FINANCIAL LITERACY AND PRIVATE OLD-AGE PROVISION IN GERMANY
– EVIDENCE FROM SAVE 2008 –

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ABSTRACT

The German population has good financial knowledge measured on the basis of three financial literacy questions. Around 85 % of the individuals comprehend the functioning of interest and inflation. And 60 % of the individuals understand the relationship of risk and diversification. Overall around 52 % of the individuals give correct answers to all three considered questions of financial literacy. Bi-variate and multivariate analyses of the relation between giving three correct answers and socio-demographic characteristics reveal that higher wealth is associated with higher levels of financial literacy. Moreover, financial literacy relates to higher levels of income and education. There is a significant difference between men and women to give three correct answers. Individuals in East and West, are equally literate, when controlling for differences in income, wealth and education.

A positive correlation of financial literacy and financial decision making is identified: more literate households are more likely to save privately for their old-age and at the same time households saving privately for their old-age acquire financial knowledge to improve their investment decisions. Interestingly, the possession of a state subsidised Riester contract is related to lower levels of financial literacy than the possession of other non-subsidised forms of private old-age provision. This indicates that Riester subsidies to some extent successfully encourage individuals with lower financial knowledge to save for old-age. Nevertheless, individuals in the lowest income quintile still have very low levels of private coverage despite the high subsidies. At the same time they show the lowest levels of financial literacy.

1. Introduction

Private old-age provision is growing increasingly important in times of demographic change and mounting strains on the public pension system. Major pension reforms were implemented in Germany in 2001, 2004 and 2007.[1] Currently about 85% of the German work force is covered by the German public pension insurance. According to Börsch-Supan and Wilke (2006) about 88% of total disposable old-age income in Germany is disbursed from the public pension system. After the recent reforms these payments will decrease dramatically and individuals are expected to accumulate substantial amounts of pension wealth in addition to their claims from the public pension system to bridge the gap that arises in old-age income (Wilke, 2009). In order to provide additional incentives for private old-age savings in 2001 the so-called Riester-pensions - state subsidised private pension or savings contracts - were introduced.[2] According to BMAS (2009) currently about 12.9 Mio. contracts are registered. In contrast to private (third pillar) retirement savings in the Netherlands and Sweden, Riester contracts are voluntary supplementary pensions.

For many individuals in Germany the "need" to save for old-age in addition to the state pension is new and households seem to face difficulties saving for old age due to the high complexity and the large variety of old-age savings contracts. In order to evaluate the effectiveness of governmental programs it is vital to examine who takes care of their old-age income and signs a Riester or other private old-age savings contract and who does not. One important dimension along which individuals may differ is their level of erudition as investors. In the light of increasing individual responsibility and potential public measures such as targeted information and education programs it is therefore important to better understand the link between their financial knowledge and financial decision-making. The OECD (2005) defines financial education as

> *"the process by which financial consumers/investors improve their understanding of financial products and concepts through information, instruction, and/or objective advice, develop the skills and confidence to become more aware of financial risks and opportunities to make informed choices, to know where to go for help, and to take effective actions to improve their financial well-being."*

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[1] See Börsch-Supan and Wilke (2004) for details of the reform until 2004 and Bucher-Koenen and Wilke (2009) for effects of the reform in 2007.

[2] For institutional details and empirical evidence on the Riester pensions see Börsch-Supan, et al. (2007).

Better financial education leads to more financially literate individuals. Thus, financial literacy is a very comprehensive concept, which includes knowledge as well as capabilities. In the course of my analysis I will concentrate on the "knowledge" aspect within the broader financial literacy concept. However, knowledge in the context of decision making is partly experience driven. The kind of knowledge required for financial decisions is highly context specific and hard to determine in general.[3] For simple every day financial decisions basic verbal and numeric abilities are sufficient. The more complex a decision, the more specific the knowledge about available alternatives, risks and the possible outcomes has to be. Much research has been conducted on ways to measure financial literacy, pioneered primarily by Annamaria Lusardi and Olivia Mitchell. Their stepping stone was the development of three questions testing the understanding of inflation, interest and risk. These questions have been included in various surveys around the world and allow for some comparison of financial knowledge across countries (Lusardi and Mitchell, 2009, 2006). They are also part of the SAVE survey and form the basis for my analysis.

Studies of financial literacy in the US and the Netherlands found that in particular low income/low education households and women are at risk of lacking financial literacy and thus accumulate low retirement wealth (see e.g. Lusardi and Mitchell (2006), van Rooji, Lusardi and Alessi (2007)). Riester pensions could address these issues, as they were designed to be especially beneficial to households with low income and households with children, yet the interaction with financial literacy has not been studied up until now. The questions arising are therefore along the following lines: How financially literate are individuals with a Riester compared to individuals with other private old-age savings and compared to households without any private provision? Are higher levels of financial literacy associated with more private pension coverage? Are these effects more or less pronounced for households with lower income?

My study contributes to the existing literature by addressing these questions using survey data from a representative sample of German households. I analyze the socio-demographic factors related to financial knowledge with the goal of gaining insights into the link of this knowledge to financial old-age provision. Several other studies found that the level of financial literacy among the German population is limited (e.g., Commerzbank (2003), Leinert and Wagner (2004), Raffelhüschen and Vic-

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[3] For a more detailed psychological examination of the different constructs relevant in the context of financial literacy see Bothe-Hutschenreuter (2007). The author finds that besides maximum behaviour (financial knowledge) typical reponse (motivation) and life data have an important effect on old-age provision. Bothe-Hutschenreuter differentiates between declarative financial knowledge, scenario-based financial knowledge, understanding of economic principles like the effects of interest, compound interest and risk, cognitive abilities like numeracy and self-assessed financial knowledge.

toria Lebensversicherung (2006) , Deutscher Bankenverband (2008)). However these studies largely failed to link financial knowledge to financial decision making of individuals. SAVE gives me the unique opportunity to fill this gap.

The remainder of this analysis is organized as follows. Section 2 examines the related literature. Section 3 describes the data and discusses potential ways to measure financial knowledge. Section 4 includes the empirical analysis and attempts to shed light on the central questions raised above. Section 5 concludes.

2.   Literature

2.1.   Existing work on life-cycle savings

When analysing old-age provision one usually draws on the classical life-cycle savings theory by Modigliani and Brumberg (1954). The central outcome of their model is that as a result of optimization-behavior individuals smooth their income and consumption path over the life-cycle (life-cycle savings hypothesis). To compensate for income-losses at old-age forward-looking individuals should accumulate capital at younger ages. Thus, taking their current information into account individuals calculate an expected value of the future development of their income, their survival probability, the discount rates, the interest rate, their investments, the pension claims and the inflation and formulate their optimal consumption and savings plan on these grounds (Lusardi, 2008a).

However, empirical contributions find that individuals' savings patterns are substantially different from the predictions of the classical life-cycle savings theory. For example in Italy, Germany, the Netherlands, France, the UK and the US savings rates are found to be positive at all ages, thus older households do not decumulate wealth as predicted by the life-cycle savings theory (Börsch-Supan, 2001).[4] Other savings motives like precautionary saving or bequest motives were subsequently included to improve the model's predictive power.[5]

Behavioral Economics emerged mainly in the 1970s and 1980s and attempts to capture behaviour of boundedly rational agents. It substantially extends the understanding of individuals' decision making, in particular savings behaviour, by admit-

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[4] See results of the International Savings Comparison Project (Special issues of „Research in Economics": Vol. 55(1+2), 2001).
[5] For a review on household savings see Browning and Lusardi (1996).

ting that individuals are limited in their capacity to make rational decisions and devi-ate systematically and predictably from rational behavior. Central contributions in this respect are by Strotz (1956), Prospect Theory by Kahneman and Tversky (1979) as well as contributions by Thaler (1981) and Thaler and Shefrin (1981). Shefrin and Thaler (1988) formulate a „Behavioral Life-cycle Hypothesis" assuming boundedly rational agents in the sense that individuals face problems with self-control, mental accounting and framing. Due to limited cognitive abilities individuals use simple rules of thumb in order to make their life-cycle savings decisions and arrive at second best solutions compared to traditional theory. Thaler (1994) criticises life-cycle savings theory and proposes three behavioral extensions to better describe actual saving be-haviour and to derive useful policy recommendations to encourage savings. However, in spite of the extensive criticism and empirical dismissal the life-cycle hypothesis still forms the major theory of saving and substantially influences the thinking of ec-onomists and public policy makers.

Given that real individuals are indeed boundedly rational in an economic sense there are most probably differences in the degree of boundedness. On the one side of the spectrum individuals that are more rational and less biased may make sound fi-nancial decisions, on the other side of the spectrum individuals that are less rational and more biased make large mistakes. For example Benjamin, Brown and Shapiro (2006) find that the "(ir)rationality" (small-stakes risk aversion and short-run dis-counting) of individuals is related to their cognitive abilities. In measuring financial literacy economists try to determine the differences in financial knowledge and capa-bilities of individuals and relate these to their financial decision-making. The overall aim is to identify the individuals at risk of making bad decisions and tailor policy programs specifically to their needs.

There are few studies that explicitly consider financial literacy in a theoretical con-text. Maki (2004) argues relatively informally that financial education does not change preference parameters of individuals (risk and time preferences) but alters the choice set that individuals face when planning for the future. Thus, financial educa-tion increases individuals' awareness of possible ways to save for future consumption and thereby improves their decisions. Delavande et al. (2008) argue on similar grounds and assume that individuals are limited in their ability to optimize consump-tion and savings over the life-cycle due to restrictions in information access and in-formation processing. However, individuals can improve their optimization abilities by acquiring financial knowledge, which is modelled as human capital production process. Peress (2004) explains the different pattern of stock holding and wealth by endogenous differences in information. He assumes that financial information about

stocks is costly, however its value for the individual increases with the amount to be invested in stocks. Thus, individuals, with more money to invest, buy information and invest more in stocks because the investment is less risky for them. Thereby they accumulate further wealth.

The feature common to all models of financial literacy acquisition is that information about financial investment opportunities is costly and individuals can acquire knowledge. However, they face different constraints when acquiring financial knowledge depending on for example the level of experience/human capital investment (Delavande, et al., 2008), wealth (Peress, 2004), cognitive abilities (Christelis, et al., 2006). In general, financial literacy and financial decision-making are mutually enhancing: The more an individual knows about different options and consequences the better her financial decisions will be. And at the same time the more decisions the individual makes the more knowledge she can acquire. Analogously, the more important saving is for an individual the higher is the incentive to acquire knowledge and, vice versa, the more an individual knows about finance the more likely she might be to save.

Besides the direct impact of financial education on financial decisions there potentially is a relation between financial knowledge and preference parameters (time and risk preferences). While Maki (2004) argues that financial literacy does not alter time and risk preferences, indirect links may exist. More patient individuals, i.e. individuals with lower discount rates, might for example be more willing to save for future consumption and at the same time be more willing to invest in education. Furthermore, the link may well be via cognitive abilities: Christelis et al. (2006) suggest that cognitive abilities reduce the effort to acquire and process information and at the same time increases risk tolerance and therefore people with higher cognition are more likely to invest in the stock market.[6]

Hypotheses

Thus, with respect to socio-demographic characteristics and financial literacy the following four hypotheses can be derived:

- *Hypothesis 1:* As the incentives to invest in financial knowledge increase with wealth, I expect the level of financial literacy to be higher for individuals with higher wealth.

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[6] For details on the effects of cognitive abilities on decision making competences in general, see for example Ballinger, et al. (2007), Benjamin, et al. (2006), Bruine de Bruin, et al. (2007).

- *Hypothesis 2:* I expect that individuals with personal characteristics that lower the cost of financial literacy acquisition, for example higher education, higher income and wealth, show superior levels of financial literacy.

- *Hypothesis 3:* Moreover, I expect to find lower levels of financial literacy in East Germany compared to West Germany as individuals socialised in the GDR are expected to have less experience with individual financial decision making. The differences should be smaller for younger individuals.

- *Hypothesis 4:* In addition, I expect to find an inverted U-shaped pattern of financial literacy over age. This pattern is expected to arise from the trade-off between increasing experience and declining cognitive abilities over age.

2.2. Financial literacy and financial decision making - empirical evidence

Empirical studies document high levels of financial illiteracy among individuals in many countries. In the US one of the first studies on financial knowledge was conducted by Bernheim (1998). He finds a low level of financial literacy among large parts of the US population. The results are confirmed among others by Hilgert and Hogarth (2002) as well as Moore (2003) and Lusardi and Mitchell (2006).[7]

The evidence on financial literacy in other countries is more limited. A report by the OECD (2005) documents low levels of financial literacy in Australia, the US, the UK, Japan and Korea. The ANZ Survey (2005) finds low levels of financial literacy for Australia and New Zealand and Atkinson et al. (2007) raise concerns about the low level of financial literacy in the UK. Van Rooji et al. (2007) examine the levels of financial literacy in the Netherlands and Monticone (2009) documents low financial literacy in the Italian population. Within all countries the subpopulations with the lowest literacy levels are those with low income, low educational degrees, women and minorities. Some studies find hump-shaped age-profiles indicating that financial literacy is highest among the middle-aged.

For Germany, studies by Commerzbank (2003), Leinert (2004), Leinert and Wagner (2004) as well as a study by the Deutsche Bankenverband (2008) document low levels of financial literacy. The Commerzbank (2003) study identifies low financial knowledge in particular among the young, less educated individuals with lower incomes and among women. They identify particular deficits of knowledge about financial investments, basic economic knowledge and private provision. Leinert (2004) and Leinert and Wagner (2004) analyse financial literacy of German individuals aged

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[7] Lusardi (2008a) provides an overview of different studies.

30-50 and find that individuals substantially overestimate the long-term effect of inflation[8] as well as the pension income of an average income earner after 30 years of contributions. Knowledge with respect to the risk, return and cost of specific products is also limited. Groups at risk are individuals with lower income and lower educational levels. The study of the Deutsche Bankenverband (2008) finds that in particular young women, individuals with a low schooling degree and individuals from East Germany have lower levels of financial competences (measured as the interest in economics and personal financial issues).

Financial literacy is of particular interest if analysed in a context of financial decision-making. Hilgert, et al. (2003) report a generally positive relation between financial literacy and financial behaviour with respect to cash-flow and credit management, saving and investment behavior. Leinert and Wagner (2004) identify that persons with the lowest financial literacy have difficulties dealing with financial matters. They feel unsure about their decisions and put financial decisions off. Thus, the least knowledgeable spend less time thinking about financial issues and are more likely to decide quickly without considering the consequences or possible alternatives. Similarly, Agnew and Szykman (2005) find experimental evidence that individuals with low financial knowledge select the default pension plan significantly more frequently than sophisticated individuals.

Other studies analyze financial literacy in connection with specific investment decisions: Financial knowledge has an important effect on old-age planning and thereby on the accumulation of wealth (Lusardi und Mitchell 2006, 2007a and b). Furthermore, Lusardi und Mitchell (2006), van Rooji, Lusardi und Alessi (2007) as well as Christelis et al. (2006) discover that individuals with less financial knowledge have fewer risky assets in their portfolio. Bertaut (1998) finds that individuals with characteristics associated with lower cost of information processing (high education, low risk aversion, greater wealth) are more likely to enter the stock market. Campbell (2006) argues along the same lines: Individuals with lower knowledge may face higher fixed cost of participation in the stock market or anticipate that their portfolio choice would be less efficient and thus stay out of risky assets. According to Calvet et al. (2006) more educated, wealthier households with higher income tend to invest more aggressively and at the same time more efficiently. They face only moderate losses due to under-diversification of their portfolios. Calvet et al. (2009) construct an index of financial sophistication on the basis of Swedish household portfolios taking the following three investment mistakes into account: underdiversification, risky share inertia and a disposition effect. According to their study, these investment mis-

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[8] However, the impact of inflation on the purchasing power was mentioned in the question.

takes decrease with wealth and household size as well as with education and financial experience. They also identify a strong positive correlation between the share of risky assets held in the portfolio and financial sophistication (as measured by the probability to make one of the three mistakes). Barasinska et al. (2008) discover that most German households do not diversify their portfolios sufficiently and invest very conservatively. They argue that lack of financial literacy is a cause for not tapping the full potential of diversification and financial literacy of individuals should be improved.

In addition to these analyses of the link between financial literacy, wealth accumulation and portfolio choice, there are a number of studies that examine the link between financial literacy and investment mistakes. According to Lusardi and Tufano (2009) individuals who know less about the effects of compound interest are more likely to report excessive debt. Campbell (2006) finds that financially sophisticated households are more likely to refinance mortgages when this is beneficial. Less educated households are much more likely to report implausibly low mortgage rates and may therefore fail to refinance. Müller and Weber (2008) discover that financially sophisticated investors are less biased towards past returns, pay lower front-end loads and less frequently miss-calibrate forecasts for their own as well as the general stock market development. They detect a minor influence of financial literacy on buying passively vs. actively managed funds.

A study by the OECD (2008) summarizes the effects of low financial literacy on the decision to annuitize, i.e. to insure against longevity risk and indicates that less literate individuals might be less likely to insure against longevity risk.

If individuals with low financial literacy know about their lack of knowledge they should contact experts. However, the problem is that individuals who know little have limited abilities to judge the quality of the advice given and face a classical principal-agent problem. Studies examining the link between financial literacy and financial advice find that more knowledgeable individuals tend to be matched with financial advisors more frequently (Hackethal, et al., 2009). Individuals with lower financial knowledge tend to rely upon informal sources of information more often (Lusardi and Mitchell, 2007b, Van Rooji, et al., 2007).

Another way out of low financial literacy would be financial education. However, the evidence regarding the effect of financial education programs is mixed.[9] Nevertheless, economists have advocated the enhancement of financial knowledge for almost two decades now. Kotlikoff (1992) started to argue for an increase in financial information about savings and retirement income to increase individuals' attention to

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[9] For a review see Braunstein and Welch (2002) and Lusardi (2008b).

retirement savings and raise savings rates. Bernheim (1997a, 1997b) discusses different policy options to stimulate savings in particular of US baby boomers. In addition to tax incentives education and promotional activities play a central role in promoting savings. Kotz and Weber (2007) also see the lack of financial knowledge as an important policy issue and argue how finance can contribute to effectively enhance consumers' abilities. More sovereign consumers make better individual decision and therefore increase long-term well-being directly. In addition individuals become more competent judges both in their own as well as in the public interest which contributes to stabilizing financial markets by limiting mistakes of financial agents and decreasing the need for regulation. Similarly, Campbell (2006) argues that low financial literacy causes reluctance regarding financial innovations and high welfare costs. He considers financial education, customer protection regulation, subsidies of suitable financial instruments, disclosure requirements and standard options (default offers) to be potential solutions to the problem.

Given the evidence on financial literacy and old-age savings the expectation is that less literate individuals show lower levels of private pension coverage and thus lower levels of pension wealth. Yet, a potential countervailing factor exists for Germany. The German Pension Reform in 2001 introduced subsidized savings schemes, the so-called Riester pensions to incentivize private savings. They were designed to be especially beneficial to households with low income and children. If financial incentives are successful they should to a certain degree compensate for low financial literacy. Thus, the following three questions arise:

1. Are higher levels of financial literacy associated with more private pension coverage?

2. How financially literate are individuals with a Riester compared to individuals with other private old-age savings and compared to households without any private provision?

3. Are these effects more or less pronounced for households with lower income, who receive the highest subsidies?

I will examine these aspects in section 4, after briefly introducing the data and methodology used for this study.

3. Data and Methodology

3.1. SAVE

SAVE is a representative German household panel designed to improve the understanding of savings behaviour. It was first conducted in 2001 by the Mannheim Research Institute for the Economics of Aging (MEA). Consecutive waves were in the field in 2003/2004, 2005, 2006, 2007, and 2008, as well as 2009. In 2008 there are 2.608 households in the panel. The questionnaire is in paper and pencil format. A detailed description of the scientific background, design and results of the survey can be found in Börsch-Supan et al. (2008). I restrict my analysis to 1.241 households in the random route sample. The socio-demographic characteristics of the sample are provided in the annex. Lusardi and Mitchell (2006) developed three basic questions on financial literacy that were included in SAVE 2008.

3.2. Measure of Financial Literacy

The three questions on financial literacy were first developed by Lusardi and Mitchell for the HRS in 2004 (see Lusardi and Mitchell (2006) for the results). In the meantime the same questions could be included in several household surveys around the world. An extended module on financial literacy consisting of five questions on basic financial literacy and eleven questions on advanced financial literacy was included in the household survey of the Dutch National Bank (Van Rooji, et al., 2007) and in the American Life Panel (Lusardi and Mitchell, 2007a, 2009). A slightly modified version of the questions was also included in the Italian SHIW survey (Monticone, 2009).[10]

Two of the questions in this study are classified as measuring basic financial concepts. The first question concerns the comprehension of interest and requires mainly the capacity to calculate. The second question examines the understanding of the joint effects of interest and inflation. The third question is categorised as measuring advanced financial knowledge and deals with risk and diversification. The exact wording is as follows:

1. *Understanding of Interest Rate (Numeracy)*
   "Suppose you had 100€ in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow: more than 102€, exactly 102€, less than 102€?"

2. *Understanding of Inflation*
   "Imagine that the interest rate on your savings account was 1% per year and infla-

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[10] See Lusardi (2008a) for an overview of these studies.

tion was 2% per year. After 1 year, would you be able to buy more than, exactly the same as, or less than today with the money in this account?"

3. *Understanding of Risk and Diversification*
   "Do you think that the following statement is true or false? "Buying a single company stock usually provides a safer return than a stock mutual fund."

In the following analysis I will use the fact if individuals were able to answer all three questions correctly as an indicator of financial literacy.

4.   Results

4.1.   How much do individuals know?

I will first analyse the answers given to these questions separately before compiling them to an index. Overall, a large fraction of German households answers the first two questions correctly: About 85% of the households know the correct answer to the interest question, and more than 86% answer the inflation question correctly. The interest question is answered incorrectly by more than 10% of the households, the inflation question by 8,5%. The fraction of missings is about 5% for both questions.

The risk question is only answered correctly by 59% of the households and incorrectly by 3,6% of the households. However, here a "don't know" option was given, which was selected by almost 35% of the households. The missing rate is about 2%. The difference in the refusals between the first two and the third question indicates that the majority of the missings in question 1 and 2 are individuals who do not know the answer and don't want to guess.[11]

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[11] For this reason a „don't know" option was included for all the questions in the questionnaire 2009.

TABLE 1: ANSWERS TO FINANCIAL LITERACY QUESTIONS IN SAVE 2008

Q1 Interest	Correct	84.73 %
	Incorrect	10.16 %
	Refuse to answer	5.10 %
Q2 Inflation	Correct	86.30 %
	Incorrect	8.56%
	Refuse to answer	5.15 %
Q3 Risk	Correct	59.39 %
	Incorrect	3.61 %
	Don't Know	34.8 %
	Refuse to answer	2.2 %

Source: Own calculation on the basis of SAVE 2008, Note: data is weighted and not imputed.

An analysis of the number of questions correctly answered reveals that only about half of the individuals were able to answer all questions. 1% did not answer any of the questions correctly.[12] Around 10% of the households gave only one correct answer, with about 5% each answering question 1 or 2 correctly and significantly fewer persons answering only question 3 correctly. About 33% gave two correct answers, the majority of which answered the first two questions correctly (see table 2).

TABLE 2: NUMBER OF CORRECTLY ANSWERED FINANCIAL LITERACY QUESTIONS

No. Questions correctly answered		In detail: Questions correctly answered	
No question	**1,04%**		
One Question	**10,4%**	Question 1	5,07%
		Question 2	5,03%
		Question 3	0,3%
Two Questions	**32,53%**	Question 1 and 2	26,01%
		Question 2 and 3	3,82%
		Question 1 and 3	2,7%
All three questions	**56,02%**		

Source: Own calculation on the basis of SAVE 2008, Note: data is weighted and not imputed.

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[12] I treat missing values as missing, as I do not know for sure, that these individuals did not know the answer, due to the lack of the „do not know" option for questions 1 and 2. This also causes a higher measurement error in the financial literacy task as some individuals might have guessed the correct answers.

Table 3 displays pair-wise Spearman rank correlations between the correct answers to the questions. The correlation between correct answers to the first two questions is low and not significantly different from 0. This result may seem surprising at first glance. As these questions were correctly answered by most of the households the low positive correlation indicates that the households who gave an incorrect answer to one of the questions did not have a higher probability of answering the other question incorrectly. Specifically: 82% of the individuals answered both questions correctly and 1.3% gave wrong answers to both questions. Around 9% gave a correct answer to the inflation question and a wrong answer to the interest question and around 8% gave a correct answer to the interest question and did not answer the inflation question correctly.

The correlation between the interest and the risk as well as the inflation and the risk question are significantly larger than zero. This suggests that the probability to answer the risk question correctly when the interest or the inflation question has already been answered correctly is higher and vice versa. In more detail: 58% of the individuals gave a correct answer to the interest question and the risk question. However, 31.5% gave an incorrect answer to the risk question and a correct answer to the interest question and only 4.2% gave a correct answer to the risk question while answering the interest question incorrectly. 6.3% gave incorrect answers to both questions. The pattern of answers for the inflation and the risk question is similar: 59% of the individuals answered both questions correctly, 32% gave a correct answer to the inflation question but a wrong answer to the risk question and 2.9% answered the risk question correctly but not the inflation question. 6% answered both questions incorrectly.

Spearman correlation coefficients between the answers to the three questions and the number of correct answers confirm that the risk question was the most difficult to answer for participants. The correlation between answering question three correctly and the number of correct answers is highest, indicating that the probability to answer this question correctly is higher if individuals already got the other questions right (see table 3).

TABLE 3: SPEARMAN CORRELATION COEFFICIENTS (SIGNIFICANCE LEVELS IN PARENTHEIS)

	Interest	Inflation	Risk
Interest	1.000		
Inflation	0.0357 (0.2261)	1,000	
Risk	0.1478 (0.000)	0.1772 (0.000)	1.000
No. of correct answers	0.4842 (0.000)	0.4503 (0.000)	0.8626 (0.000)

Source: Own calculation on the basis of SAVE 2008, Note: data is weighted and not imputed.

Overall, a large fraction the individuals in SAVE (82%) is able to give correct answers to the first two questions. However, correct answers to the risk question are substantially lower. Therefore, only 56% of the individuals answered all three questions correctly. The correlation analysis shows that the probability of giving a correct answer to the risk questions increases substantially if correct answers to the interest and the inflation question were given.

4.2 Who knows a lot and who knows little?

Bi-variate analysis

The next question arising is: Who is able to give correct answers to the financial literacy questions and who is not? Before analysing the answering behaviour in a multivariate context I will first take a look at the bi-variate relationship between answering a particular number of questions correctly and socio-demographic variables. The *hypothesis 1* put forward was that financial literacy, which is approximated here by the number of correctly answered questions, increases with wealth. The first graph in the annex shows the number of correct answers over wealth quintiles. A strong positive association between wealth and the level of financial literacy can be identified in the bi-variate context. Only 42% of the households in the bottom wealth-quintile, i.e. the poorest 20% of the households, give three correct answers, whereas 73% of the households in the top quintile, i.e. the 20% richest households, answer all questions correctly.

H*ypothesis 2* states that individuals with personal characteristics that lower the cost of financial literacy acquisition, for example higher education and higher income, show superior levels of financial literacy. The second and third as well as the fourth graph in the annex display the number of correctly answered questions over income-quintiles and educational status. The share of individuals that are able to give three correct answers increases with income, as well as years of schooling and the level of occupational education. This confirms that financial literacy is higher for individuals with lower cost of financial literacy acquisition. All these variables might be jointly influenced by general cognitive abilities.

Moreover, *hypothesis 3* proposes that levels of financial literacy should be lower in East Germany than in West Germany all else given, as individuals socialised in the GDR are expected to have less experience with individual financial decision making. The fifth figure in the annex shows that West Germans indeed answer more questions correctly on average. However, this result might be driven by the lower income and wealth levels in Eastern Germany and should be analysed in a multi-variate context.

Furthermore, *in hypothesis 4* I expect to find an inverted U-shaped pattern of financial literacy over age. This pattern is expected to arise from the trade-off between increasing experience and declining cognitive abilities as people grow older. Figure 6 in the annex shows that the share of individuals who give three correct answers over age is indeed hump-shaped. However, taking a closer look at giving a correct answer to a particular question depending on age shows that the probability to know the correct answer to the interest question declines with age, whereas giving a correct answer to the inflation question increases with age. Middle aged individuals are most likely to give a correct answer to the risk question. Thus, there is no clear hump-shaped pattern for the questions separately. The interest question manly requires mathematical capabilities. The decreasing probability to give a correct answer to this question with increasing age might indicate a correlation with cognitive abilities. Giving a correct answer to the inflation question might on the other hand be most likely driven by the experience of inflationary periods. Thus, individuals that are older and lived during periods of high inflation like the 1970s are more likely to give a correct answer. The risk question is more frequently answered correctly by middle aged individuals. This might also be experience driven. Younger individuals have less frequently invested in stocks or mutual funds than middle-aged individuals, probably due to budget restrictions. Older individuals might have made important savings decisions before the increasing popularity of stock market participation in the late 1990s and thus also lack experience.

The last picture in the annex shows that *women* on average give fewer correct answers than men (2.37 vs. 2.5 correct answers on average). This pattern has been observed in other countries as well. However, there is no sound theoretical explanation for this result. One reason could be that in households with traditional role models men are still the main decision makers in the financial domain and thus have higher levels of financial literacy. In the multi-variate context I will explicitly control for decision making within the household, income-shares of household-members and the education status of the partner.

<u>Multi-variate analysis</u>

In a next step the overall performance in the financial literacy task can be analysed controlling for differences in socio-economic status. I conduct a binary probit of the probability to answer all three financial literacy questions correctly on socio-demographic variables. Table 4 contains the marginal effects of four different specifications. Most of the independent variables are specified as dummies.

In the first multivariate regression (model 1) the following associations are identified: According to *hypothesis 1* I expected financial literacy to be associated with higher levels of wealth. The logistic regression reveals that while controlling for many other socio-economic characteristics the richest 20% of the households answer all three questions significantly more frequently. The effects between the first, the second, the third and the fourth wealth quintiles show the expected signs, however the differences are not statistically significant. As mentioned before, the relationship between wealth and financial literacy cannot be interpreted in a causal way.

Moreover, in line with *hypothesis 2,* table 4 reveals that individuals in higher income quintiles are more likely to give three correct answers. Individuals in the 4th income quintile and individuals in the fifth income quintile have significantly higher probabilities to answer all questions correctly compared to individuals in the middle of the income distribution. Households with an income below the third income quintile are less likely to give three correct answers. The difference between households in the bottom income quintile and the middle of the income distribution is statistically significant.

With respect to education the following results emerge: table 4 shows that lower levels of financial literacy are negatively related to low schooling as well as lack of vocational training. Having a high school degree (Abitur) compared to intermediate schooling (Mittlere Reife) does only have a small and insignificant positive effect. Moreover, individuals with a University degree are not significantly more likely to give three correct answers than individuals with vocational training. This indicates

that with regard to financial literacy, it is important to have a basic level of formal training or education, while high(er) levels of education do not necessarily further contribute to answering all three questions correctly.

As opposed to *hypothesis 3* and the bi-variate result in the beginning of the chapter, the regressions do not reveal that individuals in East Germany answer fewer questions correctly than individuals living in West Germany. Thus, the differences found in the bi-variate analysis are most likely associated with differences in wealth and income.

Hypothesis 4 states that financial literacy should follow a hump-shaped pattern over age. The regression in table 4 appears to substantiate this. However, the difference between individuals in the section aged between 18 and 34 and those between 35 and 54 is not statistically significant, whereas older individuals are indeed significantly less likely to give three correct answers than individuals in the middle age category. This might be related to declining cognitive abilities or a lack of the specific knowledge asked for.

The differences between *men and women* that were identified in the bi-variate analysis do persist. In the first model, men are significantly (at 1%) more likely to know the answers to all three questions compared to women. However, when controlling for decision making within the household and income share of the respondent (model 2), the coefficient of being male on giving three correct answers is reduced from 0.24 to 0.18. The effect is only significant at 10% now. Thus, decision making within the household explains some of the difference in financial literacy between men and women.[13]

Studies for example by Lusardi and Mitchell (2007a) as well as Bernheim et al. (2001) show that financial education prior to working life plays an important role in financial knowledge and decision-making. I examine the impact of childhood financial education and the influence of parental behaviour in model 3 and 4 of table 4. In order to examine the impact of financial experience at young ages on financial knowledge later in life I include two variables in the regression. The first variable measures whether individuals received pocket money on a regular basis. The second variable measures if individuals spent the money right away. In addition to this, Lusardi (2003) showed that there is a strong impact of parental behavior on financial knowledge and behavior of the offspring. Therefore, I include information on the bookkeep-

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[13] I also conducted a probit regression controlling for the educational degree of the partner and did not find a significant effect of the partner's education on the level of financial literacy, indicating that the respondents did not consult their partner, when answering the questionnaire.

ing practices of parents as an indicator of parental saving behavior. The results of the probit are displayed in table 4.

Compared to the specification in model 1, I do not find large changes in the coefficients due to the inclusion of the additional variables. The variables measuring financial experience at young age show the expected signs. However, I do not find any significant effect of receiving regular pocket money or parents' bookkeeping practice on performance. The negligible effect of including these variables is largely due to the fact that receiving pocket money as well as parental behavior is both related to other variables like education, income or the level of wealth already included in the regressions.

TABLE 4: PROBIT SOCIO-ECONOMIC VARIABLES ON FINANCIAL LITERACY (COEF.)

	Model 1	Model 2	Model 3	Model 4
Age 18-34 (d)	0.05	0.05	0.03	0.05
	[0.13]	[0.13]	[0.13]	[0.13]
Age: 35-54	Ref.	Ref.	Ref.	Ref,.
Age 55 and older (d)	-0.25	-0.26	-0.21	-0.25
	[0.09]***	[0.09]***	[0.09]*	[0.09]***
Men (d)	0.24	0.18	0.24	0.24
	[0.08]***	[0.09]*	[0.08]***	[0.08]***
East (d)	-0.02	-0.02	0.00	-0.02
	[0.09]	[0.09]	[0.09]	[0.09]
1st inc-quintile (d)	-0.26	-0.26	-0.27	-0.26
	[0.15]*	[0.15]*	[0.14]*	[0.15]*
2nd inc-quintile (d)	-0.19	-0.18	-0.19	-0.18
	[0.14]	[0.14]	[0.14]	[0.14]
3rd inc-quintile	Ref.	Ref.	Ref.	Ref.
4th inc-quintile (d)	0.26	0.27	0.25	0.26
	[0.15]*	[0.15]*	[0.15]*	[0.15]*
5th inc-quintile (d)	0.4	0.41	0.38	0.4
	[0.15]**	[0.15]**	[0.15]**	[0.15]**
1st wealth-quintile (d)	-0.2	-0.2	-0.20	-0.2
	[0.14]	[0.14]	[0.14]	[0.14]
2nd wealth-quintile (d)	0.00	0.00	0.00	0.00
	[0.16]	[0.16]	[0.16]	[0.16]
3rd wealth-quintile	Ref.	Ref.	Ref.	Ref.
4th wealth-quintile (d)	0.17	0.18	0.17	0.16
	[0.14]	[0.14]	[0.14]	[0.14]
5th wealth-quintile (d)	0.38	0.4	0.37	0.38
	[0.14]***	[0.14]***	[0.14]**	[0.14]**
Low schooling (d)	-0.28	-0.29	-0.26	-0.28
	[0.1]***	[0.10]***	[0.10]**	[0.10]***
Intermediate schooling	Ref.	Ref.	Ref.	Ref.
High schooling (d)	0.23	0.23	0.2	0.22
	[0.14]	[0.14]*	[0.14]	[0.14]
No vocational training (d)	-0.49	-0.49	-0.48	-0.49
	[0.13]***	[0.13]***	[0.13]***	[0.13]***
Vocational training	Ref.	Ref.	Ref.	Ref.
University degree (d)	0.04	0.03	0.04	0.04
	[0.15]	[0.15]	[0.15]	[0.15]
Permanently living with a	-0.12	-0.29	-0.11	-0.12
Partner (d)	[0.10]	[0.14]*	[0.1]	[0.10]
Decision maker (d)		0.13		
		[0.15]		
Income Share		0.00		
		[0.00]		
Bookkeeping of parents				-0.08
				[0.11]
Pocket money regularly			0.02	
			[0.01]	
Spending of pocket money			0.00	
			[0.01]	
N	1198	1198	1198	1198

* Standard errors in brackets; * *sig. at 10%;* ** *sig. at 5%;* *** *sig. at 1%*
(d) for discrete change of dummy variable from 0 to 1
Source: Own calculation on the basis of SAVE 2008 (5 imputed datasets, coefficients
and standard errors are calculated using Rubin's procedure (Rubin, 1987)).

In summary, the results of the analysis of the socio-economic characteristics and the performance in the financial literacy task largely support the hypotheses put forward:

- Individuals in higher wealth quintiles are more likely to answer all financial literacy questions correctly. And vice versa individuals that give three correct answers are more likely to be in higher wealth quintiles, which is in line with *hypothesis 1*.

- Financial literacy is higher if the costs of information acquisition are lower (*hypothesis 2*), i.e. individuals in higher income quintiles and individuals with higher educational and occupational degrees show a higher probability of giving three correct answers.

- Contrary to *hypothesis 3* in the multivariate context there are no significant differences in the probability to give three correct answers between individuals in East and West. Thus, the differences identified in the bi-variate context are largely associated with differences in other characteristics, most likely in wealth and income.

- As proposed by *hypothesis 4* the performance in the financial literacy task over age resembles a hump-shaped pattern in the bi-variate context. In the multivariate context there is a significant and negative effect of being older than 55 on the performance in the financial literacy task.

- Men have a higher probability than women to answer all three questions correctly. However, some of the effect disappears when controlling for decision making within the household.

- The impact of financial experience at younger ages is small. No effect of parental behaviour can be identified when controlling for all other socio-demographic differences.

4.3 How is financial literacy related to retirement savings of German households?

Due to the recent reforms in the German pension system and the resulting increase of individuals' responsibilities for financial planning, it is particularly interesting to examine the link between financial literacy and old-age savings. In the course of the 2001 pension reforms the so-called Riester pensions, state subsidised private pension plans, were introduced. Riester pensions are private savings plans, investment funds or private pension plans that are subsidised depending on individuals' income and

number of children. Every individual that is mandatorily insured in Germany's public pension system and public servants, as well as their spouses, are eligible for Riester plans. For details on the structure of the subsidies, eligibility rules and the dynamics of the Riester plans see Börsch-Supan et al. (2007).

As I am interested in individuals' saving behavior prior to retirement I restrict the analysis to households below the age of 60. Additionally, I restrict the analysis to households eligible for Riester subsidies. I exclude single households who are retired and households where both partners are retired from the analysis. In addition to the retired households I exclude self-employed and non-working households as long as they are not unemployed, raising children, doing a civil or military service or obtaining education. Thus, sample size is reduced to 600 households.[14]

The link between financial literacy and old-age savings is difficult to analyse: On the one hand, persons with better financial knowledge make better investment decisions and save more because they know more about investment options. On the other hand, persons who save a lot deal with financial matters and therefore acquire more financial knowledge. Evidence has been found for both directions with the help of instrumental variable estimation (Lusardi and Mitchell, 2007a, Monticone, 2009).

In a first step I analyse the relationship between owning a specific kind of private old-age provision and the level of financial literacy, measured as the average number of questions answered correctly (Table 5). More than 36% of the individuals eligible for a Riester contract in 2008 actually own at least one Riester contract in 2008: 16% own a Riester as their only private retirement savings contract, while around 21% own a Riester contract in addition to other non-subsidised private savings contracts. 20% own non-subsidised private old-age savings contracts and no Riester pensions. Therefore, around 43% of the households do not own any form of private old-age provision.

In addition to private pension ownership, table 5 displays the average number of correctly answered financial literacy questions for households with different forms of private old-age provision. Households with private old-age provision on average give about 2.6 correct answers, households without only 2.25. Furthermore, households who only have a Riester contract and no non-subsidised private old-age provision are slightly less literate than households who either only have non-subsidised forms of private old-age provision or have a Riester contract in addition to non-subsidised private old-age provision.

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[14] I keep households in the sample that own a Riester contract but would not be eligible in 2008.

I conduct t-tests of equal means for all categories in table 5: The hypothesis that the average number of correctly answered questions is equal across the four categories can be rejected at 0.1% significance level for comparisons between the households without any private old-age provision and all the other categories. The hypothesis that households who only have a Riester contract and households who have either non-subsidised private old-age provision only or other contracts in addition to the Riester contract answer an equal number of financial literacy questions correctly is rejected at the 10% significance level. Given that households have other non-subsidised private old-age provision the ownership of a Riester contract is not associated with higher financial literacy: The hypothesis that the means between categories 3 and 4 are identical cannot be rejected.

TABLE 5: PRIVATE OLD-AGE PROVISION AND FINANCIAL LITERACY

	Relative Frequency	Average number of correctly answered questions
No private old-age provision	43.25%	2.25
Riester	15,97%	2.47
Non-subsidised private old-age provision	20.16 %	2.65
Riester and non-subsidised private old-age provision	20,62 %	2.64

Source: Own calculation on the basis of SAVE 2008, Note: data is weighted and imputed.

In summary, households that are more literate are more likely to save privately for their old-age and at the same time households saving privately for their old-age acquire financial knowledge to improve their investment decision. Also, the possession of a Riester contract is associated with lower levels of financial literacy than the possession of other non-subsidised forms of private old-age provision. This indicates that Riester subsidies are to some extend successfully reaching individuals with lower financial knowledge.

Börsch-Supan et al. (2007) find that in the lowest income quintile Riester pensions coverage is still quite low but experiences a high dynamic over time, however, they identify a higher coverage of families with children. In a next step I will analyse how this is related to financial knowledge.

Table 6 compares the relative frequencies of private old-age provision and the average number of correctly answered financial literacy questions over income quintiles. First of all, it is notable that the average number of correctly answered questions increases with income in all categories of old-age provision. Furthermore, in all income quintiles except for the second, the average number of correctly answered ques-

tions is lowest for households without any private old-age provision. Moreover, the share of individuals without private old-age provision decreases from 67 percent in the lowest income quintile to around 18 percent in the highest income quintile. However, the share of households with only a Riester contract is somewhat hump-shaped over the income quintiles. It is highest for households in the middle of the income distribution. Households in the higher income quintiles are more likely to own non-subsidised forms of private old-age provision either only or in addition to a Riester contract. These results indicate that the incentives created by the Riester contracts are most effective for households in the middle of the income distribution. However, the coverage in the lowest income quintile is still below 20%. Almost 70% of these households do not save for their old-age. Thus, despite the high subsidy for households with low incomes[15] these households do not save.

TABLE 6: PRIVATE OLD-AGE PROVISION AND FINANCIAL LITERACY BY INCOME QUINTILES

	Average number of correctly answered questions (relative frequency in %)				
	1. Income-quintile	2. Income-quintile	3. Income-quintile	4. Income-quintile	5. Income-quintile
No private old-age provision	2.15 (68.28)	2.33 (40.28)	2.45 (27.16)	2.49 (19.74)	2.58 (17.61)
Riester only	2.32 (13.1)	2.57 (17.05)	2.53 (23.45)	2.61 (21.87)	2.45 (10.68)
Non-subsidised private old-age provision only	2.47 (12.82)	2.61 (23.52)	2.62 (17.37)	2.64 (30.6)	2.9 (29.19)
Riester and non-subsidised private old-age provision	2.42 (5.9)	2.09 (19.15)	2.63 (32.01)	2.88 (27.79)	2.79 (42.51)

Source: Own calculation on the basis of SAVE 2008, Note: data is weighted, and imputed.

Bernheim (1997a, 1997b) argues convincingly that it is important to distinguish between individuals that actively choose not to save due to their preferences and individuals that save too little to meet their own objective or even fail to form an objective due to the inability to calculate correctly. The low old-age saving in the lowest income quintile might on the one hand reflect reluctance to buy an old-age savings contract due to scepticism and lack of knowledge. On the other hand it might express personal preference: households might not save due to budget limitations or save in more liquid forms due to being close to the budget restriction. However, table 6 also indicates that the households in the lowest income quintile overall show the lowest number of correctly answered financial literacy questions. To investigate a little further upon this point I conduct probit regressions of socio-demographic variables as well as financial literacy on the ownership of private old-age provision contracts.

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[15] The minimum contribution rate is 4% of the income including the subsidy and at least 60 €per year to obtain full subsidies of currently 154 €

The results of the probit regressions displayed in table 7 and 8 reveal several interesting aspects. The first three columns of table 7 contain the three most basic models.

- First of all, financial literacy shows a significantly positive relation with owning any kind of private old-age provision (column 1). Furthermore, financial literacy shows a positive relation to the ownership of non-subsidised private old-age provision, significant at 10% (column 2). Additionally, financial literacy is positively but insignificantly associated with the ownership of a Riester contract (column 3).[16]

- The ownership of non-subsidised private old-age provision is positively related to the ownership of a Riester contract and vice versa (column 2 and column 3). Thus, households sensitive to the topic of old-age provision are more likely to have both one and the other.

- Overall, younger individuals are not more likely to own private old-age provision. Even though it is more important for them to take individual care of their old-age income. However, younger individuals are more likely to have a Riester, but they are not more likely to have non-subsidised old-age provision. This result stems largely from the fact that Riester has only been introduced in 2001 and many of the older households might already have selected other contracts before Riester subsidies were available.

- Education does make a difference when it comes to owning private old-age provision in general: Individuals with high school degree are more likely and individuals without any vocational training are less likely to own such contracts. However, when analysing the ownership of Riester contracts in particular, there is no difference in the likelihood to own one across educational attainments.

- Furthermore, the number of children is positively related to Riester ownership. This is not surprising as Riester offers large additional lump sum subsidies for families with children.

- Living with a partner has a significant positive impact on owning any kind of old-age provision. The reason is that in this specification I do not account for income or wealth of the household. However, two earner households are richer and thus more likely to own some old-age provision.

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[16] The insignificance is largely due to the small sample size. The results become significant if sample size is increased by including the households of the access panel. However, whether the two samples can be pooled requires a deeper examination.

In column 4 to 6 income was added to the regressions. The following changes in the results can be noted:

- Even when accounting for income, financial literacy is significantly and positively related to the ownership of any kind of private old-age provision (column 4). However, when analysing the ownership of non-subsidised private old-age provision and Riester contracts separately, no effect of financial literacy can be detected.

- As expected the impact of living with a partner is reduced.

- Households belonging to the lowest 20% of the income distribution show a significantly lower probability of owning subsidised as well as non-subsidised private old-age provision.

- The ownership of any kind of old-age provision (column 4) and the ownership of non-subsidised old-age provision in particular (column 5) increase over income.

- The probability to own a Riester contract is hump-shaped over income: the coefficients all have a negative sign compared to being in the middle of the income distribution. However, only the coefficients of the two lower income quintiles are significant.

Adding interaction effects between financial literacy and being in a certain slice of the income distribution does not change the results substantially (table 8).

Financial literacy does have a positive but insignificant association with owning any kind of old-age provision or non-subsidised old-age provision over most of the income quintiles (it is negative but insignificant in the second income quintile).

The relation between owning a Riester contract and higher financial literacy is mixed over the income quintiles. The interaction terms show a positive but insignificant coefficient in the first and the third quintile, while the coefficient in the fourth income quintile is positive and significant. However, the sign of the coefficient is negative but insignificant in the second and the fifth income quintile.

TABLE 7: PROBIT FINANCIAL LITERACY ON PRIVATE OLD-AGE PROVISION (COEFF.)

	Any private old-age provision 1	non-subsidised priv. old-age 1	Riester 1	Any private old-age provision 2	non-subsidised priv. old-age 2	Riester 2
Financial Literacy (d)	0.42	0.25	0.19	0.33	0.16	0.15
	[0.13]***	[0.13]*	[0.13]	[0.13]**	[0.13]	[0.13]
Riester (d)		0.39			0.35	
		[0.12]***			[0.13]**	
other private old-age provision (d)			0.41			0.36
			[0.12]***			[0.13]***
Age	0.07	0.00	0.11	0.03	-0.04	0.09
	[0.05]	[0.02]	[0.05]**	[0.06]	[0.06]	[0.05]*
Age ^2	0.00	0.00	0.00	-0.00	0.00	-0.00
	[0.00]	[0.00]	[0.00]**	[0.00]	[0.00]	[0.00]**
Men (d)	-0.18	0.00	-0.3	-0.19	-0.02	-0.30
	[0.12]	[0.12]	[0.12]**	[0.13]	[0.13]	[0.12]**
East (d)	-0.08	-0.37	-0.04	0.10	-0.19	0.05
	[0.13]	[0.13]***	[0.13]	[0.14]	[0.14]	[0.14]
Low schooling (d)	0.11	-0.07	0.01	0.19	0.00	0.04
	[0.15]	[0.15]	[0.15]	[0.15]	[0.15]	[0.15]
Intermediate schooling	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
High schooling (d)	0.5	0.4	0.18	0.5	0.40	0.21
	[0.18]***	[0.17]**	[0.17]	[0.18]***	[0.18]**	[0.17]
No vocational training (d)	-0.71	-1.17	-0.16	-0.63	-1.09	-0.1
	[0.19]***	[0.23]***	[0.20]	[0.22]***	[0.23]***	[0.20]
Vocational trai-ning	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
University degree (d)	-0.05	-0.05	0.18	-0.20	-0.19	-0.14
	[0.22]	[0.21]	[0.17]	[0.22]	[0.21]	[0.2]
Living with a partner	0.71	0.57	0.41	0.4	0.29	0.25
	[0.13]***	[0.14]***	[0.13]***	[0.15]**	[0.16]*	[0.15]
Anzahl Kinder	0.08	-0.05	0.14	0.04	-0.08	0.14
	[0.05]	[0.06]	[0.05]***	[0.05]	[0.06]	[0.05]***
1st income quintile (d)				-0.66	-0.47	-0.55
				[0.21]***	[0.20]**	[0.21]**
2nd income quintile (d)				-0.28	-0.05	-0.34
				[0.21]	[0.21]	[0.2]*
3rd income quintile				Ref.	Ref.	Ref.
4th income quintile (d)				0.14	0.20	-0.31
				[0.22]	[0.19]	[0.2]
5th incomen quintile (d)				0.25	0.5	-0.1
				[0.21]	[0.19]**	[0.19]
Observations	600	600	600	600	600	600

* Standard errors in brackets; * sig. at 10%; ** sig. at 5%; *** sig. at 1%
(d) for discrete change of dummy variable from 0 to 1
Source: Own calculation on the basis of SAVE 2008 (5 imputed datasets, coefficients and standard errors are calculated using Rubin's procedure (Rubin, 1987)).

TABLE 8: PROBIT FINANCIAL LITERACY ON PRIVATE OLD-AGE PROVISION (COEFF.)

	Any private old-age provision 3	non-subsidised priv. old-age 3	Riester 3
Riester (d)		0.33	
		[0.13]**	
other private old-age provision (d)			0.34
			[0.13]**
Age	0.03	-0.05	0.09
	[0.06]	[0.06]	[0.05]*
Age ^2	0.00	0.00	-0.00
	[0.00]	[0.00]	[0.00]**
Men (d)	-0.18	-0.01	-0.28
	[0.13]	[0.13]	[0.12]**
East (d)	0.12	-0.17	0.06
	[0.14]	[0.14]	[0.14]
Low schooling (d)	0.19	0.00	0.05
	[0.15]	[0.15]	[0.16]
Intermediate schooling	Ref.	Ref.	Ref.
High schooling (d)	0.50	0.39	0.20
	[0.18]**	[0.18]**	[0.17]
No vocational training (d)	-0.63	-1.10	-0.12
	[0.2]***	[0.23]***	[0.20]
Vocational training	Ref.	Ref.	Ref.
University degree (d)	-0.2	-0.19	-0.14
	[0.22]	[0.22]	[0.20]
Living with a partner	0.40	0.29	0.26
	[0.15]**	[0.16]*	[0.15]*
Anzahl Kinder	0.04	-0.08	0.14
	[0.05]	[0.06]	[0.05]***
1st income quintile (d)	-0.7	-0.5	-0.6
	[0.29]**	[0.29]*	[0.3]*
2nd income quintile (d)	-0.19	0.09	-0.13
	[0.29]	[0.31]	[0.30]
3rd income quintile	Ref.	Ref.	Ref.
4th income quintile (d)	-0.10	0.07	-0.58
	[0.36]	[0.34]	[0.35]
5th income quintile (d)	0.23	0.44	0.15
	[0.37]	[0.34]	[0.35]
Financia Literacy * 1 Inc_Q	0.35	0.21	0.27
	[0.23]	[0.25]	[0.24]
Financia Literacy * 2 Inc_Q	0.08	-0.12	-0.24
	[0.29]	[0.28]	[0.28]
Financia Literacy * 3 Inc_Q	0.28	0.16	0.17
	[0.3]	[0.28]	[0.28]
Financia Literacy * 4 Inc_Q	0.70	0.36	0.55
	[0.35]*	[0.30]	[0.31]*
Financia Literacy * 5 Inc_Q	0.32	0.25	-0.15
	[0.35]	[0.31]	[0.30]
Observations	600	600	600

* Standard errors in brackets; * sig. at 10%; ** sig. at 5%; *** sig. at 1%
(d) for discrete change of dummy variable from 0 to 1
Source: Own calculation on the basis of SAVE 2008 (5 imputed datasets, coefficients
and standard errors are calculated using Rubin's procedure (Rubin, 1987)).

Finally, the answers to the questions raised above can be given:

1. Are higher levels of financial literacy associated with more private pension coverage? Overall, the analysis shows that the correlation between financial literacy and any form of private provision is positive even when controlling for differences in education and income.

2. However, the correlation between financial literacy and ownership of private old-age provision is much stronger in the case of non-subsidised private provision than for Riester savers. On the one hand, this implies that Riester subsidies encourage households with lower financial literacy to engage in private old-age provision. On the other hand, this might mean that households with a Riester contract think less about their decision and thus accumulated less financial knowledge in the decision process. If this is indeed the case, providing for a state subsidy is not enough to improve the decision making of households. The simplification of products and market structures, reliable recommendations from independent advisors and enhancing individuals' financial knowledge can play important roles in stoking individuals awareness for the necessity to care for old-age and reduce possible mistakes.

3. Furthermore, provision in the lowest income quintile is still lower than in the rest of the population. Thus, more effort is needed to encourage private retirement savings among households with low income and wealth. Providing for a state subsidy is obviously not enough to encourage the poorest households, who also show the lowest degree of financial knowledge, to engage in old-age savings.

5. Conclusion

In summary, the German population has good financial knowledge measured on the basis of three financial literacy questions. Around 85 percent of the individuals comprehend the functioning of interest and inflation. Around 60% of the individuals understand the relationship of risk and diversification. Overall around 52% of the individuals were able to give three correct answers. Bi-variate and multivariate analyses of the relation between giving three correct answers and socio-demographic characteristics reveal that higher wealth is indeed associated with higher levels of financial literacy. This confirms the notion by Peress (2004) that individuals with higher wealth have higher incentives to invest in the accumulation of financial knowledge

and at the same time financial knowledge improves decisions and therefore the payoff from investments which increases wealth. Moreover, it was found that financial literacy is related to higher levels of income and education. Thus, households with lower cost of financial literacy acquisition have a higher level of knowledge. No significant difference in the probability to give three correct answers was found between individuals in East and West after controlling for education, income and wealth. However, men are more likely than women to answer all three questions correctly. This effect is diminished when controlling for decision-making within the household.

A positive relationship between financial literacy and retirement saving decisions is identified: more literate households are more likely to save privately for their old-age and at the same time households saving privately for their old-age acquire financial knowledge to improve their investment decisions. The possession of a Riester contract is related to lower levels of financial literacy than the possession of other forms of private old-age provision, indicating that Riester subsidies are to some extent successful at attracting individuals with lower financial knowledge. Nevertheless, individuals in the lowest income quintile still have very low levels of private coverage despite receiving the highest subsidies. At the same time they show the lowest levels of financial literacy. The financial incentives provided by Riester target exactly those individuals at risk of having low financial literacy and therefore not saving adequately. However, the analysis conducted above indicates that more effort is needed in the lower income quintiles. Particularly, as these individuals are at risk of receiving low public pensions due to low contributions.

Most scholars examining financial literacy argue that more financial education is needed to enhance individuals' financial knowledge and thereby their willingness to save. According to the association of German banks (Bankenverband, 2008) more than 80% of the individuals in the survey would appreciate improved economic education in school. However, the effects of financial education on decision making behavior are mixed and a comprehensive cost-benefit analysis of financial education programs is lacking so far (OECD, 2008). Before introducing economics courses into school curricula it is necessary to examine possible alternatives and carefully compare the success as well as the cost of potential measures to improve individuals' ability. The analysis above suggests that the subsidies provided by Riester successfully encourage certain groups in the middle of the income distribution and with moderate levels of financial literacy. However, the poorest 20% of the households still do not respond to the policy measures. Thus, more effort is needed here. Instead of investing in general economics courses in school, it would probably be more efficient to target specific groups at risk.

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Annex

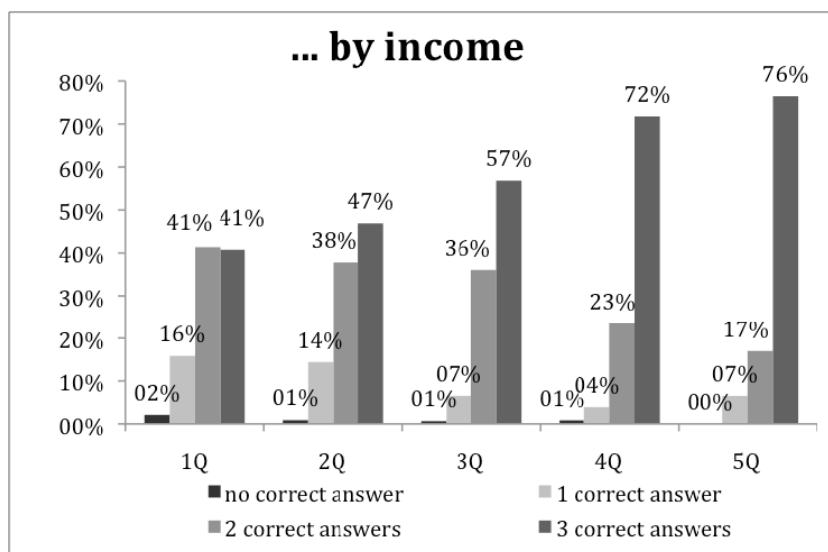TABLE: SOCIO-DEMOGRAPHICS OF THE SAVE RANDOM ROUTE SAMPLE 2008

Variable		Share in %
Gender	Male	46.0
	Female	54.0
Region	West	64.7
	East	35.3
Living with a partner	Yes	62.7
	No	37.3
Age	younger than 35	19.3
	35-54	39
	55 and older	41.7
Income	1.000€and below	21.6
	1.000 to 2.000€	38.6
	2.000 to 3000 €	22.8
	More than 3.000 €	17.0
Schooling	Low	38.2
	Intermediate	35.3
	High	26.5
Occupational training	No occupational training	16.0
	Vocational training	68.6
	University degree	15.4

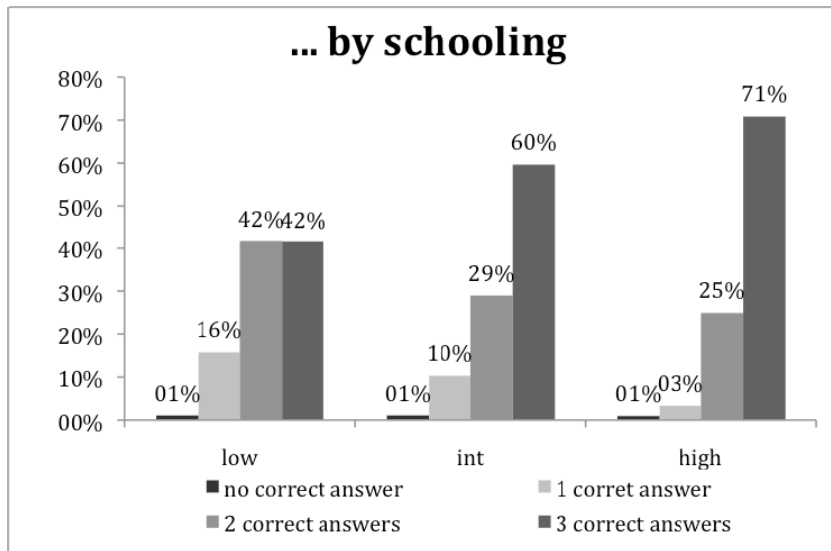* Source: Own calculation on the basis of SAVE 2008, Note: data is weighted and imputed

Number of correct answers to the
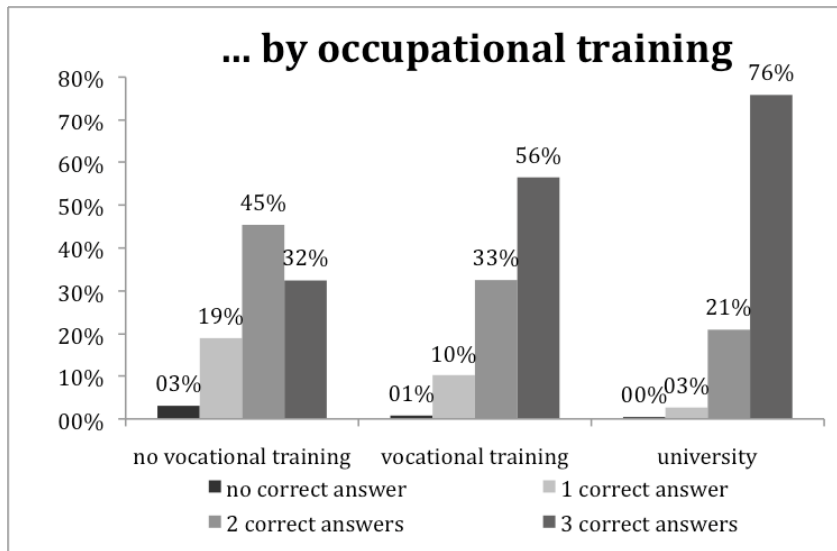# three financial literacy questions...
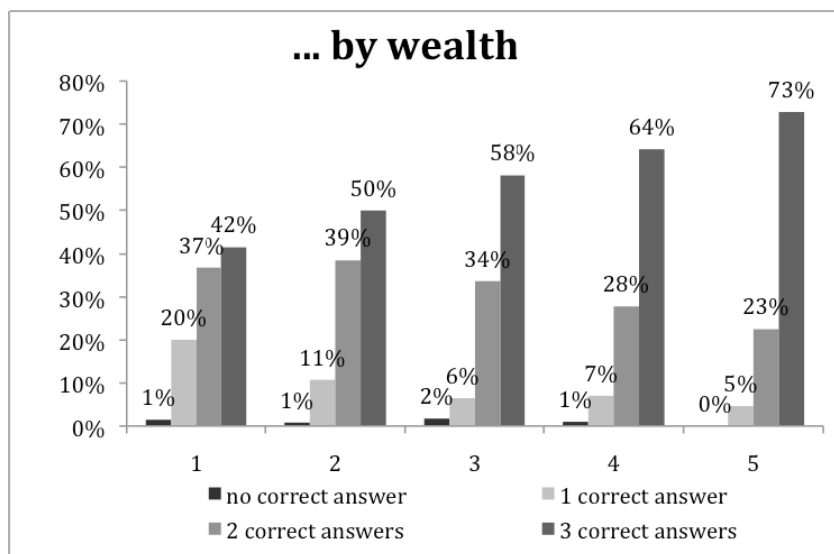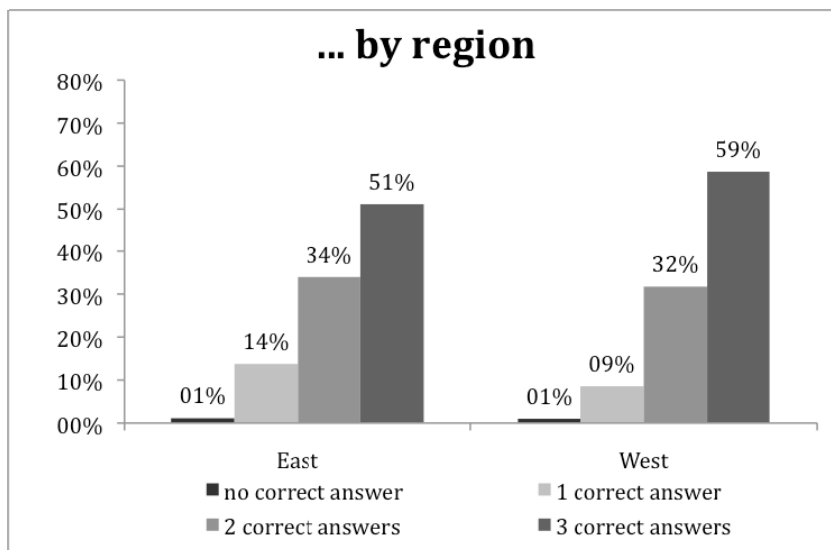
... by wealth

Source: Own calculation on the basis of SAVE 2008, Note: data is weighted and imputed

... by income

Source: Own calculation on the basis of SAVE 2008, Note: data is weighted and imputed

... by schooling

Source: Own calculation on the basis of SAVE 2008, Note: data is weighted and imputed

... by occupational training

Source: Own calculation on the basis of SAVE 2008, Note: data is weighted and imputed
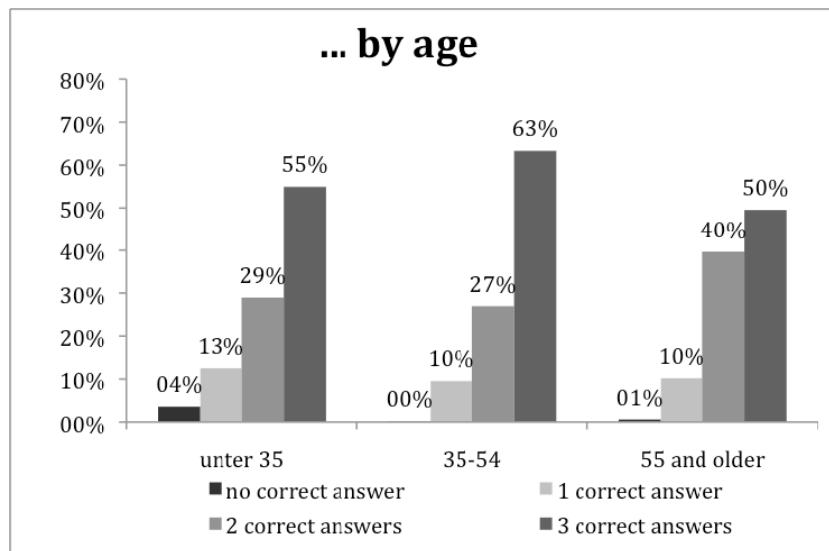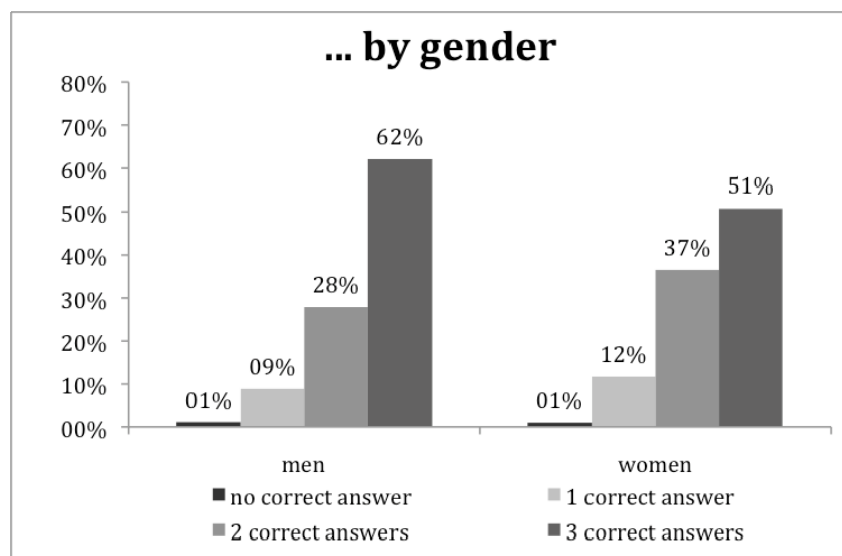

... by region

Source: Own calculation on the basis of SAVE 2008, Note: data is weighted and imputed

Source: Own calculation on the basis of SAVE 2008, Note: data is weighted and imputed

Source: Own calculation on the basis of SAVE 2008, Note: data is weighted and imputed

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