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Conference Paper

Actual and perceived financial sophistication and wealth accumulation: The role of education and gender

Beiträge zur Jahrestagung des Vereins für Socialpolitik 2016: Demographischer Wandel - Session: Saving, Wealth and Retirement, No. F07-V2

Provided in Cooperation with:

Verein für Socialpolitik / German Economic Association

Suggested Citation: Neubert, Milena; Bannier, Christina E. (2016) : Actual and perceived financial sophistication and wealth accumulation: The role of education and gender, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2016: Demographischer Wandel - Session: Saving, Wealth and Retirement, No. F07-V2, ZBW - Deutsche Zentralbibliothek für Wirtschaftswissenschaften, Leibniz-Informationszentrum Wirtschaft, Kiel und Hamburg

This Version is available at:

<https://hdl.handle.net/10419/145593>

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Actual and perceived financial sophistication and wealth accumulation: The role of education and gender

February 25, 2016

Abstract

This study examines the role of actual and perceived financial sophistication (i.e., financial literacy and confidence) for individuals' wealth accumulation. Using survey data from the German SAVE initiative, we find first of all 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 then show that these differences influence wealth accumulation: The positive effect of financial literacy is stronger for women than for men and is increasing in women's education but decreasing in men's. For highly-educated men, however, overconfidence closes this gap by increasing wealth via stronger financial engagement. Interestingly, female underconfidence does not reduce current wealth levels though it weakens future-oriented financial engagement and may thus impair future wealth accumulation.

JEL Classification: D91, G11, D83, J26

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

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).

As a consequence, a growing body of research has started to examine individuals' financial literacy, defined as "the ability to use knowledge and skills to manage one's financial resources effectively for lifetime financial security" by the Jump\$tart Coalition for Personal Financial Literacy in 1997. Various studies indicate that a large fraction of the population indeed lacks basic financial knowledge and that this severely hampers their financial engagement (Bernheim, Garrett, and Maki, 2001; Bernheim and Garrett, 2003; Lusardi and Mitchell, 2007; Lusardi and Mitchell, 2011). While knowledge improves information processing and, hence, reduces the cost of financial market participation, self-confidence has been shown to be an equally important driver for engagement (Odean, 1998; Odean, 1999; Camerer and Lovallo, 1999; Grinblatt and Keloharju, 2009). This holds particularly when difficult decisions have to be made and feedback is noisy and infrequent (Bandura and Locke, 2003), as can be expected to be the case for many financial decisions.

This paper combines the two aspects and examines whether both financial literacy and confidence, i.e. actual and perceived financial sophistication, influence wealth. We also consider financial market participation and financial planning as two major channels of financial engagement via which wealth can be accumulated. Since differences in self-perceptions have been attributed to, *inter alia*, gender stereotypes (Niederle and Vesterlund, 2007) and metacognitive skills (Kruger and Dunning, 1999), we take particular care in allowing for potential gender disparities and gaps in formal education. In doing so, we complement the earlier literature on behavioral biases in financial decisions that has mainly considered the choices of male experts, for instance executive managers (Gervais, Heaton, and Odean, 2011; Adam, Fernando, and Golubeva, 2015; Huang, Tan, and Faff, 2015), portfolio managers (Puetz and Ruenzi, 2011; Gloede and Menkhoff, 2014) or traders (Hirshleifer and Luo, 2001; Palomino and Sadrieh, 2011; Sonsino and Regeff, 2013). Less is known about the impact of self-confidence on male and female amateurs' financial decisions and wealth accumulation. This is where our study tries to contribute.

Based on a large survey dataset from SAVE, a representative panel of German households, we find not only that actual and perceived financial sophistication diverge in correspondence with respondents' gender and formal education, but also that they have different, independent effects on individuals' financial engagement and wealth levels. Four main sets of results are derived. 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 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.

This gender- and education-related divergence between actual and perceived financial knowledge appears to be also relevant for the accumulation of respondents' wealth. Our second set of results demonstrates that financial literacy plays a role in the build-up of wealth for all respondents. 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. We observe, for instance, that the percentage increase in wealth due to a one-unit change in financial literacy for highly-educated women is almost twice the size of the corresponding increase for highly-educated men. Confidence, in contrast, raises the wealth levels only of men with higher than basic education. Hence, both actual and perceived financial sophistication play important roles for the wealth-accumulation of relatively highly-educated men, but for women and lowly-educated men only actual financial knowledge is relevant.

Third, we examine the channels via which actual and perceived financial sophistication may lead to the observed wealth effects. We study the decision to invest (and the amount invested) in risky assets as proxies for current financial market participation. We also examine future-oriented financial planning behavior, i.e., the decision to save regularly and the annual savings amount, as well as the self-assessed degree of preparedness for retirement. With respect to financial market participation, we find that financial literacy has a positive impact for both male and female respondents. Again, the effect is increasing in education for women but decreasing for men. Confidence, however, influences only men with at least intermediate education. The structure of effects hence closely parallels those on wealth accumulation. With regard to future-oriented financial planning, in contrast, the impact of self-confidence is much stronger. We observe that both men and women are positively affected by their confidence if they attained sufficiently high education. Financial literacy has only fragile effects on financial planning that are also of much smaller size.¹

We finally study the effects that the discrepancy between actual and perceived financial sophistication - i.e., the over- respectively underconfidence of respondents - has on their financial engagement and wealth accumulation. We find that highly-educated men profit significantly from

¹Guiso and Viviano (2015) correctly point out that the distinction between good or bad financial decisions is often less than clear. As such, we cannot immediately claim that stronger financial engagement, i.e. larger stock holdings or higher savings, corresponds to a better financial decision than weaker engagement. Guiso and Viviano (2015) therefore consider very distinct cases where the definition of a dominating alternative becomes possible and study the effect of financial literacy on this choice. In our case, the reference to the eventual goal of wealth maximization serves as an ex-post evaluation of decision quality.

their overconfidence, in that they are able to accumulate higher wealth, 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 wealth accumulation or financial market participation.

The case for improving financial literacy has strongly gained ground over the last years with various implications for schooling, further training, and counselling.² Our work now 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.³ This holds especially for highly-educated women whose financial planning suffers from their acute underconfidence. Though current wealth levels seem to be sufficiently bolstered by their strong actual financial knowledge, the negative effects of underconfidence may be expected to be felt in the future. This problem becomes even more worrisome when taking into account that women, due to divorce or widowhood, still bear a much higher exogenous risk of hitting poverty in old age than men (Smeeding and Sandstrom, 2005).

It should be noted 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 lead to an even weaker association between actual and perceived financial sophistication for men and a stronger association only for women with higher than basic education. Offering immediate feedback as a means to raise self-perceptions (Butler, Karpicke and Roediger, 2008) in financial education courses should therefore only be considered as a suitable training tool for relatively highly-educated women. For men, in contrast, employing feedback-based methods to boost their confidence may easily be counterproductive. Rather, it may be helpful to stress the masculinity of the financial decision frame in order to emphasize the stereotypical task context that typically empowers male overconfidence (Niederle and Vesterlund, 2007). Training that intends to strengthen financial confidence hence needs to be much more specifically tailored to the individual person than simple programs to increase financial literacy.

The remainder of the paper proceeds as follows. Section 2 gives a review of the related literature. In Section 3 we describe the data. Section 4 delineates the measurement of financial literacy and confidence and their distributional characteristics in our dataset. In Section 5, we report the influence of the two variables on respondents' wealth levels, Section 6 shows the results with respect to current financial market participation and future-oriented financial planning as the two main

²For one of the few exceptions, arguing against the need for general financial education, see Willis (2011).

³? comes to a similar conclusion.

channels of wealth-accumulation. Section 7 presents further robustness checks. In Section 8, we consider the specific effects of over- and underconfidence on wealth accumulation and financial engagement. Finally, Section 9 concludes.

2 Literature review

Our work is related to different strands of the literature in behavioral finance, psychology and household finance. Studies in behavioral finance have for a long time examined the impact of self-confidence on financial market participation. Odean (1998) shows that overconfidence leads to excessive market trading and Barber and Odean (2001) report that men, due to their higher confidence in finance matters, trade even more excessively in the common stock market. Huang and Kisgen (2013) find a similar gender gap with respect to corporate financial and investment decisions. Other studies emphasize the interrelation between overconfidence and expertise. According to Lambert, Bessiere, and N’Goala (2012), self-confidence is the dominating influence on experts’ financial investment decisions, whereas laymen are more strongly affected by their risk-aversion. Gervais and Odean (2001) derive in a theoretical model how traders in their early careers take too much credit for their successes, thus nurturing their overconfidence, while recognition of their true ability becomes possible only in later career stages. We contribute to this literature by focusing on the financial decisions of non-experts, taking into account the differences in self-confidence between men and women and considering their risk aversion at the same time. In contrast to much of the behavioral finance literature, our results portray inappropriate (or over-) confidence not necessarily as a harmful metacognitive bias but show that it can lead to desirable outcomes.⁴

The endogeneity of self-confidence, induced by learning the consequences of one’s actions, is also a centrepiece of the psychological literature. Heider (1976) has been one of the first to comment on the self-serving attribution bias as a tendency to attribute success to the self and failure to external causes. The self-attribution bias has been shown to be a robust and pervasive phenomenon in human cognition (Zuckerman, 1979; Sedikides and Strube, 1995). Several studies, however, demonstrate a large variation according to 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 and science (Mezulis et al., 2004; Jakobsson, Levin, and Kotsadam, 2013). At the same time, the so-called impostor phenomenon that leads individuals to externalize success and attribute failure internally (Thompson, Davis, Davidson, 1998) has been shown to be particularly pervasive among high-achieving women (Clance and Imes, 1978; Kumar and Jagacinski, 2006). Our study confirms the gender-related differences in overconfidence with respect to financial decisions as a stereotypical masculine task and uses these insights to control for both gender and educational status when considering the impact of self-confidence on financial

⁴Our results hence support the findings by Parker, Bruine de Bruin, Yoong, and Willis (2012).

decisions and outcomes.

The main focus of our study is on the role of financial knowledge in household finance. Whereas the early literature on financial literacy has been mainly concerned with the measurement of financial knowledge along both objective test measures and subjective self-ratings (Hung, Parker, and Yoong, 2009; Huston, 2010), later studies have predominantly employed a standard set of multiple-choice test questions to calculate an objective financial literacy score. This score has been used to explain financial behaviors relating to retirement planning (Lusardi and Mitchell, 2007, 2008; Van Rooij, Lusardi, and Alessie, 2012), stock market participation (Van Rooij, Lusardi, and Alessie, 2011; Balloch, Nicolae, and Philip, 2015), wealth accumulation (Behrman et al., 2012; Gustman, Steinmeier, and Tabatabaei, 2012), debt accumulation (Lusardi and Tufano, 2009), and risk (Lusardi, 2015).

Only recently has the subjective perception of financial knowledge been considered as an additional factor influencing financial behavior. The papers most closely related to ours in this respect are Allgood and Walstad (2016), Anderson, Baker, and Robinson (2015), and Van Rooij, Lusardi, and Alessie (2012). Allgood and Walstad (2016) combine information on both actual and perceived financial knowledge of respondents to the US National Financial Capability Study in 2009. They find that perceived financial literacy in many cases has a stronger impact on a large number of financial decisions than actual literacy. Anderson, Baker, and Robinson (2015) measure objective financial literacy in a sample of LinkedIn members⁵ and additionally elicit a probability distribution of perceived literacy. This allows them to differentiate between issues of confidence and miscalibration. They also find that self-confidence explains a larger likelihood of financial engagement than actual financial literacy. Van Rooij, Lusardi, and Alessie (2012) focus on the role of financial literacy on retirement planning and wealth accumulation in a sample of Dutch households. They briefly comment on the influence of over- and underconfidence by constructing dummy variables that are based on the relative position of respondents within the distribution of actual and perceived financial knowledge. Underconfidence has a negative effect on wealth in their sample, whereas overconfidence does not show a significant association with wealth. Neither of these studies considers gender- or education-related differences in actual and perceived financial sophistication.

Our study confirms these earlier findings and extends the scope of the analyses on various accounts. First, we examine a sample of the German adult population that is representative in several dimensions, most importantly the distribution of formal education among respondents. This allows us to compare and contrast actual and perceived financial sophistication with reference to these personal characteristics. Second, we consider the individual impact of financial literacy and confidence on individuals' wealth levels, shedding light on the role that education and gender play in this process. Building on these insights, we examine the channels via which actual and perceived financial knowledge influence wealth by studying their impact on individuals' current financial

⁵Due to the high degree of education of respondents, financial literacy in their sample is clearly above-average.

market participation and future-oriented financial planning. This allows us to point out more specific requirements for transforming existing financial education programs to enhance individuals’ financial well-being. Finally, we employ a numerical score of the divergence between perceived and actual financial sophistication to study the impact of “unjustified confidence” on financial engagement and wealth accumulation. Our results hence lend themselves to more detailed interpretations as compared to studies that use dummy variables to categorize respondents into the two distinct classes of either over- or underconfident.

3 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 has been run on an annual basis since 2005. The questions in the survey are answered by the household member who knows the household’s finances best. Measures of demographic characteristics, financial literacy, and self-assessments refer to this person, whereas information on the financial situation are 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 financial circumstances of households. This could potentially threaten data validity within the context of our paper. Deleting all observations with missing items is not a desirable strategy, however, as it would reduce the sample size with an associated loss of statistical efficiency. Moreover, it would bear the risk of biased results when item non-response

⁶As robustness check we ran all regressions using weights and our main results do not change. Regression tables are available upon request.

is not randomly distributed among respondents. Multiple imputation offers a better solution 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 item 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; Ziegelmeier, 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.⁸ With respect to the main socio-demographic factors, we see that 54% of sample respondents are female, 29% live in federal states of the former East Germany. 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. 58% of respondents are married, with an average of 1.7 children per household. 36% of respondents are retired and 3% are self-employed.

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. 53% of all respondents save regularly and 25% hold risky financial investments such as, e.g., stocks, funds or certificates. Interestingly, only 20% of all households can be characterized as being prepared for retirement, judging from the basic 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?” 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).⁹ 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 38% of our respondents have been affected negatively by the financial crisis 2007/08 either due to a loss in wealth or due to detrimental labor market effects.

Further self-assessments (both ranging from 0 to 10) refer to self-control¹⁰ (average score of 6.69) and respondents’ perceived future economic well-being (average score of 4.84). Cognitive abilities

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

⁸A detailed list of variable definitions is given in Appendix B.

⁹We use the answers to this question from the SAVE survey wave of 2010 and match information to the respective unit in the 2009 wave.

¹⁰We use the answers to this question from the SAVE survey wave of 2007 and match information to the respective unit in the 2009 wave.

are measured using the cognitive reflection test (CRT) developed and tested by Frederick (2005). We construct an index from 0 to 3 corresponding to the number of correct answers to the three quiz-based questions. The average score in the total sample is 1.17. Together with the so-called “Big 3” financial literacy score from the survey wave of 2007 (average score of 2.40) these items will serve as instruments for actual and perceived financial sophistication 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.

4 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, which are a subset of the questions used in Van Rooij, Lusardi, and Alessie (2011). They contain the “Big 3” questions¹¹ (Hastings, Madrian, and Skimmyhorn, 2013) that have become a regular component of international tests of financial literacy and add some more specific questions relating, 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 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 degree 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 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 self-confidence.

Table 3 shows mean levels of both financial literacy and confidence for the total sample and for subgroups of respondents. As it is well known that task-specific self-assessments vary with gender

¹¹The “Big 3” score contains answers to the questions on numeracy, inflation and risk diversification as listed in Appendix C.

and metacognitive abilities (Mezulis et al., 2004; Jakobsson, Levin, and Kotsadam, 2013), we split our total sample according to gender and educational attainment to be able to compare the actual and perceived measures for the different subgroups.

Panel A of 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. This observation supports 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 perception of their 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 confi-

dence 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 self-confidence. As a consequence, male respondents 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.

5 Financial sophistication and wealth

The relationship between financial literacy, confidence and wealth accumulation 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, Steinmeier, and Tabatabaei, 2012; Van Rooij, Lusardi and Alessie, 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, Lusardi, and Alessie, 2011), or holding undiversified portfolios (Calvet, Campbell, and Sodini, 2007; Von Gaudecker, 2015). Of the few studies that consider the effect of excess confidence, Van Rooij, Lusardi, and Alessie (2012) show that underconfidence has an individual, negative impact, whereas overconfidence does not appear to influence household wealth.

Based on our results of Section 4, analyses of the association between wealth and financial literacy and confidence should account for both gender and education effects. For this reason, we run a multivariate OLS regression of financial wealth (in logarithmic format) on different subsamples of respondents, distinguishing between men and women at different levels of formal education. Our main explanatory variables of interest are actual and perceived financial sophistication, i.e., financial literacy and confidence. Our choice of control variables follows Van Rooij, Lusardi, and Alessie (2011) and Van Rooij, Lusardi, and Alessie (2012) and includes age, marriage status, number of children, retirement status, employment status, household income, risk tolerance and economics education. Note that our results do not change if we employ total wealth instead of financial wealth as dependent variable.

The first two columns in Table 4 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 financial wealth that is not reduced by employing confidence as an additional factor. Rather, confidence displays an independent, highly significant positive impact on wealth 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 explanatory content.

The control factors in the regressions show essentially the expected effects: Wealth increases in age, in educational attainment and in household income and decreases in the number of children. It is higher for married respondents and for respondents with a higher risk tolerance. Interestingly, self-assessed economics education has no significant influence on financial wealth.

The further columns in Table 4 report the results of the same OLS regression equation for the different subsamples of survey respondents. Columns (3) and (4) display the results for the male respectively female respondents only, columns (5) - (7) consider the subsamples of male respondents with different levels of education while columns (8) - (10) give the results for the respective subsamples of female respondents. Financial literacy has a significantly positive effect on wealth in all subsamples. Interestingly, the effect of financial literacy on women's wealth is much stronger than on men's wealth. Additionally, we observe that the impact of literacy is increasing in educational attainment for women but decreasing for men. For highly-educated respondents we therefore find strongly diverging regression coefficients of 0.30 for men and 0.56 for women. A one-unit improvement in financial literacy would hence trigger a wealth increase of approximately 56% for highly-educated women but only of about 30% for highly-educated men.

Self-confidence, in contrast, affects only the wealth of male respondents. This effect is driven by men with higher than basic education, as can be seen from columns (6) and (7). The wealth-impact of confidence for men is also rising in education as the increase in the regression coefficient from 0.28 at intermediate educational level to 0.40 at the highest educational level shows. Confidence plays no role for female respondents' financial wealth, though, nor for men with only basic education.

Judging from our results so far, there appears to be a particularly strong association between women's wealth levels and their actual financial knowledge. Since this association moreover increases in educational attainment and highly-educated women possess high financial literacy, this should lead to strong wealth increases for this subgroup due to both marginal and level effect. The female lack of self-confidence, in contrast, does not seem to hinder the accumulation of wealth as there is no significant association between the two. For men, the effect of financial literacy on wealth accumulation is smaller on the margin and decreasing in education, but since men show higher absolute levels of financial literacy than women that are increasing in education, the overall effect of actual financial knowledge on men's wealth should be equally high. Additionally, men with sufficiently high education profit from a positive self-confidence effect on their financial wealth. Again, this marginal effect should be boosted by the fact that male confidence increases in education. For highly-educated men, the increasing importance of perceived financial knowledge hence appears

to replace the decreasing importance of actual financial knowledge on the margin.

6 Financial sophistication and financial engagement

In order to shed more light on the channels via which actual and perceived financial sophistication have an effect on wealth, we examine different types of financial engagement in the following. We begin by connecting literacy and confidence with the decision to participate in financial markets and with the amount of current risky investments held by the households. We then study future-oriented financial planning. In this respect, we consider the decision to save regularly, the annual savings amounts and the more general issue of retirement preparedness.

6.1 Risky investment decisions

Several studies so far have examined whether financial literacy impacts individuals' decisions to invest in stocks. While Christelis, Jappelli, and Padula (2007) report that basic numeracy already influences portfolio composition significantly, Van Rooij, Lusardi, and Alessie (2011) show that advanced financial literacy increases the likelihood of stock market participation particularly strongly. In the same vein, Balloch, Nicolae, and Philip (2015) emphasize the importance of more specific stock market literacy. Christelis, Georgarakos, and Haliassos (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 risky financial assets in general, as these should all be expected to influence financial wealth. The risky assets that we consider could 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, Haliassos, and Jappelli (2002), our empirical specification considers many determinants of risky investments as control variables.¹² 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 make sure that the control variable on the right-hand side of the regression equation is reduced by the amount of risky investment holdings, i.e., our left-hand-side variable.

Panel A of Table 5 shows the coefficients of financial literacy and confidence from an OLS regression on a dummy variable that indicates whether or not the respondent invests in risky assets.¹³ Again, we report results for the total sample in the first column, for male and female respondents

¹²The full list of control variables comprises the same variables as in Table 4, complemented by dummies for quartiles of total gross wealth.

¹³The regression coefficients for the control variables are available upon request.

individually in the next two columns and for the different educational levels in the following columns. As can be seen, financial literacy has a highly significant positive impact on the decision to engage on risky financial markets in almost all samples considered. The influence of literacy is stronger for women than for men. As such, a one-unit increase in financial literacy raises the probability of holding risky investments by 3.4 percentage points for women and by 2.9 percentage points for men. While the effect of literacy on the decision to invest increases in women’s education, we find a decreasing effect for men that moreover loses significance for highly-educated men. Confidence, in contrast, shows a positive association only with men’s risky investment decision. This effect is furthermore driven by men with higher than basic education and increases from intermediate to higher education.

Panel B of Table 5 displays the findings from an OLS regression on the (logarithm of the) amount invested in risky assets on the basis of portfolios held at the end of 2008. The results are very similar to those in Panel A. Again, we observe that financial literacy influences positively the investment amounts of both male and female respondents. For women, the association between literacy and investment amount is stronger on average than for men and strengthens with improving educational level. For men, in contrast, it weakens and loses significance for the highest education level. Just as for the investment decision per se, we also find that confidence only affects men’s risky investment amounts. Once more, we see that the impact of confidence is driven by men with intermediate and high education, with the size of the effect increasing in educational attainment.

Our results regarding financial market participation hence strongly support our findings on the accumulation of wealth in Section 5. Women’s engagement in risky investments is strongly related to their actual financial knowledge and the association is moreover increasing in formal education. As female respondents display immense education-related gains in financial literacy, women with high educational attainment should be expected to be very active on financial markets and to be able to build up wealth despite their weak perceived financial sophistication. For men, in contrast, we observe that self-confidence replaces financial literacy in its influence on market participation with increasing education. Since both actual and perceived financial knowledge are increasing in education for men, we cannot yet assess whether this leads to an overall stronger or weaker market engagement. To answer this question, we will have to examine the net effect, i.e., the impact of unjustified confidence. This analysis will be presented in Section 8. So far, however, we may state that highly-educated male respondents appear to benefit additionally from their perceived financial knowledge as it increases their financial market participation, whereas lowly-educated men and women in general seem to be positively influenced only by their actual knowledge.

6.2 Regular savings

Setting up and managing a retirement account can be seen as an important building block for financial independence in old age. Additional precautionary savings will add to future financial

wealth. Only few studies have so far examined the link between financial literacy and general saving behavior. The few papers that do find a positive association (Allgood and Walstad, 2015; De Bassa Scheresberg, 2013). We follow this thread and study the influence of actual and perceived financial sophistication on the decision to save regularly and on the annual saving amounts.

Panels C and D of Table 5 report the results.¹⁴ Panel C shows the coefficients from an OLS regression on a dummy variable indicating whether or not respondents save regularly. Panel D displays the findings from an OLS regression on the (logarithm of the) amount of annual savings in 2008. For the decision whether to save at all, financial literacy can be seen to have only a very weak positive effect. In the subsamples, this variable is only significant for men with intermediate educational level. The amount of annual savings shows a stronger positive association with financial literacy. However, this effect appears to be predominantly driven by female respondents and, again, by men with intermediate educational level.

Confidence, in contrast, plays a much more prominent role for respondents' savings decisions. Indeed, the impact of self-confidence appears to be almost complementary to the effect of financial literacy for men: It is men with low and high educational attainment, i.e. those groups that show no impact of financial literacy, whose savings behavior is most strongly affected by their confidence. Moreover, male respondents with the highest educational level show the largest impact of confidence. A similar effect is also observed for women: Highly-educated females' savings decision and savings amounts are strongly influenced by their perceived financial sophistication. Surprisingly, our data show a weakly significant negative impact of confidence on the savings decision of women with intermediate educational level. There is no such effect, however, with respect to the savings amount.

6.3 Retirement preparedness

The link between retirement planning and wealth accumulation has been asserted in various empirical work (Lusardi, 1999; Lusardi and Mitchell, 2007; Lusardi and Mitchell, 2009). 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, Lusardi, and Alessie, 2012).

Following our earlier structure, Panel E of Table 5 shows the results from an OLS regression on the retirement preparedness score based on the self-assessment of survey respondents.¹⁵ Though we observe that financial literacy has a significantly positive impact on retirement readiness for both

¹⁴Again, the full list of control variables comprises the same variables as in Table 4, complemented by dummies for quartiles of total gross wealth

¹⁵The full list of control variables comprises the same variables as in Table 4, complemented by dummies for quartiles of total gross wealth. However, the model shown in Panel E of Table 5 does not include the control variables on retirement and employment status, as these are clearly correlated with the dependent variable.

men and women, the effect is not consistent over different educational levels. Rather, we find that financial literacy plays a role for women with higher than basic education and that the influence of literacy on retirement preparedness increases in educational attainment. Among men, however, financial literacy has a significant effect only for those with basic education.

Interestingly, self-confidence has a comparatively strong impact on both men and women’s retirement readiness. The effect is significant for men with higher than basic education - hence complementing the role of financial literacy - and is increasing in education. We also observe a significantly positive association between confidence and retirement preparedness for women with high education. It should also be noted 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 different types of financial engagement, i.e. risky investments, savings and retirement preparedness, an interesting dichotomy arises: It seems to be the case that perceived financial sophistication plays a more important role for future-oriented financial planning, i.e. savings and retirement readiness, while actual financial sophistication appears more strongly associated with current engagement on financial markets. Examining the results in more detail, we find that 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.

7 Discussion and extensions

7.1 East-West effects

Ever since the work of Jappelli (2010) it is well known that the level of financial sophistication is strongly dependent on the institutional framework and financial market development. Financial literacy should hence be higher in countries where more resources are available for private wealth accumulation. Set against the German background, Bucher-Koenen and Lamla (2014) show that this explains the lower financial knowledge of East Germans in comparison to West Germans and that the gap is persistent even 20 years after reunification.

In order to test whether our results are affected by an East-West divide, we rerun our analysis, using a Dummy variable that indicates whether a respondent is residing in one of the eastern German federal states. This allows us to control for these specific geographical effects. Before we report the results, Table 6 shows the distribution of financial literacy, confidence and unjustified confidence for East and West Germans separately. In accordance with Bucher-Koenen and Lamla (2014), we find that financial literacy is lower among East Germans than West Germans. Interestingly, however, the difference is larger for men than for women. As a consequence, the gender gap in financial literacy is smaller among East Germans than among West Germans.

A similar result is also found for confidence. However, the development of confidence over educational groups is different in the two parts of Germany. While we see that confidence increases in education for East German men, this is not the case for West German men. Here, confidence increases from basic to intermediate education but decreases for highest education, i.e. it is hump-shaped. For women, we observe that in the East confidence decreases from basic to intermediate education but increases slightly for highest education, whereas it decreases throughout for West German women.

As a consequence, we find strong differences in the development of unjustified confidence. For West German men it is positive and hump-shaped with a maximum at an intermediate level of education. For East German men, in contrast, it is increasing in education but remains negative throughout. West German women display a positive unjustified confidence at basic education that decreases with education and is negative for both intermediate and high education. For East German women, unjustified confidence is negative and strongly decreasing in education.

The East/West divide hence makes apparent slight differences in the development of our main explanatory variables over educational levels. Consideration of this divide is therefore necessary to assess the robustness of our findings. Table 7 reports the results from our earlier regressions where the East dummy is used as an additional control variable. As can be seen, accounting for the geographic area of residence does not alter the effects that financial literacy and confidence have on financial wealth, risky investment, saving and retirement preparedness. Interestingly, the East dummy does not have any effects apart from a significantly negative impact on the decision to save regularly for highly-educated women.

7.2 Crisis effects

Respondents to the 2009 SAVE questionnaire have experienced the strong downturn on financial markets in the 2007/08 crisis just a short while before answering the survey questions. Even though Germany has not been affected by a serious deterioration of real estate markets as compared to 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. Though we do control for risk attitudes in our previous regressions, we still need to ascertain whether other crisis-related effects influence our results.

Table 8 reports the regression coefficients of financial literacy and confidence from the same regressions as before. We now introduce a dummy variable “crisis” that indicates very broadly whether the respondent has been affected negatively by the crisis, either due to a loss in wealth or due to an adverse experience on the labor market (loss of job or income). The dummy variable takes the value of 0 only if there has been no negative crisis-related effect for the individual. In our

sample, 38% of all respondents have been negatively affected by the financial crisis in one way or another.

Most importantly, we find that accounting for potential crisis effects does not alter our results regarding the impact of financial literacy and confidence on wealth, financial market participation and financial planning. However, the crisis dummy shows interesting results on its own that support earlier findings by Bucher-Koenen and Ziegelmeyer (2014). We observe that respondents who experienced adverse crisis effects show higher financial wealth than those who were not negatively affected by the crisis (Panel A). As Bucher-Koenen and Ziegelmeyer (2014) clarify, this surprising observation is explained by the fact that the respondents whose wealth was reduced in the crisis were active on financial markets and profited from the markets' resurgence. Typically, these are individuals with high financial literacy. Indeed, we find that the positive crisis effect is stronger for men than for women and strongest for respondents with highest education, i.e. with the highest levels of financial literacy.

As further support for this argument, we also observe a positive association between crisis effects and the decision to invest in risky assets, respectively the amount invested (Panels B and C). Again, the effects are strongest for respondents with highest educational levels who we know to display the highest degree of financial literacy. While there is no association between the crisis dummy and respondents' savings behavior, we do observe a positive relation between the crisis dummy and retirement preparedness. This association is particularly strong for highly-educated men and there is a weakly significant relation also for women with intermediate education.

Altogether, our results indicate that future-oriented financial planning is much less strongly related to crisis experiences than current participation on risky financial markets. Given the stronger association between the crisis experience and both risky investment amounts and wealth levels among respondents with higher educational attainment, our findings may also be interpreted as a sign of more financially sophisticated individuals being able to avoid losses from financial market turmoils. Most important in our context, however, is that our results regarding the role of actual and perceived financial sophistication remain unchanged when accounting for crisis effects. Note that this is also the case for different definitions of the crisis dummy, for instance by excluding wealth effects and referring solely to negative labor market experiences. Though this changes the impact of the crisis dummy, it does not affect the influence of financial literacy and confidence on wealth and its financial channels.¹⁶

7.3 Endogeneity effects

In our analyses so far, we have employed both actual and perceived financial sophistication as exogenous characteristics of respondents. However, the exogeneity of these two variables is a con-

¹⁶The corresponding additional results are available from the authors upon request.

troversial subject. Both financial literacy and confidence could be affected by financial engagement, giving rise to reverse causality. For instance, financial literacy and confidence could be increased by learning from repeated actions on financial markets. Additionally, the measurement of financial literacy via a questionnaire could be prone to errors. If financial literacy and confidence are indeed endogenous, the estimated OLS coefficients may be biased. It is therefore necessary to use a more exogenous source of variation in both measures to support our results. In the following, we display the results from instrumental variables regressions where additional information on survey respondents has been used as instruments. Given the complexity of the problem, we clearly do not claim to have solved the endogeneity problem in its entirety. Rather, our findings should be seen as one further attempt towards rendering our conclusions more robust in this respect.

As we need to find instruments for both financial literacy and confidence, our estimation approach poses even stricter conditions than earlier studies that typically examined only the influence of financial literacy and therefore instrumented solely this variable. More precisely, we need to make sure that the chosen instruments are unrelated with the error term and influence the dependent variable only via the characteristic to be instrumented, but also that they do not influence the second characteristic to be instrumented. This, for instance, rules out the use of parents' or siblings' familiarity with financial concepts as instruments for financial literacy (Van Rooij, Lusardi and Alessie, 2011), which may easily be expected to affect financial confidence as well. As 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 (2009). We therefore need to rely on respondent-specific characteristics provided by the rich structure of the SAVE questionnaire for suitable instruments. As it is very likely, however, that variables that correlate strongly with financial literacy or confidence will also influence the financial wealth of respondents,¹⁷ we will employ the instrumental variable approach only in the regressions using our channel variables: financial market participation, savings and retirement preparedness.

Table 9 reports the results from regressions where financial literacy has been instrumented by respondents' cognitive index and their "Big 3" financial literacy score two years earlier, i.e. in the SAVE 2007 wave. We hence make use of the finding that individuals with stronger general cognitive abilities tend to have higher levels of financial literacy (Almenberg and Widmark, 2011; Gerardi, Goette, and Meier, 2010). We further assume that respondents with a high financial literacy score in 2007 should also have a high score in 2009. At the same time, we argue that the 2007 score should not considerably influence respondents' confidence level two years later, first, as the correlation between financial literacy and confidence in our sample is generally low and, second, as respondents never received direct feedback with respect to their financial literacy score.

Confidence is instrumented by two self-assessments regarding self-control and respondents' ex-

¹⁷Respondents' cognitive ability would be an example in this respect: It may well be expected to influence financial literacy, but at the same time may have an independent effect on wealth.

pected future economic well-being. With this approach, we rely on personality traits that have been shown to be related to self-confidence in psychological research but that should not be expected to be considerably related to respondents’ financial literacy. High self-control implies a belief in one’s own capability to accomplish a task and to select an effective strategy. Various psychological studies therefore support a positive association between self-control and self-confidence (Tangney, Baumeister, and Boone, 2004; Oettingen and Gollwitzer, 2009; Rhodewalt and Tragakis, 2003). We further assume that respondents’ financial confidence is related to a positive outlook on future well-being in general, and to expected economic well-being in particular. This presumption is supported by observations that people with high self-esteem also display a greater sense of confidence about positive future events (Lyubomirsky, Tkach, and Dimatteo, 2006).

The statistics reported in Table 9 show not only that the F-values from the first-stage regressions are high in the total sample and that the instruments for financial literacy and confidence are statistically significant. Instruments also remain significant with F-values above (or in the range with) the critical value for avoiding the problem of weak instruments (Staiger and Stock, 1997) in almost all subsamples.

As can be seen from Table 9, the IV results broadly support our earlier findings. More specifically, we find that the decision to participate on financial markets and the amount invested in risky assets are strongly affected by financial literacy, with the largest coefficient to be observed for highly-educated women. Confidence only plays a role for highly-educated men. The savings decision, in contrast, is much more strongly affected by respondents’ confidence. Particularly for the savings amount we observe a strongly positive impact that is largest for highly-educated respondents, both male and female. While we also see a positive effect of confidence on retirement preparedness in the total sample and in the subsample of women, the significance of this impact vanishes in the different education-divided subsamples. In a slightly broader sense, our results hence appear robust even when testing for endogeneity in actual and perceived financial knowledge.¹⁸

8 Unjustified confidence

Our results so far have focused on the individual effects that actual and perceived financial sophistication have on respondents’ wealth, 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 and outcome. However, it is clearly of interest to see whether and in which way “excessive” confidence, that is not warranted by the actual financial

¹⁸It 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, Lusardi, and Alessie (2012) report a similar finding and refer it to potential measurement errors in the proxies for financial sophistication.

knowledge, affects financial wealth and the channels towards wealth. We therefore analyse the impact of unjustified confidence and thus contribute more closely to the literature on the effects of overconfidence on financial behavior that has so far been mainly focused on financial experts rather than laymen.

Table 10 reports the results from regressions on wealth, financial market participation and planning where unjustified confidence is used as explanatory variable of interest. We employ the same control variables as in Sections 5 and 6. Panel A shows a positive association between unjustified confidence and financial wealth that is driven by men with sufficiently high education. Highly-educated male respondents hence accumulate wealth along with their overconfidence that further adds to the wealth-increasing effect of their financial literacy. A similar result is derived regarding risky investments (Panels B and C). Again, highly-educated men show a positive relation between unjustified confidence and the decision to invest in risky assets, respectively the investment amount. Even though we know that male overconfidence is decreasing in education, these findings illustrate that highly-educated men nevertheless profit from their (small) excess confidence: Their overconfidence leads them to engage more strongly on risky financial markets and, thus, raise their financial wealth.

Panels D and E show that men with both lowest and highest education display a positive association between unjustified confidence and the savings decision, respectively the savings amount. Since men with only basic education have a much higher overconfidence than those with highest education, the former will therefore show much larger overconfidence-driven savings than the latter. Interestingly, we also find a significantly positive association between unjustified confidence and savings behavior for highly-educated women. 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 tells that highly educated women save less the more underconfident they are. Similar results follow from Panel F. Both men and women with high education show a positive association between unjustified confidence and retirement preparedness. However, since men are overconfident and women are underconfident at these educational levels, the consequence is an increase in retirement readiness for men but a decrease for women with rising absolute excess confidence.

It should also be noted that we observe a negative effect of unjustified confidence on the decision to save regularly (though not on the savings amount) for women with an intermediate educational level. This corresponds with the negative effect of confidence for this subgroup of respondents that we have seen also in Panel C of Table 5. These women actually show the highest degree of underconfidence in our sample. An increase in their confidence, i.e., a reduction of their underconfidence, would not raise their inclination to save regularly but rather reduce it further.

Our overall results on unjustified confidence complement findings by Van Rooij, Lusardi, and Alessie (2012), who merely touch upon aspects of excess confidence in their analysis on retirement

planning, in interesting ways. While Van Rooij, Lusardi, and Alessie (2012) employ dummy variables for over- respectively underconfidence, we use a continuous variable for unjustified confidence and, hence, account also for the size of over- or underconfidence. This allows us to paint a more detailed picture compared to the earlier observations. As such, Van Rooij, Lusardi, and Alessie (2012) 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. We, in contrast, observe a significantly positive effect of unjustified confidence on financial wealth, financial market participation and future-oriented financial planning of highly-educated men, and on financial planning of highly-educated women. Whereas highly-educated men are on average overconfident, thus supporting part of the results of Van Rooij, Lusardi, and Alessie (2012), it should be noted that this subgroup of male respondents displays the weakest overconfidence of all men. The heterogeneity with respect to the size of over- respectively underconfidence thus seems to fulfill a vital function that remains undetected if only dummy variables are employed.

Our findings regarding the impact of unjustified confidence hence add an important aspect to the general debate regarding 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 financial literacy and confidence have the potential to raise financial wealth via stronger current financial market participation and future-oriented financial planning, but 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.

However, 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. 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 savings behavior and retirement preparedness that we found in Section 6, turns into a negative effect if confidence does not keep up with financial literacy. Even though the marginal effect of unjustified confidence is smaller than the one of confidence, as we have seen, 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.

9 Conclusion

In this paper, we have shown that the role of actual and perceived financial sophistication for financial market participation, future-oriented financial planning and, eventually, wealth accumulation is strongly dependent on gender and educational attainment of individuals. Essentially, highly-educated individuals show the strongest literacy-sensitivity in their financial decisions and outcomes. Our results hence corroborate the insight by Lusardi and Mitchell (2014): “Evidently, general knowledge (education) and more specialized knowledge (financial literacy) both contribute to more informed financial decision-making. In other words, investment in financial knowledge appears to be a specific form of human capital, rather than being simply associated with more years of schooling.”

Additionally, we observe that the financial decisions of highly-educated men benefit strongly from their excess confidence regarding their financial knowledge. Highly-educated women, in contrast, benefit from their strong financial literacy in their financial market participation and wealth accumulation, but show an underconfidence that hampers their long-term financial planning. 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, Keller and Keller, 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.

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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
East	0.29	0.46	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
d_regularsaving	0.53	0.50	0	1
Ln(saving)	4.30	3.89	0	12.52
d_riskyinvestments	0.25	0.43	0	1
Ln(riskyinvestments)	2.24	3.99	0	13.82
d_retirementpreparedness	0.20	0.40	0	1
Risk tolerance	2.25	2.60	0	10
Economics education (2010)	3.25	1.70	1	7
d_crisis	0.38	0.49	0	1
Self-control (2007)	6.69	2.07	0	10
Future economic well-being	4.84	2.11	0	10
Cognitive index	1.17	1.07	0	3
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 unjustified confidence across subgroups

The table reports the means of financial literacy (Panel A), confidence (Panel B) and unjustified confidence (Panel C) across different levels of education and across gender and the adjusted wald test statistic to test whether the difference between the means of male and female respondents is significant.

<i>Panel A: Mean financial literacy across subgroups</i>				
Education	Low level	Intermediate level	High level	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>Adj. Wald test(1) = 51.93; (p=0.000)</i>				
<i>Panel B: Mean confidence across subgroups</i>				
Education	Low level	Intermediate level	High level	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>Adj. Wald test(1) = 22.36; (p=0.000)</i>				
<i>Panel C: Mean unjustified confidence across subgroups</i>				
Education	Low level	Intermediate level	High level	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>Adj. Wald test(1) = 12.32; (p=0.001)</i>				

Table 4: Financial literacy, confidence and wealth

The table reports OLS estimates of the effect of financial literacy, confidence and several control variables on the logarithm of financial wealth for different subsamples. 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	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)
Financial literacy	0.4884*** (0.0398)	0.4759*** (0.0400)	0.4260*** (0.0564)	0.5095*** (0.0554)	0.4423*** (0.0899)	0.4132*** (0.0944)	0.3049*** (0.1139)	0.4663*** (0.0848)	0.5024*** (0.0840)	0.5573*** (0.1326)
Confidence		0.1727** (0.0678)	0.3022*** (0.1025)	0.0767 (0.0929)	0.2500 (0.1728)	0.2806* (0.1675)	0.4019** (0.1758)	0.1166 (0.1822)	0.0688 (0.1357)	0.1322 (0.1485)
Age	0.0513*** (0.0083)	0.0506*** (0.0083)	0.0580*** (0.0127)	0.0444*** (0.0118)	0.0679*** (0.0239)	0.0750*** (0.0219)	0.0301* (0.0160)	0.0571** (0.0224)	0.0464** (0.0187)	0.0214 (0.0206)
Female	0.0103 (0.1640)	0.0331 (0.1634)								
Education dummies										
Intermediate level	0.0852 (0.2044)	0.1191 (0.2050)	0.0106 (0.2747)	0.1518 (0.3073)						
High level	0.5651** (0.2216)	0.6260*** (0.2228)	0.6331** (0.2882)	0.5163 (0.3340)						
Married	0.6187*** (0.2203)	0.5870*** (0.2184)	0.6138** (0.3122)	0.4632 (0.2847)	0.3017 (0.5850)	0.3608 (0.4977)	0.9733** (0.4469)	0.7599 (0.5120)	0.1534 (0.4305)	0.2926 (0.5271)
Number of children	-0.2582*** (0.0744)	-0.2565*** (0.0733)	-0.1956* (0.1003)	-0.3034*** (0.0934)	-0.1163 (0.1693)	-0.2991* (0.1810)	-0.1988 (0.1482)	-0.5219*** (0.1788)	-0.2724** (0.1294)	0.0132 (0.1265)
Retired	-0.3519 (0.2580)	-0.3546 (0.2573)	-0.4368 (0.3433)	-0.3189 (0.3888)	-0.7443 (0.6339)	-0.4713 (0.5420)	0.1693 (0.5023)	-0.2290 (0.6931)	-0.7425 (0.5582)	0.1403 (0.6677)

Table 4 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)
Self-employed	0.5785 (0.3929)	0.4792 (0.3929)	0.3046 (0.5022)	0.8922 (0.6222)	1.3598 (1.0797)	-0.3641 (1.1877)	0.0401 (0.6012)	0.1786 (2.7558)	1.4730*** (0.5162)	0.3240 (0.6370)
Ln(household income)	1.4925*** (0.2681)	1.4545*** (0.2661)	1.3317*** (0.3827)	1.5719*** (0.3223)	1.5821* (0.8465)	2.0577*** (0.5055)	0.8099** (0.4018)	1.2903** (0.5551)	2.1991*** (0.4917)	1.1014** (0.4984)
Risk Tolerance	0.0630** (0.0319)	0.0593* (0.0317)	0.1079** (0.0472)	0.0233 (0.0454)	0.1099 (0.0838)	0.1344 (0.0834)	0.0806 (0.0767)	0.0054 (0.0856)	0.0556 (0.0648)	-0.0116 (0.0796)
Economics education	0.0343 (0.0479)	0.0085 (0.0483)	-0.0559 (0.0624)	0.0691 (0.0779)	0.0541 (0.1228)	-0.1494 (0.1203)	-0.0744 (0.0823)	0.1379 (0.1501)	-0.0051 (0.1191)	0.0516 (0.1250)
Constant	-9.0944*** (1.8977)	-9.4489*** (1.8559)	-9.1565*** (2.5171)	-9.6299*** (2.2951)	-11.6035** (5.4489)	-14.7422*** (3.5321)	-2.8448 (2.9783)	-8.2454* (4.4436)	-13.8319*** (3.6430)	-5.2370 (3.6605)
Observations	2,047	2,047	986	1,061	355	314	317	382	432	247
R^2	0.2697	0.2725	0.2909	0.2529	0.2443	0.3655	0.2271	0.1928	0.2803	0.2119

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

Table 5: Financial literacy, confidence and financial engagement

The table reports OLS estimates of the effect of financial literacy and confidence on different types of financial engagement, i.e. the channels towards the accumulation of financial wealth, across subsamples. The dependent variables are a dummy variable indicating whether the respondent is invested in risky asset classes (Panel A), the logarithm of the amount invested in risky assets (Panel B), a dummy variable indicating whether the respondent saves regularly (Panel C), the logarithm of annual household saving (Panel D), and a dummy variable proxying for retirement preparedness (Panel E), respectively.

	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: Risky investments</i>									
Financial literacy	0.0317*** (0.0038)	0.0286*** (0.0058)	0.0341*** (0.0049)	0.0336*** (0.0080)	0.0261** (0.0102)	0.0203 (0.0132)	0.0284*** (0.0074)	0.0322*** (0.0077)	0.0486*** (0.0131)
Confidence	0.0113* (0.0067)	0.0253** (0.0113)	-0.0011 (0.0083)	-0.0028 (0.0151)	0.0355* (0.0190)	0.0566** (0.0231)	0.0051 (0.0129)	-0.0090 (0.0128)	0.0116 (0.0226)
<i>Panel B: Amount of risky investments</i>									
Financial literacy	0.2898*** (0.0352)	0.2558*** (0.0553)	0.3149*** (0.0443)	0.3094*** (0.0777)	0.2423** (0.0958)	0.1767 (0.1184)	0.2628*** (0.0671)	0.3045*** (0.0688)	0.4307*** (0.1183)
Confidence	0.1179* (0.0638)	0.2509** (0.1121)	-0.0041 (0.0747)	-0.0284 (0.1526)	0.3689** (0.1783)	0.5543*** (0.2138)	0.0448 (0.1223)	-0.1137 (0.1158)	0.2040 (0.2003)
<i>Panel C: Regular savings</i>									
Financial literacy	0.0107** (0.0048)	0.0113 (0.0071)	0.0108 (0.0066)	0.0027 (0.0107)	0.0213* (0.0117)	0.0050 (0.0165)	0.0140 (0.0106)	0.0071 (0.0092)	0.0204 (0.0168)
Confidence	0.0288*** (0.0085)	0.0542*** (0.0126)	0.0097 (0.0117)	0.0607*** (0.0206)	0.0349 (0.0235)	0.0693*** (0.0232)	0.0274 (0.0205)	-0.0288* (0.0168)	0.0638*** (0.0230)
<i>Panel D: Amount of savings</i>									
Financial literacy	0.1746*** (0.0412)	0.0989 (0.0613)	0.2361*** (0.0521)	0.0378 (0.0836)	0.2343** (0.0997)	0.0029 (0.1264)	0.2819*** (0.0757)	0.1897** (0.0814)	0.3042* (0.1561)
Confidence	0.1668** (0.0699)	0.2728*** (0.1028)	0.0936 (0.0915)	0.3231** (0.1526)	0.1912 (0.1826)	0.3510* (0.2062)	0.1906 (0.1464)	-0.1083 (0.1295)	0.4125** (0.2075)

Table 5 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 E: Retirement preparedness</i>									
Financial literacy	0.0147*** (0.0036)	0.0147** (0.0059)	0.0154*** (0.0046)	0.0194** (0.0075)	0.0114 (0.0103)	0.0071 (0.0141)	0.0095 (0.0068)	0.0155** (0.0069)	0.0317** (0.0123)
Confidence	0.0305*** (0.0064)	0.0418*** (0.0106)	0.0209*** (0.0079)	0.0130 (0.0133)	0.0529** (0.0256)	0.0694*** (0.0196)	0.0181 (0.0113)	0.0063 (0.0125)	0.0512** (0.0212)

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

Table 6: Financial literacy, confidence and unjustified confidence in East and West Germany

The table reports the means of financial literacy (Panel A), confidence (Panel B) and unjustified confidence (Panel C) across different levels of education and across gender for respondents living in East vs. West Germany.

<i>Panel A: Mean financial literacy across subgroups</i>								
Education	East				West			
	Low level	Intermediate level	High level	Average	Low level	Intermediate level	High level	Average
Female	3.53	4.85	5.98	4.83	4.01	5.50	6.53	5.16
Male	3.84	5.21	6.66	5.31	5.47	6.41	7.27	6.33
All	3.67	5.00	6.30	5.04	4.69	5.87	6.94	5.71

<i>Panel B: Mean confidence across subgroups</i>								
Education	East				West			
	Low level	Intermediate level	High level	Average	Low level	Intermediate level	High level	Average
Female	4.34	4.21	4.24	4.25	4.52	4.45	4.44	4.47
Male	4.22	4.38	4.67	4.43	4.80	4.96	4.82	4.85
All	4.29	4.28	4.45	4.33	4.65	4.65	4.65	4.65

<i>Panel C: Mean unjustified confidence across subgroups</i>								
Education	East				West			
	Low level	Intermediate level	High level	Average	Low level	Intermediate level	High level	Average
Female	-0.07	-0.34	-0.41	-0.29	0.06	-0.16	-0.27	-0.10
Male	-0.21	-0.19	-0.05	-0.15	0.20	0.26	0.04	0.16
All	-0.13	-0.28	-0.24	-0.23	0.12	0.01	-0.10	0.02

Table 7: East-west effects

The table reports OLS estimates of the effect of financial literacy and confidence on different dependent variables across subsamples, while controlling for respondents residing in one of the eastern German federal states (Dummy variable East). The dependent variables are the logarithm of financial wealth (Panel A), a dummy variable indicating whether the respondent is invested in risky asset classes (Panel B), the logarithm of the amount invested in risky assets (Panel C), a dummy variable indicating whether the respondent saves regularly (Panel D), the logarithm of annual household saving (Panel E), and a dummy variable proxying for retirement preparedness (Panel F), respectively.

	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: Financial wealth</i>									
Financial literacy	0.4695*** (0.0407)	0.4168*** (0.0578)	0.5052*** (0.0557)	0.4457*** (0.0939)	0.3988*** (0.0948)	0.2995*** (0.1145)	0.4625*** (0.0845)	0.4949*** (0.0831)	0.5697*** (0.1324)
Confidence	0.1677** (0.0672)	0.2938*** (0.1009)	0.0746 (0.0925)	0.2526 (0.1692)	0.2595 (0.1652)	0.3978** (0.1760)	0.1086 (0.1790)	0.0614 (0.1362)	0.1185 (0.1465)
East	-0.2903 (0.2083)	-0.2886 (0.2867)	-0.3009 (0.2866)	0.1110 (0.6444)	-0.5341 (0.4697)	-0.1687 (0.3983)	-0.7717 (0.5987)	-0.4762 (0.4197)	0.6849 (0.4204)
<i>Panel B: Risky investments</i>									
Financial literacy	0.0318*** (0.0038)	0.0284*** (0.0059)	0.0342*** (0.0050)	0.0344*** (0.0082)	0.0255** (0.0103)	0.0208 (0.0133)	0.0284*** (0.0074)	0.0322*** (0.0077)	0.0501*** (0.0133)
Confidence	0.0114* (0.0067)	0.0251** (0.0113)	-0.0011 (0.0083)	-0.0022 (0.0151)	0.0342* (0.0190)	0.0570** (0.0230)	0.0053 (0.0130)	-0.0090 (0.0129)	0.0099 (0.0224)
East	0.0037 (0.0215)	-0.0106 (0.0329)	0.0147 (0.0273)	0.0314 (0.0552)	-0.0354 (0.0552)	0.0210 (0.0625)	0.0127 (0.0439)	-0.0005 (0.0410)	0.0726 (0.0627)

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 C: Amount of risky investments</i>									
Financial literacy	0.2904*** (0.0354)	0.2548*** (0.0560)	0.3156*** (0.0445)	0.3140*** (0.0790)	0.2399** (0.0969)	0.1816 (0.1200)	0.2625*** (0.0668)	0.3036*** (0.0687)	0.4455*** (0.1196)
Confidence	0.1184* (0.0637)	0.2500** (0.1117)	-0.0037 (0.0747)	-0.0249 (0.1528)	0.3641** (0.1781)	0.5570*** (0.2132)	0.0456 (0.1225)	-0.1151 (0.1163)	0.1866 (0.1989)
East	0.0378 (0.1976)	-0.0392 (0.3063)	0.0989 (0.2464)	0.1871 (0.5170)	-0.1321 (0.5083)	0.1878 (0.5827)	0.0521 (0.4053)	-0.1126 (0.3654)	0.7172 (0.5753)
<i>Panel D: Regular savings</i>									
Financial literacy	0.0108** (0.0048)	0.0126* (0.0072)	0.0105 (0.0066)	0.0050 (0.0109)	0.0222* (0.0117)	0.0062 (0.0164)	0.0140 (0.0106)	0.0070 (0.0092)	0.0170 (0.0168)
Confidence	0.0288*** (0.0085)	0.0553*** (0.0126)	0.0096 (0.0117)	0.0623*** (0.0204)	0.0368 (0.0234)	0.0699*** (0.0234)	0.0277 (0.0205)	-0.0289* (0.0168)	0.0679*** (0.0225)
East	0.0027 (0.0258)	0.0513 (0.0383)	-0.0346 (0.0365)	0.0867 (0.0692)	0.0547 (0.0687)	0.0484 (0.0680)	0.0581 (0.0632)	-0.0071 (0.0514)	-0.1810*** (0.0671)
<i>Panel E: Amount of savings</i>									
Financial literacy	0.1774*** (0.0411)	0.1046* (0.0617)	0.2366*** (0.0520)	0.0456 (0.0845)	0.2395** (0.1006)	0.0041 (0.1275)	0.2817*** (0.0758)	0.1916** (0.0815)	0.2986* (0.1557)
Confidence	0.1689** (0.0697)	0.2776*** (0.1028)	0.0939 (0.0914)	0.3288** (0.1511)	0.2017 (0.1836)	0.3516* (0.2060)	0.1917 (0.1462)	-0.1056 (0.1293)	0.4196** (0.2092)
East	0.1736 (0.1954)	0.2183 (0.3010)	0.0658 (0.2547)	0.3015 (0.5563)	0.3128 (0.5116)	0.0487 (0.5555)	0.1406 (0.4635)	0.2301 (0.3797)	-0.3160 (0.5181)

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 F: Retirement preparedness</i>									
Financial literacy	0.0146*** (0.0036)	0.0143** (0.0059)	0.0154*** (0.0046)	0.0207*** (0.0077)	0.0114 (0.0103)	0.0060 (0.0141)	0.0095 (0.0068)	0.0155** (0.0069)	0.0321** (0.0124)
Confidence	0.0304*** (0.0064)	0.0415*** (0.0105)	0.0209*** (0.0079)	0.0140 (0.0134)	0.0530** (0.0254)	0.0693*** (0.0197)	0.0181 (0.0113)	0.0064 (0.0125)	0.0508** (0.0211)
East	-0.0070 (0.0207)	-0.0143 (0.0309)	0.0041 (0.0263)	0.0513 (0.0523)	0.0012 (0.0537)	-0.0401 (0.0572)	-0.0110 (0.0364)	0.0055 (0.0391)	0.0200 (0.0578)

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

Table 8: Crisis effects

The table reports OLS estimates of the effect of financial literacy and confidence on different dependent variables across subsamples, while controlling for crisis effects. The dependent variables are the logarithm of financial wealth (Panel A), a dummy variable indicating whether the respondent is invested in risky asset classes (Panel B), the logarithm of the amount invested in risky assets (Panel C), a dummy variable a dummy variable indicating whether the respondent saves regularly (Panel D), the logarithm of annual household saving (Panel E), and a dummy variable proxying retirement preparedness (Panel F), respectively.

	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: Financial wealth</i>									
Financial literacy	0.4555*** (0.0404)	0.4090*** (0.0564)	0.4919*** (0.0565)	0.4175*** (0.0881)	0.4139*** (0.0954)	0.2947*** (0.1098)	0.4591*** (0.0877)	0.4950*** (0.0850)	0.5138*** (0.1288)
Confidence	0.1609** (0.0675)	0.2779*** (0.1003)	0.0726 (0.0929)	0.2289 (0.1644)	0.2813* (0.1677)	0.3548** (0.1755)	0.1150 (0.1824)	0.0654 (0.1362)	0.1220 (0.1459)
d.crisis	0.8174*** (0.1746)	1.0173*** (0.2267)	0.5786** (0.2502)	1.8287*** (0.4130)	-0.0298 (0.4279)	0.9940*** (0.3203)	0.2898 (0.6071)	0.2389 (0.3851)	1.1948*** (0.3593)
<i>Panel B: Risky investments</i>									
Financial literacy	0.0256*** (0.0036)	0.0248*** (0.0057)	0.0272*** (0.0048)	0.0311*** (0.0075)	0.0222** (0.0102)	0.0177 (0.0123)	0.0238*** (0.0072)	0.0264*** (0.0076)	0.0368*** (0.0122)
Confidence	0.0077 (0.0064)	0.0192* (0.0107)	-0.0027 (0.0080)	-0.0050 (0.0138)	0.0333* (0.0184)	0.0396* (0.0225)	0.0039 (0.0127)	-0.0118 (0.0126)	0.0067 (0.0207)
d.crisis	0.2808*** (0.0212)	0.3114*** (0.0301)	0.2446*** (0.0301)	0.2723*** (0.0485)	0.1850*** (0.0552)	0.4216*** (0.0521)	0.1965*** (0.0494)	0.1949*** (0.0447)	0.3755*** (0.0565)

Table 8 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 C: Amount of risky investments</i>									
Financial literacy	0.2317*** (0.0336)	0.2185*** (0.0537)	0.2507*** (0.0424)	0.2837*** (0.0722)	0.2038** (0.0952)	0.1524 (0.1092)	0.2188*** (0.0648)	0.2527*** (0.0682)	0.3198*** (0.1096)
Confidence	0.0836 (0.0610)	0.1904* (0.1059)	-0.0188 (0.0718)	-0.0508 (0.1399)	0.3467** (0.1736)	0.3923* (0.2076)	0.0335 (0.1193)	-0.1387 (0.1143)	0.1579 (0.1818)
d.crisis	2.6878*** (0.1939)	3.0486*** (0.2792)	2.2597*** (0.2722)	2.7320*** (0.4717)	1.8356*** (0.4943)	4.0154*** (0.4879)	1.8488*** (0.4562)	1.7370*** (0.4062)	3.5214*** (0.5182)
<i>Panel D: Regular savings</i>									
Financial literacy	0.0103** (0.0048)	0.0113 (0.0071)	0.0096 (0.0066)	0.0026 (0.0107)	0.0227* (0.0117)	0.0049 (0.0165)	0.0132 (0.0107)	0.0060 (0.0092)	0.0181 (0.0167)
Confidence	0.0285*** (0.0085)	0.0542*** (0.0126)	0.0094 (0.0117)	0.0606*** (0.0206)	0.0358 (0.0236)	0.0683*** (0.0233)	0.0271 (0.0205)	-0.0294* (0.0169)	0.0630*** (0.0231)
d.crisis	0.0191 (0.0237)	-0.0016 (0.0343)	0.0416 (0.0325)	0.0197 (0.0612)	-0.0707 (0.0615)	0.0247 (0.0544)	0.0365 (0.0611)	0.0366 (0.0501)	0.0734 (0.0619)
<i>Panel E: Amount of savings</i>									
Financial literacy	0.1717*** (0.0414)	0.0962 (0.0613)	0.2363*** (0.0526)	0.0333 (0.0837)	0.2277** (0.0992)	0.0032 (0.1262)	0.2918*** (0.0757)	0.1783** (0.0823)	0.3097* (0.1616)
Confidence	0.1650** (0.0699)	0.2682*** (0.1028)	0.0936 (0.0914)	0.3199** (0.1529)	0.1874 (0.1818)	0.3536* (0.2071)	0.1933 (0.1458)	-0.1140 (0.1297)	0.4149** (0.2081)
d.crisis	0.1415 (0.1814)	0.2497 (0.2591)	-0.0091 (0.2460)	0.5902 (0.4122)	0.3353 (0.4760)	-0.0630 (0.4429)	-0.4166 (0.4777)	0.3803 (0.3844)	-0.1666 (0.5518)

Table 8 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 F: Retirement preparedness</i>									
Financial literacy	0.0134*** (0.0036)	0.0137** (0.0059)	0.0146*** (0.0046)	0.0187** (0.0075)	0.0103 (0.0103)	0.0065 (0.0136)	0.0099 (0.0068)	0.0127* (0.0070)	0.0317*** (0.0121)
Confidence	0.0297*** (0.0063)	0.0400*** (0.0104)	0.0207*** (0.0079)	0.0127 (0.0132)	0.0523** (0.0254)	0.0642*** (0.0193)	0.0182 (0.0113)	0.0052 (0.0123)	0.0513** (0.0213)
d.crisis	0.0594*** (0.0194)	0.0959*** (0.0288)	0.0257 (0.0259)	0.0889* (0.0458)	0.0544 (0.0552)	0.1307*** (0.0501)	-0.0162 (0.0451)	0.0801* (0.0417)	0.0006 (0.0523)

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

Table 9: IV Regressions

The table reports GMM estimates of the effect of financial literacy and confidence on different financial decisions, i.e. the channels towards the accumulation of financial wealth, across subsamples. Financial literacy has been instrumented by respondents' cognitive index and the number of correct answers to the "Big 3" financial literacy questions from the SAVE survey in 2007. Confidence is instrumented by two self-assessments regarding self-control and respondents' expected future economic well-being. The dependent variables are a dummy variable indicating whether the respondent is invested in risky asset classes (Panel A), the logarithm of the amount invested in risky assets (Panel B), a dummy variable a dummy variable indicating whether the respondent saves regularly (Panel C), the logarithm of annual household saving (Panel D), and a dummy variable proxying for retirement preparedness (Panel E), respectively.

	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: Risky investments</i>									
Financial literacy	0.0584*** (0.0099)	0.0485*** (0.0151)	0.0649*** (0.0132)	0.0681*** (0.0220)	0.0254 (0.0202)	0.0305 (0.0397)	0.0692*** (0.0197)	0.0449** (0.0198)	0.1020*** (0.0376)
Confidence	0.0500 (0.0467)	0.1286 (0.0833)	0.0141 (0.0499)	0.0611 (0.1590)	0.0275 (0.1060)	0.2272* (0.1196)	-0.0029 (0.0759)	0.0122 (0.0843)	0.0955 (0.0856)
F-value of excl. instruments									
Financial Literacy	135.7702	79.6448	60.4358	31.6544	26.8408	15.2711	21.3469	28.0851	13.4378
Confidence	12.4501	6.3717	7.1651	1.6878	2.4284	4.8675	1.8229	4.3877	3.6718
p-value of excl. instruments									
Financial literacy	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Confidence	0.0000	0.0001	0.0000	0.2245	0.0377	0.0012	0.1273	0.0019	0.0074

Table 9 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: Amount of risky investments</i>									
Financial literacy	0.5327*** (0.0906)	0.4518*** (0.1392)	0.5852*** (0.1222)	0.6076*** (0.2051)	0.2591 (0.1817)	0.3373 (0.3879)	0.6291*** (0.1827)	0.3982** (0.1793)	0.9562*** (0.3624)
Confidence	0.6486 (0.4359)	1.3938* (0.7932)	0.2718 (0.4605)	1.0080 (1.5898)	0.4370 (0.9703)	2.2339* (1.1488)	0.0591 (0.7071)	0.0868 (0.7636)	1.3067 (0.8209)
F-value of excl. instruments									
Financial literacy	135.7702	79.6448	60.4358	31.6544	26.8408	15.2711	21.3469	28.0851	13.4378
Confidence	12.4501	6.3717	7.1651	1.6878	2.4284	4.8675	1.8229	4.3877	3.6718
p-value of excl. instruments									
Financial literacy	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Confidence	0.0000	0.0001	0.0000	0.2245	0.0377	0.0012	0.1273	0.0019	0.0074
<i>Panel C: Regular saving</i>									
Financial literacy	-0.0106 (0.0156)	-0.0146 (0.0232)	-0.0161 (0.0219)	-0.0557 (0.0494)	0.0622** (0.0290)	-0.0536 (0.0520)	0.0231 (0.0369)	-0.0367 (0.0288)	0.0001 (0.0422)
Confidence	0.3606*** (0.0796)	0.4725*** (0.1341)	0.3032*** (0.0869)	0.6792* (0.4073)	0.1498 (0.1561)	0.4007*** (0.1397)	0.2769* (0.1641)	0.2014 (0.1226)	0.1395 (0.0874)
F-value of excl. instruments									
Financial literacy	135.2162	78.6838	61.5253	31.65512	26.6274	15.0941	21.7946	30.3384	14.7072
Confidence	12.1837	6.0811	7.1477	1.3378	2.6090	4.5833	1.8546	4.2627	3.5780
p-value of excl. instruments									
Financial literacy	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Confidence	0.0000	0.0001	0.0000	0.2792	0.0386	0.0022	0.1210	0.0024	0.0085

Table 9 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 D: Amount of savings</i>									
Financial literacy	0.0882	-0.0792	0.1957	-0.3484	0.4202*	-0.3323	0.4343**	0.1086	-0.1106
	(0.1134)	(0.1906)	(0.1449)	(0.4069)	(0.2158)	(0.3881)	(0.1875)	(0.2361)	(0.3541)
Confidence	2.3872***	3.3681***	1.8745***	4.8724	1.7723	2.4347**	0.7636	1.8999*	1.6908**
	(0.5870)	(1.0636)	(0.6032)	(3.2879)	(1.3179)	(1.1121)	(0.8959)	(0.9814)	(0.8158)
F-value of excl. instruments									
Financial literacy	135.2162	78.6838	61.5253	31.6551	26.6274	15.0941	21.7946	30.3384	14.7072
Confidence	12.1834	6.0811	7.1477	1.3378	2.6090	4.5833	1.8546	4.2627	3.5780
p-value of excl. instruments									
Financial literacy	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Confidence	0.0000	0.00006	0.0001	0.27916	0.03864	0.00216	0.12098	0.0024	0.0085
<i>Panel E: Retirement preparedness</i>									
Financial literacy	0.0189**	0.0233*	0.0225*	0.0264	0.0335*	-0.0089	0.0439**	0.0018	0.0436
	(0.0092)	(0.0129)	(0.0128)	(0.0205)	(0.0196)	(0.0417)	(0.0206)	(0.0194)	(0.0310)
Confidence	0.1444***	0.0964	0.1297**	0.1376	0.0222	0.0233	0.1245	0.0753	0.0823
	(0.0460)	(0.0807)	(0.0559)	(0.1588)	(0.1057)	(0.1319)	(0.0827)	(0.0825)	(0.0798)
F-value of excl. instruments									
Financial literacy	135.0136	77.6486	62.5619	30.5577	26.5801	15.1927	21.8939	30.8492	15.5574
Confidence	12.4768	6.1531	7.4632	1.3435	2.5809	4.2805	2.061	4.4075	3.6958
p-value of excl. instruments									
Financial literacy	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Confidence	0.0000	0.0001	0.0001	0.2758	0.0369	0.0039	0.0922	0.0021	0.0091

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

Table 10: 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 different financial decisions, i.e. the channels towards the accumulation of financial wealth, across subsamples. The dependent variables are the logarithm of financial wealth (Panel A), a dummy variable indicating whether the respondent is invested in risky asset classes (Panel B), the logarithm of the amount invested in risky assets (Panel C), a dummy variable indicating whether the respondent saves regularly (Panel D), the logarithm of annual household saving (Panel E), and a dummy variable proxying for retirement preparedness (Panel F), respectively.

				Male by education			Female by education		
	All	Male	Female	Low	Intermediate	High	Low	Intermediate	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Panel A: Financial wealth</i>									
Unjustified confidence	0.1367*	0.2660**	0.0480	0.2074	0.1868	0.4159**	0.0934	0.0945	-0.0077
	(0.0731)	(0.1100)	(0.1005)	(0.1886)	(0.1772)	(0.1828)	(0.1862)	(0.1468)	(0.1658)
<i>Panel B: Risky investments</i>									
Unjustified confidence	0.0082	0.0220*	-0.0035	-0.0070	0.0291	0.0569**	0.0021	-0.0077	0.0003
	(0.0068)	(0.0114)	(0.0085)	(0.0149)	(0.0194)	(0.0231)	(0.0135)	(0.0131)	(0.0232)
<i>Panel C: Amount of risky investments</i>									
Unjustified confidence	0.0898	0.2210*	-0.0261	-0.0670	0.3088*	0.5564**	0.0173	-0.1019	0.1009
	(0.0646)	(0.1132)	(0.0771)	(0.1519)	(0.1826)	(0.2154)	(0.1278)	(0.1185)	(0.2052)
<i>Panel D: Regular saving</i>									
Unjustified confidence	0.0275***	0.0524***	0.0088	0.0596***	0.0296	0.0693***	0.0257	-0.0287*	0.0577**
	(0.0085)	(0.0126)	(0.0116)	(0.0205)	(0.0238)	(0.0232)	(0.0206)	(0.0168)	(0.0230)
<i>Panel E: Amount of savings</i>									
Unjustified confidence	0.1484**	0.2590**	0.0759	0.3140**	0.1360	0.3511*	0.1604	-0.1021	0.3328*
	(0.0709)	(0.1036)	(0.0923)	(0.1526)	(0.1884)	(0.2060)	(0.1530)	(0.1302)	(0.1987)
<i>Panel F: Retirement preparedness</i>									
Unjustified confidence	0.0289***	0.0398***	0.0197**	0.0102	0.0493*	0.0694***	0.0170	0.0069	0.0428**
	(0.0064)	(0.0107)	(0.0079)	(0.0134)	(0.0253)	(0.0197)	(0.0113)	(0.0125)	(0.0212)

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
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
East	Dummy=1 if respondent is residing in one of the eastern German federal states
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. jewelery, 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
d.regularsaving	Dummy=1 if household declares to save regularly
Ln(saving)	Logarithm of annual household saving in 2008
d.riskyinvestments	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)
ln(riskyinvestments)	Logarithm of the amount invested in individual stocks, stock mutual and real estate funds or other risky financial assets (e.g. discount certificates, hedge funds, money market funds)
d.retirementpreparedness	Dummy=1 if respondent 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)
d.crisis	Dummy=1 if respondent is affected by the financial crisis 2007/08 via wealth losses or detrimental labor market effects (loss of income, unemployment, shorter hours worked etc.)
Self-control (2007)	Self-assessment ranging from [0] “I live for the moment and take life as it is. I do not worry about the future.“ to [10] “I deal a lot with the future and know exactly what I want to be and do later on.“ on the following question: “Where would you rank yourself between the two types of persons?“ (SAVE survey wave of 2007)
Future economic well-being	Score ranging from [0] “very negative“ to [10] “very positive“ on the following question: “How would you rate your expected future economic well-being?“
Cognitive index	Number of correct answers to the three questions of the cognitive reflection test (CRT) developed and tested by Frederick (2005)
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]