth. On the other hand, these people might get involved into complex products that they do not fully understand and could end up making financial mistakes with serious money at stake. In the literature of overconfidence, it is argued that individuals with too much trust in their own skills could be inclined to interpret and filter information in accordance with their own beliefs and might trade excessively (ending up with high trading costs and lower net investment returns). Barber and Odean (2000, 2001) for instance

[9] The increase in the 70 plus age group could also be partly related to different mortality rates depending upon the wealth position (Hurd, 1990).

provide evidence of overconfident investors trading excessively and ending up with lower returns.

At the start of our survey, we ask respondents '*How would you assess your understanding of economics (on a 7-points scale; 1 means very low and 7 means very high)?*' Based upon this self-assessment of economic literacy, we construct a relative measure of overconfidence. The self-reported literacy question and our basic ability index are not directly comparable due to the use of different scales, but do provide information on the relative position of respondents within the distribution of actual basic literacy and self-assessed literacy, respectively. We start with grouping both variables into four categories and rank the respondents accordingly from the top category to the lowest group. Thereafter, we create a dummy for overconfidence that equals unity if the respondents' self-assessed literacy ranking is higher than his classification for basic financial skills. In addition, we construct a dummy for relatively low confidence or underconfidence measuring whether the ranking on self-assessed literacy is more modest than warranted. Thereafter, we rerun the first wealth regression now including both dummies (the reference group being the respondents with a proper assessment of their skills). The construction of the confidence measures is explained in more detail in appendix A. Our main interest is whether the effect of basic financial ability on wealth accumulation is affected by the inclusion of the information on over- and underconfidence. The coefficient of basic financial capabilities remains significant and increases somewhat (Table 5, column 2).[10] The coefficient of overconfidence is negative albeit insignificant. Underconfidence however has a significant negative impact on net worth. Compared to persons with proper knowledge of their financial skills, these people do not seem to take full advantage of their capabilities.

Experimental evidence reveals that individuals with lower cognitive abilities are likely to be less risk tolerant and more impatient (Benjamin, Brown and Shapiro, 2006; Dohmen, Falk, Huffman and Sunde, 2007). To test whether the effect of cognitive ability runs through an association with risk attitude, we include a measure of risk aversion. In the annual DHS respondents are asked to indicate to what extent they agree with the following statement *'Investing in stocks is something I don't do, since it is too risky'*. The response scale runs from 1 to 7, where 1 corresponds to complete disagreement and 7 to complete agreement. Kapteyn and

[10] The number of observations has now decreased from 1091 to 1060 as, in constructing the measures for under and overconfidence, we ignore respondents answering 'do not know' when asked to assess their financial skills.

Teppa (2002) use this measure and show that it has more explanatory power in models of portfolio choice than measures of risk tolerance based on a series of hypothetical choices between uncertain streams of lifetime income as introduced by Barsky, Juster, Kimball, and Shapiro (1997). The regression results in Table 5 (column 3)[11] show that there is indeed an important role for risk aversion in explaining wealth heterogeneity, but the coefficient of basic financial skills is virtually unaffected.[12]

We subsequently test whether financial ability serves as a proxy for patience. We do not have direct information on time preferences, but we include information on smoking and drinking behavior as a proxy for myopic behavior as it is done in many other studies since the work by Fuchs (1980) on the relation between different types of health decisions and patience. We use information on whether people smoke and how often, and on whether they are heavy drinkers (more than four alcoholic drinks on average per day). We do not find any relation between net worth and these proxies for time preference and the coefficient of the basic financial literacy index remains virtually unaffected (Table 5, column 4)

In the next step, we investigate whether basic financial abilities could be a proxy for more advanced financial skills (as suggested by the results in Van Rooij, Lusardi and Alessie, 2007) and include a more advanced measure of financial sophistication. Indeed the effect of advanced literacy is strongly significant, reduces the coefficient on basic financial capacity and wipes out its significance (Table 5, column 5). The coefficient of advanced literacy is higher than the original effect of the basic capacity index and a unit increase in financial sophistication raises the household net worth position by €24000 on average. However, we need to be cautious with the interpretation of the OLS coefficient for financial sophistication. Where the financial ability index touches upon very basic cognitive skills that people more or less need on a daily basis (including questions on numeracy and a basic understanding of inflation and interest rates), the advanced literacy index includes questions on the working of stocks, bonds and mutual funds and thus addresses skills which for most people are not a necessity in daily transactions. It is conceivable that wealth management fosters the collection of a larger financial knowledge and

[11] The information on risk aversion and time preferences is available in the DHS modules on saving attitudes, income and health. Due to the merging process the total number of observations in our regression is reduced by 57 (even though we were able to retain some households by using information on time preferences and risk tolerance from adjacent years).

thus the coefficient could be biased upwards (simultaneity bias). On the other hand the measurement of advanced financial knowledge could be surrounded with substantial error and the coefficient on financial sophistication could also be biased to zero (attenuation bias). Indeed Van Rooij, Lusardi and Alessie (2007) provide evidence of the importance of slight variations in the wording of questions for responses patterns, which suggests that there is some guessing going on for questions that are apparently hard to grasp.

Therefore, we perform an IV regression including economics education as an instrument. This variable measures the exposure to education before entering the job market, It is based upon the answers to the question *'How much of your education was devoted to economics?'*, where response categories include the options 'a lot', 'some', 'little' and 'hardly at all'.[13] This information is unrelated to wealth, but has strong predictive power for financial literacy as shown by the test on instrument relevance in the first stage regression (Table 5, column 6). The F-value equals 13, clearly above 10 the value that is often recommended as a rule of thumb to be sure that problems due to weak instruments are avoided (Staiger and Stock, 1997). The estimation results show that the IV coefficient remains significant at the 5% level and increases substantially to €67000 suggesting that financial literacy is indeed measured with imprecision. The Hansen J-test on the validity of the overidentifying restrictions is not rejected. Overall, our estimates are in line with the hypothesis that financial sophistication is an important determinant for wealth accumulation also after accounting for information on attitudes and preferences which might be associated with the level of financial sophistication.

5. Extensions

One potential concern with our instrument is that accumulating wealth, and becoming literate or being exposed to economics education are choice variables depending on a common unobserved factor or another omitted variable. One possible candidate for a variable that drives literacy, education and wealth but is usually not available in wealth regressions is ability as some people are intrinsically more gifted by nature with talent and basic cognitive skills then others. For this reason, we maintain the basic literacy variable in the wealth regressions to control for

[12] As a robustness check we have included the Barsky et al. (1997) measure of risk tolerance as it has proved to be a valuable measure in other papers (e.g. Van Rooij, Prast and Kool, 2007), but it turned out to be insignificant confirming the results of Kapteyn and Teppa (2002).
[13] See appendix B for the precise wording.

cognitive ability. Carefulness is an example of an important common factor that is perhaps not sufficiently taken into account yet. Careful persons taking many precautions to prevent bad thing happening to them could be more likely to hold additional savings buffers and to invest in financial education as well to lower the probability to enter a debt situation or end up with financial problems. To explore this possibility we run two additional specifications including information from two separate questions on whether respondents consider themselves as a '*careful person*', and whether they *'take many precautions'*. The response scale runs from 1 (completely disagree) to 7 (completely agree). Appendix B reports the precise wording of these questions, which are available in a separate DHS module. By merging this information with our dataset we lose close to 300 observations. Due to the lower number of observations, the F-value of the joint significance of economics education in the first stage regression decreases to 6, but remains strongly significant. More importantly, Table 6A shows that the inclusion of the information on how careful the respondents are does not take anything away from the effect of financial sophistication on net worth. The coefficient remains significant at the 5% confidence level and even increases in value.

Another potential concern with respect to our result that financial sophistication leads to higher net wealth holdings is that net worth is a very heterogeneous concept. Although we have included controls for the impact of demographics, risk aversion, time preferences and confidence measures many other potential drivers of wealth heterogeneity could be related to financial sophistication - possibly in an unexpected way - and might influence the relation between financial literacy and the accumulation of savings. In this section we further exploit the richness of the DHS dataset to investigate whether the importance of the effect of financial sophistication is taken away once we control for alternative explanations of wealth dispersion.

One potential explanation for wealth heterogeneity is different appetites for saving. Venti and Wise (1998, 2000) eliminate successively lifetime earnings, chance events and investment choices as sufficient explanations for wealth inequality and conclude that a major driving factor must be unobserved heterogeneity in the taste for savings. Our dataset contains a direct proxy for the appetite for saving; we include the responses to the question on what respondents *'do with money that is left over after having paid for food, rent, and other necessities'*. The response scale runs from 1 to 7, where 1 means *'I like to spend all my money immediately'* and 7 means '*I want to save as much as possible'*. Exact wording and responses are reported in appendix B. Table 6B

(columns 1 and 2) indeed shows that across the board a higher taste for saving translates into higher accumulated savings. Being a crude proxy that perhaps could also serve as a measure of patience, the most important result from the table is that the magnitude and significance of the coefficient of financial sophistication is unaffected.

Another alternative measure for time preference can be obtained from the question whether people use a short or a long forward looking horizon in their spending decisions. Being a direct measure of patience and saving compared to the commonly used smoking and drinking proxies for time preference, the disadvantage is that responses to this question could already be conditioned on a number of other personal characteristics and background information. That said the estimates show that the responses have clear predictive value for wealth accumulation (Table 6B, columns 3 and 4). Nevertheless, the inclusion of this measure does not take away the effect of financial sophistication on net worth.

Self-control is indisputably an important factor in saving outcomes. No matter how much importance people attach to savings, if they have difficulties to withstand the short term temptations of consumption and cannot find ways to constrain their consumption behavior, they will hold accumulated savings below their target level. The question to respondents whether they find it difficult to control their expenditures (on a scale from 1 to 7 where 1 means '*very easy*' and 7 means '*very difficult*') appeals directly to problems of self-control. As expected self-control is a major determinant for wealth accumulation (Table 6C, columns 1 and 2). The difference in net worth between those who have little or no problems in controlling their expenses and those who recognize that this is a major challenge is as much as nearly €90000. The inclusion of self-control, however, does not fundamentally affect the relation between financial literacy and wealth accumulation.

The same is true if we take into account that bequest motives might be associated with vast differences in wealth accumulations. Although there is no a priori reason to believe that financial sophistication is related to the intention to leave bequests, the bequest motive might be an omitted variable explaining a large part of the variation in wealth accumulation. Indeed the empirical results suggest that some households apparently hold substantial amounts of their wealth for intentional bequests (Table 6C, columns 3 and 4). The positive impact of financial sophistication on net worth survives upon inclusion of the bequest motive: its magnitude and significance even increase somewhat.

In addition to these extensions we have incorporated a large number of variables which based upon the theoretical and empirical literature could principally account for part of the variation in net worth among households. To this end, we have utilized the rich dataset we have available by merging our dataset with information from other modules which sometimes inevitably leads to a loss of observations. At the same time the variables employed are sometimes simple, crude proxies but may serve at least as a first test for the underlying hypotheses. We have included several alternative health measures, the self-assessed probability of the respondent for survival until certain age levels to account for heterogeneity with respect to perceived longevity, income uncertainty, expectations regarding house price developments, the perceived likelihood of a future reduction in the generosity of the state pension, and the expected replacement rate (based upon state pension eligibility and mandatory employer company savings). The latter variable proxies annuitized pension wealth which is not part of the household net worth position. All these variables appear insignificant and do take away the effect of financial sophistication. Finally, we have tested the robustness of our results to other specifications of the wealth regression. Using net worth over permanent income as a dependent variable, where the latter variable follows from an auxiliary regression of income on a number of demographics, we find a positive and significant impact of financial sophistication on wealth.

6. Discussion

6.1 Financial sophistication and stock market participation

Given that financial sophistication increases household wealth holdings, it might be attractive from a public policy point of view to invest in financial education initiatives. To learn about what type of education programs might be most effective it is important to understand the mechanisms at work behind the relation between financial sophistication and net worth. We will explore two possible explanations related to the well documented limited stock market participation puzzle and to another puzzling fact in household finance, i.e. the lack of retirement planning.

Economic theory dictates that possibly except for a small proportion of households it is optimal to hold at least part of their wealth in the form of stocks (Haliassos and Bertaut, 1995). Investments in the stock market provide the opportunity to exploit the equity premium and to

benefit from risk diversification. International evidence on the composition of household portfolios shows that many households have no stocks at all in their wealth portfolio (Guiso, Haliassos and Jappelli, 2002). In our sample about a quarter of the households invest in stocks either direct or indirect via mutual funds. The limited participation in stock markets is mostly explained by transaction costs and the costs of processing information which create a threshold for entering the stock markets (Haliassos and Bertaut, 1995; Vissing-Jorgenson, 2004). In addition, it has been argued that households are either simply unaware of the opportunities to invest in stock markets or refrain from doing so due to a lack of trust (Guiso and Jappelli, 2005; Guiso, Sapienza and Zingales, 2008).

An increase in financial sophistication lowers information costs as well as impediments to participating due to a lack of knowledge or trust in the working of financial markets. Indeed, the regression results reported in Table 7 (columns 1 and 2) show that the probability to own stocks increases by 8 percentage points upon a one-standard deviation increase in the level of financial sophistication, and about 14 percentage points when we employ the IV approach correcting for measurement error in the index for financial sophistication as well as taking into account that one might improve financial knowledge in the process of investing in stocks. The regression results reported here include the same controls as the wealth regressions. They remain unaffected in other specifications and when we employ a variety of robustness checks (Van Rooij, Alessie and Lusardi, 2007).

The fact that financial knowledge boosts stock ownership provides an opportunity to exploit the risk premium on equity investments and might contribute to the positive effect of financial literacy on net worth. This is true regardless of the fact that some households may in fact be better off by not investing in the stock market due to excessive trading or a bad timing of transactions as the evidence in the finance literature shows that the vast majority of households investing in the stock market follow very passive investment strategies (see e.g. Ameriks and Zeldes, 2004).

6.2 Financial sophistication and retirement planning

A second potentially important channel for wealth accumulation is that financial sophistication is related to planning behavior. As an example, the model by Reis (2006) distinguishes inattentive consumers who do not plan and do not accumulate wealth from those

who do plan and thereby accumulate savings. Empirical evidence supports the assertion that planning affects wealth accumulation (Ameriks, Caplin and Leahy, 2003; Lusardi and Mitchell, 2007a). Planning is an inherently complex task requiring advanced cognitive skills and financial understanding. One needs to collect and process information from different sources on current and future income and expenditures and calculate savings needs based upon alternative scenarios. Thus, it is obvious that the effect of financial literacy on total net worth might be related to planning capabilities.[14] Indeed, Lusardi and Mitchell (2007b) report convincing evidence of financial sophistication fostering thinking about retirement. Lusardi and Mitchell (2008) document a positive relation between simple measures of financial knowledge and more specific measures of retirement planning related to the calculation of saving needs. In the following, we will take these two approaches a step further by relating the latter more concrete definition of retirement planning to well-developed measures of financial sophistication.

Our survey includes a series of questions on retirement planning developed by Lusardi and Mitchell (2006) and inserted in the 2004 wave of HRS. The precise wording and variation therein depending on marital status and employment status are reported in appendix B. The first question relates to the very first step in setting up a retirement plan: 'H*ave you ever tried to figure out how much your household would need to save for retirement?'*. Out of 1508 respondents 564 answered affirmatively and are labeled as 'simple' planners. The proportion of simple planners is comparable to the one found for US households in HRS 2004, although the latter figure is based on a sample of older households. Those respondents who answered 'yes', were given the next follow-up question *'Have you developed a plan for retirement saving?* The majority seems to have developed some sort of a retirement savings plan as 161 plus 299 respondents answered 'yes' or 'more or less', respectively. Out of this group of 'serious' planners, the large majority claims to have been successful in the sense that 169 plus 250 respond 'always' or 'mostly' to the third question *'How often have you been able to stick to this plan'*. The proportion of simple, serious and successful planners is roughly comparable to, albeit

[14] Even if people outsource much of the work to financial planners, they have to come up with a lot of information some of which is complex to retrieve and communicate (e.g. subjective information on their preferences and the uncertainty around the main scenario they foresee) and have to be financially smart enough to understand the implications of proposals by intermediaries to judge whether these plans indeed fit their needs best. Interestingly, multivariate regressions reveal that financial sophistication does not exert an independent effect on the probability of consulting a financial intermediary. Illiterate households do however rely significantly more often on the advice of friends and acquaintances when making important financial decisions (the results are not reported but available upon request)

somewhat higher than, the findings for US households in HRS 2004, although the latter is based on a sample of elderly households (Lusardi and Mitchell, 2006). The weighted percentage of simple, serious and successful planners in our sample equals 34.6, 27.6, and 25.1 respectively.

Descriptive statistics on retirement planning and demographics are reported in Tables 8 and 9. As expected, there is a strong correlation with age. The closer people get to retirement the more likely they are to start rethinking their retirement needs. No differences in planning activities between men and women come forward, while couples are more likely to be successful in executing their plans. While there is not much evidence that planning is related to education or basic literacy, there is a strong correlation with advanced financial literacy. The proportion of planners in the most literate group is almost double the number for households with the lowest level of financial understanding.

The relation between financial sophistication and simple retirement planning is confirmed in a multivariate regression analysis including the same explanatory variables as before (Table 7, columns 3 and 4). We report the outcomes of OLS and IV regressions, as we are cautious of possible simultaneity bias because one could become more financially educated in the process of calculating saving needs, and developing and executing a retirement plan. The IV-coefficients however suggest that the downward bias in the OLS coefficient due to imprecise measurement of financial sophistication is more important than the effect of planning on financial sophistication. A one standard deviation increase in financial sophistication increases the probability to plan for retirement with more than 20 percentage points. Another interesting result is the role of confidence. Those people who are very confident in their financial capabilities are more likely to start making calculations on how much they need to save for retirement purposes. This suggests that worries about their own financial skills and capacity to handle complex retirement savings decisions withhold people from attempting to calculate retirement savings needs and setting up plans.

Critics might argue that, in particular in the Netherlands, it is not clear that sophisticated persons decide to save more for retirement when they compare the expected retirement income with spending needs.[15] Informed people could as well come to the conclusion that they are currently holding more wealth than necessary and adjust their savings downward, since the

[15] Also for the US the conclusion - drawn in many studies - that retirement savings are insufficient is not undisputed (Scholz, Seshadri, and Khitatrakun, 2006).

Dutch pension system is known to be relatively generous and the vast majority of employees save via mandatory defined benefit retirement plans with mandatory pension contributions (Van Rooij, Kool and Prast, 2007). Nevertheless, research findings show that the replacement rates provided in Dutch mandatory pension system are in many cases below the expectations by households and insufficient to provide in the desired old age standard of living (Van Duijn, Lindeboom, Lundborg, and Mastrogiacomo, 2008; Binswanger and Schunk, 2008). This suggests that also in the Dutch system doing retirement calculations, and subsequently developing targets for spending and saving might help people overcoming problems of self-control and improving their wealth position.

6.3 Cost of ignorance

A question of major relevance for public policy decisions is whether the impact of financial sophistication on net wealth positions is not only statistically significant but also quantitatively meaningful, in other words. whether financial literacy really matters in economic terms. From the household's point of view it is important as well to know whether it is worthwhile to invest time, effort and financial resources in building up a high level of financial sophistication. The regression results that document a positive and statistically significant effect of financial literacy on wealth accumulation provide also a basis for some simple calculations on the difference in net worth associated with different levels of financial sophistication.

Table 10 reports the difference in net worth for individuals with lower and higher levels of financial sophistication based upon our estimate for the advanced literacy coefficient.[16] The table shows that a small increase in financial sophistication from just below the level of an average consumer to somewhat above the average, i.e. from the 45th to the 55th percentile of its distribution, increases net worth in expected terms by €11500. This certainly constitutes a non-negligible number as about 20 percent of the households in our sample have lower levels of total net worth. Wealth effects for larger improvements along the literacy distribution are even more substantial: the net worth difference associated with the 75th percentile of the financial literacy distribution up from the 25th percentile equals over €81000. Comparison with the median net worth level of about €120000 and the mean household net worth of less than two hundred

[16] In the calculations we use the coefficient and confidence interval for the effect of financial sophistication on wealth from the preferred specification among the regression in Table 5 (see column 6).

thousand euro makes clear that this type of wealth differences are associated with big jumps in the relative wealth position. The 95%-confidence interval surrounding this estimate ranges from €11500 to €150600 reflecting that the estimate of the coefficient of financial literacy is surrounded by substantial uncertainty. The net worth difference associated with an increase from the bottom to the top tail of the financial literacy distribution is estimated at over €200000. Note that these calculations do not take into account possible wealth effects of changes in risk attitude or other personal characteristics associated with higher levels of financial literacy.

Summarizing even though we have to recognize that our calculations provide crude approximations, it is clear that from a public policy point of view the wealth effects of financial sophistication are likely to be substantial. Also for households it seems attractive in terms of wealth holdings to invest in financial education insofar as these efforts boost financial skills. For the ultimate impact on personal welfare though it makes a difference whether the higher wealth holdings come from improved wealth management leading to the avoidance of financial mistakes and to higher portfolio returns or are the result of households being in a better position to control their expenses. The two channels described above suggest that both mechanisms are at work here. That said it is important to realize that any effect of financial education on household wealth is not instantaneous but needs time to materialize.

7. Concluding remarks

Household financial skills, their effect on decisions and the prevalence of financial mistakes have become an important topic in policy debates. It obvious that the management of a wealth portfolio nowadays requires more sophisticated knowledge and skills than say two or three decades ago. Not only have households become more and more responsible for their individual welfare, but at the same time the landscape of financial markets and products has dramatically changed; changes that have been characterized by a vast increase in complexity and possibilities. To the best of our knowledge, this is the first study on the relation between financial sophistication and wealth accumulation. Using explicit measures for the level of basic cognitive financial ability and more advanced measures of financial sophistication, we have documented empirical evidence of an independent positive effect from financial sophistication on wealth accumulation. This effect of financial sophistication on accumulated savings is robust across specifications and continuous to hold if we control for many other determinants of dispersion in

wealth holdings.

We have highlighted and documented evidence of two important channels that could drive this relation which is the fact that financially literate persons are more likely to invest in stocks and have a higher propensity to plan for retirement. We argue that this is the result of financial sophistication lowering the costs of collecting and processing information, and reducing planning costs. Thereby it facilitates the execution of financial decisions and brings down economic and psychological thresholds for participating in the stock market or calculating retirement savings needs and subsequently developing retirement plans. In addition, we have illustrated that the economic effects of changes in financial sophistication are likely to be substantial. Our estimates suggest that even small difference in financial sophistication are likely to be responsible for substantial differences in wealth holdings, but this figure easily extends to over €80000 for larger differences in financial sophistication (e.g. comparing the expected net worth difference associated with the 75^{th} and 25^{th} percentile for financial literacy).

Our study is complementary to the studies by Bernheim, Garret and Maki (2001), and Bernheim and Garrett (2003) who have shown that financial education in the US (either at high school or via seminars at the work place) exerted a positive impact on savings, but could not identify whether this effect runs via its influence on tastes for saving, via the provision of information and the supply of commitment devices, through a broad improvement in financial literacy and reduction in financial mistakes or worked mainly via peer effects. The latter might be the case if at least some students are stimulated to further enhance their financial education and neighbors, relatives, colleagues or others benefit via word-of-mouth information or community effects. Our work shows that financial sophistication does directly boost wealth accumulation, but this does not imply that the effect of financial education programs in indeed runs through an increase in financial literacy.[17] For this we need to separate the impact of several financial educating programs on financial ability and knowledge from other channels.

An alternative to financial education could be to consider and stimulate initiatives aiming to simplify complex decisions or to increase the transparency of markets and products. Ironically, firms have less of an incentive to come up with more transparent and simple products the larger the part of the population with low financial sophistication (Gabaix and Laibson,

[17] Interestingly, a further analysis shows that peer effects might indeed play an important role in financial behavior especially for those with less financial sophistication as they are more likely to consult friends and relatives as their most important source of information for advice on financial decisions.

2006). The idea is that these firms employ strategies to profit from less sophisticated individuals even if this means that part of these gains are used to subsidize financial sophisticated individuals who make optimal use of selling strategies to attract less sophisticated, more inattentive consumers.

From a policy perspective, the benefits of higher financial sophistication are clear. Our results show that financial sophistication leads to higher net worth levels, boosts the participation in the stock market and increases the propensity to plan for retirement. These effects are very much welcome as they all contribute to consumers being well equipped to take individual responsibility for their financial well being over the life cycle. An important issue that is beyond the scope of this paper but certainly warrants more study is how and to what extent financial sophistication can be stimulated and enhanced effectively.

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Appendix A. Measuring literacy and confidence

Basic and advanced financial literacy

The construction of the basic and advanced literacy index is explained in detail in a previous paper (Van Rooij, Lusardi and Alessie, 2007). In short, the basic literacy index follows from a factor analysis based on five simple questions. For each question, we create a binary dummy equal to unity if the respondent provides the correct answer. The five questions measure numeracy and the understanding of economic concepts (related to the working of inflation and interest rates) that are more or less necessary in day--to-day transactions. The index of advanced literacy is based on eleven questions about more advanced concept like the understanding of stocks and bonds, the relation between risk and return and the benefits of diversification. To do justice to the important role of do-not-know answers, we have created two binary dummies for each question, measuring whether the question is answered correctly, respectively whether the respondent indicated that he did not know the answer. The factor analysis on these 22 dummies clearly points to one factor that adequately describes the variation in responses. The procedure takes into account the fact that we have used minor variations in wording for three out of eleven questions to test the sensitivity of responses to these variations.

Overconfidence and underconfidence

At the beginning of our survey, we ask respondents to assess their own literacy. Table A.1 reports the exact wording of the question and the distribution of the responses. We have grouped the bottom three categories and the top two categories from the 7-points response scale to retrieve four categories with about equal size. We also divide the basic literacy index based on simple economic questions over four different groups and thereby try to mimic the size of the groups of the self-reported literacy groups. Thereby, we obtain a relative ranking of self-reported literacy and one for measured basic literacy. Those respondents that rank themselves higher than the rank we find for the basic literacy score are labeled overconfident and those who are modest about their financial skills compared to the actual measure of basic literacy are labeled underconfident. Both variables are binary dummies taking the value unity if the respondent is overconfident or underconfident, respectively, and zero otherwise. This way, we end up with 404 overconfident respondents, 599 underconfident respondents, 464 respondents with an equal ranking for actual and self-reported literacy, and 41 respondents with missing information because they did not answer the self-assessed literacy question. The fact that we obtain more relatively underconfident than overconfident persons is related to the fact that we are not able to match the group sizes exactly, since the top category for basic literacy is relatively large, containing the 677 respondents (out of 1508) who answer all five questions correctly.

Table A.1 Self-assessed literacy
Number and percentage of respondents

How would you assess your understanding of economics (on a 7-points scale; 1 means very low and 7 means very high)?	N	%
1 (very low)	9	0.60
2	56	3.71
3	137	9.08
4	366	24.27
5	499	33.09
6	355	23.54
7 (very high)	45	2.98
Do not know	31	2.06
Refusal	10	0.66
Total	1508	100.00

Appendix B. Wording of questions and construction of variables used in empirical work

This appendix provides information on important variables used in the regression analysis. The squared brackets in the retirement planning questions indicate the different wording used depending on the marital status of the respondent and depending on whether the respondent is retired or not.

Risk aversion
To what extent do you agree or disagree with the statement *'Investing in stocks is something I don't do, since it is too risky'* (on a scale from 1 to 7, where 1 means 'completely disagree' and 7 means 'completely agree')?

Completely disagree *Completely agree*
[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] 6 [ ] 7

This provides us with a measure of risk aversion. The reference group in the empirical work consists of those respondents who disagree completely (category 1).

Economics education
How much of your education was devoted to economics?

[ ] A lot
[ ] Some
[ ] Little
[ ] Hardly at all
[ ] Do not know
[ ] Refusal

The instrument variable *economics education in the past* is used in the regression analysis by including four dummy variables for the response categories 'some', 'little', 'hardly at all,' and 'do not know/refusal' respectively. The reference group consists of those respondents whose education was devoted 'a lot' to economics.

Taste for saving
Some people spend all their income immediately. Others save some money in order to have something to fall back on. Please indicate what you do with money that is left over after having paid for food, rent, and other necessities (on a scale from 1 to 7, where 1 means 'I like to spend all my money immediately' and 7 means 'I want to save as much as possible')?

I like to spend all my money immediately *I want to save as much as possible*
[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] 6 [ ] 7

The measure of *taste for saving* used in the regression analysis is constructed by grouping together the two lowest categories (very few respondents have chosen the lowest level), recoding the remaining six levels of *taste for saving* from 1 (quite low) to 6 (very high). The reference group in the empirical work consists of those respondents who like to spend all their money immediately (category 1).

Time preference
People use different time horizons when they decide about what part of the income to spend, and what part to save. Which of the time horizons mentioned below is in your household MOST important with regard to planning expenditures and savings?

[ ] The next couple of months
[ ] The next year
[ ] The next couple of years
[ ] The next 5 to 10 years
[ ] More than 10 years from now

The reference group in the empirical work consists of those respondents who state that the most important time horizon is shortest, i.e. the next couple of months (category 1).

Self-control
Do you find it difficult to control your expenditures? Please indicate how difficult you find this (on a scale from 1 to 7, where 1 means 'very easy' and 7 means 'very difficult')?

Very easy						*Very difficult*
[ ] 1	[ ] 2	[ ] 3	[ ] 4	[ ] 5	[ ] 6	[ ] 7

The measure of *self-control* used in the regression analysis is constructed by grouping together the two highest categories (very few respondents have chosen the highest level), recoding the remaining six levels of self-control from 1 (very easy) to 6 (quite difficult). The reference group in the empirical work consists of those respondents who find it very easy to control their expenditures (category 1).

Bequest motive
Please indicate which of the following four statements about parents leaving a bequest to their children would be closest to your own opinion about this?

[ ] If our children would take good care of us when we get old, we would like to leave them a considerable bequest
[ ] We would like to leave our children a considerable bequest, irrespective of the way they will take care of us when we are old
[ ] We have no preconceived plans about leaving a bequest to our children
[ ] We don't intend to leave a bequest to our children
[ ] None of the above-mentioned statements

Carefulness
To what extent do you agree or disagree with the statement *'I would describe myself as a careful person'* (on a scale from 1 to 7, where 1 means 'completely disagree' and 7 means 'completely agree')?

Completely disagree *Completely agree*
[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] 6 [ ] 7
[ ] Do not know
[ ] Refusal

The measure of *carefulness* used in the regression analysis is constructed by grouping together the two lowest categories (very few respondents have chosen the lowest category), recoding the remaining six levels of carefulness from 1 (quite low) to 6 (very high). The few respondents that have chosen 'do not know' are added to the last category. The reference group in the empirical work consists of those respondents who strongly disagree with the statement that they are careful person (category 1).

Precaution
To what extent do you agree or disagree with the statement 'When there is possible danger, I take many precautions' (on a scale from 1 to 7, where 1 means 'completely disagree' and 7 means 'completely agree')?

Completely disagree *Completely agree*
[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] 6 [ ] 7
[ ] Do not know
[ ] Refusal

The measure of *precaution* used in the regression analysis is constructed by grouping together the two lowest categories (very few respondents have chosen the lowest category), recoding the remaining six levels of precaution from 1 (quite low) to 6 (very high). The few respondents that have chosen 'do not know' are added to the last category. The reference group in the empirical work consists of those respondents who strongly disagree with the statement that they take many precautions (category 1).

Thinking about retirement
How much have you thought about retirement?

[ ] A lot
[ ] Some
[ ] Little
[ ] Hardly at all
[ ] Do not know
[ ] Refusal

In the regression analysis, we use a dummy which takes the value 1 if respondents have thought 'a lot' or 'some' about retirement, and 0 otherwise.

Simple planning
[Have you [or your husband/wife/partner] ever tried\Did you [or your husband/wife/partner] try] to figure out how much your household would need to save yourself for [retirement?/ before you retired?]

[ ] Yes
[ ] No
[ ] Do not know
[ ] Refusal

In the regression analysis, we use a dummy which takes the value 1 if respondents answered affirmatively and 0 otherwise.

Serious planning
[Have you\Did you] [or your husband/wife/partner] develop(ed) a plan for retirement saving?

[ ] Yes
[ ] More or Less
[ ] No
[ ] Do not know
[ ] Refusal

In the regression analysis, we use a dummy which takes the value 1 if respondents answered affirmatively and 0 otherwise.

Successful planning
How often [have you [and your husband/wife/partner] been\were you [and your husband/wife/partner]] able to stick to this plan: would you say always, mostly, rarely, or never?

[ ] Always
[ ] Mostly
[ ] Rarely
[ ] Never
[ ] Do not know
[ ] Refusal

In the regression analysis, we use a dummy which takes the value 1 if respondents answered affirmatively and 0 otherwise

Self-assessed literacy
How would you assess your understanding of economics (on a 7-points scale; 1 means very low and 7 means very high)?

Very low *Very high*
[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] 6 [ ] 7
[ ] Do not know
[ ] Refusal

The index *of self-assessed literacy* used in the regression analysis is constructed by grouping together the two lowest categories (very few respondents have chosen the lowest level), recoding the remaining six levels of self-assessed literacy from 1 to 6 and excluding 'do not know' answers and 'refusals.'

Table 1. Total net worth versus basic and advanced literacy
Thousands of euro (N=1091)

	Total net worth		
Total net worth	Median	Mean	Standard deviation
before trimming (N=1116)	119.7	184.3	279.3
after trimming	119.7	167.1	189.0
	Total net worth		
Basic literacy quartiles	Median	Mean	Standard deviation
1 (low)	43.9	117.2	162.3
2	98.8	150.2	164.7
3	111.2	156.5	173.6
4 (high)	142.8	195.7	209.3
	Total net worth		
Advanced literacy quartiles	Median	Mean	Standard deviation
1 (low)	46.7	100.1	121.2
2	82.0	129.3	151.0
3	112.4	167.5	181.4
4 (high)	185.9	236.3	228.4

Table 2A. Basic financial literacy
Weighted percentages of total number of respondents (N=1508)

	Numeracy	Interest compounding	Inflation	Time value of money	Money illusion
Correct	90.8	76.2	82.6	72.3	71.8
Incorrect	5.2	19.6	8.6	23.0	24.3
Do not know	3.7	3.8	8.5	4.3	3.5

Note: Correct, incorrect, and do not know responses do not sum up to 100% because of refusals.

Table 2B. Basic literacy: Summary of responses
Weighted percentages of total number of respondents (N=1508)

	Number of correct, incorrect and do not know answers (out of five questions)						
	None	1	2	3	4	All	Mean
Correct	2.3	2.8	6.7	15.1	32.8	40.2	3.94
Incorrect	45.2	35.7	13.6	4.4	1.1	0.0	0.81
Do not know	88.9	5.9	1.7	1.4	0.7	1.5	0.24

Note: Categories do not sum up to 100% because of rounding and means do not sum up to 5 due to refusals.

Table 3A. Advanced financial literacy
Weighted percentages of total number of respondents (N=1508)

	Correct	Incorrect	Do not know
Which statement describes the main function of the stock market? [1)]	67.0	12.9	19.7
What happens if somebody buys the stock of firm B in the stock market? [1)]	62.2	25.7	11.0
Which statement about mutual funds is correct? [1)]	66.7	11.1	21.7
What happens if somebody buys a bond of firm B? [1)]	55.6	17.8	26.4
Considering a long time period (for example 10 or 20 years), which asset normally gives the highest return: savings accounts, bonds or stocks?	47.2	30.1	22.3
Normally, which asset displays the highest fluctuations over time: savings accounts, bonds, stocks?	68.5	12.7	18.4
When an investor spreads his money among different assets, does the risk of losing money increase, decrease or stay the same?	63.3	17.4	19.0
If you buy a 10-year bond, it means you cannot sell it after 5 years without incurring a major penalty. True or false?	30.0	28.3	37.9
Stocks are normally riskier than bonds. True or false? [2)]	60.2	15.1	24.3
Buying a company fund usually provides a safer return than a stock mutual fund. True or false? [2)]	48.2	24.8	26.6
If the interest rate falls, what should happen to bond prices: rise/fall/stay the same/none of the above? [2)]	24.6	37.1	37.5

1) See exact wording in the text;
2) This question has been phrased in two different ways.
Note: Correct, incorrect and do not know responses do not sum up to 100% because of refusals.

Table 3B. Advanced literacy: Summary of responses
Weighted percentages of total number of respondents (N=1508)

	Number of correct, incorrect and do not know answers (out of eleven questions)												
	None	1	2	3	4	5	6	7	8	9	10	All	Mean
Correct	7.6	5.1	5.2	6.4	7.3	10.0	11.1	11.3	10.8	10.6	9.8	5.0	5.93
Incorrect	18.7	20.2	19.8	16.8	10.4	7.1	4.7	1.6	0.6	0.1	0.0	0.0	2.33
Do not know	44.2	11.4	8.0	6.1	5.1	3.7	4.1	4.2	2.8	3.2	3.5	3.6	2.65

Note: Categories do not sum up to 100% because of rounding and means do not sum up to 11 due to refusals.

Table 4. Asset ownership versus basic and advanced literacy
Weighted percentages (N=1116)

	% of households owning			
Basic literacy quartiles	Stocks	Mutual funds	Bonds	Home
1 (low)	2.4	5.6	1.9	40.5
2	9.7	17.6	3.8	53.4
3	10.2	16.5	3.0	54.4
4 (high)	18.1	23.9	6.1	60.8

	% of households owning			
Advanced literacy quartiles	Stocks	Mutual funds	Bonds	Home
1 (low)	2.0	6.5	1.4	44.6
2	5.0	11.8	1.2	44.8
3	14.2	18.5	5.0	56.0
4 (high)	25.2	33.1	8.8	70.9

Note: Percentages may not sum up to 100 due to rounding.

Table 5. Total net worth versus financial ability and financial literacy: multivariate regressions

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) IV
Advanced financial literacy index					23514***	67122**
					(4.86)	(2.28)
Basic financial literacy index	12328***	15804***	15712***	16694***	9050	-5129
	(3.42)	(3.37)	(3.08)	(3.17)	(1.64)	(-0.45)
Age dummy (30<age<=40)	26904**	24581**	22398*	20743	24756*	32198**
	(2.25)	(2.02)	(1.69)	(1.55)	(1.81)	(2.12)
Age dummy (40<age<=50)	72269***	72359***	74986***	76027***	77806***	81106***
	(5.42)	(5.34)	(5.20)	(5.24)	(5.31)	(5.24)
Age dummy (50<age<=60)	131181***	130456***	136511***	136072***	134470***	131499***
	(8.71)	(8.49)	(8.33)	(8.17)	(8.05)	(7.49)
Age dummy (60<age<=70)	143929***	144246***	152902***	151976***	150595***	148034***
	(7.01)	(6.94)	(7.25)	(7.18)	(7.11)	(6.71)
Age dummy (age>70)	166320***	161898***	168605***	169144***	169701***	170733***
	(6.31)	(5.88)	(6.15)	(6.16)	(6.17)	(6.08)
Intermediate vocational	18230	12666	12961	16282	12459	5368
	(1.37)	(0.93)	(0.92)	(1.14)	(0.87)	(0.35)
Secondary pre-university	10709	2851	4714	5994	-1197	-14533
	(0.65)	(0.18)	(0.28)	(0.35)	(-0.070)	(-0.76)
Higher vocational	25853*	22434	18835	17733	11324	-563
	(1.85)	(1.59)	(1.30)	(1.21)	(0.77)	(-0.034)
University	37059**	35853*	26112	25821	16848	208
	(1.98)	(1.88)	(1.32)	(1.30)	(0.84)	(0.0094)
Male	-7952	-10204	-20710**	-19907*	-26884**	-39823***
	(-0.81)	(-1.02)	(-1.97)	(-1.84)	(-2.49)	(-3.01)
Married	30905***	26639**	24494**	22754*	24778**	28533**
	(2.72)	(2.29)	(2.08)	(1.89)	(2.07)	(2.28)
Number of children	10285*	11166*	10199	10687*	11424*	12790**
	(1.70)	(1.80)	(1.59)	(1.66)	(1.79)	(1.99)
Retired	45437**	45454**	42855**	43503**	41651**	38215*
	(2.16)	(2.11)	(2.03)	(2.06)	(1.98)	(1.78)
Self-employed	26205	25016	25300	26025	24797	22520
	(1.17)	(1.12)	(1.04)	(1.07)	(1.03)	(0.93)
Ln(household income)	-3277982***	-3261105***	-3062710***	-3066220***	-3011077***	-2908803***
	(-3.76)	(-3.72)	(-3.69)	(-3.68)	(-3.57)	(-3.28)
Ln(household income)^2	315864***	314721***	297871***	299340***	293782***	283474***
	(3.71)	(3.67)	(3.67)	(3.66)	(3.57)	(3.30)
Ln(household income)^3	-9676***	-9648***	-9179***	-9261***	-9084***	-8754***
	(-3.51)	(-3.45)	(-3.48)	(-3.48)	(-3.40)	(-3.17)
High confidence		-10738	-9253	-8685	-9829	-11951
		(-0.79)	(-0.66)	(-0.61)	(-0.70)	(-0.84)
Low confidence		-26368**	-21614*	-23286*	-19605	-12778
		(-2.15)	(-1.70)	(-1.83)	(-1.55)	(-0.94)
Risk aversion dummy 2 (low)			-1181	-3888	-8001	-15629
			(-0.043)	(-0.14)	(-0.29)	(-0.57)
Risk aversion dummy 3			-16204	-21340	-23968	-28841
			(-0.65)	(-0.86)	(-0.97)	(-1.17)
Risk aversion dummy 4			-30789	-35329	-33869	-31162
			(-1.24)	(-1.41)	(-1.36)	(-1.23)
Risk aversion dummy 5			-13917	-16025	-19345	-25502
			(-0.53)	(-0.60)	(-0.74)	(-0.99)

Risk aversion dummy 6			-55402**	-57751**	-54037**	-47149**
			(-2.41)	(-2.51)	(-2.37)	(-1.98)
Risk aversion dummy: very high			-64013***	-66105***	-60545***	-50234**
			(-2.85)	(-2.93)	(-2.71)	(-2.07)
Smoking: every now and then				-20230	-18589	-15544
				(-1.22)	(-1.15)	(-0.95)
Smoking: daily (< 20 cigarettes)				-6861	-5978	-4339
				(-0.39)	(-0.34)	(-0.25)
Smoking: daily (>= 20 cigarettes)				-20227	-21097	-22711
				(-0.73)	(-0.76)	(-0.82)
Drinking: daily (> 4 drinks)				-966	-1802	-3353
				(-0.040)	(-0.076)	(-0.15)
Constant	10880396***	10818615***	10088240***	10066777***	9897789***	9584366***
	(3.67)	(3.65)	(3.58)	(3.56)	(3.45)	(3.15)
Observations	1091	1060	1013	1003	1003	1003
R-squared	0.32	0.32	0.34	0.34	0.35	0.32
p-value test age=0	0.00	0.00	0.00	0.00	0.00	0.00
p-value test education=0	0.26	0.27	0.61	0.64	0.81	0.84
p-value test income=0	0.00	0.00	0.00	0.00	0.00	0.00
p-value test confidence=0		0.10	0.24	0.18	0.30	0.56
p-value test risk aversion=0			0.00	0.00	0.01	0.48
p-value test smoking, drinking=0				0.74	0.77	0.83
p-value Hansen J test						0.30
F-statistic first stage regression						13.0
p-value exogeneity test						0.18

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. The dependent variable is net worth. The most risk tolerant, none smoking and moderately drinking (4 alcoholic drinks or less a day) respondents are in the reference group. The advanced literacy index has been instrumented using dummy variables indicating how much the respondent's education was devoted to economics. The reference group consists of those respondents whose education was devoted a lot to economics.

Table 6A. Total net worth regressions: including carefulness and precaution

	(1) OLS	(2) IV	(3) OLS	(4) IV
Advanced financial literacy index	24139***	92061**	25390***	96858**
	(4.03)	(2.19)	(4.26)	(2.33)
Basic financial literacy index	10023	-12794	10813*	-13227
	(1.60)	(-0.82)	(1.68)	(-0.85)
Carefulness dummy 2 (low)	-43822	-40941		
	(-1.18)	(-1.13)		
Carefulness dummy 3	-50935	-33725		
	(-1.48)	(-0.97)		
Carefulness dummy 4	-10235	3741		
	(-0.30)	(0.11)		
Carefulness dummy 5	6059	10025		
	(0.17)	(0.29)		
Carefulness dummy 6 (very high)	-6969	-8211		
	(-0.19)	(-0.23)		
Precaution dummy 2 (low)			24382	1035
			(0.64)	(0.024)
Precaution dummy 3			7903	5677
			(0.24)	(0.16)
Precaution dummy 4			25802	16869
			(0.80)	(0.48)
Precaution dummy 5			19022	5463
			(0.59)	(0.15)
Precaution dummy 6 (very high)			29969	29647
			(0.88)	(0.82)
Demographics (see table 5)	yes	yes	yes	yes
Observations	721	721	721	721
R-squared	0.38	0.31	0.37	0.29
p-value test carefulness=0	0.00	0.03		
p-value test precaution=0			0.80	0.78
p-value Hansen J test		0.14		0.15
F-statistic first stage regression		6.24		6.12
p-value exogeneity test		0.12		0.10

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. The dependent variable is net worth. The reference group in the first two columns contains those respondents who strongly disagree with the statement that they consider themselves as a careful person. The reference group in the last two columns contains those respondents who strongly disagree with the statement that they take many precautions. The advanced literacy index has been instrumented using dummy variables indicating how much the respondent's education was devoted to economics. The reference group consists of those respondents whose education was devoted a lot to economics.

Table 6B. Total net worth: including taste for saving and alternative time preferences

	(1) OLS	(2) IV	(3) OLS	(4) IV
Advanced financial literacy index	20951***	63127**	23189***	64954**
	(4.40)	(2.15)	(4.85)	(2.21)
Basic financial literacy index	6763	-6445	10022*	-3589
	(1.21)	(-0.58)	(1.81)	(-0.31)
Taste for saving dummy 2 (low)	41138**	31847		
	(2.20)	(1.61)		
Taste for saving dummy 3	52947***	47649***		
	(3.18)	(2.76)		
Taste for saving dummy 4	68209***	61623***		
	(4.37)	(3.79)		
Taste for saving dummy 5	100078***	86603***		
	(5.94)	(4.53)		
Taste for saving dummy 6 (very high)	68491***	57392***		
	(3.42)	(2.62)		
Time preference: horizon 3-12 months			663	-939
			(0.053)	(-0.074)
Time preference: horizon 1-5 years			32813**	33408***
			(2.56)	(2.59)
Time preference: horizon 5-10 years			55025***	52812***
			(2.67)	(2.59)
Time preference: horizon > 10 years			60375**	55111**
			(2.32)	(2.08)
Demographics (see table 5)	yes	yes	yes	yes
Observations	1003	1003	1003	1003
R-squared	0.37	0.34	0.37	0.34
p-value taste for saving=0	0.00	0.00		
p-value test time preference=0			0.00	0.00
p-value Hansen J test		0.33		0.26
F-statistic first stage regression		12.6		13.0
p-value exogeneity test		0.20		0.22

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. The dependent variable is net worth. The reference group in the first two columns contains those respondents with a very low taste for saving. The reference group in the last two columns contains those respondents with a very sort time horizon (a couple of months). The advanced literacy index has been instrumented using dummy variables indicating how much the respondent's education was devoted to economics. The reference group consists of those respondents whose education was devoted a lot to economics.

Table 6C. Total net worth regressions: including self-control and bequest motives

	(1) OLS	(2) IV	(3) OLS	(4) IV
Advanced financial literacy index	21539***	63363**	18918***	71014**
	(4.47)	(2.18)	(4.04)	(2.45)
Basic financial literacy index	5950	-7420	8797	-7154
	(1.06)	(-0.66)	(1.63)	(-0.66)
Self-control dummy 2 (quite easy)	-13081	-9695		
	(-0.79)	(-0.58)		
Self-control dummy 3	-43830**	-35643*		
	(-2.45)	(-1.84)		
Self-control dummy 4	-47582**	-39237*		
	(-2.46)	(-1.95)		
Self-control dummy 5	-68355***	-58363***		
	(-3.86)	(-2.99)		
Self-control dummy 6 (quite difficult)	-88070***	-86862***		
	(-4.48)	(-4.41)		
Dummy bequest motive: yes			106732***	103244***
			(4.81)	(4.66)
Dummy bequest motive: no			-12838	-10935
			(-0.88)	(-0.73)
Dummy bequest motive: other			-57490***	-32600
			(-2.87)	(-1.26)
Demographics (see table 5)	yes	yes	yes	yes
Observations	1003	1003	1003	1003
R-squared	0.37	0.34	0.40	0.36
p-value taste self-control=0	0.00	0.00		
p-value test bequest motive=0			0.00	0.00
p-value Hansen J test		0.21		0.29
F-statistic first stage regression		13.4		12.8
p-value exogeneity test		0.23		0.08

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. The dependent variable is net worth. The reference group in the first two columns contains those respondents who find it very easy to control their expenditures. The reference group in the last two columns contains those respondents who do not have children. The advanced literacy index has been instrumented using dummy variables indicating how much the respondent's education was devoted to economics. The reference group consists of those respondents whose education was devoted a lot to economics.

Table 7. Stock market participation and retirement planning versus financial ability and financial literacy

	Stock ownership		Simple retirement planning	
	(1) OLS	(2) IV	(3) OLS	(4) IV
Advanced financial literacy index	0.080***	0.14**	0.072***	0.25***
	(6.54)	(1.98)	(4.13)	(2.66)
Basic financial literacy index	0.034**	0.015	0.031*	-0.026
	(2.40)	(0.54)	(1.79)	(-0.71)
Dummy (30<age<=40)	0.026	0.036	0.026	0.056
	(0.54)	(0.73)	(0.43)	(0.89)
Dummy (40<age<=50)	0.11**	0.11**	0.084	0.097
	(2.27)	(2.36)	(1.39)	(1.62)
Dummy (50<age<=60)	0.090*	0.086*	0.18***	0.17***
	(1.89)	(1.79)	(2.99)	(2.77)
Dummy (60<age<=70)	0.18***	0.17***	0.16**	0.15**
	(3.02)	(3.01)	(2.16)	(2.04)
Dummy (age>70)	0.27***	0.27***	0.052	0.056
	(3.95)	(4.03)	(0.62)	(0.69)
Intermediate vocational	-0.0033	-0.013	0.0029	-0.026
	(-0.091)	(-0.34)	(0.062)	(-0.49)
Secondary pre-university	-0.018	-0.036	-0.0081	-0.062
	(-0.43)	(-0.77)	(-0.15)	(-1.02)
Higher vocational	0.026	0.0099	-0.033	-0.080
	(0.73)	(0.25)	(-0.74)	(-1.57)
University	0.022	-0.00065	0.073	0.0064
	(0.48)	(-0.012)	(1.31)	(0.095)
Male	-0.034	-0.052	-0.061*	-0.11**
	(-1.24)	(-1.54)	(-1.79)	(-2.55)
Married	-0.033	-0.028	-0.032	-0.017
	(-1.10)	(-0.93)	(-0.87)	(-0.44)
Number of children	0.011	0.013	0.017	0.022
	(0.74)	(0.86)	(0.92)	(1.20)
Retired	-0.027	-0.031	0.034	0.020
	(-0.54)	(-0.65)	(0.54)	(0.32)
Self-employed	-0.022	-0.025	0.0090	-0.000095
	(-0.34)	(-0.39)	(0.13)	(-0.0012)
Ln(household income)	-1.46	-1.32	-0.13	0.28
	(-0.92)	(-0.84)	(-0.050)	(0.092)
Ln(household income)^2	0.14	0.13	0.029	-0.012
	(0.96)	(0.87)	(0.12)	(-0.043)
Ln(household income)^3	-0.0044	-0.0039	-0.0013	0.0000036
	(-0.94)	(-0.84)	(-0.16)	(0.00039)
High confidence	0.013	0.0097	0.14***	0.13***
	(0.35)	(0.27)	(3.35)	(2.98)
Low confidence	-0.036	-0.027	-0.048	-0.021
	(-1.17)	(-0.83)	(-1.30)	(-0.51)
Risk aversion dummy 2 (low)	0.12**	0.11*	0.0085	-0.022
	(2.06)	(1.93)	(0.13)	(-0.32)
Risk aversion dummy 3	-0.040	-0.046	0.023	0.0034
	(-0.61)	(-0.73)	(0.34)	(0.050)
Risk aversion dummy 4	-0.17***	-0.16***	0.017	0.028
	(-2.80)	(-2.79)	(0.27)	(0.43)

Risk aversion dummy 5	-0.26***	-0.27***	0.017	-0.0078
	(-4.11)	(-4.33)	(0.24)	(-0.11)
Risk aversion dummy 6	-0.38***	-0.37***	-0.052	-0.025
	(-7.17)	(-6.97)	(-0.85)	(-0.38)
Risk aversion dummy: very high	-0.39***	-0.38***	-0.010	0.031
	(-7.61)	(-7.19)	(-0.17)	(0.48)
Smoking: now and then	-0.030	-0.025	-0.046	-0.034
	(-0.56)	(-0.47)	(-0.69)	(-0.48)
Smoking: daily (1-20 cigarettes)	0.025	0.027	0.0100	0.017
	(0.62)	(0.68)	(0.20)	(0.33)
Smoking: daily (> 20cigarettes)	0.056	0.054	-0.096	-0.10
	(0.90)	(0.88)	(-1.30)	(-1.28)
Drinking: daily (> 4 glasses)	0.062	0.060	-0.024	-0.030
	(1.23)	(1.18)	(-0.37)	(-0.46)
Constant	4.91	4.48	0.061	-1.20
	(0.89)	(0.81)	(0.0068)	(-0.11)
Observations	1003	1003	1003	1003
R-squared	0.29	0.28	0.07	-0.01
p-value test age=0	0.00	0.00	0.01	0.06
p-value test education=0	0.85	0.87	0.38	0.32
p-value test income0	0.00	0.00	0.46	0.78
p-value test confidence=0	0.35	0.61	0.00	0.00
p-value test risk aversion=0	0.00	0.00	0.84	0.93
p-value test smoking, drinking=0	0.60	0.63	0.68	0.71
p-value Hansen J test		0.58		0.25
F-statistic first stage regression		13.0		13.0
p-value exogeneity test		0.38		0.06

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Dependent variables are 0-1 dummies indicating whether respondents own stocks or mutual funds respectively have tried to calculate saving needs for retirement. The most risk tolerant, none smoking and moderately drinking (4 alcoholic drinks or less a day) respondents are in the reference group. The advanced literacy index has been instrumented using dummy variables indicating how much the respondent's education was devoted to economics. The reference group consists of those respondents whose education was devoted a lot to economics.

Table 8. Retirement planning across demographics
Weighted household percentages

	Percentage of planners			
Education	Simple	Serious	Successful	N
Primary	20.6	16.9	15.9	67
Preparatory intermediate voc.	37.3	27.6	25.1	345
Intermediate vocational	33.0	26.2	22.7	295
Secondary pre-university	33.1	26.6	23.1	207
Higher vocational	35.5	30.8	29.1	397
University	39.8	29.9	28.9	197
Pearson chi2(5)	9.50	3.37	4.75	
p-value	0.09	0.64	0.45	
Age	Simple	Serious	Successful	N
21-30 years	24.8	18.5	14.9	179
31-40 years	30.0	23.0	21.8	306
41-50 years	34.6	27.1	24.8	333
51-60 years	45.4	36.7	34.0	311
61-70 years	34.8	28.4	25.3	217
71 years and older	34.4	28.9	27.0	162
Pearson chi2(5)	23.4	19.7	19.8	
p-value	0.00	0.00	0.00	
Gender	Simple	Serious	Successful	N
Female	32.6	26.5	24.4	674
Male	36.6	28.4	25.7	834
Pearson chi2(1)	0.42	0.03	0.02	
p-value	0.52	0.86	0.88	
Marital status	Simple	Serious	Successful	N
Single/divorced/widow	0.323	0.237	0.213	
Married/living together	0.364	0.304	0.279	476 1032
Pearson chi2(1)	1.59	3.35	4.04	
p-value	0.21	0.07	0.04	

Note: Percentages may not sum up to 100 due to rounding.

Table 9. Retirement planning versus literacy
Weighted household percentages

	Percentage of planners			
Basic literacy	Simple	Serious	Successful	N
1 (low)	31.9	23.8	21.7	217
2	33.7	27.9	22.9	284
3	31.4	26.4	24.0	350
4 (high)	38.1	29.5	28.2	657
Pearson chi2(3)	1.95	0.94	3.62	
p-value	0.58	0.82	0.31	
Advanced literacy	Simple	Serious	Successful	N
1 (low)	24.5	19.9	18.6	330
2	31.8	22.9	20.9	354
3	38.2	31.7	28.3	371
4 (high)	44.1	35.5	32.5	453
Pearson chi2(3)	32.6	22.9	20.6	
p-value	0.00	0.00	0.00	
Self-assessed literacy	Simple	Serious	Successful	N
1 (very low)	53.4	44.1	44.1	9
2	33.3	17.8	15.0	56
3	21.2	17.3	16.2	137
4	26.7	20.3	16.1	366
5	37.0	30.7	28.2	499
6	45.7	37.7	36.1	355
7 (very high)	51.4	42.7	41.5	45
Do not know	17.6	10.2	10.2	31
Refusal	27.2	13.9	13.9	10
Pearson chi2(8)	48.6	43.6	49.9	
p-value	0.00	0.00	0.00	

Note: Percentages may not sum up to 100 due to rounding.

Table 10. Net worth differences associated with different levels of financial sophistication

Improvement within financial literacy distribution (percentiles)		Simulated net worth difference (thousands of euro)	
From	To	Expected	95%-confidence interval
45	55	11,5	(1,6 -21,4)
40	60	24,1	(3,4 -44,8)
25	75	81,1	(11,5-150,6)
10	90	181,6	(25,8-337,5)
5	95	220,9	(31,3-410,5)
1	99	251,1	(35,6-466,5)

Note: the expected net worth difference and its 95%-interval are derived from the estimate and its 95%-confidence interval for the coefficient on advanced financial literacy in the IV specification from Table 5, keeping the values of all other variables unchanged.