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Beyond knowledge: Confidence and the Gender Gap in Financial Literacy

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Abstract

We investigate the gender gap in financial literacy and confirm the findings of Bucher-Koenen et al. (2021). Women are less likely to answer the “Big-3”-financial literacy questions correctly and a substantial share of the gap reflects women’s lower confidence levels. In our experiment, women are more likely to choose “do not know” or refuse to answer financial literacy questions. If these options are unavailable, the gender gap diminishes substantially. We provide an easy-to-implement method to disentangle financial knowledge and confidence applicable in cross-sectional studies. Moreover, both factors explain stock market participation. Our results suggest that increasing confidence among women is an important element of financial education interventions.

Keywords: financial knowledge, gender gap, financial decision making, confidence, measurement error, survey methodology

JEL Classification: G53, C81, D14, D91

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1 Introduction

Financial literacy is an important determinant of individual financial decision-making and financial well-being (Lusardi & Mitchell, 2011, 2014, 2023), retirement planning and household wealth (van Rooij et al., 2012). Moreover, the pronounced gender gap in financial literacy has been the subject of an increasing number of investigations (Bucher-Koenen et al., 2016; Klapper & Lusardi, 2019), and financial literacy programs tailored to boost financial literacy of women are emerging widely.¹ Based on earlier evidence on women’s lower confidence regarding financial topics (Chen & Volpe, 2002; Webster & Ellis, 1996) and evidence that female survey respondents are more likely to skip questions in multiple-choice settings (Coffman, 2014a; Riener & Wagner, 2017), Bucher-Koenen et al. (2021) show that the persistent gender gap in financial literacy reflects both lower knowledge regarding financial matters, but also a substantial lack of confidence. Lower confidence, in particular among women, impacts measurement of financial knowledge and thus creates systematic measurement error.

We build on their work and propose a new experimental setup to analyze whether and to what extent confidence contributes to the persistent gender gap in financial literacy and financial behavior. Bucher-Koenen et al. (2021) build on a within-individual approach to identify the contribution of confidence to the gender gap in financial literacy and financial behavior. Our proposal uses a between-subjects design. More specifically, we use five financial literacy questions, which measure knowledge about several basic but fundamental financial concepts, including compound interest, inflation, risk diversification, credit interest, and loan repayment.² Respondents in the control group receive the standard mode of asking financial literacy questions, i.e., including the options to either refuse to answer or to indicate that they “do not know”. In contrast, treated respondents do not have the option to indicate that they “do not know” the answer and cannot refuse to answer (i.e., the treatment includes forced answers). Furthermore, treated respondents receive a follow-up question measuring their confidence in their response. In contrast to the approach of Bucher-Koenen et al. (2021), this follow-up question includes an

¹Countries with coordinated governmental strategies to deliver financial education to girls and women include Australia, Austria, Bangladesh, Brazil, Canada, Chile, Colombia, the Dominican Republic, India, Indonesia, Italy, Mexico, New Zealand, Nigeria, Peru, Spain, and the United Kingdom (Monticone, 2023), Lebanon, Singapore, Palestine and Poland (Hung et al., 2012). These programs are often broadly targeted at female financial literacy (e.g. Australian Securities and Investments Commission’s *Women Talk Money*), but also include targeted interventions (e.g. Bank of Italy’s financial education courses for vulnerable women). Many privately funded programs focus on subgroups of the female population, including female students (e.g., US Council for Economic Education’s *Invest in Girls*, see Park et al., 2021), working women (e.g., *Women’s Financial Information Program* (WFIP) in the US, see DeVaney et al., 1996), female micro-entrepreneurs (e.g., FINCA-Peru, see Frisncho et al., 2008), or low-income elderly women (e.g. Citi-Tsao Foundation’s Financial Education Program in Singapore).

²The survey includes (versions of) the most commonly used questions to measure financial knowledge (the “Big-3” financial literacy questions) proposed by Lusardi and Mitchell (2011). We add two questions on debt literacy proposed by Lusardi and Tufano (2015). For more information on the exact wording of the questions, see Appendix B.

option that allows respondents to “admit to guessing” – that is, we allow respondents to indicate that they did not know the answer but guessed.

We use this setup to measure financial literacy unconfounded by differences in the response behavior caused by differing confidence. Allowing respondents to admit guessing is an important methodological innovation vis-à-vis the approach of Bucher-Koenen et al. (2021) and has profound implications for measuring financial knowledge. We use admitted guesses to adjust the responses to the financial literacy questionnaire and treat them as incorrect responses. This method provides us with a measure of true financial knowledge without econometrically modeling each respondent’s probability of truly knowing the answer to the respective financial literacy question. Hence, the treatment group’s financial literacy measure is neither plagued by the measurement error introduced by low confidence nor by measurement error caused by respondents guessing the correct answer. Overall, our empirical strategy allows estimating the association between financial literacy and financial behavior that is unbiased by the respondents’ level of confidence.

Our three main findings confirm the results of Bucher-Koenen et al. (2021) based on a different sample of German respondents about ten years after the initial data collection and based on a different experimental design. First, we find a pronounced gender gap in financial literacy. Men provide the correct answers to financial literacy questions significantly more often than women in the treatment and the control group. Moreover, women are more likely to refuse to answer or indicate that they do not know the answer than men. If these answers are unavailable, both men and women answer correctly more often, but the increase in correct answers is significantly larger for women. That is, compared to women in the control group, women in our treatment group answered 0.7 additional questions correctly (of the five financial literacy questions included in our survey). In contrast, treated men answered 0.4 additional questions correctly compared to men in the control group. When we account for the number of admitted guesses, these results are qualitatively unaffected: Compared to women (men) in the control group, treated women (men) provide 0.4 (0.2) additional correct answers. Hence, we confirm the finding of Bucher-Koenen et al. (2021) that removing the “do not know” response option substantially reduces the gender gap in financial literacy.

Second, our results confirm the finding of Bucher-Koenen et al. (2021) that about two-thirds of the gender gap in financial literacy can be explained by lower financial knowledge, and the remaining third is associated with lower confidence of women in their financial knowledge. This finding supports the notion that though women, on average, have less financial knowledge, they often know more than they think.

Third, our results underline that confidence in financial knowledge is an important determinant of stock market participation. One standard deviation above average level of confidence is associated with an about 5-7 percentage points higher level of stock market participation. We show that the association between financial literacy and stock market participation is substantially lower when we account for differences in confidence in financial knowledge. Notably, the association between financial literacy and stock market participation is about one-third lower when we account for differences in confidence in financial knowledge. Hence, our results underline that *how* we measure financial literacy is important, and it is crucial to collect data on confidence to understand gender differences in financial behavior.

Our contribution to the literature is threefold. First, we add to the emerging methodological discussion on financial literacy measurement. Forcing responses and asking about the respondent’s confidence in the provided answers to the financial literacy questionnaire allows us to disentangle the confidence and knowledge dimensions that may impede sound measurement of financial knowledge. Moreover, allowing respondents to report whether they guessed their answer in the follow-up question enables us to remove the noise introduced by the forced responses without relying on a latent class model. In contrast to the within-subjects design of Bucher-Koenen et al. (2021), our between-subjects approach provides an easy and cost-effective way to improve financial literacy measurement, which is also applicable in other cross-sectional studies.

Second, we add to the vast literature on gender differences in financial literacy. We not only confirm earlier findings of significant gender gaps in financial literacy but also further the understanding of determinants of this gap.³ Our findings align with earlier contributions that highlight gender differences in confidence as an essential driver of the gap in financial knowledge (Bannier & Schwarz, 2018; Driva et al., 2016). On a more general level, our findings relate to the literature on gender stereotypes (e.g. Bordalo et al., 2019) and (self-)stereotyping (Coffman, 2014b).

Third, our findings also highlight the relationship between financial literacy and financial behavior (for an overview of the literature, see, e.g., Lusardi and Mitchell, 2011, 2014). We confirm earlier studies, which find a positive relationship between financial literacy and stock market participation (see e.g. Bucher-Koenen et al., 2021; van Rooij et al., 2011). We show that financial behavior is significantly associated with confidence in one’s financial knowledge. This finding is related to the literature that highlights the positive association of financial behavior with “perceived” financial literacy (Allgood & Walstad, 2015; Anderson et al., 2017; Lusardi & Mitchell, 2017), which is especially relevant for women (Bannier & Neubert, 2016). Moreover,

³For an overview on the literature on the financial literacy gender gap, see Bucher-Koenen et al. (2016).

confidence and financial literacy are both important elements when interacting with financial advisors (see Bucher-Koenen et al., 2023).

Our findings have implications for educational policies aimed at improving financial literacy and, ultimately, financial decision-making. Closing the gender gap in financial inclusion requires educational programs to improve women’s financial decision-making. However, our results underline that combining these programs with initiatives aimed at fostering women’s confidence and confronting gender stereotypes around the financial domain.

In the next section, we provide an overview of our experimental setup and describe our data in more detail. In section 3, we report descriptive results. In section 4, we explore the relationship between gender and our financial literacy measures in detail and analyze the implications for financial behavior, namely stock market participation. Section 5 concludes.

2 Sample and experimental design

2.1 Sample

The experiment was part of a larger survey on the social security system in Germany and conducted by a German survey agency on behalf of the Leibniz-Centre for European Economic Research (ZEW) between October 8 and December 9, 2020. The surveys are delivered either as Computer Assisted Web Interviews (CAWI, $N_{CAWI} = 4,993$) or via pen and paper surveys ($N_{P\&P} = 179$).⁴ The survey agency recruited participants by phone or invited active participants of a standing online panel. Phone recruitment was conducted via Computer Assisted Telephone Interviews (CATI) in a dual-frame procedure, including landline and mobile phone numbers. The *next birthday method* ensured random draws within multi-person households of participants reached by landline phone numbers. Individuals reached by mobile phones are immediate targets for the survey. 11.9% of the phone recruitments were successful ($N_{phone}=1,361$). We supplemented our sample with an actively recruited online panel ($N_{online}=4,162$). Shopping vouchers incentivized participants recruited by phone, and the compensation of online panel participants was at the discretion of the panel operator. By combining CATI-recruited individuals and respondents from the online panel, we received a sample representative for the German-speaking resident population in the Federal Republic of Germany aged 30 and above living in private households.⁵

⁴We exclude pen and paper respondents because they received the standard financial literacy questionnaire by default. Including these individuals does not change the results, which are available upon request.

⁵The descriptive statistics presented here are weighted to achieve the representativeness of this population. See Appendix C for details about the weighting procedure.

2.2 Experiment

To disseminate financial knowledge and confidence, we conducted a between-subjects survey experiment. At the beginning of our financial literacy module, we randomly allocated each participant to either treatment condition. Respondents in our control group received the standard mode of asking about financial literacy. That is, the survey includes a “do not know” option, and respondents could “refuse” to answer by not selecting any of the displayed categories.⁶ Respondents in the treatment group do not receive the “do not know” response option and cannot skip any question of the financial literacy questionnaire. Moreover, respondents receive a follow-up question about how confident they are regarding their response. We collect information on the respondents’ confidence on a Likert-Scale ranging from “0 (not confident)” to “10 (very confident)”. Notably, the question on the respondent’s confidence also includes the option to report that the respondent does not know the answer but guessed. In the following, we refer to this as “admitted guesses”.

Both experimental groups received five questions on financial literacy. The first three questions are closely related to the ‘Big-3 Financial Literacy Questions’ proposed by Lusardi and Mitchell (2011). While questions on the basic understanding of inflation and risk diversification are direct German translations of the Big-3 questions, our interest rate question is more complex than the standard “Big-3” interest question, as the possible answer options target the understanding of compound interest. The fourth and fifth questions draw upon the debt literacy module proposed by Lusardi and Tufano (2015) and cover credit interest rates and loan repayment, respectively.⁷

2.3 Composition of experimental groups

Our data include 3,715 respondents in the control group and 1,212 treated participants. Overall, our sample displayed in table 1 includes 51.4% of respondents who self-identified as female and 48.6% who self-identified as male. The treatment and control groups are not significantly different regarding the number of children, marital status, age, monthly household net income, homeownership status, region within Germany (East/West), retirement status, stock market participation, and self-assessed knowledge regarding financial matters.⁸ However, despite our randomization efforts, there is a significant imbalance regarding educational attainment. A

⁶Survey participants were only required to answer questions in the screening module, but there was no obligation to respond to other survey items, although the survey did not communicate this actively. Questions on sensitive issues, such as the financial situation of the household, offered an explicit option to indicate “do not know” and “no answer” (refusal) to reduce survey drop-outs.

⁷See Appendix B for the exact wording of the questionnaire.

⁸Self-assessed knowledge regarding financial matters was not part of the financial literacy experiment but included within a module on preferences and attitudes at an earlier position within the survey.

significantly higher share of respondents in our treatment has certificates that qualify for higher education.⁹ Moreover, a significantly larger share of our treatment group holds a university or college degree.¹⁰

We assume a positive association between educational attainment and financial literacy based on earlier studies. Our main analyses control for socioeconomic and demographic characteristics to ensure that the imbalance of educational attainment does not drive our results based on the comparison between the treatment and control group.

[Table 1 about here]

3 Descriptive evidence

3.1 Comparing the answers across experimental conditions

In table 2, we present the answers to the five financial literacy questions for the treatment and control group separately for men and women. Moreover, the last three columns of the table present the answers after we adjust for the number of *admitted guesses* of respondents who do not know the answer to the respective financial literacy question.

When we consider the first financial literacy question on compound interest, our results show that the share of correct answers is significantly lower in our control condition compared to the raw answers in the treatment condition. Whereas 49.5% of respondents in our control group answered correctly, 54.6% of respondents in our treatment group did (difference of 5.1 percentage points, $p = 0.008$).¹¹ Recall that we force answers in the treatment, but in return, allow respondents in the follow-up question to answer that they do not know the answer but guessed (“admitted guessing”). In the last three columns of table 2, we tabulate the answers of the treatment condition but include admitted guesses. While the treatment increases the share of correct answers to the compound interest question, 9.5% of treated respondents admit guessing. Adjusting for these admitted guesses reduces the share of correct answers to 50.9%, which implies an insignificant difference in the share of correct answers between the treatment and control condition of 1.4 percentage points ($p = 0.475$).

Table 2 also provides insights into the gender gap in the share of correct answers to the financial literacy questionnaire. When considering our control group’s answers to the compound

⁹This category includes *Fachhochschulreife*, *Allgemeines Abitur*, and *fachgebundenes Abitur*, which correspond to categories 34 and 44 of the International Standard Classification of Education (ISCED) 2011.

¹⁰This category includes degrees from higher education corresponding to ISCED categories 6 and 7, namely *Hochschulabschluss (Fachhochschule oder Universität)*.

¹¹We test differences using weighted t-tests. We did not include the results in table 2 for brevity. They are available upon request.

interest question, we find that 56.7% of men answered correctly, compared to 42.6% of women. The gender gap of 14.1 percentage points is highly significant ($p = 0.000$). Furthermore, women tend to report significantly more often that they “do not know” the answer or refuse to answer than men. Whereas 15.0% of women pick “do not know” or refuse to answer, only 7.1% of men do. This sizable gender gap in the tendency to pick DNK/refusal of 6.9 percentage points is highly significant ($p = 0.000$). In our treatment group, these options are not available. 60.8% of men and 49.3% of women pick the correct answer in this setting. The “raw” gender difference in the share of correct answers (i.e., not accounting for admitted guesses) decreases to 11.5 percentage points, which is still sizable and highly significant ($p = 0.000$). Men and women also differ in their share of admitted guessing. We find that 7.3% of male respondents admit guessing, compared to 11.3% of women. This sizable gender gap of 4.0 percentage points is significant ($p = 0.017$) and has implications for the “adjusted” gender gap regarding the number of correct answers. Accounting for guessing decreases the gender gap in the share of correct answers to the compound interest question to 12.2 percentage points, as 57.5% of men and 45.3% of women answer the question correctly (after adjusting for admitted guesses).

Notably, the gender gaps in the share of correct answers do not differ significantly between the treatment and control group, irrespective of whether we adjust for admitted guesses: The difference between the control group’s gender gap and the adjusted gender gap in our treatment group is 1.9 percentage points ($p = 0.570$), and the difference between the gender gap in our control group and our treatment group’s “raw” gender gap is 2.6 percentage points ($p = 0.427$).

The answers to our second question indicate that knowledge about the workings of inflation is more widespread than understanding compound interest. 75.0% of respondents in the control group provided the correct answer, and only 13.4% reported not to know or refused to answer. In contrast, 82.5% of treated respondents answered correctly. The difference between both experimental conditions of 7.5 percentage points is highly significant ($p = 0.000$). However, 10.6% of treated respondents admitted guessing in the follow-up question. Adjusting for these guesses reduces the share of correct answers to the inflation question among treated respondents to 75.2%, implying an insignificant difference between the share of correct answers between our control and adjusted treatment responses of 0.2 percentage points ($p = 0.904$).

Similar to the first question, more men and women in our treatment group answered the inflation question correctly, compared to the control group. 84.9% of treated men and 80.4% of treated women provide the correct answer. In contrast, 81.0% of men and 69.3% of women in the control group answered correctly. The gender gap of 11.7 percentage points in our control group is highly significant ($p = 0.000$) and considerably larger than the “raw”, unadjusted gender gap

among treated respondents (4.5 percentage points), which is also significantly different from zero ($p = 0.038$). Furthermore, these gender gaps are highly significantly different from each other (difference of 7.1 percentage points, $p = 0.011$). A much higher percentage of women in the control group indicates that they do not know or refuse to answer compared to men (17.9% vs. 8.9%). The difference of 9.0 percentage points is highly significant ($p = 0.000$). Similarly, 14.9% of treated women and only 5.6% of treated men admit guessing. The differences between men and women in admitted guessing is comparable to the gender difference in the “do not know”s and refusals in the control group (difference of 9.3 percentage points, $p = 0.000$). In contrast to the first question, adjusting for admitted guesses widens the gender gap substantially to 11.7 percentage points. Hence, the difference between the gender gap in our control group (11.8 percentage points) and the gender gap in the adjusted treatment measure (11.7 percentage points) is small and insignificantly different from zero ($p = 0.971$).

The third item of our financial literacy questionnaire assesses the respondents’ knowledge of risk diversification. 56.5% of respondents in our control condition answered this question correctly. This question differs from other financial literacy questions of our questionnaire due to its outstandingly high share of 35.2% of respondents in our control condition, indicating that they do not know or refuse to answer. 25.6% of men and 44.5% of women choose either of these options. In contrast, most respondents in our treatment group provided the correct answer (82.8%), and only a small share of respondents admitted guessing in the follow-up question (9.3%). The large difference between the share of correct answers in the control condition and the share of correct “raw” answers (26.3 percentage points) is highly significant ($p = 0.000$). When we adjust for admitted guesses, the share of correct answers is still large (75.6%) and significantly larger than the share of correct answers in our control group (difference of 19.1 percentage points, $p = 0.000$).

Whereas most male respondents in the control group provided the correct answer to the risk diversification question (65.4%), only 47.9% of women in the control group did. The gender gap of 17.5 percentage points is highly significant ($p = 0.000$). However, the gender gap is considerably smaller in the treatment group. With forced responses, 84.1% of men and 81.6% of women pick the correct answer, which reduces the gender difference to 2.5 percentage points and renders it insignificant ($p = 0.259$). When correcting for admitted guesses, we find that 79.3% of men and 72.3% of women did not guess and answer correctly, resulting in a larger gender gap of 7.0 percentage points, which is significantly different from zero ($p = 0.005$). Similar to the previous questions, the share of women who admit guessing is significantly larger (12.3%) than among men (5.9%). Interestingly, the gender gap regarding “do not know”s and refusals

is much larger than the gender gap in admitted guesses. 25.6% of men and 44.5% of women in the control group did not know or refused to answer, resulting in a significant gender gap of 18.8 percentage points that is substantially larger than the gender gap in admitted guessing (6.5 percentage points).

We now turn to the credit interest question, the first of our two debt literacy questions introduced by Lusardi and Tufano (2015). Less than half of the respondents in our control condition correctly identify that it will take “2 to less than 5 years” for a credit of EUR 1000 to double at an interest rate of 20 percent (43.4%), which is significantly lower than the 55.1% of treated respondents answer correctly (difference of 11.7 percentage points, $p = 0.000$). In our control group, about one in five respondents refused to answer or did not know the answer (22.4%). Among all financial literacy questions in our survey, the credit interest question has the largest share of admitted guesses (14.2%). Note that the share of admitted guesses is still lower than the share of “do not know” or refusals in our control group. Accounting for admitted guessing reduces the share of correct answers among treated respondents to 48.8%, which is still significantly higher ($p = 0.001$) than the share of correct answers in the control group (by 5.4 percentage points).

We find a pronounced gender gap in the share of correct answers in both treatment conditions. In our control group, 52.8% of men and 34.2% of women answered the question correctly, resulting in a significant gender gap of 18.6 percentage points. When we consider the “raw” share of correct answers in the treatment group, we find that 63.3% of men and 48.1% of women answer the question correctly, which implies a gender gap of 15.2 percentage points. This difference is highly significant ($p = 0.000$) but only insignificantly different from the gender gap in the control group ($p = 0.301$). 18.6% of women and 9.1% of men admit guessing the answer to this question. Adjusting the answers in the treatment group leaves 58.3% of men and 40.6% of women with correct answers. The gender gap in the adjusted shares of correct answers is still highly significant ($p = 0.000$), with 17.7 percentage points even closer to the gender gap in our control group. Moreover, the gender gap in admitted guessing is significant but substantially smaller (9.5 percentage points), with 18.6% of women and 9.1% of men admitted guessing. Similar to the risk diversification question, we also find a sizable gender gap in the share of “do not know” answers and refusals, with a significantly higher share of women (30.3%) choosing these options compared to men (14.2%).

Our second debt literacy question on loan repayment appears to be the most difficult financial literacy question. Only a minority in both treatment and control conditions provides the correct answer that the debt remains. Among respondents in our control group, 24.4% answered this

question correctly, significantly fewer than the 31.0% correct “raw” answers among treated respondents ($p = 0.000$). Whereas 21.7% in our control group responded that they did not know or refused to answer, only 13.8% of treated respondents admitted that they did not know the answer but guessed. Adjusting the treatment group’s responses using their admitted guesses shows that 28.0% answered correctly, which is significantly higher than among our control group ($p = 0.015$).

The gender gap in the share of correct answers is sizable in both groups. 32.3% of men and 16.8% of women in the control group answered correctly, which is lower than the share of raw correct answers among men (40.5%) and women (22.8%) in our treatment group. The gender gap is lower but still significant if we control for admitted guesses. Accounting for these leaves us with 37.5% correct answers among men and 19.8% correct answers among women. These gender differences are significantly different from zero ($p = 0.000$), although they are not significantly different from each other. Women pick the do not know and refusal options significantly more often than men (28.4% of women vs. 14.9% of men, $p = 0.000$), and women also admit guessing significantly more often than men in our treatment group (17.5% of women vs. 9.4% of men).

The last two panels of table 2 show the number of correct answers across the “Big-3” financial literacy questions and to all financial literacy questions included in our survey (which we call “FL-5” for brevity). Among respondents in our control group, 30.7% answered all three of the “Big-3” questions correctly. In our treatment group, a significantly larger share of 42.8% answered all of these questions correctly, which still holds when we adjust for the admitted guesses in the follow-up question, leaving us with 38.0% answering all three questions correctly. The share of male respondents correctly answering all “Big-3” questions is considerably larger than the share of female respondents that did, which is true for both the control group (39.6% of men vs. 21.1% of women) and the treatment group (51.7% of men vs. 35.2% of women). Similarly, adjusting for admitted guesses leaves us with 47.6% of men and 29.7% of women who provided all correct, non-guessed answers.

The results are comparable when we turn to our second financial literacy measure of interest, the “FL-5”-count-measure. When we account for all financial literacy questions, the gender difference in the percentage of respondents correctly answering all questions increases considerably. The share of respondents that answered all questions correctly is unsurprisingly lower, with 11.3% perfect scores in our control group and 15.1% “raw” perfect scores in our treatment group. While adjusting for admitted guesses reduces the share of perfect scores to 13.3%, it is still significantly higher than in the control group ($p = 0.000$).

In our control group, a larger share of men than women answered all financial literacy

questions correctly (17.4% vs. 5.4%, $p = 0.000$), and a larger share of men answered four of these questions correctly (21.9%), compared to women (12.2%). Similarly, the treatment group’s share of “raw perfect scores” is higher among men (23.8%) than among women (7.7%). The gender gap rises substantially when adjusting for admitted guesses, with 21.6% of men having all answers correct versus 6.3% of treated women.

[Table 2 about here]

Thus, our results highlight a potential problem with the standard mode of asking about financial literacy. Women reported more often that they “do not know” the answer or skip the questions, which makes their financial literacy appear lower than men’s. When these options are unavailable, the gender gap in financial literacy diminishes considerably. Hence, we confirm the notion of Bucher-Koenen et al. (2021) that the “do not know” answers and refusals also indicate a lack of confidence.¹² To analyze this further, we turn to the treatment group’s stated confidence levels in the next section.

3.2 Confidence in knowledge

As mentioned in subsection 2.2, treated respondents receive a follow-up after every financial literacy question in which we ask about the confidence level in the previous question. Respondents can report their confidence on a Likert scale from “0 (not confident)” to “10 (very confident)”. This subsection presents our results based on the confidence reported in these follow-up questions.

Overall, respondents are rather confident in their answers to the financial literacy questionnaire. The average confidence level among respondents who did not admit guessing ranges from 6.8 for both debt literacy questions (the credit interest and loan repayment questions) to 7.6 for the inflation question. Across all financial literacy questions included in our survey, being “completely confident” is the most common answer to the follow-up question, which also holds when we treat respondents who do not know the answer to the respective financial literacy question and admit guessing as being “not confident at all”. Notably, being “completely confident” remains the most common answer even when we combine the admitted guesses and “0 (not confident)” responses.

Respondents who answered the respective financial literacy question correctly are significantly more confident than those who answered incorrectly. The difference in the average con-

¹²We provide further evidence on this by comparing the treatment group’s responses to the financial numeracy score proposed by Von Gaudecker (2015), who assumes that respondents who do not know the answer would randomly pick an answer if responses are forced. The results in appendix D.2 show that the share of correct answers is significantly larger compared to the control group if we assume all respondents who answered that they do not know or refused to answer would pick an answer at random.

confidence level is highly significant and ranges between 0.97 points for the credit interest question and 3.28 points for the inflation question.¹³

Our results highlight a persistent confidence gender gap. As our results in figure 1 show, men are significantly more confident in their answers than women across all financial literacy questions. This confidence gender gap ranges between 1.26 points for the loan repayment question and 1.58 points for the credit interest question.¹⁴

[Figure 1 and 2 about here!]

Combining differences in confidence across genders and the correctness of the responses reveals three remarkable patterns, which we present graphically in figure 2. First, both men and women who answered correctly were significantly more confident in their responses than those who did not. Men who answered correctly are between 0.86 points (credit interest question) and 3.14 points (inflation question) more confident compared to men who did not give the correct answer (both differences are highly significant, $p = 0.000$). Similarly, women who answered correctly were significantly more confident than women who answered incorrectly, with differences ranging from 0.66 points (credit interest question) to 3.20 (inflation question). Second, while men who answered correctly are significantly more confident in their responses than any other group, women who answered incorrectly are the least confident across all financial literacy questions. Third, the confidence levels are insignificantly different for women answering correctly and men answering incorrectly for the compound interest (difference -0.20 points, $p = 0.441$) and risk diversification question (difference 0.49 points, $p = 0.110$). Women are also significantly less confident in their correct answers to the credit interest question than men answering incorrectly (difference -0.70 points, $p = 0.006$).

Thus, there are substantial gender differences in the levels of confidence. On average, women are substantially less confident in their knowledge than men. Moreover, even when they answer correctly, women are substantially less confident than men.

4 Results

4.1 Comparing measures of financial literacy

We present our financial literacy count measures in table 3. In our analyses, we focus on our measure based on the “Big-3” financial literacy questions and on all five financial literacy

¹³The t-tests on the equality of means, the Wilcoxon rank-sum (Mann-Whitney) tests, and the nonparametric equality-of-medians test all reject the Null that the confidence levels between correct and incorrect respondents are the same ($p = 0.000$). These results are available upon request.

¹⁴The t-tests on the equality of means all reject that the gender gap regarding the confidence level equals zero ($p = 0.000$). Results are available upon request.

questions included in our survey (which we refer to as “FL-5”). We present the results of our analyses in table 3. We do not control for any socioeconomic and demographic characteristics in Panel A. The results are, therefore, a more condensed presentation of the information we included in the description of table 2. The table contains the three main findings of our “unconditional” analyses that do not account for socioeconomic and demographic characteristics. First, we find that women answered significantly fewer questions correctly than men. Second, we find that respondents in the treatment group gave more correct answers than those in our control group. Lastly, our unconditional results highlighted that our treatment affected men and women differently. In our raw measure, the difference between the treatment and control group is significantly larger for women than for men (about 0.25 additional correct answers in the “Big-3” questionnaire). Controlling for socioeconomic and demographic characteristics in the lower panel of table 3 broadly confirms our unconditional results. In line with earlier contributions to the literature, gender differences become smaller when including socioeconomic and demographic characteristics, given the - on average - lower income and educational attainment of women in Germany. Our results confirm a significant gender gap in the number of correct answers to the “Big-3” and to all financial literacy questions included. This gender gap holds for the “raw” number of correct answers and the adjusted measures that account for the number of admitted guesses. After accounting for socioeconomic and demographic characteristics, women provided about 0.405 fewer correct answers to the “Big-3” financial literacy questions than men in the control group. In the treatment group, the gender gap is smaller, with 0.158 fewer correct answers if we do not adjust for admitted guesses and 0.255 fewer correct answers if we do. Our results are very similar if we use all financial literacy questions instead of the first three only. When considering all financial literacy questions, women answered 0.725 fewer questions correctly than men in the control group. Women in the treatment group answered 0.439 fewer questions correctly than men if we do not account for admitted guesses and 0.550 fewer if we adjust for admitted guesses.

[Table 3 about here!]

Our findings endorse the notion that it is crucial to consider the gender dimension when analyzing the effect of our treatment. The results in table 4 point towards a significant difference in the number of correct answers between the treatment and control groups for women but not necessarily for men. Comparing the “raw” number of correct answers to the “Big-3” financial literacy questions of treated men (on av. 2.26) and men in the control group (on av. 2.07) highlights a significantly positive difference of 0.191 additional correct answers. Similarly, treated women (on av. 2.10 correct) answered an additional 0.439 questions correctly, compared to

women in the control group (on av. 1.67 correct). Therefore, before adjusting for admitted guesses, the difference between treated women and women in the control group is significantly larger than between treated men and men in the control group (by about 0.248 additional correct answers across the “Big-3”).

When we compare the adjusted number of correct answers to the “Big-3” financial literacy questions of treated men (on av. 2.14 correct) and men in our control group, we find an insignificant difference of 0.075 additional correct answers ($p = 0.082$). In contrast, treated women answered significantly more questions correctly after adjusting for admitted guesses (on average, 1.89 correct) than women in our control group. The difference between women in the treatment and control groups is significantly larger than between men in the treatment and control groups (by about 0.147 additional correct answers). Our results are virtually unchanged if we consider the responses to all financial literacy questions instead, which columns 3 and 4 of table 4 show.

[Table 4 about here!]

Notably, our results based on the Big-3 financial literacy questions closely align with the findings of Bucher-Koenen et al. (2021) that used similar questions on their sample of Dutch individuals. They report an “unconditional” financial literacy gender gap of 0.442 in the standard mode of asking about financial literacy, comparable to the gender gap in our control group of 0.432. Furthermore, when Bucher-Koenen et al. (2021) make use of their “true knowledge” measure derived from a latent class model, they find a gender gap of 0.284, which is comparable to the “adjusted” gender gap that accounts for admitted guesses in our treatment group of 0.310. Hence, we confirm their finding that about one-third of the financial literacy gender gap is associated with differences in response behavior and confidence across survey modes. Similarly, we confirm their results when controlling for socioeconomic and demographic characteristics. Bucher-Koenen et al. (2021) find a “conditional” gender gap of 0.361 when using the standard financial literacy questionnaire, comparable to the gender difference in our control group of 0.405. Similarly, the “conditional” gender gap based on their true financial literacy measure is 0.225, which resembles the gender gap in the adjusted number of correct answers of 0.254. Hence, our results also confirm that about 38.2% of the gender difference in the share of correct answers is associated with the differences in response behavior and confidence.¹⁵

¹⁵The results are similar if we include the additional information based on our two debt literacy questions. We find that about one-sixth (14.5%) of the unconditional financial literacy gender gap and one-fourth (24.6%) of the gender gap conditional on socioeconomic and demographic characteristics can be attributed to differences in response behavior and confidence.

4.2 Financial literacy and stock market participation

Our results so far show the survey mode to ask about financial knowledge affects the levels of financial knowledge and the associated gender gap in financial literacy. Similar to the approach of Bucher-Koenen et al. (2021), we also investigate how our proposed measurement procedure affects the association of financial literacy and financial behavior. We focus on stock market participation, which not only facilitates the comparison to the results on the financial behavior of Bucher-Koenen et al. (2021) but is also motivated by policy discussions regarding the pension landscape in Germany. Reforms in Germany increasingly shifted the responsibility to save for retirement from the statutory retirement system to the individuals, which elevates the importance of portfolio choice for well-being in old age. Equities are one important tool to close the pension gap. Earlier studies consistently find highly significant associations between traditional measures of financial literacy and stock market participation.¹⁶ Lower levels of financial literacy among women might therefore have severe long-run consequences. In the following, we study whether and to what extent the associations uncovered in earlier contributions reflect a mix of financial knowledge and confidence.

Similar to earlier studies, we capture stock market participation using a dummy that equals one if the respondent holds investments in shares, equity funds, or real estate funds (including reverse convertibles, exchange-traded funds, mixed funds, or similar investments) and 0 otherwise. As risk-aversion is unequally distributed across genders and negatively associated with stock market participation (Almenberg & Dreber, 2015; Halko et al., 2012), we account for this alongside socioeconomic and demographic characteristics (including the number of children, marital status, age, education, income, homeownership status, and East Germany dummy). Moreover, as 36.3% of our sample are retired and potentially decumulate their equity holdings, we control for retirement status in all regressions on stock market participation.

As a preliminary check, we analyze the correlation between gender and stock market participation in our sample in table 5. The models in our first three columns do not control for socioeconomic or demographic characteristics. Notably, the gender differences in stock market participation are comparable in our treatment and control groups. When we control for the socioeconomic and demographic characteristics in columns 4 to 6, we confirm the patterns uncovered in our unconditional estimates. The gender gap in stock market participation is smaller but remains highly significant, as expected. Conditional on socioeconomic and demographic characteristics, women have about 7.7 percentage points lower chance of owning stocks than men. The difference in stock market participation is insignificantly different between our

¹⁶See Lusardi and Mitchell (2014) for a review, and Bucher-Koenen and Ziegelmeyer (2013) for evidence on German data.

experimental conditions, as are the gender gaps within both groups.¹⁷

[Table 5 about here!]

We now turn to the association between the measures of financial literacy and stock market behavior. Table 6 shows the estimated associations when we use the basic measure of financial literacy, the standardized count measure of correct answers to the “Big-3” financial literacy questions. In column 1, we focus on respondents in the control group. When accounting for financial knowledge using the standardized measure of financial literacy, the estimated gender gap in stock market participation decreases strongly but remains significant. Women have a 5.1 percentage point lower chance of owning stocks than men. Moreover, a one standard deviation higher level of financial literacy results in an approximately 7.8 percentage points higher probability of owning stocks, comparable to the effect found in earlier contributions to the literature.

In the following two columns, we consider respondents in the treatment group. Column 2 shows the association of the standardized “raw measure”, which does not adjust for admitted guesses. While this measure may contain noise due to guesses, it is unconfounded by low confidence. Our results indicate that a one standard deviation higher level of financial literacy is associated with a 5.7 percentage points higher chance of stock ownership. Notably, this association is substantially higher in our control group. In column 3, we present the results based on the “adjusted” financial literacy measure. Beyond being unconfounded by low confidence, this measure should be unaffected by the noise introduced by guessing due to the forced responses as we adjust for admitted guessing. Using this measure, we find that one standard deviation higher level of financial literacy is associated with about 7.2 percentage points higher chance of stock market participation. Our results are qualitatively similar when we include one or both debt literacy questions, as tables 8 and 9 show.

[Table 6 about here!]

The findings described in subsections 3.2 underline that women are substantially less confident in their financial knowledge, irrespective of whether they provide the correct answer. We add confidence measures to our regression models to further investigate the role of confidence and knowledge and how we can disentangle both dimensions. Table 7 presents the results of these additional specifications. As the results are qualitatively similar when we include one or both debt literacy questions, we do not describe these results in detail.¹⁸

¹⁷See table 20 in appendix D for tests of the differences between treatment and control group.

¹⁸The results of these regressions can be found in tables 10 and 11 in appendix D.

First, we turn to the results based on the standard mode of financial literacy measurement employed in the control group. In column 1, we follow the strategy of Bucher-Koenen et al. (2021) and include the number of “do not know” responses and refusals to the “Big-3” questions of financial literacy as an imperfect proxy for low confidence in financial knowledge. Notably, we find a significantly negative association between the standardized number of “do not know” responses and refusals with stock market participation. A one standard deviation above average level of “do not know” responses or refusals is associated with an about 2.4 percentage points lower chance of participating in the stock market. Moreover, this strategy reduces the point estimate of the financial literacy measure considerably. A one standard deviation higher level of financial literacy is associated with a 6.1 percentage points higher chance of owning stocks in this specification (compared to 7.8 percentage points without this measure). Hence, including this measure reduces the coefficient of our financial literacy indicator by about 22 % (that is, $(0.0784 - 0.061)/0.0784$), see column 1 of table 6).¹⁹ Moreover, including this proxy of confidence moves the point estimate of financial literacy among respondents in the control group closer to the point estimate based on the treatment group (as presented in column 2 of table 7). Hence, the standard estimate of financial literacy could be affected by the respondent’s confidence in financial knowledge and could be improved by including an (imperfect) proxy for this dimension. Nevertheless, this measure is likely very noisy because it captures the inability to answer the question correctly and the respondents’ low confidence in financial knowledge.

Our treatment allows us to disentangle those two dimensions better. Letting respondents admit guessing when they do not know the answer allows us to separate the lack of knowledge and confidence. The results in column 2 include the number of admitted guesses in addition to the standardized count measure of financial literacy. Among treated respondents, a one standard deviation higher level of the “raw” measure of financial literacy is associated with a 5.5 percentage points higher chance of owning stocks, and a one standard deviation higher number of admitted guesses is associated with a 3.4 percentage points lower chance of owning stocks. Hence, the magnitude of the point estimates of the “raw” measure of financial literacy and the number of (admitted) “do not know” responses in both our control and treatment groups are comparable.

In contrast to the control group, respondents in the treatment also report the confidence they put into their answers, allowing us to further disentangle the lack of knowledge and confidence. In column 3, we add the standardized mean level of confidence the respondents put into their

¹⁹The association between the number of “do not know”s and refusals with stock market participation and the reduction of the financial literacy coefficient after controlling for “do not know”s and refusals are comparable to the reduction reported by Bucher-Koenen et al. (2021) (reduction of 26 % and an association of the number of “do not know” responses and stock market participation of -0.0279).

answers to the “Big-3” financial literacy questions. Our results show a highly significantly positive association with stock market participation. Specifically, a one standard deviation above average confidence level is associated with a 7.7 percentage points higher chance of owning stocks. At the same time, the financial literacy coefficient is still significant but reduced substantially by about 40 percent to 0.0345 $((0.0576 - 0.0345)/0.0576)$, see column 2 of table 6), which suggests that the confidence measure captures information relevant to explaining stock market participation and shows that at least some of the association between financial literacy and stock market participation works through the confidence channel.

Adding the number of admitted guesses to the model in column 4 does not change the results qualitatively. Both measures of financial knowledge and confidence are significantly positively associated with stock market participation, and their associations with stock market participation are in the same order of magnitude as the results in column 3. In contrast, the coefficient of the number of admitted guesses is insignificantly different from zero in this specification. When controlling for financial knowledge and confidence explicitly using the number of correct answers and average confidence level, the admitted guesses only capture random guessing, which we confirm to be unrelated to stock market participation.

Lastly, we turn to the adjusted measure of financial literacy in column 5. Instead of adding a count measure of admitted guesses as in columns 2 and 4, we directly adjust the responses to the financial literacy questionnaire and treat guessing as incorrect answers. These results highlight a significantly positive association of both financial knowledge and confidence. A one standard deviation higher confidence level is associated with a 6.8 percentage points higher chance of owning stocks. Notably, the adjusted measure of financial literacy is about 52 % smaller than in the specification that does not control for confidence $((0.0717-0.0347)/0.0717)$, see column 3 of table 6).²⁰

[Table 7 about here!]

Overall, our results confirm the findings of Bucher-Koenen et al. (2021). Both financial knowledge and confidence in financial knowledge are significantly associated with stock market participation. Not explicitly accounting for confidence may lead to overestimating the association between stock market participation and commonly used measures of financial literacy. Therefore, our results have important implications for financial literacy measurement. Our proposed methodology allows disentangling knowledge and confidence, is easy to implement

²⁰Differentiating between very low confidence and random guessing could be challenging for respondents. The results are qualitatively similar when we treat very low confidence as random guessing, as tables 12 and 13 in appendix D show.

in cross-sectional studies, and is therefore relevant for researchers interested in estimating the association between financial knowledge and financial behavior.

5 Discussion and conclusion

Our proposed measurement for financial literacy allows us to disentangle knowledge and confidence, and our results show that both channels are relevant to financial behavior. Our findings have implications for financial literacy research and policymakers who seek to close the gender gaps in financial knowledge and financial inclusion.

Our results underline that neglecting the role of confidence in assessing financial knowledge impedes the measurement of the gender gap in financial literacy and overstates the effect of gender and financial literacy on stock market participation. Our proposed methodology provides a simple and cost-effective way to disentangle knowledge and confidence and is applicable in cross-sectional studies. Hence, the approach is particularly interesting to researchers who want to estimate the associations between financial knowledge and financial behaviors precisely.

Although women know more than they think, there is still a sizable gender gap in financial knowledge. Recent experimental evidence shows that financial education programs (especially active learning environments) can foster financial knowledge (Kaiser & Menkhoff, 2022) and financial attitudes (Bruhn et al., 2016), and have substantial (intergenerational) spill-over effects (Frisancho, 2022, 2023). In a recent meta-analysis of financial education programs, Kaiser et al. (2022) show that the positive treatment effects are not limited to financial knowledge but improve downstream financial behaviors. Our findings indicate that tailoring financial education programs to the needs of women is an integral component in closing the gender gap in financial inclusion.

Nevertheless, our results suggest that financial education may not close the financial literacy gender gap entirely. Our findings support policies and private initiatives to foster women’s confidence. While our results cannot speak to the design of these interventions, earlier research shows that confronting substantial gender stereotypes around the financial domain (Bottazzi & Lusardi, 2021; Driva et al., 2016; Tinghög et al., 2021) and strengthening the attitude and affinity of women with numbers (Skagerlund et al., 2018) are promising complementary strategies to close the financial literacy gender gap. Another potential pathway to spark interest in the topic, promote the acquisition of financial knowledge, and instill confidence is to enable and incentivize stock market participation directly. Experimental evidence of Jha and Shayo (2022) shows that trading stocks for only a few weeks improves financial knowledge, confidence, and risk tolerance, with particularly strong effects for women. Nonetheless, more research is needed

to design further effective policies that boost women's confidence and foster their knowledge regarding financial matters.

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A Main tables and figures

Table 1: Socioeconomic and demographic characteristics across experimental conditions

	Experimental condition		Total %	p-value
	Control %	Treatment %		
Gender				0.1008
Male	49.3	46.2	48.6	
Female	50.7	53.8	51.4	
No. of children in HH				0.4391
0	67.4	65.9	67.1	
1	16.01	18.9	16.8	
2	12.9	11.4	12.5	
3	2.8	3.1	2.9	
4	0.6	0.4	0.5	
5+	0.3	0.3	0.3	
Marital status				0.2525
Single	16.4	15.4	16.2	
Unmarried, living together	11.1	12.4	11.4	
Married, living together	55.0	52.0	54.3	
Divorced / separated / widow	14.4	16.5	14.9	
Divorced / separated / widowed, with partner in HH	3.1	3.7	3.2	
Age				0.4975
30 to 39	19.3	18.9	19.2	
40 to 49	17.8	18.8	18.1	
50 to 59	23.4	25.2	23.8	
60+	39.4	37.0	38.9	
Education				0.0000
Haupt-/Volksschule	21.0	18.5	20.4	
Mittlere Reife	50.7	44.8	49.3	
Abitur (allg., fachgeb., Fach- hochschulreife)	28.3	36.7	30.3	

Table continued on next page!

Table 1: Socioeconomic and demographic characteristics across experimental conditions (*continued*)

	Experimental condition		Total %	p-value
	Control %	Treatment %		
Vocational education				0.0297
Did not complete vocational training	7.2	6.7	7.1	
Completed vocational training	73.9	70.4	73.1	
Holds a University degree	18.9	22.9	19.8	
Monthly household net income				0.2630
[0, 1000)	10.7	10.8	10.7	
[1000, 1500)	11.8	11.6	11.7	
[1500, 2000)	11.8	10.8	11.6	
[2000, 2500)	11.1	12.6	11.4	
[2500, 3000)	10.4	12.4	10.9	
[3000, 3500)	9.1	8.2	8.9	
[3500, 4500)	11.3	12.0	11.4	
[4500, inf)	9.5	10.1	9.6	
Refuse	14.4	11.5	13.7	
Homeownership status				0.2070
Owner	43.9	46.3	44.5	
Tenant	56.1	53.7	55.5	
Region in Germany				0.5014
West	83.2	82.2	83.0	
East	16.8	17.8	17.0	
Retirement status				0.0628
Not retired	62.9	66.3	63.7	
Retired	37.1	33.7	36.3	
Stock holding				0.2746
No	70.5	68.6	70.1	
Yes	29.5	31.4	29.9	

Table continued on next page!

Table 1: Socioeconomic and demographic characteristics across experimental conditions (*continued*)

	Experimental condition		Total %	p-value
	Control %	Treatment %		
Self-assessed financial knowledge				0.5237
(0) very low	1.8	1.2	1.7	
(1)	1.7	1.8	1.7	
(2)	3.8	2.8	3.6	
(3)	7.2	5.7	6.9	
(4)	7.8	7.5	7.7	
(5)	19.4	19.3	19.3	
(6)	13.9	15.1	14.1	
(7)	20.0	21.1	20.3	
(8)	15.2	15.3	15.3	
(9)	5.8	6.2	5.9	
(10) very high	3.4	4.1	3.5	
Observations	3,715	1,121	4927	

Note: The treatment group did not have the option to respond “do not know” and could not refuse to answer the questions. We report the shares of respondents of our control- and treatment conditions, and the total share of respondents. The p-values are the result of Pearson χ^2 test statistics corrected for survey weights (using the second-order correction of Rao and Scott, 1984) and converted into a F statistics.

Table 2: Answers to the financial literacy questionnaire across treatment conditions

	Control			Treatment (raw)			Treatment (adj.)		
	Male %	Female %	Total %	Male %	Female %	Total %	Male %	Female %	Total %
Compound Interest: Suppose you had EUR 100 in a savings account, and the interest rate was 2% per year. After five years, how much do you think you would have in the account if you left the money to grow?									
<i>More than € 110</i>	56.7	42.6	49.5	60.8	49.3	54.6	57.5	45.3	50.9
Exactly € 110	24.3	28.8	26.6	27	36.1	31.9	24.6	31.7	28.4
Less than € 110	11.9	13.6	12.8	12.2	14.6	13.5	10.6	11.7	11.2
Do not know	4.6	11.5	8.1						
Refuse	2.5	3.5	3						
Admitted guess							7.3	11.3	9.5
Inflation: Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After one year, would you be able to buy the exactly same as, more than, or less than today with the money in this account?									
More	2.8	2.7	2.7	3.6	4.2	3.9	2.3	3.1	2.7
Just as much	7.4	10.1	8.8	11.5	15.4	13.6	10.6	12.3	11.5
<i>Less than today</i>	81.0	69.3	75	84.9	80.4	82.5	81.5	69.8	75.2
Do not know	6.3	13.5	9.9						
Refuse	2.6	4.4	3.5						
Admitted guess							5.6	14.9	10.6
Risk Diversification: Do you agree with the following statement: “Buying a single company stock is less risky than investing in a mutual fund with stocks of similar companies”?									
I agree	9	7.7	8.3	15.9	18.4	17.2	14.8	15.3	15.1
<i>I disagree</i>	65.4	47.9	56.5	84.1	81.6	82.8	79.3	72.3	75.6
Do not know	21.7	37.7	29.8						
Refuse	3.9	6.8	5.4						
Admitted guess							5.9	12.3	9.3

Table continued on next page!

Table 2: Answers to the financial literacy questionnaire across treatment conditions (*continued*)

	Control			Treatment (raw)			Treatment (adj.)		
	Male %	Female %	Total %	Male %	Female %	Total %	Male %	Female %	Total %
Credit Interest: Suppose you take out a loan of EUR 1,000 from the bank at an interest rate of 20% per year. If you do not pay anything off at this interest rate, how long will it take to double the amount you own the bank?									
Less than 2	7.7	10.2	9	6.7	13.5	10.4	6.1	10	8.2
2 to less than 5	52.8	34.2	43.4	63.3	48.1	55.1	58.3	40.6	48.8
5 to less than 10	20.5	20.1	20.3	25.1	30.2	27.9	23	24.3	23.7
10 or more	4.8	5.1	5	4.9	8.1	6.6	3.5	6.5	5.1
Do not know	10.7	24.1	17.5						
Refuse	3.5	6.2	4.9						
Admitted guess							9.1	18.6	14.2
Loan Repayment: Suppose you have taken out a loan of EUR 3,000 with the bank. You pay the minimum payment of EUR 30 per month to the bank. The annual interest is 12% (or 1% per month). How many years will it take to pay off this loan?									
Less than 5	4.3	5.2	4.8	2.7	8.2	5.7	2.2	6.9	4.7
Between 5 and 10	20	23	21.5	27.3	34.1	31	24	28	26.1
Between 10 and 15	28.5	26.7	27.6	29.5	34.9	32.4	26.9	27.8	27.4
Never, debt remains	32.3	16.8	24.4	40.5	22.8	31	37.5	19.8	28
Do not know	11	21.5	16.3						
Refuse	3.9	6.9	5.4						
Admitted guess							9.4	17.5	13.8
No. correct in 'Big-3'									
0	9	15.9	12.5	4.9	4.3	4.5	8.3	11.7	10.2
1	18.6	30.6	24.7	12.1	15.4	13.8	12.6	18.9	16
2	32.8	31.4	32.1	31.4	45.2	38.8	31.5	39.7	35.9
3	39.6	22.1	30.7	51.7	35.2	42.8	47.6	29.7	38
No. correct in FL-5									
0	7.4	13.4	10.4	2.9	1.9	2.4	6.3	8.9	7.7
1	13.7	23.9	18.8	6.9	9.2	8.1	8	14.2	11.3
2	19	24.6	21.8	16.7	29.6	23.6	17.5	27.5	22.9
3	20.6	20.5	20.5	24.6	30.9	28	23.5	24.9	24.3
4	21.9	12.2	17	25.2	20.7	22.8	23.2	18.1	20.5
5	17.4	5.4	11.3	23.8	7.7	15.1	21.6	6.3	13.3

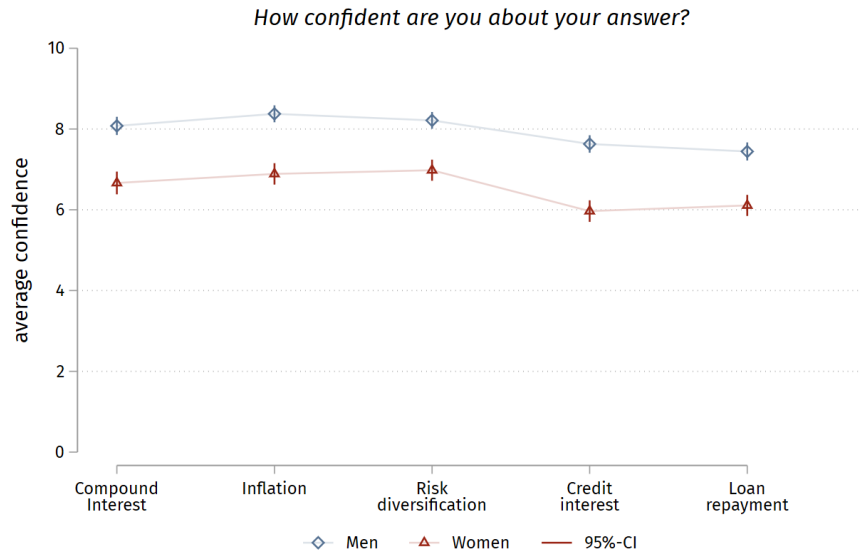


Figure 1: Average confidence in answers to financial literacy questions by gender

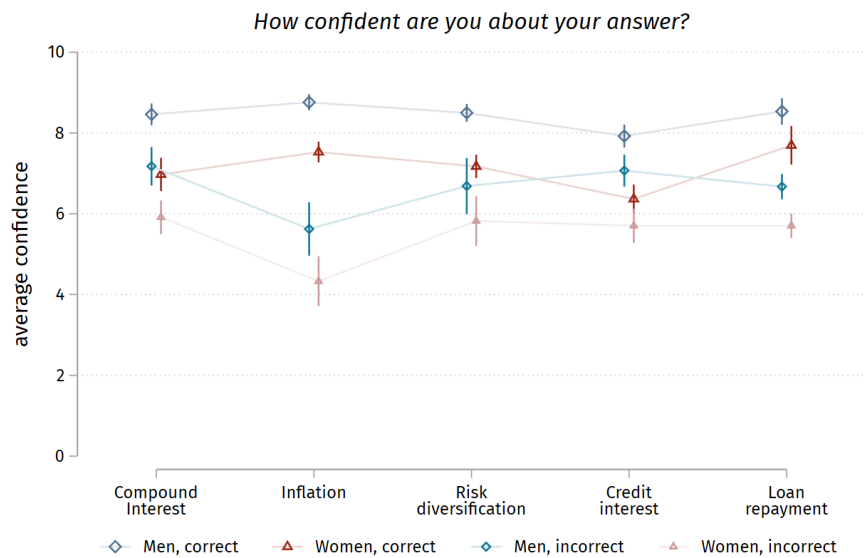


Figure 2: Average confidence in answers to financial literacy questions by gender and correctness of the provided answer

Table 3: OLS regressions on financial literacy measures

Panel A: Only controlling for gender						
	(1)	(2)	(3)	(4)	(5)	(6)
		Big-3			FL-5	
	Control	Treatment raw	Treatment adjusted	Control	Treatment raw	Treatment adjusted
Female	-0.432*** (0.0385)	-0.185** (0.0576)	-0.310*** (0.0665)	-0.773*** (0.0568)	-0.513*** (0.0850)	-0.662*** (0.0961)
Controls.	NO	NO	NO	NO	NO	NO
N	3715	1212	1212	3715	1212	1212
R2	0.0459	0.0120	0.0252	0.0658	0.0409	0.0527
Adj. R2	0.0457	0.0112	0.0244	0.0655	0.0401	0.0519
Panel B: Controlling for socioeconomic and demographic characteristics						
	(1)	(2)	(3)	(4)	(5)	(6)
		Big-3			FL-5	
	Control	Treatment raw	Treatment adjusted	Control	Treatment raw	Treatment adjusted
Female	-0.405*** (0.0303)	-0.158** (0.0481)	-0.255*** (0.0548)	-0.725*** (0.0446)	-0.439*** (0.0702)	-0.550*** (0.0796)
Controls.	YES	YES	YES	YES	YES	YES
N	3715	1212	1212	3715	1212	1212
R2	0.177	0.115	0.129	0.213	0.165	0.174
Adj. R2	0.172	0.0978	0.112	0.208	0.149	0.158

Note: Results from OLS regressions with robust standard errors, using the number of correct answers to the “Big-3” financial literacy questions (columns “Big-3”) or all financial literacy questions (columns “FL-5”) as dependent variable. Socioeconomic controls include marital status, number of children living in the household, age groups, educational attainment, homeownership status, household’s monthly net income, and a dummy for East Germany. Robust standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 4: Full sample regression on financial literacy, including interaction

	(1)	(2)	(3)	(4)
	Big-3 (raw)	Big-3 (adj.)	FL-5 (raw)	FL-5 (adj.)
Female	-0.402*** (0.0301)	-0.402*** (0.0302)	-0.723*** (0.0443)	-0.723*** (0.0443)
Treatment	0.191*** (0.0401)	0.0750 (0.0431)	0.330*** (0.0614)	0.137* (0.0657)
Female \times Treatment	0.248*** (0.0548)	0.147* (0.0596)	0.303*** (0.0806)	0.180* (0.0873)
Constant	1.636*** (0.0696)	1.633*** (0.0713)	2.299*** (0.0993)	2.333*** (0.102)
Socioecon. controls.	YES	YES	YES	YES
N	4927	4927	4927	4927
R2	0.181	0.168	0.219	0.206
Adj. R2	0.176	0.164	0.215	0.202

Note: Results from OLS regressions with robust standard errors, using the number of correct answers to the “Big-3” financial literacy questions or all financial literacy questions as dependent variable. Socioeconomic controls include marital status, number of children living in the household, age groups, educational attainment, homeownership status, household’s monthly net income, and a dummy for East Germany. Robust standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: OLS regressions on stock market participation, gender and socioeconomic controls

	(1) All	(2) Control	(3) Treatment	(4) All	(5) Control	(6) Treatment
Female	-0.125*** (0.0149)	-0.112*** (0.0170)	-0.170*** (0.0305)	-0.0770*** (0.0127)	-0.0827*** (0.0145)	-0.0593* (0.0262)
Constant	0.364*** (0.0115)	0.352*** (0.0130)	0.405*** (0.0244)	0.171*** (0.0300)	0.175*** (0.0337)	0.163* (0.0655)
Socioecon. controls.	NO	NO	NO	YES	YES	YES
N	4927	3715	1212	4927	3715	1212
R2	0.0187	0.0151	0.0333	0.184	0.178	0.218
Adj. R2	0.0185	0.0148	0.0325	0.180	0.173	0.201

Note: Results from OLS regressions with robust standard errors, using a dummy for stock market participation as dependent variable. Socioeconomic controls include marital status, number of children living in the household, age groups, educational attainment, a measure of risk aversion, homeownership status, household's monthly net income, a dummy for East Germany and retirement status. Robust standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 6: Stock market participation, sociodemographics and correct answers to 'Big-3' financial literacy questions

	(1) Control	(2) Treatment raw	(3) Treatment adj.
No. correct in 'Big-3' (std.)	0.0784*** (0.00734)	0.0576*** (0.0117)	0.0717*** (0.0118)
Female	-0.0512*** (0.0146)	-0.0490 (0.0261)	-0.0413 (0.0261)
Constant	0.210*** (0.0336)	0.166* (0.0650)	0.170** (0.0647)
Socioecon. controls	YES	YES	YES
N	3715	1212	1212
R2	0.202	0.231	0.238
Adj. R2	0.197	0.214	0.222

Note: Results from OLS regressions with robust standard errors, using a dummy for stock market participation as dependent variable. Socioeconomic controls include marital status, number of children living in the household, age groups, educational attainment, a measure of risk aversion, homeownership status, household's monthly net income, a dummy for East Germany and retirement status. The financial literacy measure and our measure of risk aversion are standardized by subtracting the mean and dividing them by the standard deviation (both relative to treatment condition). Robust standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 7: OLS regression on stock market participation and measures based on Big-3 financial literacy questions

	(1) Control	(2) Treatment raw	(3) Treatment raw	(4) Treatment raw	(5) Treatment adj.
No. correct in 'Big-3' (std.)	0.0610*** (0.0107)	0.0546*** (0.0117)	0.0345** (0.0120)	0.0329** (0.0121)	0.0347* (0.0139)
DNK/Refusals in Big-3 (std.)	-0.0244* (0.00953)				
Guesses in Big-3 (std.)		-0.0337*** (0.0101)		0.0128 (0.0128)	
Av. confidence in Big-3 (std.)			0.0767*** (0.0131)	0.0858*** (0.0166)	0.0677*** (0.0150)
Female	-0.0498*** (0.0146)	-0.0424 (0.0263)	-0.0154 (0.0269)	-0.0140 (0.0269)	-0.0173 (0.0270)
Socioecon. controls	YES	YES	YES	YES	YES
N	3715	1212	1212	1212	1212
R2	0.203	0.236	0.251	0.251	0.250
Adj. R2	0.198	0.219	0.234	0.234	0.233

Note: Results from OLS regressions with robust standard errors, using a dummy for stock market participation as dependent variable. Socioeconomic controls include marital status, number of children living in the household, age groups, educational attainment, a measure of risk aversion, homeownership status, household's monthly net income, a dummy for East Germany and retirement status. The financial literacy measure and our measure of risk aversion are standardized by subtracting the mean and dividing them by the standard deviation (both relative to treatment condition). Robust standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

B Financial literacy questions and the financial literacy experiment

The first three questions in the module on financial literacy are closely related to the “Big-3” questions of Lusardi and Mitchell (2011) and translated into German. Whereas the first two questions measure the respondents’ basic understanding of interest rates and inflation, the third question is more advanced and evaluates the knowledge of risk diversification. In contrast to the interest rate question of Lusardi and Mitchell (2011), the first question of this survey targets the understanding of compound interest differently. It is more complex than the question in the original “Big-3”. The fourth and fifth questions cover credit interest and loan repayment. Both draw upon the debt literacy questions proposed by Lusardi and Tufano (2015). The correct answer choices are in bold.

1. **Compound interest question:** Suppose you had EUR 100 in a savings account, and the interest rate was 2% per year. After five years, how much do you think you would have in the account if you left the money to grow? **More than EUR 110** / Exactly EUR 110 / Less than EUR 110 / *Do not know / Refuse to answer*
2. **Inflation question:** Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After one year, would you be able to buy the exactly same as, more than, or less than today with the money in this account? More / Exactly the same / **Less than today** / *Do not know / Refuse to answer*
3. **Risk diversification question:** Do you agree with the following statement: “Buying a single company stock is less risky than investing in a mutual fund with stocks of similar companies”? I agree / **I disagree** / *Do not know / Refuse to answer*
4. **Credit interest question:** Suppose you take out a loan of EUR 1,000 from the bank at an interest rate of 20% per year. If you do not pay anything off at this interest rate, how long will it take to double the amount you owe the bank? Less than 2 years / **2 to less than 5 years** / 5 to less than 10 years / 10 years or more / *Do not know / Refuse to answer*
5. **Loan repayment question:** Suppose you have taken out a loan of EUR 3,000 with the bank. You pay the minimum payment of EUR 30 per month to the bank. The annual interest is 12% (or 1% per month). How many years will it take to pay off this loan? Less than 5 years / Between 5 and 10 years / Between 10 and 15 years / **Never, the debt will remain** / *Do not know / Refuse to answer*

While most respondents are allocated randomly to participate in either the treatment- or control condition, this was not the case for pen and paper participants. Given that it is challenging to implement the obligation to answer the questions and subsequently ask about confidence in their answers, pen and paper participants receive the standard financial literacy questionnaire mode by default. In our main results, we only use the information of respondents who are randomly allocated to either condition. However, the results are robust towards including the 172 pen and paper respondents (which are by default assigned to the control group).

C Calculation of survey weights

The survey weights used for our descriptive statistics are based on data from the Federal Statistical Office (from December 31, 2019) and are calculated in a two-stage procedure. In the first stage, respondents recruited by telephone are re-weighted by household size to ensure similar selection probabilities. In the second stage, the weights are adjusted along a wide range of socioeconomic and demographic characteristics, including household size, age, gender, highest educational attainment, and German federal state of residence. In some cases, several variables are combined to account for deviations between specific subgroups using nested data (e.g., gender, household size, and age). Furthermore, we instructed the survey agency to include a representative share of homeowners. To ensure a share of 48 % homeowners (share reported by the Federal Statistical Office in 2019), we include one screening question on whether the respondent rents or owns their current accommodation. Of the respondents included in our main results (without pen and paper respondents), the minimum weight is 0.13, and the maximum weight is 5.30, with a median weight of 0.86 and a standard deviation of 0.59.

D Robustness checks

In the following section, we present robustness checks of the main results. Tables 8 and 9 present the associations of stock market participation and our measures based on the “Big-3” and one or both debt-literacy questions. Tables 10 and 11 present the OLS regressions on stock market participation and measures of knowledge and confidence based on the extended financial literacy measures (“Big-3” and one or both debt-literacy questions). Overall, these results show that our findings presented in table 6 and 7 are robust to including the additional information on financial knowledge and confidence included in our survey.

Tables 12 and 13 show the results presented in tables 6 and 7 are robust to alternative specifications of confidence and guessing. In these regressions, we treat respondents who report

a level of “0 confidence” as if they admitted to guessing. Specifically, columns 1 and 2 control for our regular “raw” standardized count-measures of financial literacy but additionally control for the number of admitted guesses and 0 confidence. In columns 3 and 4, we make use of adjusted count measures. Here, we correct the number of correct answers for both admitted guesses and reported levels of 0 confidence and treat their responses as incorrect, independent of their actual answer. The results are qualitatively similar to the findings presented in the main text.

In subsection [D.2](#), we provide further evidence that our treatment reveals higher financial literacy levels compared to what would be expected if people randomly guessed. We follow the methodology of Von Gaudecker ([2015](#)) who proposes a financial numeracy score and codes the “do not know” and “refusal” responses with the probability that the respondent chooses the correct answer at random. That is, respondents reporting to not know the answer receive the value of one divided by the available answer categories other than do not know or refusal. Hence, the methodology of Von Gaudecker ([2015](#)) implies that respondents that did not know the answer or refused to respond would pick a random answer if they were forced to do so. We test this assumption by comparing the forced responses of our treatment group with a financial numeracy score in our treatment group. Our findings highlight that the share of correct responses is significantly higher than the financial numeracy scores for and our financial literacy count measures.

Subsection [D.3](#) presents evidence that our results are robust towards using Probit models instead of the linear probability models used in the main body of the paper. The average marginal effects presented in these tables are comparable to the associations described in the main text.

Lastly, subsection [D.4](#) shows that the stock market participation is insignificantly different for both men and women across both experimental conditions.

D.1 Alternative specifications of financial literacy

Table 8: OLS regression on stock market participation, sociodemographics and correct answers to 'Big-3' and credit interest question

	(1) Control	(2) Treatment raw	(3) Treatment adj.
No. correct in "Big-4" (std.)	0.0792*** (0.00755)	0.0673*** (0.0122)	0.0800*** (0.0122)
Female	-0.0479** (0.0147)	-0.0411 (0.0261)	-0.0338 (0.0262)
Constant	0.205*** (0.0336)	0.168* (0.0652)	0.167* (0.0650)
Socioecon. controls	YES	YES	YES
N	3715	1212	1212
R2	0.202	0.236	0.243
Adj. R2	0.197	0.219	0.226

Note: Results from OLS regressions with robust standard errors, using a dummy for stock market participation as dependent variable. Socioeconomic controls include marital status, number of children living in the household, age groups, educational attainment, a measure of risk aversion, homeownership status, household's monthly net income, a dummy for East Germany and retirement status. The financial literacy measure and our measure of risk aversion are standardized by subtracting the mean and dividing them by the standard deviation (both relative to treatment condition). Robust standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 9: OLS regressions on stock market participation, sociodemographics and correct answers to all financial literacy questions included

	(1) Control	(2) Treatment raw	(3) Treatment adj.
No. correct in FL-5 (std.)	0.0825*** (0.00782)	0.0665*** (0.0128)	0.0802*** (0.0127)
Female	-0.0432** (0.0148)	-0.0374 (0.0263)	-0.0306 (0.0263)
Constant	0.201*** (0.0335)	0.165* (0.0653)	0.165* (0.0650)
Socioecon. controls	YES	YES	YES
N	3715	1212	1212
R2	0.204	0.235	0.242
Adj. R2	0.198	0.218	0.225

Note: Results from OLS regressions with robust standard errors, using a dummy for stock market participation as dependent variable. Socioeconomic controls include marital status, number of children living in the household, age groups, educational attainment, a measure of risk aversion, homeownership status, household's monthly net income, a dummy for East Germany and retirement status. The financial literacy measure and our measure of risk aversion are standardized by subtracting the mean and dividing them by the standard deviation (both relative to treatment condition). Robust standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 10: OLS regression on stock market participation and measures based on Big-3 and Credit Interest question

	(1) Control	(2) Treatment raw	(3) Treatment raw	(4) Treatment raw	(5) Treatment adj.
No. correct in 'Big-4' (std.)	0.0696*** (0.0106)	0.0637*** (0.0122)	0.0478*** (0.0125)	0.0469*** (0.0125)	0.0506*** (0.0144)
DNK/Refusals in Big-4 (std.)	-0.0139 (0.00921)				
No. of guesses in Big-4 (std.)		-0.0298** (0.0103)		0.0124 (0.0131)	
Av. confidence in Big-4 (std.)			0.0703*** (0.0132)	0.0788*** (0.0168)	0.0564*** (0.0152)
Female	-0.0470** (0.0147)	-0.0354 (0.0264)	-0.0106 (0.0269)	-0.00930 (0.0269)	-0.0145 (0.0269)
Socioecon. controls	YES	YES	YES	YES	YES
N	3715	1212	1212	1212	1212
R2	0.203	0.240	0.252	0.253	0.251
Adj. R2	0.197	0.222	0.235	0.235	0.234

Note: Results from OLS regressions with robust standard errors, using a dummy for stock market participation as dependent variable. Socioeconomic controls include marital status, number of children living in the household, age groups, educational attainment, a measure of risk aversion, homeownership status, household's monthly net income, a dummy for East Germany and retirement status. The financial literacy measure and our measure of risk aversion are standardized by subtracting the mean and dividing them by the standard deviation (both relative to treatment condition). Robust standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 11: OLS regression on stock market participation and measures based on all financial literacy questions included

	(1) Control	(2) Treatment raw	(3) Treatment raw	(4) Treatment raw	(5) Treatment adj.
No. correct in FL-5 (std.)	0.0767*** (0.0104)	0.0630*** (0.0128)	0.0451*** (0.0133)	0.0441** (0.0134)	0.0514*** (0.0152)
DNK/Refusals in FL-5 (std.)	-0.00869 (0.00868)				
Guesses in FL-5 (std.)		-0.0304** (0.0104)		0.00859 (0.0133)	
Av. confidence in FL-5 (std.)			0.0661*** (0.0133)	0.0722*** (0.0171)	0.0519*** (0.0153)
Female	-0.0428** (0.0148)	-0.0317 (0.0265)	-0.0113 (0.0270)	-0.0105 (0.0270)	-0.0149 (0.0269)
Socioecon. controls	YES	YES	YES	YES	YES
N	3715	1212	1212	1212	1212
R2	0.204	0.239	0.249	0.249	0.249
Adj. R2	0.198	0.221	0.232	0.231	0.232

Note: Results from OLS regressions with robust standard errors, using a dummy for stock market participation as dependent variable. Socioeconomic controls include marital status, number of children living in the household, age groups, educational attainment, a measure of risk aversion, homeownership status, household's monthly net income, a dummy for East Germany and retirement status. The financial literacy measure and our measure of risk aversion are standardized by subtracting the mean and dividing them by the standard deviation (both relative to treatment condition). Robust standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 12: OLS regression on stock market participation and measures based on number of correct answers in Big-3 financial literacy questions, treating very low confidence as admitted guessing

	(1) Treat.	(2) Treat.	(3) Treat.	(4) Treat.
No. correct in 'Big-3' (raw, std.)	0.0531*** (0.0118)	0.0372** (0.0127)		
No. correct in 'Big-3' (std., adj. by treating 0 conf. as guess)			0.0761*** (0.0120)	0.0517*** (0.0145)
Guesses in Big-3 (std., incl. confidence=0 as guess)	-0.0320** (0.0107)	-0.00198 (0.0153)		
Av. confidence in Big-3 (std.)		0.0647*** (0.0145)		0.0546*** (0.0143)
Female	-0.0398 (0.0265)	-0.0156 (0.0274)	-0.0366 (0.0262)	-0.0130 (0.0272)
Socioecon. controls	YES	YES	YES	YES
N	1212	1169	1212	1169
R2	0.236	0.244	0.241	0.247
Adj. R2	0.218	0.226	0.224	0.229

Note: Results from OLS regressions with robust standard errors, using a dummy for stock market participation as dependent variable. Socioeconomic controls include marital status, number of children living in the household, age groups, educational attainment, a measure of risk aversion, homeownership status, household's monthly net income, a dummy for East Germany and retirement status. The financial literacy measure and our measure of risk aversion are standardized by subtracting the mean and dividing them by the standard deviation (both relative to treatment condition). Robust standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 13: OLS regression on stock market participation, measures based on all financial literacy questions included, treating very low confidence as admitted guessing

	(1) Treat.	(2) Treat.	(3) Treat.	(4) Treat.
No. correct in FL-5 (raw, std.)	0.0616*** (0.0129)	0.0474*** (0.0137)		
No. correct in FL-5 (std., adj. by treating 0 conf. as guess)			0.0848*** (0.0128)	0.0668*** (0.0152)
Guesses in FL-5 (std., incl. confidence=0 as guess)	-0.0300** (0.0110)	-0.00856 (0.0143)		
Av. confidence in FL-5 (std.)		0.0528*** (0.0144)		0.0435** (0.0141)
Female	-0.0291 (0.0266)	-0.0117 (0.0273)	-0.0257 (0.0264)	-0.00867 (0.0272)
Socioecon. controls	YES	YES	YES	YES
N	1212	1176	1212	1176
R2	0.238	0.243	0.244	0.248
Adj. R2	0.221	0.225	0.228	0.230

Note: Results from OLS regressions with robust standard errors, using a dummy for stock market participation as dependent variable. Socioeconomic controls include marital status, number of children living in the household, age groups, educational attainment, a measure of risk aversion, homeownership status, household's monthly net income, a dummy for East Germany and retirement status. The financial literacy measure and our measure of risk aversion are standardized by subtracting the mean and dividing them by the standard deviation (both relative to treatment condition). Robust standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

D.2 Robustness regarding random guessing

Table 14: Raw responses among treated individuals and financial numeracy scores following Von Gaudecker (2015)

	Treatment		Control		Treatment vs. Control	
	mean	sd	mean	sd	difference	t-stat.
All						
Compound Interest	0.546	0.498	0.532	0.474	0.0141	(0.88)
Inflation	0.825	0.380	0.795	0.365	0.0297*	(2.42)
Risk Diversification	0.828	0.378	0.741	0.323	0.0868***	(7.72)
Credit Interest	0.551	0.498	0.490	0.456	0.0618***	(3.97)
Loan Repayment	0.310	0.463	0.299	0.411	0.0111	(0.78)
No. correct in 'Big-3'	2.199	0.842	2.068	0.776	0.131***	(4.94)
No. correct in FL-5	3.060	1.267	2.857	1.209	0.203***	(4.98)
Observations	1,212		3,715		4,927	
Male						
Compound Interest	0.608	0.489	0.590	0.476	0.0178	(0.76)
Inflation	0.849	0.358	0.839	0.340	0.0104	(0.62)
Risk Diversification	0.841	0.366	0.782	0.327	0.0591***	(3.60)
Credit Interest	0.633	0.482	0.563	0.469	0.0699**	(3.03)
Loan Repayment	0.405	0.491	0.360	0.450	0.0446*	(1.98)
No. correct in 'Big-3'	2.298	0.863	2.211	0.775	0.0873*	(2.24)
No. correct in FL-5	3.336	1.339	3.135	1.273	0.202**	(3.20)
Observations	551		1,825		2,376	
Female						
Compound Interest	0.493	0.500	0.476	0.465	0.0176	(0.81)
Inflation	0.804	0.397	0.753	0.383	0.0514**	(2.91)
Risk Diversification	0.816	0.388	0.701	0.314	0.115***	(7.56)
Credit Interest	0.481	0.500	0.418	0.432	0.0633**	(3.08)
Loan Repayment	0.228	0.420	0.239	0.359	-0.0106	(-0.62)
No. correct in 'Big-3'	2.114	0.815	1.929	0.752	0.184***	(5.25)
No. correct in FL-5	2.823	1.151	2.586	1.077	0.237***	(4.73)
Observations	661		1,890		2,551	

Note: Adjustment following Von Gaudecker (2015) codes responses indicating “do not know” or refusals with the probability that a randomly chosen answer would be correct (i.e. incorrect=0, DNK/Ref = 1/(available answers that are not DNK/Ref.), and correct=1). Difference and corresponding t-statistics based on tests of difference in weighted means. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

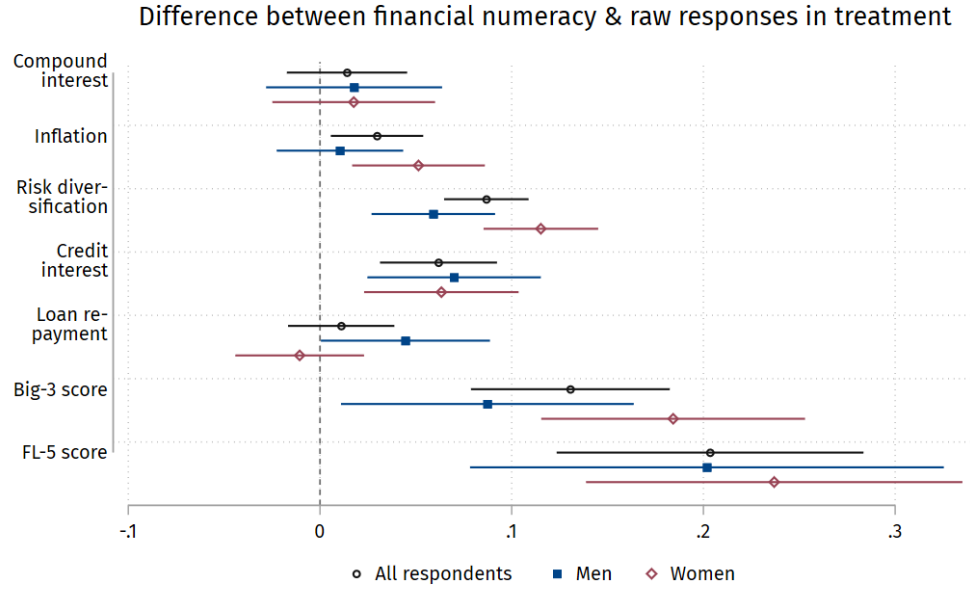


Figure 3: Tests of the weighted difference between the mean financial numeracy score following von Gaudecker (2015) and the share of correct answers to the forced responses in the treatment group

D.3 Probit regressions on stock market participation

Table 15: Average marginal effects of probit regression on stock market participation, gender and socioeconomic controls

	(1) All	(2) Control	(3) Treatment	(4) All	(5) Control	(6) Treatment
Female	-0.121*** (0.0128)	-0.116*** (0.0147)	-0.138*** (0.0257)	-0.0721*** (0.0120)	-0.0777*** (0.0138)	-0.0540* (0.0246)
Socioecon. controls	No	No	No	Yes	Yes	Yes
N	4927	3715	1212	4927	3715	1212
Pseudo R2	0.0142	0.0132	0.0178	0.159	0.155	0.190
Loglikelihood	-3005.2	-2258.7	-745.6	-2562.3	-1934.8	-614.6

Note: Average marginal effects based on probit regressions, using a dummy for stock market participation as dependent variable. Socioeconomic controls include marital status, number of children living in the household, age groups, educational attainment, a measure of risk aversion, homeownership status, household's monthly net income, a dummy for East Germany and retirement status. Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 16: Average marginal effects of probit regression on stock market participation, correct answers to 'Big-3' financial literacy questions and socioeconomic controls

	(1) Control	(2) Treatment raw	(3) Treatment adj.
No. correct in 'Big-3' (std)	0.0790*** (0.00720)	0.0580*** (0.0126)	0.0729*** (0.0125)
Female	-0.0454** (0.0139)	-0.0425 (0.0245)	-0.0354 (0.0244)
Socioeconomic controls	Yes	Yes	Yes
N	3715	1212	1212
Pseudo R2	0.180	0.204	0.212
Loglikelihood	-1877.7	-604.1	-598.2

Note: Marginal effects from probit regressions, using a dummy for stock market participation as dependent variable. Socioeconomic controls include marital status, number of children living in the household, age groups, educational attainment, a measure of risk aversion, homeownership status, household's monthly net income, a dummy for East Germany and retirement status. The financial literacy measure and our measure of risk aversion are standardized by subtracting the mean and dividing them by the standard deviation (both relative to treatment condition). Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 17: Average marginal effects of probit regression on stock market participation, correct answers to all financial literacy questions and socioeconomic controls

	(1) Control	(2) Treatment raw	(3) Treatment adj.
No. correct in FL-5 (std.)	0.0788*** (0.00711)	0.0619*** (0.0124)	0.0761*** (0.0123)
Female	-0.0377** (0.0141)	-0.0323 (0.0247)	-0.0256 (0.0246)
Socioeconomic controls	Yes	Yes	Yes
N	3715	1212	1212
Pseudo R2	0.180	0.206	0.214
Loglikelihood	-1877.6	-602.6	-596.5

Note: Marginal effects from probit regressions, using a dummy for stock market participation as dependent variable. Socioeconomic controls include marital status, number of children living in the household, age groups, educational attainment, a measure of risk aversion, homeownership status, household's monthly net income, a dummy for East Germany and retirement status. The financial literacy measure and our measure of risk aversion are standardized by subtracting the mean and dividing them by the standard deviation (both relative to treatment condition). Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 18: Average marginal effects of probit regression on stock market participation, explained by financial literacy measures based on 'Big-3' financial literacy questions

	(1) Control	(2) Treatment raw	(3) Treatment raw	(4) Treatment raw	(5) Treatment adj.
No. correct in 'Big-3' (std.)	0.0511*** (0.0101)	0.0542*** (0.0126)	0.0318* (0.0133)	0.0304* (0.0135)	0.0340* (0.0154)
DNK/Refusals in Big-3 (std.)	-0.0442*** (0.0112)				
Guesses in Big-3 (std.)		-0.0410** (0.0138)		0.0110 (0.0176)	
Av. confidence in Big-3 (std.)			0.0791*** (0.0139)	0.0863*** (0.0181)	0.0705*** (0.0160)
Female	-0.0431** (0.0139)	-0.0372 (0.0244)	-0.0122 (0.0248)	-0.0110 (0.0249)	-0.0138 (0.0248)
Socioeconomic controls	Yes	Yes	Yes	Yes	Yes
N	3715	1212	1212	1212	1212
Pseudo R2	0.183	0.210	0.225	0.226	0.225
Loglikelihood	-1869.8	-599.5	-588.1	-587.9	-588.5

Note: Marginal effects based on probit regressions, using a dummy for stock market participation as dependent variable. Socioeconomic controls include marital status, number of children living in the household, age groups, educational attainment, a measure of risk aversion, homeownership status, household's monthly net income, a dummy for East Germany and retirement status. The financial literacy measure and our measure of risk aversion are standardized by subtracting the mean and dividing them by the standard deviation (both relative to treatment condition). Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 19: Average marginal effects of probit regression on stock market participation, explained by financial literacy measures based on all financial literacy questions included

	(1) Control	(2) Treatment raw	(3) Treatment raw	(4) Treatment raw	(5) Treatment adj.
No. correct in FL-5 (std.)	0.0656*** (0.00926)	0.0571*** (0.0125)	0.0381** (0.0133)	0.0376** (0.0134)	0.0460** (0.0152)
DNK/Refusals in FL-5 (std.)	-0.0226* (0.0101)				
Guesses in FL-5 (std.)		-0.0368** (0.0136)		0.00480 (0.0173)	
Av. confidence in FL-5 (std.)			0.0680*** (0.0141)	0.0711*** (0.0181)	0.0553*** (0.0160)
Female	-0.0366** (0.0141)	-0.0274 (0.0246)	-0.00819 (0.0250)	-0.00773 (0.0251)	-0.0104 (0.0249)
Socioeconomic controls	Yes	Yes	Yes	Yes	Yes
N	3715	1212	1212	1212	1212
Pseudo R2	0.181	0.211	0.221	0.222	0.222
Loglikelihood	-1875.1	-598.8	-591.0	-591.0	-590.6

Note: Average marginal effects based on probit regressions, using a dummy for stock market participation as dependent variable. Socioeconomic controls include marital status, number of children living in the household, age groups, educational attainment, a measure of risk aversion, homeownership status, household's monthly net income, a dummy for East Germany and retirement status. The financial literacy measure and our measure of risk aversion are standardized by subtracting the mean and dividing them by the standard deviation (both relative to treatment condition). Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

D.4 Similarity of stock market participation across groups

The following table presents evidence on the similarity of stock market participation across our treatment and control group.

Table 20: OLS regressions on stock market participation, gender and socioeconomic controls

	(1) SMP	(2) SMP	(3) SMP	(4) SMP
Female	-0.126*** (0.0149)	-0.112*** (0.0170)	-0.0770*** (0.0127)	-0.0764*** (0.0143)
Treatment	0.0229 (0.0172)	0.0535 (0.0276)	-0.00199 (0.0139)	-0.000626 (0.0214)
Female \times Treatment		-0.0577 (0.0349)		-0.00254 (0.0280)
Constant	0.359*** (0.0121)	0.352*** (0.0130)	0.203*** (0.0289)	0.202*** (0.0290)
Controls for socioecon. char.	NO	NO	YES	YES
N	4927	4927	4927	4927
R2	0.0192	0.0199	0.184	0.184
Adj. R2	0.0188	0.0193	0.180	0.180

Note: Results from OLS regressions with robust standard errors, using a dummy for stock market participation as dependent variable. Socioeconomic controls include marital status, number of children living in the household, age groups, educational attainment, a measure of risk aversion, homeownership status, household's monthly net income, a dummy for East Germany and retirement status. Robust standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.