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Skilled but unaware of it:
Occurrence and potential long-term effects of females' financial
underconfidence

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Abstract

This study examines actual and perceived financial sophistication (i.e., financial literacy and confidence) and its relation with individuals' current financial market participation and future-oriented financial planning. Using survey data from the German SAVE initiative, we find strong gender- and education-related differences in the distribution of the two variables: Whereas financial literacy rises in formal education, confidence increases in education for men but decreases for women. As a consequence, highly-educated women become strongly underconfident, while men remain overconfident. We show that these differences influence financial engagement: The financial decisions of highly-educated men benefit strongly from their excess confidence. Highly-educated women, in contrast, gain from their strong actual financial literacy with regard to current financial market participation, but their underconfidence impairs their long-term financial planning.

JEL Classification: D91, G11, D83, J26

Keywords: Household finance, behavioral finance, financial sophistication, financial literacy, confidence, wealth, gender, formal education

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1 Introduction

Recent technical advances and market liberalization processes have strongly raised the complexity of the financial environment that consumers face today. At the same time, changes to social security and pension systems have left private individuals with much higher responsibility for their own financial well-being. Fuelled by the widespread losses in the financial crisis 2007/08, many observers have therefore begun to question whether consumers possess the necessary knowledge and competence to make increasingly complex but important financial decisions (Mishkin, 2008). Using a fairly standardized set of multiple-choice questions to measure financial literacy, various studies indicate that a large fraction of the population indeed lacks basic financial knowledge and that this severely hampers their financial engagement (Bernheim et al., 2001; Bernheim and Garrett, 2003; Lusardi and Mitchell, 2007; Lusardi and Mitchell, 2011). In this respect, financial (il)literacy has been linked to retirement planning (Lusardi and Mitchell, 2007; Lusardi and Mitchell, 2008; Van Rooij et al., 2012), stock market participation (Van Rooij et al. 2011; Balloch et al. 2015), wealth accumulation (Behrman et al., 2012; Gustman et al., 2012), debt accumulation (Lusardi and Tufano, 2015), and risk (Lusardi, 2015).

Only recently have scholars begun to argue that the self-perception of financial sophistication might be an additional factor influencing financial behavior. As a reflection of an individual's (subjective) confidence in the (objective) factual knowledge, efficacy beliefs have long been shown to be closely linked to the level of performance in a non-financial context (Bandura and Locke, 2003). Regarding complex financial decisions with infrequent and noisy feedback, it is particularly likely that individuals hold permanently distorted perceptions of their own financial abilities (Butler et al., 2008). As a matter of fact, the correlation between actual and perceived financial sophistication has been found to be rather weak (Parker et al., 2012). The resulting over- or underconfidence may therefore reasonably be expected to play an individual role for individuals' financial decision-making. Indeed, perceived financial knowledge has been shown to have a stronger impact on a large number of financial decisions than actual financial literacy (Allgood et al., 2016; Anderson et al., 2016). Kramer (2016) furthermore finds that individuals with higher confidence are less likely to seek formal advice and Van Rooij, Lusardi, and Alessie (2012) show that overconfidence is not significantly associated with wealth, whereas underconfidence has a negative effect on wealth.

While the potential deviation between actual and perceived financial sophistication and its consequences for financial decisions have been investigated recently, structural characteristics of the actual-perceived gap in the finance context have hardly been examined so far. This is particularly surprising since many structural properties of financial literacy and confidence, when considered in isolation, are well known. As such, it is a persistent finding in the literature that financial illiteracy is particularly severe among women (Bucher-Koenen et al., 2016) and that women are also less confident in their financial knowledge (Lusardi and Mitchell, 2011; Lusardi and Mitchell,

2014; Bucher-Koenen et al., 2016). Furthermore, cognitive abilities measured by formal education have been shown to be strongly correlated with financial literacy (Hastings et al., 2013; Barboza et al., 2014), though there is hardly any evidence of the link between education and confidence in the finance context. There is, however, a large literature in psychology that explains the gap between actual and perceived ability with lacking metacognitive skills. Dunning and Kruger’s (1999) “Unskilled and unaware of it”-phenomenon refers to low-skilled individuals who lack the capacity to recognize their ineptitude and therefore display tremendous overconfidence. In addition, self-confidence has been shown to be inherently endogenous, induced by the consequences of one’s actions. This gives rise to a self-serving attribution bias as the tendency to attribute success to the self and failure to external causes (Heider, 1976). The self-attribution bias not only appears to be a robust and pervasive phenomenon in human cognition (Zuckerman, 1979; Sedikides and Strube, 1995), but also varies along with age, gender and stereotypical task context. As a consequence, middle-aged men are reported to be much more overconfident than women, in particular with respect to masculine tasks relating to, e.g., math, science or finance (Mezulis et al., 2004; Niederle and Vesterlund, 2007; Jakobsson et al., 2013; Hoffmann and Post, 2014).¹ At the same time, the so-called impostor phenomenon that leads individuals to externalize success and attribute failure internally (Thompson et al., 1998) has been shown to be particularly pervasive among high-achieving women (Clance and Imes, 1978; Kumar and Jagacinski, 2006).

Both gender and metacognitive skills have thus been extensively discussed in relation with the actual-perceived knowledge gap outside the finance context. However, they have not yet received much attention in the literature on household finance, nor have they been considered in combination. This is where our study contributes: We show that both the gap between actual and perceived financial sophistication and its effect on financial decisions are dependent on gender and formal education as a proxy for metacognitive ability. A detailed understanding of the relation between these structural characteristics on the one hand and financial knowledge and behavior on the other is a prerequisite for developing financial education programs that are tailored to the needs of the individual. This is particularly important for women, who, due to divorce or widowhood, still bear a much higher risk of hitting poverty in old age than men (Smeeding and Sandstrom, 2005). Our work hence aims at furthering our understanding of the effects of actual and perceived financial knowledge on financial behavior by segmenting individuals along the two dimensions, their gender and education.

Based on a large survey dataset from SAVE, a representative panel of German households, we derive four main sets of results. The first considers the development of financial literacy and confidence over different educational levels of survey respondents. We observe that with rising education, financial literacy increases - with a stronger effect for women than for men. The confidence

¹Hoffmann and Post (2014) give rise to the assumption that the self-attribution bias is also of relevance in the context of consumer financial decision-making. However, they do not consider gender differences.

regarding this knowledge, however, increases in education only for male respondents but decreases for female respondents. As a consequence, women with higher than basic education are shown to be strongly underconfident of their actual financial knowledge. Men, in contrast, are found to consistently overestimate their expertise, though their overconfidence decreases in education.

Our second set of results relates actual and perceived financial sophistication with the decision to participate on financial markets. We show that financial literacy is positively associated with market participation for both gender. Interestingly, the positive impact of financial literacy is much higher for women than for men. It furthermore increases in women’s educational attainment but decreases in men’s and even loses significance for highly-educated men. Confidence, in contrast, raises the probability of market participation only for men with higher than basic education and seems to substitute the effect of financial literacy for male respondents with the highest educational level. Hence, perceived financial sophistication plays an important role for the financial market participation of highly-educated men, but for women and lowly-educated men only actual financial knowledge appears to be relevant.

Third, we examine future-oriented financial planning behavior, i.e., whether respondents save regularly and whether they report awareness of their saving needs for retirement. In contrast to the results on current financial market participation, we find the impact of confidence to be much stronger. We observe that both men’s and women’s financial planning are positively affected by their confidence if they attained sufficiently high education. While this effect complements the impact of financial literacy for highly-educated women, it again substitutes the effect of actual knowledge for men with highest educational attainment.

We finally study the discrepancy between actual and perceived financial sophistication - i.e., the over- respectively underconfidence of respondents - and its impact on financial engagement. For this, we employ a numerical score of the discrepancy as a proxy of “unjustified confidence”.² In contrast to much of the earlier literature, our results show that unjustified confidence does not necessarily lead to undesirable outcomes:³ We rather find that highly-educated men profit significantly from their overconfidence, in that they are able to engage more strongly on financial markets and plan more actively for their financial future with increasing overconfidence. Highly-educated women, in contrast, are at a disadvantage from their underconfidence with respect to financial planning but there is no significant association between their underconfidence and current financial market participation.

²Our results hence lend themselves to more detailed interpretations than earlier work that use dummy variables to categorize respondents into the groups of over- oder underconfident individuals (Allgood and Walstad, 2016; Kramer, 2016; Bannier and Neubert (2016)).

³Our results hence support the findings by Parker et al. (2012). However, as Guiso and Viviano (2015) point out, the distinction between good or bad financial decisions is often less than clear. As such, we cannot immediately claim that financial engagement, e.g. stock market participation, corresponds to “better” financial decisions than non-participation in financial markets.

The case for improving financial literacy has strongly gained ground over the last years with various implications for schooling, further training, and counselling.⁴ Our work demonstrates that confidence with respect to financial matters also plays a non-negligible role in financial decision making. This role appears to be particularly relevant for highly-educated individuals and for decisions regarding future-oriented financial planning. Since higher financial literacy and higher confidence do not necessarily go hand in hand, as we show, it is important to strengthen financial confidence in its own right for securing financial well-being and independence.⁵ This holds especially for highly-educated women whose financial planning suffers from their acute underconfidence. The negative effects of underconfidence may therefore be expected to be felt in the future. Taking into account that women tend to have less attainment to the labor market and therefore dispose of fewer financial resources to stretch over their longer life expectancy, this makes them especially vulnerable to old-age poverty.

It should be noted, however, that the recommended strengthening of financial confidence does not necessarily coincide with reducing the bias between actual and perceived financial sophistication. Rather, fostering confidence would imply a lower actual-perceived gap predominantly for highly-educated women. For men, in contrast, it would feed into an even stronger overconfidence, particularly for lowly-educated men. As unjustified confidence seems to unfold its effect on financial behavior only for higher educational levels, this should be less of a concern. Nevertheless, our results suggest that training intended to strengthen financial confidence should be more specifically tailored to the individual person than simple programs to increase financial literacy.

The remainder of the paper proceeds as follows. Section 2 describes the data. Section 3 delineates the measurement of financial literacy and confidence and their distributional characteristics in our dataset. Section 4 reports the influence of the two variables on respondents' current financial market participation and future-oriented financial planning. Section 5 presents further robustness checks. Section 6 considers the specific effects of over- and underconfidence on financial engagement and Section 7 concludes.

2 Data

Our study is based on the SAVE panel, a representative survey of German households' financial behavior with a special focus on savings and old-age provision. The SAVE panel was initiated by the Munich Center for the Economics of Aging (MEA) in 2001 and was run on an annual basis from 2005 to 2013. The questions in the survey are answered by the household member with the best oversight over the household's finances. Measures of demographic characteristics, financial literacy, and self-assessments hence refer to this person, whereas information on the financial situation are

⁴For one of the few exceptions, arguing against the need for general financial education, see Willis (2011).

⁵Asaad (2015) comes to a similar conclusion.

collected for the household as a unit (e.g. wealth).

Our analysis uses data from the survey wave of 2009 that contains a large set of questions on financial literacy as well as respondents' self-assessments of their financial knowledge. The panelized structure of the data allows us to match complementary information on the sampling households from other waves (2007 and 2010) to the respective unit. Our final dataset consists of 2,047 households.

To improve ex post representativeness of the sample, sample-specific weights with respect to income and age are constructed and calibrated according to income and age classes in the German Microcensus (for a detailed description, see Börsch-Supan et al., 2009). According to Deaton (1997) and Winship and Radbill (1994) such weights should always be used in univariate survey analyses. In multivariate regressions, in contrast, they argue that sample-specific weights tend to reduce the precision of the estimates without providing any real benefit. We follow their recommendation and weight the descriptive statistics throughout our paper, but use no weights for the regressions.⁶

For the vast majority of variables in SAVE, item non-response is not a problem (Börsch-Supan et al., 2009). However, due to privacy concerns and elevated cognitive requirements, there are higher rates of missing values for questions on households' financial circumstances. This could potentially threaten data validity in the context of our paper. Deleting observations with missing items would reduce the sample size with an associated loss of statistical efficiency, however. Moreover, it would bear the risk of biased results when item non-response is not randomly distributed among respondents. Multiple imputation offers a better solution to the item non-response problem by simulating the distribution of the missing data. This should increase the efficiency of estimates - based on the larger number of observations - and reduce the non-response bias.⁷ Missing observations in our dataset are therefore imputed using an iterative multiple imputation procedure based on a Markov-Chain Monte-Carlo method (Schunk, 2008; Ziegelmeyer, 2013). We use five multiply imputed data sets for our analysis and results are derived by using Rubin's rule (Rubin, 1987, 1996).

Table 1 in Appendix A presents basic descriptive statistics of our dataset (variable definitions are given in Appendix B). With respect to the main socio-demographic factors, we see that 54% of sample respondents are female. The age of respondents varies between 22 and 97 years with a mean of 53 years. Regarding formal education, 35% of respondents obtained only basic schooling (9 years), 38% hold an intermediate educational degree (10 years of schooling) and 28% possess the highest degree (minimum of 12 years of schooling) that qualifies for tertiary education. We will use these three levels of formal education in the following to segregate the total sample into education-dependent sub-samples. Further, 58% of respondents are married, with an average of 1.7 children per household. 36% of respondents are retired and 3% are self-employed.

⁶Our main results do not change if we use weighted observations. Regression tables are available upon request.

⁷For a comparison of different approaches to deal with item non-response and the relative advantages of multiple imputation, see Rässler and Riphahn (2006).

Table 1 also gives information on various indicators of financial engagement such as income, wealth, investment and savings amounts. As can be seen, average total gross wealth, which includes also real estate wealth, stands much higher at 184,694.10 Euros per household than average financial gross wealth at 39,283.51 Euros. 25% of respondents are active on financial markets by investing in, e.g., stocks, funds or certificates. Interestingly, only 14% of all households plan for their financial future by saving regularly or reporting an awareness of saving needs for retirement. These last items will serve as dependent variables in our analyses.

With respect to further control factors, Table 1 reports descriptive statistics on the self-assessment regarding financial risk tolerance (ranging between 0 and 10) and past economics education at school (ranging between 1 and 7).⁸ With average assessments of 2.25 for risk tolerance and 3.25 for economics education, both scores can be seen to be relatively low. We also observe that 33% of respondents demand formal financial advice and that 25% have been affected negatively by the financial crisis 2007/08 due to detrimental labor market effects.

The so-called “Big 3” financial literacy score from the survey wave of 2007 (average score of 2.40) as well as information on the financial sophistication of respondents’ parents (average score of 4.58, ranging between 1 and 7) serve as instruments for financial literacy in one of our robustness checks. More detailed information on the measurement of financial literacy and confidence, our main variables of interest, and their basic distributional characteristics in our dataset will be delineated in the following section.

3 Measurement and distribution of financial literacy and confidence

In the SAVE survey wave of 2009, objective financial literacy is measured by a set of multiple-choice questions relating to an understanding of core financial concepts such as interest compounding, inflation or diversification. We make use of nine financial literacy questions included in the special module of the 2009 SAVE questionnaire. These are a subset of the questions used in Van Rooij, Lusardi, and Alessie (2011) and contain the “Big 3” questions (Hastings, Madrian, and Skimmyhorn, 2013) on numeracy, inflation and risk diversification that have become a regular component of international tests of financial literacy. The SAVE survey adds some more specific questions that relate, e.g., to stock and bond markets. Appendix C reports the exact wording for each question. We construct a financial literacy score that adds the number of correct answers for each respondent.

Table 2 reports the distribution of responses. The first four questions consider basic financial concepts (numeracy, interest compounding, inflation and money illusion). Most respondents answer them accurately, with the proportion of correct answers ranging between 55.9% and 85.2% for the

⁸We use the answers to this question from the SAVE survey wave of 2010 and match information to the respective unit in the 2009 wave.

individual questions. Advanced financial concepts examined in the latter five questions (diversification, volatility, stock markets, balanced funds, bond prices), in contrast, appear to present a higher level of difficulty. While not only the proportion of correct answers is lower (ranging between 40.2% and 71.7%) also the number of “do not know” answers is much higher for these issues. Overall, only 12% of respondents answer all nine questions correctly. In the SAVE survey, the financial literacy query is preceded by a question regarding respondents’ self-assessment of their financial knowledge. Respondents are asked “How would you assess your understanding of financial matters?” and may choose between answers of 1 (“very low”) and 7 (“very high”). We employ this score as our measure of confidence.

Table 3 shows mean levels of both financial literacy and confidence for the total sample and for subgroups of respondents. As indicated earlier, we split our total sample according to gender and educational attainment, where we consider three different educational levels corresponding with the German schooling system as delineated in Table 1. Panel A in Table 3 reports the mean financial literacy score. The average score in the total sample is 5.59. This splits into a lower score of 5.16 for female and a higher score of 6.08 for male respondents. The difference between the female and the male average score is highly significant, supporting earlier discussions of a gender gap in financial literacy by Bucher-Koenen, Lusardi, Alessie, and van Rooij (2014) and Fonseca, Mullen, Zamarro, and Zissimopoulos (2012). Panel A furthermore shows that financial literacy increases along with formal education. While this corroborates earlier findings of a positive relation between financial literacy and academic performance by Barboza, Smith, and Pesek (2014), we observe additionally that this effect is stronger for women (increase by 64% from the lowest to the highest educational level) than for men (increase by 37%).

Panel B of Table 3 reports the corresponding results for the confidence score. For the total sample, the average confidence score is 4.58. Once more, we find that women’s perceived financial knowledge is lower than men’s (4.42 against 4.76), with the difference being highly significant. Surprisingly, however, women’s confidence decreases when moving from the lowest to the intermediate level of education and increases slightly again for higher education (but remains below the level of basic education), whereas men’s confidence increases along with education throughout. As a consequence, we observe a U-shaped relation between self-confidence and educational attainment for the total sample.

Since financial literacy is measured on a score running from 0 to 9, while confidence is evaluated along a score running from 1 to 7, we cannot calculate a simple difference to assess over- or underconfidence. To derive a measure of perceived financial sophistication not justified by actual sophistication, we therefore follow Parker and Stone (2014) and calculate the residual from a regression of the confidence score on the financial literacy score. Panel C of Table 3 displays the mean of this “unjustified confidence” score, which captures both underconfidence (if negative) and overconfidence (if positive), over the different subgroups of sample respondents. Interestingly, the

average unjustified confidence score over the total sample is almost indistinguishable from zero, so that the average respondent neither over- nor underestimates his or her actual financial knowledge. However, this no longer holds once we split the total sample into the different subsamples. As may have been expected, female respondents on average show a negative unjustified confidence of -0.11 and are, hence, underconfident of their financial knowledge. The mean unjustified confidence score for men, in contrast, is positive at 0.13, indicating that male respondents are generally overconfident of their financial expertise.

Additionally, we find that both men and women show lower unjustified confidence scores with increasing levels of formal education. For men, the negative relation between unjustified confidence and education is comparatively weak as it is driven by the fact that the positive development of financial literacy along with education is stronger than the also positive development of confidence. As a consequence, male respondents do become more realistic in their self-assessment, but still persistently overestimate their knowledge even for intermediate and high levels of education. For women, in contrast, the decrease in unjustified confidence is caused by both a decreasing confidence and a strongly increasing literacy with rising educational attainment. Therefore, female respondents move from a low, positive unjustified confidence score for the lowest level of education to a negative score for the intermediate and highest levels of education. The drop in unjustified confidence is particularly stark when moving from low to intermediate educational degree. Hence, women with more than basic education strongly underestimate their actual financial knowledge in our dataset.

We finally also assess the relation between perceived and actual financial sophistication by assigning respondents to the group of above- or below-average confidence and to the group of above- or below-average financial literacy. This allows us to form combinations of the two that are mutually exclusive and indicate whether respondents assess their financial knowledge correctly or incorrectly relative to the average. In this respect, the Low_Low (High_High) category refers to those respondents who perceive their financial knowledge to be below (above) average and who are indeed below (above) average in their actual financial knowledge. The Low_High (High_Low) category captures those respondents who perceive their knowledge to be below (above) average even though it is actually above (below). Panel D in Table 3 shows the distribution of respondents over these four combined categories. As can be seen from the last column in Panel D, most respondents are in the High_High category. The difference between men and women is, however, very strong (44% vs. 29%). The Low_Low category, in contrast, is the smallest group for men (15%) but the second largest for women (28%). When examining the development over different educational levels, we see that the two combined groups with below-average financial literacy (Low_Low and High_Low) diminish with increasing education. The two combined groups with above-average financial literacy (High_High and Low_High), in contrast, increase in education. Interestingly, within the group of respondents who perceive their financial knowledge as below-average even though it actually is above-average, i.e., the Low_High category, we see a much stronger increase over educational levels

for women than for men. This again underlines the comparatively large underconfidence of highly educated women that Panel C has already indicated.

4 Financial sophistication and financial engagement

The relationship between financial literacy, confidence and financial behavior is of obvious policy interest in an era that increasingly asks individuals to take responsibility for their own financial well-being. A number of studies have examined the impact of financial knowledge on wealth and, generally, find a positive association (Lusardi, 2004; Behrman et al., 2012; Gustman et al., 2012; Van Rooij et al., 2012). The corresponding negative effect of a lack of financial knowledge has been attributed to financial mistakes such as paying too high fees or interest on credit card debt and home equity loans (Agarwal et al., 2009), not participating in financial markets (Van Rooij et al., 2011), or holding undiversified portfolios (Calvet et al., 2007; Von Gaudecker, 2015). Of the few studies that consider the effect of excess confidence, Van Rooij et al. (2012) show that underconfidence has an individual, negative impact, whereas overconfidence does not appear to influence household wealth. Following their lead, we try to shed more light on the channels via which actual and perceived financial sophistication have an effect on financial behavior. To achieve this, we examine two types of financial engagement in the following. We begin by connecting literacy and confidence with the decision to participate in financial markets. We then study future-oriented financial planning.

4.1 Current financial market participation

Several studies so far have examined whether financial literacy impacts individuals' decisions to invest in stocks. While Christelis et al. (2007) report that basic numeracy already influences portfolio composition significantly, Van Rooij et al. (2011) show that advanced financial literacy increases the likelihood of stock market participation particularly strongly. In the same vein, Balloch et al. (2015) emphasize the importance of more specific stock market literacy. Christelis et al. (2011) furthermore report that direct stockholdings (as compared to mutual fund participation) are particularly strongly correlated with both financial literacy and educational attainment.

We take a slightly broader perspective and examine not only stock market participation but the decision to invest in financial securities in general. The securities that we consider can be individual stocks but also mutual fund investments, real estate funds, discount certificates, money market funds, etc. The investment decision hence approximates individuals' financial market participation in the broadest sense. Following Haliassos and Bertaut (1995) and Guiso et al. (2002), our empirical specification considers many determinants of risky investments as control variables. Most importantly, we control for risk tolerance as gender gaps in stock market participation have been referred to gender-specific risk attitudes (Almenberg and Dreher, 2015). Additionally, we control for wealth effects where we reduce the wealth variable on the right-hand side of the regression equation by the

amount of financial market investments.

Table 4 reports the results from an OLS regression on a dummy variable that indicates whether or not the respondent participates in financial markets, i.e., invests in financial securities. The first two columns report the results from a regression on the total sample where model (1) employs only financial literacy and model (2) contains both financial literacy and confidence as explanatory variables. As can be seen, financial literacy has a highly significant, positive effect on the decision to participate in financial markets that is not reduced by employing confidence as an additional factor. Rather, confidence displays an independent, significantly positive association with the dependent variable as well. Given the rather low correlation between financial literacy and confidence of 0.18 in our sample, this may be seen as evidence that actual and perceived financial sophistication indeed capture different effects on financial market participation. The control factors in the regressions show essentially the expected effects: The probability to invest in financial securities increases in educational attainment, household income and wealth. It is higher for respondents with a higher risk tolerance and for respondents who demand financial advice. Interestingly, self-assessed economics education has no significant influence.

In columns (3) and (4) of Table 4, we report results for male and female respondents individually, and for different educational levels in columns (5)-(7) and (8)-(10), respectively. As can be seen, financial literacy has a highly significant, positive impact on the decision to participate in financial markets in almost all sub-samples. Interestingly, the influence of literacy is stronger for women than for men. Moreover, while the effect of literacy increases in women's education, we find a decreasing effect for men that loses significance for highly-educated men. Women's financial literacy hence not only increases strongly in educational attainment but its association with financial market participation rises in education as well. As a consequence, an increase in financial literacy should have a particularly strong impact on financial market participation for highly-educated women.

Confidence, in contrast, shows a positive association only with men's financial market participation, but not with women's. The effect of confidence for men is nearly as strong as the effect of financial literacy: This follows from comparing the respective coefficients in column (3). When considering the different educational levels, it becomes moreover evident that the effect of confidence is driven by men with higher than basic education and increases considerably from intermediate to higher education. For highly-educated men, the impact of confidence even appears to crowd out the effect of financial literacy as the latter is no longer significant.

So far, we may hence state that women and lowly-educated men raise their financial market participation with increasing actual financial knowledge, highly-educated men with increasing perceived financial knowledge. As such, there seems to be a clear dominance of either dimension of financial sophistication for financial behavior once we control for different levels of formal education. This has not been possible to deduce from earlier work. In Bannier and Neubert (2016) for

instance, we differentiate between standard and sophisticated investments on financial markets⁹ but do not consider respondents' educational levels. We find that men's standard investments are affected by both actual and perceived financial knowledge, while women's standard investments are associated only with actual knowledge. Sophisticated investments, in contrast, show a relation with both dimensions of financial sophistication for male and female respondents. Without consideration of different educational levels, actual and perceived financial sophistication hence appear to have mostly interrelated effects on financial investments. To assess further whether there is a dominance of either type of financial knowledge within specific educational classes, we will have to examine their net effect, i.e., the impact of unjustified confidence. This analysis will be presented in Section 6.

4.2 Future-oriented financial planning

Setting up and managing a retirement account can be seen as an important building block for financial independence in old age (Lusardi, 1999; Lusardi and Mitchell, 2007; 2010). Additional precautionary savings will further add to future financial wealth. Only few studies have so far examined the link between financial literacy and general savings behavior, though. Allgood and Walstad (2016) as well as De Bassa Scheresberg (2013) find a positive association. Other studies show that individuals with low financial knowledge are less likely to plan for retirement (Bucher-Koenen and Lusardi, 2011; Lusardi and Mitchell, 2011) and that highly confident individuals are more likely to calculate their savings needs for retirement (Van Rooij et al., 2012).

Our analysis of future-oriented financial planning uses a combination of the earlier approaches. We ask whether respondents save regularly as well as whether they have ever attempted to undertake a retirement saving calculation. We call a respondent a *financial planner* only if both factors apply and construct a dummy variable correspondingly. While this definition of a financial planner may seem as rather strict, we feel that each individual factor may not capture financial planning in a true sense. Regular savings, for instance, could also be designed to fulfill simple consumption needs. Similarly, a person who is aware of savings needs for retirement might not actually save as a consequence. By combining both factors, we believe that we proxy future-oriented financial planning in the most meaningful way. Using comparable measures, Lusardi and Mitchell (2008) demonstrate that financially literate women are more likely to develop a plan for their retirement savings needs than financially illiterate ones. Anderson et al. (2016) show that precautionary savings and retirement planning are mostly driven by confidence, not by actual literacy. This leads us to suspect that confidence might play an especially important role for future-oriented financial planning.

Table 5 shows the results from an OLS regression on the financial planning dummy variable.

⁹In Bannier and Neubert (2016), standard investments comprise stocks and real estate funds, whereas sophisticated investments contain discount certificates, hedge funds, etc.

Again, we run a regression both on the total sample and on the subsamples segmented by gender and educational level. We employ the same control variables as in Table 4 with the exception of the dummy variables on retirement and employment status as these are clearly correlated with the dependent variable. From the regression results, we see that financial literacy has a significantly positive impact on financial planning. The effect is slightly stronger for men than for women, but it is not consistent over different educational levels. Rather, we find a significant association only for men with basic and intermediate level of education and for women with higher than basic education.

Interestingly, confidence shows a comparatively strong association with both men’s and women’s financial planning, with the economic size of the confidence effect being greater than that of financial literacy. For both male and female respondents, the confidence effect is focused on the highest educational level. For highly-educated men, however, confidence appears to replace the influence of financial literacy on future-oriented financial planning as the latter variable loses significance in this subsample. For highly-educated women, in contrast, confidence seems to complement financial literacy in its relation with financial planning. It should be noted, however, that the economic size of the confidence effect for highly-educated women is much stronger than that of the literacy effect.

Comparing the structure of effects of actual and perceived financial sophistication on the two types of financial engagement, i.e., current financial market participation and future-oriented financial planning, an interesting dichotomy arises: It seems to be the case that perceived financial sophistication plays a more important role for future-oriented financial planning, while actual financial sophistication appears more strongly associated with current engagement on financial markets. Moreover, the marginal effect of financial literacy is higher for women than for men and vice versa for the impact of confidence. Overall, we observe the strongest influence of both actual and perceived financial sophistication for individuals with highest educational attainment.

5 Discussion and extensions

5.1 Crisis experiences and the impact of confidence on financial engagement

Respondents to the 2009 SAVE questionnaire have experienced the strong downturn on financial markets in the 2007/08 crisis only just before answering the survey questions. Even though Germany has not been affected by an as serious deterioration of real estate markets as other countries, Bucher-Koenen and Ziegelmeyer (2014) nevertheless report average financial losses due to the crisis of 13,153 Euros per household with a median of 5,000 Euros. Since earlier work has commented on the negative effects of economic depressions on risk-taking and market participation (Malmendier and Nagel, 2011), it may be well conceivable that our results are affected by the crisis experience as well. In this respect, Weber et al. (2013) demonstrate changes in risk-taking behavior over the course of the financial crisis to be mainly associated with changes in subjective expectations of market risk and returns. Hoffmann et al. (2013) examine how individual investor perceptions change during

the 2007/08 financial crisis and document substantial swings in trading and risk-taking behavior as a consequence.

Though we do control for risk attitudes in our regressions, we still need to ascertain whether other crisis-related effects influence our results. It may, for instance, be the case that the confidence effects we measure are biased by the experiences that household made during the crisis. We hence need to ensure that the impact of confidence on financial engagement is really driven by perceived knowledge and not by recent experiences. This should also help us improve the generality of our results by making sure that they are not influenced by the timing of the survey.

Table 6 reports the results from regressions on both current financial market participation and future-oriented financial planning where we now introduce a dummy variable “Crisis effects” that indicates very broadly whether the respondent has been affected negatively by the financial crisis. We proxy the crisis effect as a crisis-induced adverse experience on the labor market, either in the form of a job loss or an income loss. The dummy variable takes the value of 0 only if there has been no negative crisis-related effect for the individual. In the regression, we interact the confidence variable with the crisis-dummy to estimate whether the effect of confidence differs between respondents who self-report negative effects of the recent financial crisis and those who do not. Table 6 reports the regression coefficients only of financial literacy, confidence, crisis-dummy and interaction between confidence and crisis dummy, though we use the same set of control variables as in Tables 4 and 5 before.¹⁰

We find that the interaction term is only weakly significant for one subsample in each of the two regressions: In the analysis of current financial market participation, female respondents with basic level of education show a positive association of confidence with the dependent variable only if they have been affected by the financial crisis. With regard to future-oriented financial planning, the same holds for female respondents with intermediate level of education. However, as we did not find a significant effect of confidence on financial market participation nor on financial planning for these two subgroups in our original regressions in Section 4, this observation does not seem to alter our main results much. We therefore conclude that our findings with regard to confidence are not solely driven by the experiences households made during the financial crisis 2007/08.

5.2 Endogeneity effects

In our analyses so far, we have treated actual financial sophistication as an exogenous characteristic of respondents. However, this assumed exogeneity is clearly a controversial topic. Financial literacy could be affected by financial engagement, by learning from repeated actions on financial markets, for instance. This would give rise to reverse causality, a common form of endogeneity. Additionally, the measurement of financial literacy via questionnaires could be prone to errors. As a consequence,

¹⁰The coefficients of these control variables are equivalent to those in Tables 4 and 5. They are available upon request.

if financial literacy is indeed endogenous, the estimated OLS coefficients may be biased. In order to support our results, we therefore additionally employ a more exogenous source of variation in financial knowledge. In the following, we display the results from an Instrumental Variable (IV) estimation where additional information on survey respondents has been used to instrument financial literacy.¹¹ Given the complexity of endogeneity in household finance and its relation with financial knowledge, we certainly do not claim to have solved the problem. Rather, our findings should be seen as one further attempt towards rendering our conclusions more robust in this respect.

Appropriate instruments need to be unrelated with the error term and influence the dependent variable only via the characteristic to be instrumented. We believe that economics education acquired in school can only be a weak instrument in our context,¹² as Van Rooij et al. (2011) show that it affects the decision to participate in the stock market in its own right. Rather than employing economics education as an instrument, we therefore use it as a control factor in our main regressions on current financial market participation and future-oriented financial planning. Since the German education system is moreover quite homogenous across the different federal states, there is also no possibility to exploit geographic variation as has been done, e.g., by Lusardi and Mitchell (2010). We therefore need to rely on respondent-specific characteristics provided by the rich structure of the SAVE questionnaire for suitable instruments.

We decide to follow Van Rooij et al. (2011) in using a respondent’s family members’ familiarity with financial concepts as one instrument for financial literacy and use a respondent’s actual financial knowledge in 2007 as a second.¹³ Using lagged explanatory variables is a common strategy to confront challenges to causal identification using observational data. Lagged variables have the advantage to have a direct effect on the explanatory factor, while the correlation between variables sampled at different points in time - i.e., the lagged independent variable and the dependent variable in the IV regression - is usually lower than the correlation between variables sampled simultaneously. However, in our case, this clearly comes with the disadvantage that the lagged level of objective financial knowledge suffers from the same possible measurement errors than our endogenous factor and might as well be correlated to the error term. We employ the financial literacy score from the 2007 wave of SAVE, where respondents have only been asked the “Big 3” questions on numeracy, inflation and risk diversification.

¹¹It could be argued that perceived financial knowledge needs to be instrumented as well as it might also be prone to issues of endogeneity. However, finding meaningful instruments for both dimensions of financial sophistication that are unrelated to the error term in the regression equations is extremely difficult. When trying different sets of personality traits as instruments for confidence, we moreover found only weak F-values for the resulting regressions. We therefore follow Kramer (2016), who also uses measures of financial confidence as a central explanatory factor in his models, but only instruments financial literacy in his attempt to deal with endogeneity problems.

¹²Economics education has been successfully employed as an instrument in the studies by Kramer (2016) and Lusardi and Mitchell (2007b).

¹³Compare Binswanger and Carman (2012) who also use an over-identified IV model to address endogeneity concerns with regard to planning behavior.

We therefore use the financial knowledge of a respondent’s parents as an additional instrument. Through peer learning, this variable is likely to have an effect on the respondent’s financial literacy, but unlikely to have a direct impact either on current financial market participation or on future-oriented financial planning of the respondent. The parents’ financial knowledge has moreover been proven to function as a valid instrument for financial literacy by Van Rooij et al., 2011. However, the authors also argue that this instrument, which implies that the respondent received some sort of advice from his family members on how to budget, is not suitable for instrumenting advanced types of financial knowledge. This is problematic in our case since we our main results focus on the highest level of formal education, where - as we show - the level of literacy is especially high for both male and female respondents. In order to control for endogeneity issues in our models, we therefore employ a combination of the two instruments, lagged own financial literacy and parents’ financial literacy. Both of our instruments have the advantage that they are not influenced by the financial crisis 2007/08, so that results should be robust in this respect.

Table 7 reports the results from the instrumental variable regressions using the Generalized Method of Moments (GMM) estimation method.¹⁴ For reasons of brevity, we again display only the coefficients on (instrumented) financial literacy and confidence, but the regressions include the same set of control variables that have been used before. The statistics given in Table 7 show not only that F-values from first-stage regressions are high in the total sample and that the instruments for financial literacy are statistically significant.¹⁵ Instruments also remain significant with F-values above the critical value for avoiding the problem of weak instruments (Staiger and Stock, 1997) in almost all subsamples. Only in the subsample of women with highest level of education, the F-statistic of the first-stage regression might not be high enough to rule out weak instruments problems. We therefore rerun our analysis by using the LIML estimator, which has been shown to be more robust against weak instruments (Stock et al., 2002). Our results remain basically unchanged.¹⁶ The results of the Hansen J-test further show that the over-identifying restrictions are not rejected, giving us the confidence that our instrument set is appropriate.

As can be seen from Table 7, the IV results broadly support our earlier findings. More specifically, we observe that the decision to participate on financial markets (Panel A) is strongly affected by financial literacy. Again, the association between financial literacy and market participation is stronger for women than for men and shows the largest coefficient for highly-educated women. For the financial planning decision (Panel B), the relation with financial literacy is much weaker. Similar to our earlier results, we find equally sized effects for men and women. These are centered on the lower educational levels for male respondents. In fact, similar to our main results, financial literacy

¹⁴Note that we estimate simple linear probability models in Section 4. As the error term of a linear probability model is heteroskedastic, we use Generalized Method of Moments (GMM) estimation when performing IV estimations.

¹⁵Complete first-stage regressions are available from the authors upon request.

¹⁶Table 7 reports only the results from the GMM estimation. LIML estimation results are available upon request.

loses significance for highly-educated men. In contrast to the findings in Table 5, however, we do not observe any significant effects within the different educational levels for female respondents. The findings for the effect of confidence remain essentially unchanged for all subsamples. Our results hence appear broadly robust even when testing for endogeneity in actual financial knowledge.¹⁷

6 Combined measures of financial literacy and confidence

Our analyses so far have focused on the individual effects that actual and perceived financial sophistication have on respondents' current financial market participation and future-oriented financial planning. This has allowed us to see for each subgroup of respondents whether one or both explanatory variables drive financial engagement. However, it is clearly of interest to see whether and in which way *excessive* confidence, that is not warranted by the actual financial knowledge, affects financial decisions. In our attempt to do so, we use two different approaches.

First, we employ the measure of perceived financial sophistication not justified by actual sophistication, defined as the residual from a regression of the confidence score on the financial literacy score. As a numerical measure, this unjustified confidence allows detailed interpretations of the underlying effects, as can be seen from Table 8. Again, we use simple OLS regressions and employ the same set of control variables as before. In Panel A, we observe a significantly positive association between unjustified confidence and current financial market participation for men that is driven by those with highest education. Panel B reports the same result for future-oriented financial planning. Even though we know that male overconfidence is decreasing in education, these findings imply that highly-educated men nevertheless profit from their (small) excess confidence: Their overconfidence leads them to engage more strongly on risky financial markets and to plan more actively for their financial future.

For women, unjustified confidence shows a significant relation only with financial planning but not with market participation. As for men, the association of unjustified confidence with planning is driven by female respondents with the highest educational attainment. However, since women at this educational level are underconfident of their financial knowledge, i.e. display a negative unjustified confidence on average, this finding actually implies that highly-educated women fare even worse in their financial planning if their underconfidence increases. The severe underconfidence of highly-educated women is hence really harmful for their future financial well-being and cannot be dismissed as a mere side effect. Rather, as our analysis shows, the underconfidence of this subgroup may be expected to show long-lasting effects as it cannot be overcompensated by these women's

¹⁷It should be noted that our IV estimates tend to be slightly larger than the OLS estimates. Due to reverse causality or omitted variable bias, one would have expected OLS regression estimates to be upward biased. However, Van Rooij et al. (2012) report a similar finding and refer it to potential measurement errors in the proxies for financial sophistication.

actual financial knowledge.

Table 9 examines this last aspect in even more detail. In this final regression, we use the second approach of approximating excessive confidence by resorting to the four mutually exclusive groups of respondents. In the regression, we employ the “High_High”-category (IV) as the default group so that the coefficients of the remaining groups need to be interpreted in relation to the respondents with above average confidence and above average literacy. The coefficient on the “Low_Low” category (I) will then report the results from a reduction in both perceived and actual financial knowledge, whereas the coefficients on the two remaining factors refer to a change in only one dimension of financial sophistication. Of highest relevance for the current discussion may be the coefficient of the “Low_High” category (II) as it should capture those respondents that underestimate their actual financial knowledge.

As should have been expected, Panel A in Table 9 shows that men’s current financial market participation decreases whenever one or both dimensions of financial sophistication change from above average to below average. For women, in contrast, it is only the reduction in actual financial knowledge (categories I and III) that is associated with a lower market participation. For both male and female respondents, we observe the strongest association for the highest educational attainment (with the exception of category III that shows no significance for men with highest level of education). For future-oriented financial planning in Panel B, we see these results mainly confirmed. However, and supporting the results on unjustified confidence from Table 8, we find that any change in the two dimensions of financial sophistication is associated with a significant change in financial planning only for women with highest educational attainment.

Our results on the combined effects of financial literacy and confidence hence underline the gender- and educational dependency of the effects of financial literacy and confidence on current financial market participation and future-oriented financial planning. This allows us to demonstrate that the lack of confidence plays a particularly important role for highly-educated women’s financial planning that cannot be compensated even by their high actual financial knowledge and that may be expected to hamper their future financial well-being. Our results hence naturally feed into the analysis by Van Rooij et al. (2012) who find that underconfidence has a negative influence on wealth, whereas overconfidence has no significant impact. They also report a positive impact of overconfidence on retirement preparedness, but do not find a significant role of excess confidence on stock market participation. Considering the structural characteristics of over- and underconfidence we are able to portray a richer picture of the relation with different financial decisions as such augmenting the earlier results.

Our findings regarding the impact of unjustified confidence hence add an important aspect to the general debate on the role of actual and perceived financial sophistication for achieving a high degree of financial well-being. It is not only the case that both dimensions of financial sophistication have the potential to raise financial wealth via stronger current financial market participation and

future-oriented financial planning. Rather, the difference between the two, i.e., excess or unjustified confidence, may have an additional positive impact, depending on the gender and educational level of the individual. Since unjustified confidence decreases in education and turns into underconfidence for women with higher than basic education while staying positive for men on average, we need to be cautious in interpreting its effect and in drawing policy implications, however. More precisely, highly-educated men not only profit from their confidence, but additionally benefit from their overconfidence, i.e. their excess confidence over and above their actual financial literacy. As a consequence, there appears to be no need for a closer alignment between actual and perceived financial sophistication for them. Rather, as confidence seems to replace the impact of financial literacy with higher educational levels, a higher overconfidence may even be welcome for men. For highly-educated women, in contrast, the positive general impact of confidence on planning behavior that we found in Section 4, turns into a negative effect if confidence does not keep up with financial literacy. Such underconfidence reduces financial planning and can be expected to exert a negative influence on future wealth accumulation. As, on the other hand, actual financial literacy has a strong impact on current financial market participation for these women, the only viable policy to improve their future financial well-being is a strengthening of their confidence per se.

7 Conclusion

In this paper, we have shown that the association between actual and perceived financial knowledge on the one hand and financial decisions on the other is strongly dependent on gender and educational attainment of individuals. In particular the gap between actual and perceived knowledge appears to exert an effect on financial decisions that is strongest for individuals with highest educational attainment. At the same time, the gap tends to affect both current financial market participation and future-oriented financial planning for men, but only financial planning for women. Our findings hence put earlier results into perspective: Survey data from predominantly male respondents with high education should deliver totally different results than data from female respondents or respondents with low education. Future research working with specific datasets should take this into account.

Kruger and Dunning (1999) have argued that individuals tend to be “unskilled and unaware of it”, so that a certain degree of metacognitive skills is needed to recognize one’s own (in)competencies. This seems to hold only for male subjects in our context, who become less overconfident (i.e. more realistic) the more educated they are. Women, in contrast, seem to be “skilled and unaware of it”: With increasing levels of education - which go hand in hand with higher levels of actual literacy - they increasingly underestimate their financial abilities. What renders this observation problematic is that it comes with a potential long-term cost for women, who are already at a high risk of old-age poverty in general: While we observe that the financial decisions of highly-educated men benefit

strongly from the excess confidence regarding their financial knowledge, highly-educated women, in contrast, benefit from their strong financial literacy in their financial market participation, but show an underconfidence that hampers their long-term financial planning.¹⁸ In order to secure future financial well-being for this group of women, designing advanced training programs that further enhance their financial literacy will therefore not be enough. Despite the success of past financial education programs for women (Clark et al., 2006; Lusardi et al., 2008), future programs should be tailored specifically to the needs of highly-educated women for nurturing their confidence. Training programs that offer immediate feedback from financial decisions may be helpful in this respect as they allow to bring the perceived level of financial knowledge closer to the actual level. At an even more basic level, counteracting the perception of financial decisions as typically “masculine” tasks may be a suitable strategy for this target group as well as this may reduce a misalignment between actual and perceived levels of financial sophistication in the first place.

¹⁸Critics might argue that those women, who are especially vulnerable with regard to old-age poverty, are probably not those with the highest levels of education. However, women are more likely to be poor in old age than men - regardless of their educational background (CESifo Group, 2015; Brown and Rhee, 2016), which underlines the importance of our findings, although we do not claim higher confidence to be a solution for female old-age poverty in general, of course.

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Appendix A: Tables

Table 1: Descriptive statistics

The table presents summary statistics (means, standard deviations, minimum and maximum values) for all dependent and independent variables. The description and construction of all variables can be found in Appendix B.

	Mean	Std.dev.	Minimum	Maximum
Female	0.54	0.50	0	1
Age	52.67	16.01	22	97
Education dummies				
Low level	0.35	0.48	0	1
Intermediate level	0.38	0.48	0	1
High level	0.28	0.45	0	1
Married	0.58	0.49	0	1
Number of children	1.72	1.39	0	10
Retired	0.36	0.48	0	1
Self-employed	0.03	0.18	0	1
Ln(household income)	7.46	0.75	0	10.23
Total gross wealth	184,694.10	467,201.80	0	11,400,000
Financial gross wealth	39,283.51	123,174.7	0	3,215,000
Ln(gross financial wealth)	7.72	4.19	0	14.98
Financial market participation	0.25	0.43	0	1
Financial planning	0.14	0.35	0	1
Risk tolerance	2.25	2.60	0	10
Economics education (2010)	3.25	1.70	1	7
Financial advice	0.33	0.47	0	1
Crisis effects	0.25	0.43	0	1
Parents' financial knowledge	4.58	1.69	1	7
Financial literacy "Big 3" (2007)	2.40	0.74	0	3
Number of observations	2,047			

Table 2: Financial literacy: Distribution of answers

Panel A reports the proportion of households providing correct, incorrect, and “do not know“ answers to each of the nine literacy questions presented in Appendix C. Panel B reports the distribution of the number of correct, incorrect, and “do not know“ (DK) answers to the nine literacy questions.

<i>Panel A: Percentages of total number of respondents (N=2,047)</i>										
	Numeracy	Interest compounding	Inflation	Money Illusion	Risk Diversification	Return Volatility	Stock Market	Balanced funds	Bond prices	
Correct	85.21	64.20	79.13	55.91	64.91	71.65	52.36	45.15	40.19	
Incorrect	5.06	24.50	4.24	32.14	6.19	9.88	16.08	7.48	23.64	
DK	9.73	11.29	16.63	11.95	28.90	18.47	31.56	47.37	36.17	
<i>Panel B: Summary of responses (N=2,047)</i>										
	None	1	2	3	4	5	6	7	8	All Mean
Correct	0.07	0.03	0.05	0.08	0.10	0.09	0.12	0.17	0.17	0.12 5.59
Incorrect	0.29	0.35	0.20	0.09	0.04	0.02	0.01	0.00	0.00	0.00 1.29
DK	0.39	0.16	0.12	0.08	0.08	0.05	0.03	0.03	0.02	0.05 2.12

Table 3: Financial literacy, confidence and combined measures across subgroups

The table reports the means of financial literacy (Panel A), confidence (Panel B), unjustified confidence (Panel C) and of four mutually exclusive categories of excessive confidence relative to the average (Panel D) across different levels of education and across gender.

<i>Panel A: Mean financial literacy across subgroups</i>				
Education	Low	Intermediate	High	All
Female	4.00	5.31	6.55	5.16
Male	5.20	5.99	7.13	6.08
All	4.56	5.59	6.86	5.59

<i>Panel B: Mean confidence across subgroups</i>				
Education	Low	Intermediate	High	All
Female	4.52	4.34	4.44	4.42
Male	4.72	4.75	4.81	4.76
All	4.61	4.50	4.64	4.58

<i>Panel C: Mean unjustified confidence across subgroups</i>				
Education	Low	Intermediate	High	All
Female	0.09	-0.21	-0.23	-0.11
Male	0.18	0.13	0.08	0.13
All	0.13	-0.07	-0.06	$6.08e^{-10}$

<i>Panel D: Combined categories across subgroups</i>				
Education	Low	Intermediate	High	All
Female				
Low_low	0.36	0.29	0.13	0.28
Low_high	0.10	0.24	0.35	0.22
High_low	0.34	0.18	0.13	0.22
High_high	0.20	0.29	0.39	0.29
Male				
Low_low	0.21	0.16	0.07	0.15
Low_high	0.16	0.21	0.31	0.23
High_low	0.28	0.17	0.08	0.18
High_high	0.34	0.45	0.54	0.44
All				
Low_low	0.29	0.24	0.10	0.22
Low_high	0.13	0.23	0.33	0.22
High_low	0.31	0.18	0.10	0.20
High_high	0.27	0.36	0.47	0.36

Table 4: Financial literacy, confidence and current financial market participation

The table reports OLS estimates of the effect of financial literacy, confidence and several control variables on current financial market participation for different subsamples. The dependent variable is a dummy variable indicating whether the respondent is invested in risky asset classes. Column 1 and 2 report effects for all households, column 3 (4) only for male (female) respondents. Columns 5, 6 and 7 (8, 9, 10) differentiate between different levels of male (female) respondents' education. The reference category for education is "low level of education". Variable definitions are presented in Appendix B.

	All (1)	All (2)	Male (3)	Female (4)	Male by education			Female by education		
					Low (5)	Intermediate (6)	High (7)	Low (8)	Intermediate (9)	High (10)
Financial literacy	0.0308*** (0.0037)	0.0300*** (0.0037)	0.0269*** (0.0059)	0.0324*** (0.0049)	0.0325*** (0.0079)	0.0259** (0.0102)	0.0141 (0.0135)	0.0267*** (0.0073)	0.0300*** (0.0076)	0.0480*** (0.0131)
Confidence		0.0121* (0.0067)	0.0267** (0.0112)	-0.0007 (0.0083)	-0.0039 (0.0148)	0.0359* (0.0189)	0.0649*** (0.0229)	0.0064 (0.0126)	-0.0093 (0.0129)	0.0117 (0.0227)
Age	0.0003 (0.0009)	0.0002 (0.0009)	0.0018 (0.0015)	-0.0007 (0.0012)	0.0013 (0.0021)	0.0018 (0.0027)	0.0001 (0.0029)	-0.0034** (0.0017)	0.0014 (0.0020)	-0.0015 (0.0025)
Female	-0.0326 (0.0201)	-0.0310 (0.0201)								
Education dummies										
Intermediate level	0.0533** (0.0219)	0.0557** (0.0219)	0.0853** (0.0331)	0.0239 (0.0277)						
High level	0.1014*** (0.0282)	0.1058*** (0.0281)	0.1405*** (0.0387)	0.0520 (0.0385)						
Married	-0.0246 (0.0219)	-0.0266 (0.0219)	-0.0763** (0.0352)	0.0073 (0.0268)	-0.0654 (0.0560)	-0.0541 (0.0615)	-0.0871 (0.0638)	-0.0204 (0.0364)	0.0678 (0.0417)	-0.1078 (0.0671)
Number of children	-0.0038 (0.0064)	-0.0037 (0.0064)	-0.0039 (0.0109)	-0.0029 (0.0083)	0.0140 (0.0163)	-0.0445** (0.0197)	0.0096 (0.0200)	-0.0149 (0.0103)	-0.0089 (0.0138)	0.0262 (0.0230)
Retired	0.0211 (0.0275)	0.0210 (0.0276)	-0.0082 (0.0423)	0.0467 (0.0360)	-0.0257 (0.0598)	-0.0403 (0.0738)	0.1264 (0.0875)	0.0523 (0.0500)	0.0221 (0.0579)	0.1107 (0.0896)

Table 4 continued

					Male by education			Female by education		
	All	All	Male	Female	Low	Intermediate	High	Low	Intermediate	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Self-employed	-0.0098 (0.0586)	-0.0162 (0.0590)	-0.0601 (0.0732)	0.0498 (0.1072)	0.0728 (0.1521)	0.0102 (0.1273)	-0.1762* (0.1019)	0.1808 (0.2333)	-0.1635 (0.1356)	0.1886 (0.1804)
Ln(household income)	0.0595*** (0.0229)	0.0573** (0.0228)	0.0405 (0.0329)	0.0817*** (0.0248)	0.0637* (0.0380)	0.1002*** (0.0382)	-0.0090 (0.0437)	0.0384 (0.0277)	0.1448*** (0.0422)	0.0656 (0.0499)
Second wealth quartile	0.0905*** (0.0245)	0.0900*** (0.0245)	0.0594 (0.0401)	0.1146*** (0.0313)	0.0509 (0.0618)	0.0856 (0.0574)	0.0195 (0.0860)	0.0997** (0.0409)	0.1398*** (0.0438)	0.1078 (0.0819)
Third wealth quartile	0.1372*** (0.0263)	0.1356*** (0.0263)	0.1644*** (0.0418)	0.1019*** (0.0320)	0.0702 (0.0622)	0.2205*** (0.0766)	0.2017** (0.0888)	0.0843* (0.0465)	0.0694 (0.0491)	0.1749** (0.0860)
Forth wealth quartile	0.2087*** (0.0303)	0.2053*** (0.0303)	0.2468*** (0.0460)	0.1580*** (0.0394)	0.0691 (0.0735)	0.4123*** (0.0698)	0.2197** (0.0915)	0.1242* (0.0640)	0.1291** (0.0622)	0.2106** (0.0963)
Risk Tolerance	0.0210*** (0.0036)	0.0207*** (0.0036)	0.0292*** (0.0055)	0.0131*** (0.0044)	0.0154* (0.0080)	0.0281*** (0.0097)	0.0443*** (0.0111)	0.0064 (0.0063)	0.0099 (0.0071)	0.0324*** (0.0120)
Economics education	0.0027 (0.0055)	0.0009 (0.0056)	-0.0097 (0.0080)	0.0114 (0.0076)	0.0055 (0.0129)	-0.0355*** (0.0130)	-0.0056 (0.0146)	0.0190* (0.0111)	0.0116 (0.0125)	-0.0109 (0.0174)
Financial advice	0.0928*** (0.0216)	0.0936*** (0.0216)	0.0827*** (0.0310)	0.1038*** (0.0297)	0.0736 (0.0509)	0.0361 (0.0532)	0.1215** (0.0549)	0.1134** (0.0461)	0.1116** (0.0490)	0.0737 (0.0618)
Constant	-0.5514*** (0.1711)	-0.5802*** (0.1695)	-0.5852** (0.2294)	-0.7441*** (0.1832)	-0.5929** (0.2773)	-0.8889*** (0.2594)	-0.1911 (0.3353)	-0.2322 (0.2315)	-1.2575*** (0.3117)	-0.6740* (0.3585)
Observations	2,047	2,047	986	1,061	355	314	317	382	432	247
R^2	0.1951	0.1963	0.2020	0.1945	0.1171	0.3071	0.1884	0.1861	0.2145	0.1834

Note: Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Financial literacy, confidence and future-oriented financial planning

The table reports OLS estimates of the effect of financial literacy, confidence and several control variables on future-oriented financial planning for different subsamples. The dependent variable is a dummy variable indicating whether the respondent saves regularly and is aware of his saving needs for retirement. Column 1 and 2 report effects for all households, column 3 (4) only for male (female) respondents. Columns 5, 6 and 7 (8, 9, 10) differentiate between different levels of male (female) respondents' education. The reference category for education is "low level of education". Variable definitions are presented in Appendix B.

	All (1)	All (2)	Male (3)	Female (4)	Male by education			Female by education		
					Low (5)	Intermediate (6)	High (7)	Low (8)	Intermediate (9)	High (10)
Financial literacy	0.0138*** (0.0032)	0.0120*** (0.0031)	0.0134*** (0.0049)	0.0115*** (0.0040)	0.0125* (0.0067)	0.0284*** (0.0085)	-0.0071 (0.0129)	0.0090 (0.0059)	0.0119** (0.0057)	0.0243** (0.0108)
Confidence		0.0278*** (0.0067)	0.0395*** (0.0095)	0.0185** (0.0093)	0.0184 (0.0117)	0.0306 (0.0192)	0.0682*** (0.0179)	0.0135 (0.0093)	-0.0051 (0.0113)	0.0686** (0.0268)
Age	-0.0036*** (0.0006)	-0.0037*** (0.0006)	-0.0042*** (0.0008)	-0.0036*** (0.0008)	-0.0059*** (0.0013)	-0.0034** (0.0015)	-0.0048*** (0.0014)	-0.0021*** (0.0007)	-0.0042*** (0.0012)	-0.0039** (0.0015)
Female	-0.0301* (0.0176)	-0.0262 (0.0174)								
Education dummies										
Intermediate level	-0.0163 (0.0192)	-0.0103 (0.0191)	-0.0006 (0.0306)	-0.0211 (0.0229)						
High level	-0.0318 (0.0231)	-0.0228 (0.0231)	-0.0239 (0.0326)	-0.0215 (0.0337)						
Married	0.0153 (0.0200)	0.0117 (0.0201)	0.0129 (0.0294)	0.0182 (0.0273)	0.0236 (0.0448)	-0.0131 (0.0513)	0.0508 (0.0548)	0.0081 (0.0283)	0.0057 (0.0430)	0.0635 (0.0643)
Number of children	-0.0020 (0.0061)	-0.0016 (0.0060)	-0.0000 (0.0100)	-0.0026 (0.0068)	0.0211 (0.0163)	-0.0102 (0.0188)	-0.0055 (0.0166)	0.0070 (0.0081)	-0.0129 (0.0105)	-0.0046 (0.0221)

Table 5 continued

	All	All	Male	Female	Male by education			Female by education		
					Low	Intermediate	High	Low	Intermediate	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ln(household income)	0.0586*** (0.0140)	0.0528*** (0.0136)	0.0591*** (0.0185)	0.0403* (0.0214)	0.0502 (0.0428)	0.0484 (0.0339)	0.0538** (0.0244)	0.0420 (0.0263)	0.0309 (0.0380)	0.0620 (0.0432)
Second wealth quartile	0.0534* (0.0302)	0.0531* (0.0303)	0.0410 (0.0402)	0.0639 (0.0410)	0.0473 (0.0496)	0.0167 (0.0712)	0.0886 (0.0712)	0.0577 (0.0393)	0.1272** (0.0571)	-0.0426 (0.1014)
Third wealth quartile	0.0244 (0.0239)	0.0230 (0.0235)	0.0348 (0.0401)	0.0127 (0.0278)	0.0548 (0.0573)	0.0049 (0.0696)	0.0659 (0.0679)	0.0237 (0.0307)	0.0467 (0.0421)	-0.0615 (0.0849)
Forth wealth quartile	0.0815*** (0.0311)	0.0743** (0.0307)	0.0836* (0.0475)	0.0666 (0.0413)	0.0453 (0.0693)	0.0304 (0.0858)	0.1548** (0.0732)	0.1230* (0.0648)	0.1423** (0.0585)	-0.1093 (0.0884)
Risk Tolerance	0.0052 (0.0032)	0.0048 (0.0032)	0.0037 (0.0050)	0.0055 (0.0039)	-0.0033 (0.0073)	0.0132 (0.0098)	0.0001 (0.0091)	0.0067 (0.0063)	0.0040 (0.0051)	0.0038 (0.0101)
Economics education	0.0031 (0.0052)	-0.0012 (0.0050)	-0.0002 (0.0071)	-0.0037 (0.0072)	0.0129 (0.0112)	-0.0053 (0.0130)	-0.0055 (0.0122)	0.0005 (0.0099)	-0.0127 (0.0120)	-0.0001 (0.0146)
Financial advice	0.0585*** (0.0207)	0.0600*** (0.0205)	0.0723** (0.0329)	0.0486* (0.0259)	0.1014** (0.0447)	0.1634** (0.0654)	-0.0259 (0.0482)	0.0024 (0.0331)	0.0795* (0.0436)	0.0912* (0.0541)
Constant	-0.2045* (0.1045)	-0.2667*** (0.1016)	-0.3903*** (0.1247)	-0.1768 (0.1708)	-0.2017 (0.2897)	-0.3793* (0.2277)	-0.3176* (0.1876)	-0.2659 (0.1916)	0.0105 (0.3236)	-0.6092** (0.2764)
Observations	2,047	2,047	986	1,061	355	314	317	382	432	247
R^2	0.1058	0.1165	0.1264	0.1038	0.1636	0.1596	0.1421	0.1076	0.1281	0.1701

Note: Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Crisis effects

The table reports OLS estimates of the effect of financial literacy and confidence on current financial market participation (Panel A) and future-oriented financial planning (Panel B) across subsamples, while controlling for an interaction term between effects of the financial crisis and confidence.

	All	Male	Female	Male by education			Female by education		
				Low	Intermediate	High	Low	Intermediate	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Panel A: Current financial market participation</i>									
Financial literacy	0.0301*** (0.0037)	0.0271*** (0.0059)	0.0325*** (0.0048)	0.0340*** (0.0080)	0.0264*** (0.0102)	0.0143 (0.0136)	0.0268*** (0.0073)	0.0306*** (0.0076)	0.0472*** (0.0129)
Confidence	0.0093 (0.0071)	0.0263** (0.0118)	-0.0066 (0.0090)	-0.0035 (0.0149)	0.0335* (0.0202)	0.0657** (0.0261)	-0.0037 (0.0139)	-0.0147 (0.0140)	0.0142 (0.0257)
Crisis effects	-0.0310 (0.0806)	0.0156 (0.1288)	-0.0850 (0.1016)	0.1139 (0.1929)	-0.1361 (0.2745)	0.0430 (0.2227)	-0.2080 (0.1364)	-0.1386 (0.1396)	0.1534 (0.2503)
Confidence*Crisis effects	0.0127 (0.0167)	0.0016 (0.0263)	0.0255 (0.0219)	-0.0031 (0.0393)	0.0131 (0.0582)	-0.0043 (0.0455)	0.0595* (0.0312)	0.0240 (0.0304)	-0.0142 (0.0528)
Other controls (see Table 4)	yes	yes	yes	yes	yes	yes	yes	yes	yes
<i>Panel B: Future-oriented financial planning</i>									
Financial literacy	0.0127*** (0.0030)	0.0159*** (0.0048)	0.0108*** (0.0038)	0.0180*** (0.0059)	0.0242*** (0.0079)	0.0000 (0.0135)	0.0068 (0.0060)	0.0120** (0.0054)	0.0234*** (0.0089)
Confidence	0.0207*** (0.0056)	0.0328*** (0.0095)	0.0104 (0.0069)	0.0094 (0.0111)	0.0254 (0.0195)	0.0680*** (0.0197)	0.0110 (0.0093)	-0.0111 (0.0106)	0.0486** (0.0206)
Crisis effects	-0.0706 (0.0619)	-0.0068 (0.1132)	-0.1104 (0.0712)	-0.0377 (0.1395)	0.0297 (0.2368)	0.0464 (0.2092)	-0.0890 (0.1223)	-0.1723* (0.1008)	0.0042 (0.1707)
Confidence*Crisis effects	0.0170 (0.0137)	0.0040 (0.0243)	0.0264 (0.0166)	0.0127 (0.0314)	-0.0197 (0.0494)	0.0041 (0.0428)	0.0265 (0.0278)	0.0395* (0.0232)	-0.0008 (0.0402)
Other controls (see Table 5)	yes	yes	yes	yes	yes	yes	yes	yes	yes

Note: Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Instrumental variable regressions

The table reports the results from instrumental variables regressions using the GMM estimation method. Financial literacy has been instrumented by the financial knowledge of respondents' parents and the number of correct answers to the "Big 3" financial literacy questions from the SAVE survey in 2007. Dependent variables are current financial market participation (Panel A) and future-oriented financial planning (Panel B).

	All	Male	Female	Male by education			Female by education		
				Low	Intermediate	High	Low	Intermediate	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Panel A: Current financial market participation</i>									
Financial literacy	0.0563*** (0.0093)	0.0546*** (0.0129)	0.0579*** (0.0132)	0.0715*** (0.0175)	0.0130 (0.0205)	0.0769** (0.0329)	0.0694*** (0.0199)	0.0421** (0.0188)	0.1006** (0.0450)
Confidence	0.0067 (0.0070)	0.0208* (0.0115)	-0.0063 (0.0087)	-0.0114 (0.0160)	0.0361* (0.0188)	0.0484* (0.0260)	-0.0024 (0.0136)	-0.0133 (0.0137)	0.0132 (0.0224)
Other controls (see Table 4)	yes	yes	yes	yes	yes	yes	yes	yes	yes
F-value of excl. instruments	116.601	71.7072	50.3494	50.913	15.9244	11.3933	16.1106	27.9243	7.80994
p-value of excl. instruments	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006
Hansen J-test p-value	0.6413	0.5187	0.8204	0.4546	0.6395	0.6127	0.9968	0.6766	0.9798
p-Value exogeneity test	0.0060	0.0093	0.0944	0.0082	0.0680	0.0313	0.0869	0.3778	0.2041

Table 7 continued

	All	Male	Female	Male by education			Female by education		
				Low	Intermediate	High	Low	Intermediate	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Panel B: Future-oriented financial planning</i>									
Financial literacy	0.0242*** (0.0070)	0.0254** (0.0101)	0.0241** (0.0099)	0.0263* (0.0145)	0.0293* (0.0165)	0.0126 (0.0269)	0.0258 (0.0170)	0.0177 (0.0162)	0.0448 (0.0310)
Confidence	0.0220*** (0.0055)	0.0319*** (0.0090)	0.0131* (0.0069)	0.0108 (0.0109)	0.0217 (0.0193)	0.0678*** (0.0188)	0.0103 (0.0096)	-0.0033 (0.0122)	0.0476*** (0.0177)
Other controls (see Table 5)	yes	yes	yes	yes	yes	yes	yes	yes	yes
F-value of excl. instruments	116.124	71.0342	51.6922	50.366	16.0474	11.9126	16.8856	28.6937	7.81879
p-value of excl. instruments	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006
Hansen J-test p-value	0.8801	0.4191	0.4375	0.7946	0.7238	0.3328	0.8172	0.3176	0.5061
p-Value exogeneity test	0.0610	0.4430	0.0870	0.8197	0.9281	0.9556	0.3532	0.5347	0.0441

Note: Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Combined measure of financial literacy and confidence: Unjustified confidence

The table reports OLS estimates of the effect of unjustified confidence (measured as the residual from a regression of the confidence score on the financial literacy score) on current financial market participation (Panel A) and future-oriented financial planning (Panel B), across subsamples.

	All	Male	Female	Male by education			Female by education		
	(1)	(2)	(3)	Low	Intermediate	High	Low	Intermediate	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Panel A: Current financial market participation</i>									
Unjustified confidence	0.0093	0.0238**	-0.0029	-0.0082	0.0295	0.0658***	0.0037	-0.0081	0.0004
	(0.0068)	(0.0113)	(0.0085)	(0.0147)	(0.0193)	(0.0230)	(0.0131)	(0.0131)	(0.0231)
Other controls (see Table 4)	yes	yes	yes	yes	yes	yes	yes	yes	yes
<i>Panel B: Future-oriented financial planning</i>									
Unjustified confidence	0.0265***	0.0373***	0.0178*	0.0160	0.0228	0.0680***	0.0126	-0.0048	0.0619**
	(0.0067)	(0.0094)	(0.0094)	(0.0116)	(0.0196)	(0.0179)	(0.0093)	(0.0113)	(0.0271)
Other controls (see Table 5)	yes	yes	yes	yes	yes	yes	yes	yes	yes

Note: Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Combined measure of financial literacy and confidence: Four groups

The table reports OLS estimates of the combined effects of actual and perceived financial knowledge, where four groups have been constructed along the mean of the variables (compare Appendix B for a detailed description) on current financial market participation (Panel A) and future-oriented financial planning (Panel B). Group “High_High” is the omitted category.

	All	Male	Female	Male by education			Female by education		
	(1)	(2)	(3)	Low	Intermediate	High	Low	Intermediate	High
	(4)	(5)	(6)	(7)	(8)	(9)			
<i>Panel A: Current financial market participation</i>									
Low_Low (I)	-0.1866*** (0.0257)	-0.2061*** (0.0384)	-0.1581*** (0.0347)	-0.1862*** (0.0614)	-0.2257*** (0.0618)	-0.2757*** (0.0889)	-0.1917*** (0.0638)	-0.0977* (0.0538)	-0.2157** (0.0942)
Low_High (II)	-0.0859*** (0.0269)	-0.1519*** (0.0369)	-0.0187 (0.0396)	-0.1648** (0.0653)	-0.1742*** (0.0609)	-0.1232* (0.0631)	-0.0999 (0.0795)	0.0113 (0.0576)	-0.0232 (0.0726)
High_Low (III)	-0.1945*** (0.0264)	-0.1775*** (0.0403)	-0.1956*** (0.0338)	-0.1867*** (0.0542)	-0.2288*** (0.0736)	-0.0158 (0.0940)	-0.1902*** (0.0585)	-0.1684*** (0.0503)	-0.2898*** (0.0860)
Other controls (see Table 4)	yes	yes	yes	yes	yes	yes	yes	yes	yes
<i>Panel B: Future-oriented financial planning</i>									
Low_Low (I)	-0.1130*** (0.0251)	-0.1427*** (0.0340)	-0.0866** (0.0354)	-0.0898** (0.0456)	-0.1529** (0.0708)	-0.1464** (0.0658)	-0.0582 (0.0501)	-0.0438 (0.0464)	-0.1902** (0.0809)
Low_High (II)	-0.0955*** (0.0255)	-0.1500*** (0.0347)	-0.0426 (0.0366)	-0.0482 (0.0579)	-0.1110 (0.0717)	-0.2172*** (0.0487)	0.0075 (0.0692)	-0.0024 (0.0489)	-0.1183* (0.0688)
High_Low (III)	-0.0935*** (0.0241)	-0.1010*** (0.0356)	-0.0793** (0.0339)	-0.0657 (0.0501)	-0.1477** (0.0666)	-0.0590 (0.0798)	-0.0234 (0.0524)	-0.0865* (0.0447)	-0.1645** (0.0817)
Other controls (see Table 5)	yes	yes	yes	yes	yes	yes	yes	yes	yes

Note: Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix B: Variable definitions

Variable	Definition
Financial literacy	Number of correct answers to the nine financial literacy questions listed in Appendix C
Confidence	Score ranging from [1] “very low“ to [7] “very high“ on the following question: “How would you assess your understanding of financial matters?”
Unjustified confidence	Residual taken from a regression of the confidence score on the score of financial literacy
Financial literacy groups	(I) Low_Low = <i>confidence</i> ≤ <i>mean</i> and <i>financialliteracy</i> ≤ <i>mean</i> ; (II) Low_High = <i>confidence</i> ≤ <i>mean</i> and <i>financialliteracy</i> > <i>mean</i> ; (III) High_Low = <i>confidence</i> > <i>mean</i> and <i>financialliteracy</i> ≤ <i>mean</i> ; (IV) High_High = <i>confidence</i> > <i>mean</i> and <i>financialliteracy</i> > <i>mean</i>
Age	Age of respondent
Female	Dummy=1 if respondent is female
Education dummies	
Low level	Dummy=1 if respondent has lower secondary education (9 years of schooling)
Intermediate level	Dummy=1 if respondent has intermediate level of education (10 years of schooling)
High level	Dummy=1 if respondent has high level of education (12 or 13 years of schooling)
Married	Dummy=1 if respondent is married
Number of children	Number of children living within or outside the household
Retired	Dummy =1 if respondent is retired
Self-employed	Dummy=1 if respondent is self-employed
Ln(household income)	Logarithm of average monthly disposable household income
Total gross wealth	Amount of financial wealth plus home and business equity, additional real estate and other real assets (e.g. jewelry, antiques etc.) (on the basis of portfolios held at the end of 2008)
Ln(gross financial wealth)	Logarithm of the amount of deposits held in savings accounts, building savings contracts, fixed income securities, stocks, stock mutual and real estate funds, life insurance contracts, private and employer-based pension wealth as well as other financial assets
Financial market participation	Dummy=1 if respondent owns individual stocks, stock mutual and real estate funds or other risky financial assets (e.g. discount certificates, hedge funds, money market funds)
Financial planning	Dummy=1 if household declares to save regularly and affirmed the following question “Have you and your partner ever tried to find out how much you would have to save today to reach a certain standard of living at old-age?”
Risk tolerance	Self-assessment ranging from [0] “completely disagree“ to [10] “completely agree“ on the following statement: “I do not mind taking risks with respect to financial matters“
Economics education (2010)	Score ranging from [1] “not at all“ to [7] “very intensively“ on the following question: “How intensively did you deal with economic issues in school?“ (SAVE survey wave of 2010)
Financial advice	Dummy=1 if household talks his financial matters with a financial advisor
Crisis effects	Dummy=1 if respondent is affected by the financial crisis 2007/08 via detrimental labor market effects (loss of income, unemployment, shorter hours worked etc.)
Parents’ financial knowledge (2010)	Score ranging from [1] “very low“ to [7] “very high“ on the following question: How would you assess the understanding of financial matters of your parents?
Financial literacy “Big 3” (2007)	Number of correct answers to “Big 3” financial literacy questions (numeracy, inflation, risk diversification; SAVE survey wave of 2007)

Appendix C: Wording of financial literacy questions

The table provides a translation of financial literacy questions in the 2009 SAVE questionnaire based on Dick and Jaroszek (2013). Correct answers are in bold font.

Label	Question
Numeracy	Suppose you own 100 Euro in a savings account. This balance yields interest of 2% per year and you leave it on this account for 5 years. What do you think: What is the deposit account balance after 5 years? [more than 102 Euro ; exactly 102 Euro; less than 102 Euro; Don't know]
Interest Compounding	Suppose you had 100 Euro in a savings account and the interest rate is 20% per year and you leave it on this account for 5 years. What do you think: What is the deposit account balance after 5 years? [More than 200 Euro ; Exactly 200 Euro; Less than 200 Euro; Don't know]
Inflation	Assuming your savings account yields interest of 1% per year and inflation amounts to 2% per year. What do you think: Will you be able to buy more, less, or as much as today with your deposit account balance after one year? [More; As much as today; Less ; Don't know]
Money Illusion	Suppose that in the year 2012 your income has doubled and prices of all goods have doubled too. How much will you be able to buy with your income in 2012? [More than today; As much as today ; Less; Don't know]
Risk Diversification	Is the following statement right or wrong: An investment in a single stock is less risky than an investment in an equity mutual fund? [Right; False ; Don't know]
Return Volatility	Which of the following assets exhibits the highest return volatility? [Savings books, bonds, stocks , Don't know]
Stock Market	What is the main task of the stock market? [The stock market predicts stock gains, the stock market increases stock prices; The stock market is the place where equity demand meets equity supply ; None of the above; Don't know]
Balanced funds	Which of the following statements is correct? [If you invest in a balanced fund, you cannot withdraw money within the first year of your investment; Balanced funds invest in several asset classes like stocks and bonds ; Balanced funds guarantee a fixed interest rate which is based on past performance; None of the above statements is correct; Don't know]
Bond prices	How does a fixed-coupon bond price react to decreasing interest rates? [Bond price increases ; Bond price remains constant; Bond price decreases; Don't know]