Multipliers of Financial Literacy in Germany and Russia?

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In Germany and Russia, the majority of the population shows significant deficits in financial literacy. To overcome this situation both countries need people who are able to share and teach their knowledge. Economic students could be such multipliers. Therefore, it is important to understand the qualification of these students as ambassadors of financial literacy.

We examine the financial competence of German and Russian economic students. Based on a survey with international-comparable questions we find that most students perform indeed better than the international average. But only few students are able to answer all questions correctly with gender and age specific divergences. Women perform better at numeracy but worse at financial questions and younger students perform worse than older. Finally, we show that students with better understanding and education in finance are more likely to assign a probability to future crisis and that Russian students are more pessimistic than German students.

Keywords: financial literacy, financial competence, economic students, retirement planning, crisis expectation

INTRODUCTION

Many studies provide evidence that a large proportion of the population knows little about finance and that many individuals are unfamiliar with basic economic concepts, such as risk diversification in stock investing, inflation, and interest compounding (OECD, 2006, 2008). This lack of knowledge is one reason why individuals avoid dealing with topics like personal retirement saving or equity investing. Emerging a retirement saving system from a more or less complete government provision to more private individual investing enforces on individuals the responsibility to save, invest and consume reasonable over a lifetime

cycle (Lusardi & Mitchell, 2011b) and depends on individuals possessing the skills needed to manage their financial responsibilities well. Research from Lusardi and Mitchell (2017) and van Rooij et al. (2011a) into retirement savings behaviour shows that financial skills, retirement planning and retirement income are strongly related and that retirement planning is a strong predictor of wealth. Higher levels of financial knowledge are associated with increased stock market participation (Yoong, 2010; van Rooij et al., 2011b), higher private retirement savings (Bucher-Koenen, 2009), greater portfolio diversification (Guiso & Jappelli, 2008) and increased wealth holdings (Lusardi & Mitchell, 2007; van Rooij et al., 2012; Behrman et al., 2012). Further, Gerardi et al. (2010) show that mortgage delinquency rates are higher among borrowers with poor numerical ability (using the same measure of numeracy we use here) and Banks and Oldfield (2007) link poor numeracy with low savings.

Based on the relationship between financial literacy and retirement savings it is hardly surprising that there is overall a low level of financial knowledge in countries like Germany and Russia. Bucher-Koenen and Lusardi (2011) document this low level of financial literacy in Germany, and there is an ongoing debate how to overcome this undesired state of knowledge. Given the large number of less informed, often older people politicians are looking for multipliers who share their superior knowledge and teach financial literacy. Students of economics could be such multipliers. Consequently, we analyse whether a university education in economics leads to superior investment knowledge to enable people for an effective retirement planning. To address this question, we conduct a comparable survey (Lusardi & Mitchell, 2017; Gerardi et al., 2010) for assessing numeracy, basic and sophisticated financial literacy at top universities in Germany and Russia respectively. This survey design facilitates to compare our results directly with outcomes from earlier studies in other countries. The findings show a good general financial knowledge but still difficulties when it comes to more sophisticated questions and answering all questions correctly.

In search for a simple proxy to forecast who might be especially qualified to communicate financial topics we analyse the link between mathematical and financial knowledge. The known good mathematical education of Russian students indicates good numeracy results. Our findings confirm these math skills but do not show a link to financial knowledge. Actually a country comparison shows worse results for Russian economic students than for general populations.

The rest of the study is organized as follows. In section 2 we introduce the theoretical framework for financial literacy and present patterns often analysed in the context of financial literacy. Section 3 provides information on data and methodology, before section 4 shows the results. Section 5 summarizes the findings and concludes.

THEORETICAL FRAMEWORK FOR FINANCIAL LITERACY

Financial planning of household finances is an important type of non-market production that requires its own form of human capital, especially financial literacy. Like human capital, financial literacy accumulation is purposive based on its costs and benefits. Public and scholarly interest in financial literacy and informed financial decision-making is increasing in part because of the poor financial outcomes that are associated with low levels of financial literacy: problems with debt (Lusardi & Tufano, 2009b) and lack of retirement planning (Lusardi & Mitchell, 2007, 2017), among others. Especially the connection between financial literacy and retirement planning is of particular importance. Even after accounting for a large set of economic characteristics and circumstances the results that those who are more financially literate are more likely to plan for retirement are striking consistent throughout international studies (Lusardi & Mitchell, 2011b). Given that there is no evidence that people invest much in financial knowledge, partially because of a lack of adult education programs in several countries, a few papers have begun to examine the decision to acquire financial literacy and to study the links between financial knowledge, saving and investment behaviour, especially incentives to invest, (Delavande, et al., 2008; Jappelli & Padula, 2013; Hsu, 2016; Lusardi et al., 2013).

The notion that financial knowledge is a form of human capital was introduced in Delavande et al. (2008), which related the production of human capital to portfolio choice. Usually studies analysing financial literacy harness a two period approach of saving and portfolio allocation across different assets

and allow the acquisition of human capital in form of financial knowledge. The results suggest that individuals acquire knowledge mostly when it becomes relevant (Hsu, 2016), that wealth and financial literacy are strongly correlated (Banks & Oldfield, 2007; van Rooij et al., 2007) and that in countries with generous social security benefits the incentives to save and accumulate wealth and to invest in financial literacy are smaller (Jappelli & Padula, 2013).

Several studies show that these patterns are consistent through different countries or stages of economic development and that financial illiteracy is widespread even when financial markets are well developed as in the U.S., Germany, the Netherlands, Sweden, Italy, Japan, and New Zealand (Lusardi & Mitchell, 2011b). However, there are differences across countries. For example, where people score high on math and science tests, they also tend to score high on questions measuring numeracy (e.g. the Programme for International Student Assessment; (OECD, 2005)). Furthermore, people are more knowledgeable about inflation if their country has experienced it recently. For example, Italians are more likely to answer the question on inflation correctly. Conversely, in a country like Japan that experienced deflation, fewer people answer the inflation question correctly. If a country like Sweden experienced a pension privatization in recent times the people are more aware of risk diversification. Whereas, Russians and people born in East Germany know less about it (Lusardi & Mitchell, 2011).

More studies concerned with geographic and population related differences within countries show large racial and ethnic differences in the U.S. For example, Whites and Asians are consistently more likely to be financially knowledgeable compared to African Americans and Hispanics (Lusardi & Mitchell, 2007a, 2007b, 2011b). In Italy the Northern and Central regions score higher than the Southern regions, though not all of the Northern regions show high levels of financial knowledge (Fornero & Monticone, 2011). In Russia and Romania people living in urban areas tend to be more financially literate than people living in rural areas (Klapper et al., 2013; Beckmann, 2013). And in the Netherlands other religious beliefs seem to have an influence on financial knowledge meaning that another than the main religion (including Muslims and other smaller religious groups) are less financial literate (Lusardi & Mitchell, 2011b). At the same time, studies find that U.S. citizens tend to display low levels of financial literacy (Bernheim, 1998; Hilgert et al., 2003; Lusardi & Tufano, 2009). Financial illiteracy and financial mistakes are particularly widespread among older Americans (Lusardi & Mitchell, 2011b; Agarwal et al., 2009). Recent government policies, including the establishment of the Consumer Financial Protection Bureau, aim to increase financial literacy among the public (Hsu, 2016).

When reviewing the available literature certain factors are particularly consistent over countries. For this reason, we deal specifically with them in the following.

Gender

One striking feature of the empirical data on financial literacy is the large and persistent gender difference. Not only are older men generally more financially literate than older women, but similar patterns also show up among younger respondents as well (Lusardi et al., 2010; Lusardi & Mitchell, 2017; Lusardi & Tufano, 2009, 2015). Moreover, these gaps persist across both the basic and the more sophisticated literacy questions (Lusardi et al.,2010; Hung et al., 2009). One twist on the differences by sex, however, is that while women are less likely to answer financial literacy questions correctly than men, they are also far more likely to say they "do not know" as an answer to a question, a result that is strikingly consistent across countries. This awareness of their own lack of knowledge may make women ideal targets for financial education programs. Lusardi and Mitchell (2008) show for example that only 61.9% of all women answer the interest rate question correct, whereas 70.6% answer the inflation and only 47.6% of all woman are able to answer the risk diversification question correctly. With the exceptions of Russia and East Germany where women and men are equally illiterate (Lusardi & Mitchell, 2011b) these sex differences in financial literacy are so persistent and widespread across surveys and countries, several researchers seek to explain them. Hsu (2016) proposes that some sex differences may be rational, with specialization of labour within the household leading married women to build up financial knowledge only late in life (close to widowhood). Chen and Volpe (2002) and Mandell (2008) show further that even women in high school and college are usually less financial literate and confirm the observations that single woman in charge of their own finances

have lower finance knowledge. Fonseca et al. (2012) suggest that women may acquire financial literacy differently from men, while Bucher-Koenen et al. (2017) point to a potentially important role of self-confidence that differs by sex. Brown and Graf (2013) also show that sex differences are not due to different interests in finance and financial matters between women and men. To shed more light on women's financial literacy, Mahdavi and Horton (2014) examined alumnae from a highly selective U.S. women's liberal arts college. Even in this talented and well-educated group, women's financial literacy was found to be very low. In other words, even very well educated women are not particularly financially literate, which could confirm Fonseca et al. (2012) that women may acquire financial literacy differently from men. Nevertheless, this debate is far from closed, and additional research will be required to better understand these observed differences.

Age

A study by Agarwal et al. (2009) which focused on financial mistakes shows that these are most predominant among the young and old subsample, groups which usually display the lowest financial knowledge. Age patterns are notable, in that financial knowledge follows an inverted U-shaped pattern, being lowest for the young and the older groups, but peaks in the middle of the life cycle. Lusardi and Mitchell (2011a) show for US-Americans over 50 years a very low performance on basic financial literacy questions with 75% correct answers for the numeracy, 56% correct on the inflation and only 52% correct answers for the risk diversification question which are used to test gender differences and is also used in our survey. At the same time Lusardi and Mitchell (2017) show in another study how very young respondents score worse than middle age people, 60% correct versus 69% for older respondents on the risk diversification question. This is a finding which is robust across countries (Lusardi & Mitchell, 2014). Additionally, it is of interest that older people give themselves very high scores regarding their own financial literacy, despite scoring poorly on the basic financial literacy questions (Lusardi & Mitchell, 2011a; Lusardi & Tufano, 2015) and not just in the United States, but other countries as well (Lusardi & Mitchell, 2011c). Similarly, Finke et al. (2016) develop a multidimensional measure of financial literacy for the old and confirm that, though actual financial literacy falls with age, people's confidence in their own financial decision-making abilities actually increases with age. The mismatch between actual and perceived knowledge might explain why financial scams are often perpetrated against the elderly (Deevy et al., 2012).

Education

In all countries, higher educational attainment is strongly correlated with financial knowledge, but even at the highest level of schooling, financial literacy tends to be low (Lusardi & Mitchell, 2008). Moreover, education is not a good proxy for financial literacy. That is, when education and financial literacy are included in multivariate regression models, both tend to be statistically significant, indicating that financial literacy has an effect above and beyond education. Financial literacy is also higher among those who are working, and in some countries among the self-employed, compared to those who do not work. This difference may in part result from financial education programs offered in the workplace (as in the United States); it could also be the effect of learning from colleagues or skills acquired on the job (Lusardi & Mitchell, 2011a). Furthermore, they show how the percentage of correct answers for the compound interest (inflation, risk diversification) question rises with better education up to 81.2% (85.1%, 70.2%) correct answers for a level of education corresponding to "College and More". Christiansen et al. (2008) use a large register-based panel data set containing detailed information on Danish investors' education attainment, and financial and socioeconomic variables. The authors show that stock-holding increases if individuals have completed an economics education program and if an economist becomes part of the household. To sort out the double causality between portfolio choice and the decision to become an economist, Christiansen et al. (2008) use better access to education due to the establishment of a new university, as an instrument for economics

There are substantial differences in financial knowledge by education: specifically, those without a college education are much less likely to be literate about basic financial literacy concepts, as reported in several U.S. surveys and across countries (Lusardi & Mitchell, 2007a, 2011c). Moreover, numeracy is

especially poor for those with low educational attainment (Christelis et al., 2010; Lusardi, 2012). How to interpret the finding of a positive link between education and financial literacy has been subject to some debate in the economics literature. One possibility is that the positive correlation might be driven by cognitive ability (McArdle et al., 2009), implying that one must control on measures of ability when seeking to parse out the separate impact of financial literacy. Lusardi, Mitchell, and Curto (2010) did find a positive correlation between financial literacy and cognitive ability among young NLSY respondents, but they also showed that cognitive factors did not fully account for the variance in financial literacy. That means that substantial heterogeneity in financial literacy remains even after controlling on cognitive factor.

Understanding

Not only are there patterns in measured financial literacy, but we also can compare what people actually know with their self-assessed understanding of finance. So for example that women tend to indicate a higher self-rated understanding when approaching widowhood (Hsu, 2016). Across countries younger people know very little and acknowledge it. By contrast, older people consistently rate themselves as very well-informed although they are actually less literate than average. There are also important international differences in self-reports: in the U.S. a majority of respondents give themselves high scores, whereas in Japan people rate themselves quite low (Lusardi & Mitchell, 2011b).

Other Patterns

There are numerous other empirical regularities in the financial literacy literature that are, again, persistent across countries. Financial savvy varies by income and employment type, with lower-paid individuals doing less well and employees and the self-employed doing better than the unemployed (Lusardi & Tufano, 2015; Lusardi & Mitchell, 2011c). These findings hold across age groups and many different financial literacy measures (Lusardi & Mitchell, 2017). The literature also points to differences in financial literacy by family background. For instance, Lusardi, Mitchell, and Curto (2010) link financial literacy of 23-28-year old NLSY respondents to characteristics of the households in which they grow up controlling for a set of demographic and economic characteristics. Respondents' financial literacy is also significantly positively correlated with parental education (in particular, that of their mothers), and whether their parents hold stocks or retirement accounts when the respondents are teenagers. Mahdavi and Horton (2014) report a connection between financial literacy and parental background; in this case, fathers' education is positively associated with their female children's financial literacy. In other words, financial literacy may well get its start in the family, perhaps when children observe their parents saving and investing habits, or more directly by receiving financial education from parents (Chiteji & Stafford, 1999; Li 2014; Shim et al., 2009). Other studies note a nationality gap in financial literacy, with foreign citizens reporting lower financial literacy than the native born (Brown & Graf, 2013). Or differences in financial literacy according to religion (Alessie et al., 2011) and political opinions (Arrondel et al., 2013).

To summarize, while financial illiteracy is widespread, it is also concentrated among specific population subgroups and demographic and self-assessed characteristics in most countries studied to date.

DATA AND SURVEY DESIGN

Survey Design

We interview 63 students of an economics master course in Germany at the Technical University of Darmstadt and a mix of 59 students of an economics bachelors' and masters' degree course in St. Petersburg in Russia at the UNECON. Our survey aims to determine the link between an education at university level with demographic and self-assessed characteristics, numeracy and financial skills, the tendency to think about the future and the differences between Russia and Germany.

First the demographic and self-assessed part contains questions about the gender and age of the students. The next part asked about the self-assessment of the students regarding their previous education in finance on a four step scale from "Hardly at all" to "A lot" and their understanding in the finance field on a scale from 1 (very low) to 7 (very high).

The numeracy and financial skill questions are divided in three parts: a numeracy test, a basic and a sophisticated financial literacy test. The numeracy test contains five questions about simple mathematical tasks regarding multiplying, dividing, percentages and fractions. The basic literacy part contains five questions as well and asks for knowledge about numeracy, compound interest, inflation, time value of money and money illusion. The eight sophisticated literacy questions are on the function of stock markets, the knowledge of mutual funds, the relation between interest rates and bond prices, the safety of company stocks and mutual funds, about risky assets, about long period returns, about volatility and about risk diversification.

The last two questions are concerned with the tendency to predict the future. We ask how likely the respondents estimate another crisis in 5 and in 25 years.

Data

In total 122 students answer the survey. Divided per country the sample consists of 65 German and 59 Russian respondents with at least a partly background in economics. The sex is unequally distributed between the subsamples.

TABLE 1
SURVEY SAMPLE DEMOGRAPHIC AND SELF-ASSESSMENT CHARACTERISTICS

Survey respondent population							
	Germany	Russia	Total		Germany	Russia	Total
Gender				*Understanding of finance?*			
Female	15	31	46	1 (very low)	0	2	2
Male	47	28	75	2	7	2	9
Prefer not to answer	1	0	1	3	14	4	18
				4	21	12	33
				5	17	16	33
Age				6	5	9	14
17	0	2	2	7 (very high)	0	10	10
18	0	8	8				
19	0	8	8	*Education devoted to financial education?*			
20	0	10	10				
21	1	7	8	A lot	8	16	24
22	15	5	20	Some	38	29	67
23	14	13	27	A little	18	10	28
24	15	3	18	Hardly at all	0	4	4
25	11	0	11				
26	4	1	5				
27	1	1	2				
28	1	0	1				
30	0	1	1				
32	1	0	1				

Notes: Table shows responses to survey questions. Missing statements are listed in the table.

Whereas Russians are mostly female the German group consists mainly of male students. Because we ask students the distribution of age is quite young with the oldest student from Germany with 32 years and the youngest student from the Russian subsample with 17 years. Regarding the self-assessed understanding

of finance, the Russian group seems to rate itself better than the Germans whereas the German group avoids extreme statements like a very low and very high understanding. For the education devoted to finance the picture is similar. Although the Russian group is smaller the amount of students stating that they receive "A lot" of finance education is higher compared to the German group. Table 1 shows summarized both samples.

RESULTS

As a first step we analyse the three sets of questions, numeracy, basic and sophisticated financial literacy, separately. The numeracy questions are designed to test mathematical skills like division, multiplication, percentages and fractions. Nearly 95% of the students answer each of the five questions correctly and over 90% answer all five questions correctly. The mean is 4.9 correct questions for the German and Russian subsample respectively. The question with the most incorrect answers is Q5 which asks how many people out of 1000 will get a disease if the chance of getting one is 1 in 10. Q5 reframes Q2 which asks for a 10 percent probability of getting a disease. Taking into account that Q2 has the second most incorrect answers it seems that percentages are most difficult to answer whereby the differences to the other questions are in general small. Table 2 reports the results for every question, for all five question together and for each question split up per gender, age, understanding of finance and education devoted to finance. The questions were generally answered correctly with a rate of 100% with a few exceptions.

TABLE 2
NUMERACY QUESTIONS

a.) Percent correct by numeracy question

	Q1 (%) DE/RU	Q2 (%) DE/RU	Q3 (%) DE/RU	Q4 (%) DE/RU	Q5 (%) DE/RU
Correct	96.9/98.3	96.9/98.3	96.9/100	98.5/98.3	96.9/94.9

b.) Summary of correct responses to all numeracy questions

	Five (%) DE/RU	Four (%) DE/RU	Three (%) DE/RU	Two (%) DE/RU	One (%) DE/RU	None (%) DE/RU	Mean DE/RU
Correct	93.8/91.5	3.1/6.8	1.5/1.7	0/0	0/0	1.5/0	4.9/4.9

Notes: Table shows correct responses by demographic characteristics and in aggregate form. The numeracy questions were designed to test concepts of fractions, percentages, division, multiplication and simple probability.

Following Lusardi and Mitchell (2017) and van Rooij et al. (2011b) the financial literacy questions are summarized in two parts. The first five questions test basic concepts of numeracy, compound interest, inflation, time value of money and money illusion. The second part consists of eight questions and aims to measure more sophisticated concepts like volatility, differences between bonds and stocks, long period returns and risk diversification, which, among other things, are relevant for retirement planning.

The results for the basic literacy questions are worse compared to the numeracy part. Q1, which asks about interest rates, is the only question answered in more than 90% correct from both subsamples. The biggest discrepancy between the groups shows question Q2 about compound interest. On the other side Q4 about the time value of money seems to cause the most difficulties for both groups of students. More than one quarter of the Russian group gets it wrong. This result is in line with Bateman et al. (2012) who ask the same questions in an Australian survey and got the worst results for the time value of money question as well.

TABLE 2
NUMERACY QUESTIONS (CONTINUED)

c.) Percent correct by numeracy question and demographics

	Q1 (%) DE/RU	Q2 (%) DE/RU	Q3 (%) DE/RU	Q4 (%) DE/RU	Q5 (%) DE/RU
Gender					
Female	100/100	100/96.8	100/100	100/100	100/93.5
Male	100/96.4	97.9/100	97.9/100	100/96.4	97.9/96.4
Prefer not to answer	0/-	100/-	100/-	100/-	100/-
Age					
17	-/100	-/100	-/100	-/100	-/100
18	-/100	-/100	-/100	-/100	-/100
19	-/90.9	-/100	-/100	-/100	-/100
20	-/100	-/100	-/100	-/100	-/90.0
21	100/100	100/100	100/100	100/100	100/85.7
22	100/80.0	100/80.0	100/100	100/80.0	100/100
23	92.9/100	92.9/100	100/100	100/100	92.9/92.3
24	100/100	100/100	100/100	100/100	100/100
25	100/-	100/-	100/-	100/-	100/-
26	100/100	100/100	100/100	100/100	100/100
27	100/100	100/100	100/100	100/100	100/100
28	100/-	100/-	100/-	100/-	100/-
30	-/100	-/100	-/100	-/100	-/100
32	100/-	100/-	0/-	100/-	100/-
Understanding of finance?					
1 (very low)	-/100	-/100	-/100	-/100	-/100
2	100/100	100/100	100/100	100/100	100/100
3	100/75.0	100/100	100/100	100/75.0	100/75.0
4	100/100	100/100	100/100	100/100	100/100
5	100/100	100/100	100/100	100/100	100/90.0
6	80/100	80/100	80/100	100/100	80/100
7 (very high)	-/100	-/90.0	-/100	-/100	-/100
Education devoted to financial education?					
A lot	100/93.8	100/100	87.5/100	100/93.8	100/100
Some	97.4/100	97.4/96.6	100/100	100/100	97.4/93.1
A little	100/100	100/100	100/100	100/100	100/90.0
Hardly at all	-/100	-/100	-/100	-/100	-/100

Notes: Table shows correct responses by demographic characteristics and in aggregate form. The numeracy questions were designed to test concepts of fractions, percentages, division, multiplication and simple probability.

From the German subsample 72.3% answer all five questions, with a mean of 4.6, correct whereas only 27.1% of the Russians, with a mean of 3.8 correct answers, get all questions right. Table 3 shows the correct answers per question and the share of students who answered all five questions correct. However, Table 3c breaks down responses by demographic characteristics. Female students answer the questions about numeracy and money illusion better than male students whereas males answer questions about compound interest, inflation and time value of money better than females. Comparing the results with other studies female respondents with an economics education answer better. For example, Lusardi and Mitchell (2008) show that woman in general answer the interest rate and inflation question 61.9% and 70.6% correctly whereas our results indicate 100% and 93.3% correct answers for the German subsample. The Russian subsample confirms it partly with 96.8% and 67.7% correct answers. Considering students who indicate a high understanding of finance usually the German group answers better than the Russian. The general pattern shown by Lusardi and Mitchell (2017) that very young people answer worse than middle age respondents is also seen in Table 3 with only correct answers from the age of 26 on. Regarding the education, respondents who indicate "A little" score better than students with "A lot" of education in finance. Comparing to other studies (Lusardi & Mitchell, 2011a) students with an economic background perform still better than general populations for the compound interest and inflation question.

Table 4 presents answers to the sophisticated financial literacy questions and shows some difficulties for the concepts of the relation between interest rates and bond prices, for knowledge of mutual funds and long period returns of different assets. All this questions are answered largely incorrect. That means that even students with an economics background don't know how bond prices behave depending on interest rates and whether stocks give a higher return than bonds or saving accounts. Similar patterns show Lusardi and Mitchell (2008) who state that even at the highest level of schooling financial literacy tends to be low. 18.5% of the German group and 1.7% of the Russian students answer all possible eight questions correct. A gender comparison shows that men are in 5 out of 8 cases better than women and older students usually better than younger. The effect that women perform worse than men is in line with Lusardi and Mitchell (2011b), Chen and Volpe (2002) and Mandell (2008) who state that women in high school and college show worse results than men. But compared to woman in a general population they still perform better with 60% correct answers for example for the risk diversification question than 47.6% correct in general (Lusardi & Mitchell, 2008). The results vary in general more over gender, age, understanding and education and are worse compared to the basic literacy questions.

TABLE 3
BASIC FINANCIAL LITERACY QUESTIONS

a.) Percent correct by basic financial literacy question

	Q1 (%) DE/RU	Q2 (%) DE/RU	Q3 (%) DE/RU	Q4 (%) DE/RU	Q5 (%) DE/RU
Correct	98.5/90.0	92.3/58.3	95.4/76,7	86.2/61.7	84.6/85.0

b.) Summary of correct responses to all basic financial literacy questions

	Five (%) DE/RU	Four (%) DE/RU	Three (%) DE/RU	Two (%) DE/RU	One (%) DE/RU	None (%) DE/RU	Mean DE/RU
Correct	72.3/27.1	20.0/37.3	4.6/25.4	0/8.5	1.5/0	1.5/1.7	4.6/3.8

c.) Percent correct by basic financial literacy question and demographics

	Numeracy Q1 (%) DE/RU	Compound interest Q2 (%) DE/RU	Inflation Q3 (%) DE/RU	Time value of money Q4 (%) DE/RU	Money illusion Q5 (%) DE/RU
Gender					
Female	100/96.8	93.3/58.1	93.3/67.7	80.0/58.1	93.3/90.3
Male	100/85.7	93.6/60.7	97.9/89.3	91.5/67.9	85.1/82.1
Prefer not to answer	100/-	100/-	100/-	0/-	0/-
Age					
17	-/100	-/0	-/0	-/100	-/100
18	-/87.5	-/50.0	-/62.5	-/25.0	-/87.5
19	-/100	-/75.0	-/100	-/37.5	-/75.0
20	-/90.0	-/70.0	-/70.0	-/70.0	-/80.0
21	100/71.4	100/71.4	100/100	100/42.9	0/85.7
22	100/100	93.3/40.0	100/100	93.3/80.0	86.7/100
23	100/100	100/46.2	100/76.9	85.7/84.6	92.9/92.3
24	100/66.7	93.3/66.7	100/33.3	86.7/100	80/66.7
25	100/-	90.9/-	90.9/-	81.8/-	81.8/-
26	100/100	100/100	100/100	100/100	100/100
27	100/100	100/100	100/100	0/100	100/100
28	100/-	100/-	100/-	100/-	100/-
30	-/100	-/100	-/100	-/0	-/100
32	100/-	0/-	0/-	100/-	100/-
Understanding of finance?					
1 (very low)	-/0	-/50.0	-/0	-/50.0	-/50.0
2	100/100	85.7/0	85.7/50.0	71.4/50.0	85.7/100
3	100/75.0	100/50.0	100/100	92.9/50.0	78.6/100
4	100/100	90.5/75.0	100/66.7	85.7/75.0	85.7/83.3
5	100/95.0	100/55.0	100/75.0	94.1/60.0	94.1/75.0
6	100/100	80.0/66.7	80.0/88.9	80.0/66.7	80/100
7 (very high)	-/90.0	-/60.0	-/100	-/60.0	-/100
Education devoted to financial education?					
A lot	100/87.5	87.5/75.0	87.5/75.0	87.5/87.5	75/93.8
Some	100/96.6	92.1/48.3	97.4/82.8	89.5/58.6	86.8/86.2
A little	100/90.0	100/70.0	100/80.0	83.3/40.0	88.9/80.0
Hardly at all	-/75.0	-/50.0	-/50.0	-/50.0	-/75.0

Notes: Table shows correct responses by demographic characteristics and in aggregate form.

TABLE 4
SOPHISTICATED FINANCIAL LITERACY QUESTIONS

a.) Percent correct by sophisticated financial literacy question

	Q1 (%) DE/RU	Q2 (%) DE/RU	Q3 (%) DE/RU	Q4 (%) DE/RU	Q5 (%) DE/RU	Q6 (%) DE/RU	Q7 (%) DE/RU	Q8 (%) DE/RU
Correct	95.4/86.7	60.0/46.7	55.4/31.7	76.9/53.3	75.4/66.7	67.7/38.3	78.5/71.7	95.4/80.0

b.) Summary of correct responses to all sophisticated financial literacy questions

	Eight (%) DE/RU	Seven (%) DE/RU	Six (%) DE/RU	Five (%) DE/RU	Four (%) DE/RU	Three (%) DE/RU	Two (%) DE/RU	One (%) DE/RU	None (%) DE/RU	Mean DE/RU
Correct	18.5/1.7	35.4/18.6	24.6/15.3	6.2/30.5	1.5/13.6	4.6/8.5	4.6/5.1	1.5/5.1	3.1/1.7	6.0/4.8

c.) Percent correct by sophisticated financial literacy question and demographics

	Function of Stock Market Q1 (%) DE/RU	Knowledge of Mutual Funds Q2 (%) DE/RU	Relation between Interest Rates and Bond Prices Q3 (%) DE/RU	Safer: Company stock or Mutual Fund Q4 (%) DE/RU	Risky Assets Q5 (%) DE/RU	Long period Returns Q6 (%) DE/RU	Volatility Q7 (%) DE/RU	Risk Diversification Q8 (%) DE/RU
Gender								
Female	86.7/83.9	33.3/35.5	60.0/35.5	60.0/61.3	73.3/74,2	53.3/38.7	53.3/71.0	93.3/80.6
Male	100/92.9	70.2/60.7	53.2/28.6	83/46.4	78.7/60.7	72.3/39.3	87.2/75.0	97.9/82.1
Prefer not to answer	100/-	100/-	100/-	100/-	0/-	100/-	100/-	100/-
Age								
17	-/50.0	-/0	-/50.0	-/0	-/0	-/50.0	-/0	-/50.0
18	-/62.5	-/25.0	-/0	-/37.5	-/62.5	-/25.0	-/62.5	-/50.0
19	-/87.5	-/37.5	-/25.0	-/37.5	-/62.5	-/62.5	-/50.0	-/62.5
20	-/90.0	-/40.0	-/40.0	-/40.0	-/60.0	-/50.0	-/60.0	-/70.0
21	100/85.7	100/57.1	0/14.3	100/85.7	100/57.1	100/28.6	100/57.1	100/100
22	100/100	60.0/60.0	60.0/40.0	86.7/40.0	80.0/60.0	80.0/40.0	80.0/100	93.3/100
23	100/100	78.6/61.5	64.3/53.8	78.6/69.2	78.6/84.6	78.6/30.8	92.9/100	100/100
24	93.3/100	46.7/33.3	53.3/33.3	73.3/66.7	80.0/100	60.0/33.3	60.0/100	100/100
25	90.9/-	63.6/-	63.6/-	72.7/-	72.7/-	81.8/-	90.9/-	90.9/-

26	100/100	50.0/100	50.0/100	75.0/100	50.0/100	0/0	75.0/100	100/100
27	100/100	100/100	0/0	0/100	100/100	0/0	100/100	100/100
28	100/-	100/-	0/-	100/-	100/-	100/-	100/-	100/-
30	-/100	-/100	-/0	-/100	-/100	-/100	-/100	-/100
32	100/-	0/-	0/-	100/-	0/-	0/-	0/-	100/-
Understanding of finance?								
1 (very low)	-/50.0	-/0	-/0	-/50.0	-/50.0	-/0	-/100	-/50.0
2	71.4/50.0	28.6/50.0	42.9/50.0	42.9/0	14.3/50.0	28.6/0	42.9/50.0	71.4/50.0
3	100/100	64.3/50.0	50.0/25.0	71.4/75.0	78.6/75.0	57.1/75.0	71.4/25.5	100/75.0
4	100/91.7	76.2/33.3	71.4/16.7	76.2/50.0	81.0/58.3	71.4/16.7	95.2/75.0	100/83.3
5	100/80.0	47.1/45.0	47.1/25.0	94.1/45.0	100/60.0	88.2/35.0	82.4/85.0	100/75.0
6	100/100	80.0/55.6	60.0/55.6	100/66.7	60.0/88.9	80.0/55.6	80.0/66.7	100/100
7 (very high)	-/100	-/70.0	-/50.0	-/70.0	-/80.0	-/60.0	-/70.0	-/90.0
Education devoted to financial education?								
A lot	100/100	62.5/68.8	62.5/31.3	87.5/68.8	75.0/75.0	75.0/43.8	87.5/81.3	100/100
Some	97.4/89.7	65.8/48.3	63.2/34.5	81.6/55.2	89.5/69.0	76.3/34.5	84.2/72.4	97.4/82.8
A little	94.4/80.0	50.0/30.0	38.9/20.0	66.7/40.0	50.0/70.0	50.0/50.0	66.7/70.0	94.4/60.0
Hardly at all	-/50.0	-/0	-/50.0	-/25.0	-/25.0	-/25.0	-/50.0	-/50.0

Notes: Table shows correct responses by demographic characteristics and in aggregate form.

Comparing these results to international studies with the same questions in Table 5 TU Darmstadt students perform better in four basic financial literacy questions and in two out of four comparable sophisticated financial literacy questions.

TABLE 5
INTERNATIONAL COMPARISON OF FINANCIAL LITERACY RESPONSES

	Basic financial literacy					Sophisticated financial literacy			
	Numeracy (%)	Compound interest (%)	Inflation (%)	Time value of money (%)	Money illusion (%)	Risky assets (%)	Long period returns (%)	Volatility (%)	Diversification (%)
Australia[a]	88.4	71.8	78.4	54.9	86.7	64.1	54.9	76.7	73.3
US-ALP[b]	91.8	69.0	87.1	73.8	78.4	80.2	62.3	88.3	74.9
US-NFCS[c]	64.9	n.a.	64.3	n.a.	n.a.	n.a	n.a	n.a	n.a
New Zealand[d]	86.0	n.a.	81.0	n.a.	n.a.	n.a	n.a	n.a	n.a
Germany[e]	82.4	n.a.	78.4	n.a.	n.a.	n.a	n.a	n.a	n.a
Netherlands[f]	84.8	n.a.	76.9	n.a.	n.a.	n.a	n.a	n.a	n.a
UNECON St. Petersburg	90.0	58.3	76.7	61.7	85.0	66.7	38.3	71.7	80.0
TU Darmstadt	**98.5**	**92.3**	**95.4**	**86.2**	84.6	75.4	**67.7**	78.5	**95.4**

Notes: Table shows correctly answered respondents in percentages of survey. n.a., not applicable. In bold font are the values that are higher than the international comparison. The table is taken from Bateman et al. (2012) and adjusted with given results. [a]CenSoc-UNSW survey of 1199 superannuation account holders, May 2010; [b]American Life Panel (ALP) (Lusardi & Mitchell, 2017); [c]National Financial Capability Study (NFCS) (Lusardi, 2011b); [d]ANZ-New Zealand Retirement Commission Financial Knowledge Survey (Retirement Commission, 2009); [e]SAVE 2009 survey (Bucher-Koenen & Lusardi, 2011); [f]Dutch Central Bank Household Survey (Alessie et al., 2011).

Comparing the Russian and German group of students directly in Table 6 the results show that the German group performs in most comparison better even though not all results are significant. One pattern that emerges is that the Russian group seems to be overall better at the numeracy questions even though not significant whereas the basic and sophisticated financial literacy questions show significant better results for the German group. The only significant result indicating better Russian students is for students with a high self-assessed understanding of finance for numeracy questions.

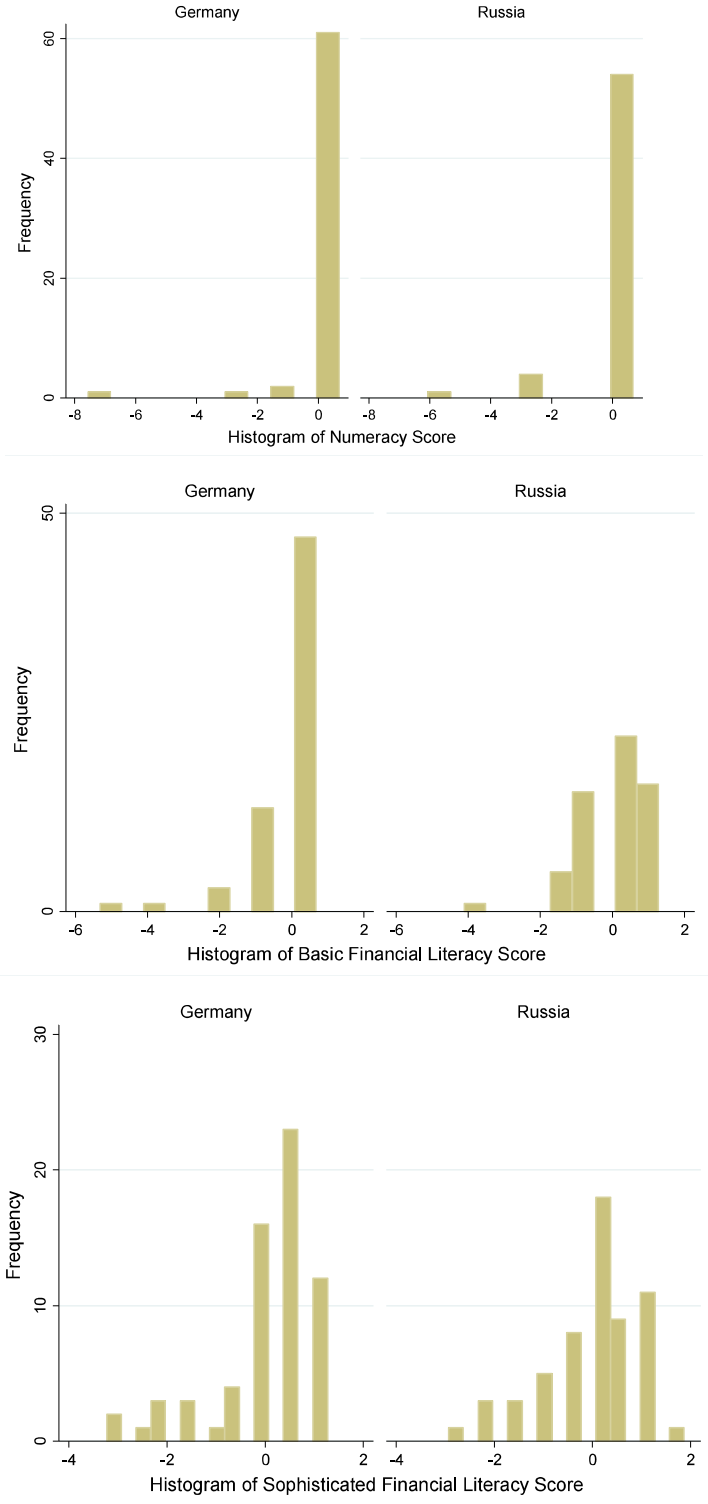
TABLE 6
DIFFERENCE BETWEEN THE GERMAN AND RUSSIAN SUBSAMPLE OVER DEMOGRAPHIC AND SELF-ASSESSMENT CHARACTERISTICS

	T-Test		
	Numeracy	Basic Financial Literacy	Sophisticated Financial Literacy
Gender			
Female	1.2399	2.8311***	0.4892
Male	0.5033	4.1842***	4.1503***
Prefer not to answer	-	-	-
Understanding of finance?			
1 (very low)	-	-	-
2	-	1.1578	0.2006
3	3.1909***	3.5821***	0.9774
4	-	2.1878**	4.6482***
5	1.3367	4.8413***	4.0124***
6	-2,9692**	-0.0393	0.7564
7 (very high)	-	-	-
Education devoted to financial education?			
A lot	0	0.6325	1.2778
Some	0.2934	4.3029***	4.3053***
A little	1.3628	3.6259***	1.0872
Hardly at all	-	-	-
Overall	-0.3706	4.4634***	3.5632***

Notes: *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. The columns report T-statistics for the test of equality of relative correct answers for the numeracy (basic, sophisticated) questions between the German and Russian subsample.

Index Construction

FIGURE 1
HISTOGRAMS OF NUMERACY, BASIC AND SOPHISTICATED FINANCIAL LITERACY



In contrast to Gerardi et al. (2010) who include only numeracy and basic financial literacy questions and Lusardi and Mitchell (2017) and van Rooij et al. (2011a) who only ask for basic and financial literacy questions this study includes all three. Banks (2010) states that numeracy questions are closer linked with cognition, whereas basic literacy questions refer to common economic decisions (inflation and time value of money) and sophisticated literacy questions relate to more financial specialised knowledge (Bateman et al., 2012). We include all three categories and investigate any significant differences between these skillsets at different demographic and self-assessed characteristics.

In order to compare the different skillsets and to analyse the connections to the demographic and self-assessed characteristics we follow the approach of Bateman et al. (2012) and create a score for every respondent and every set of questions. This score results by counting the correct answers per group of questions and standardising them using the sample means and standard deviations to make three indices per respondent.

Figure 1 shows the histograms of the numeracy, basic and sophisticated financial literacy score for the German and Russian subsample. The distributions are negatively skewed and present a slightly more balanced distribution for the sophisticated literacy score.

Financial Competence and General Demographics

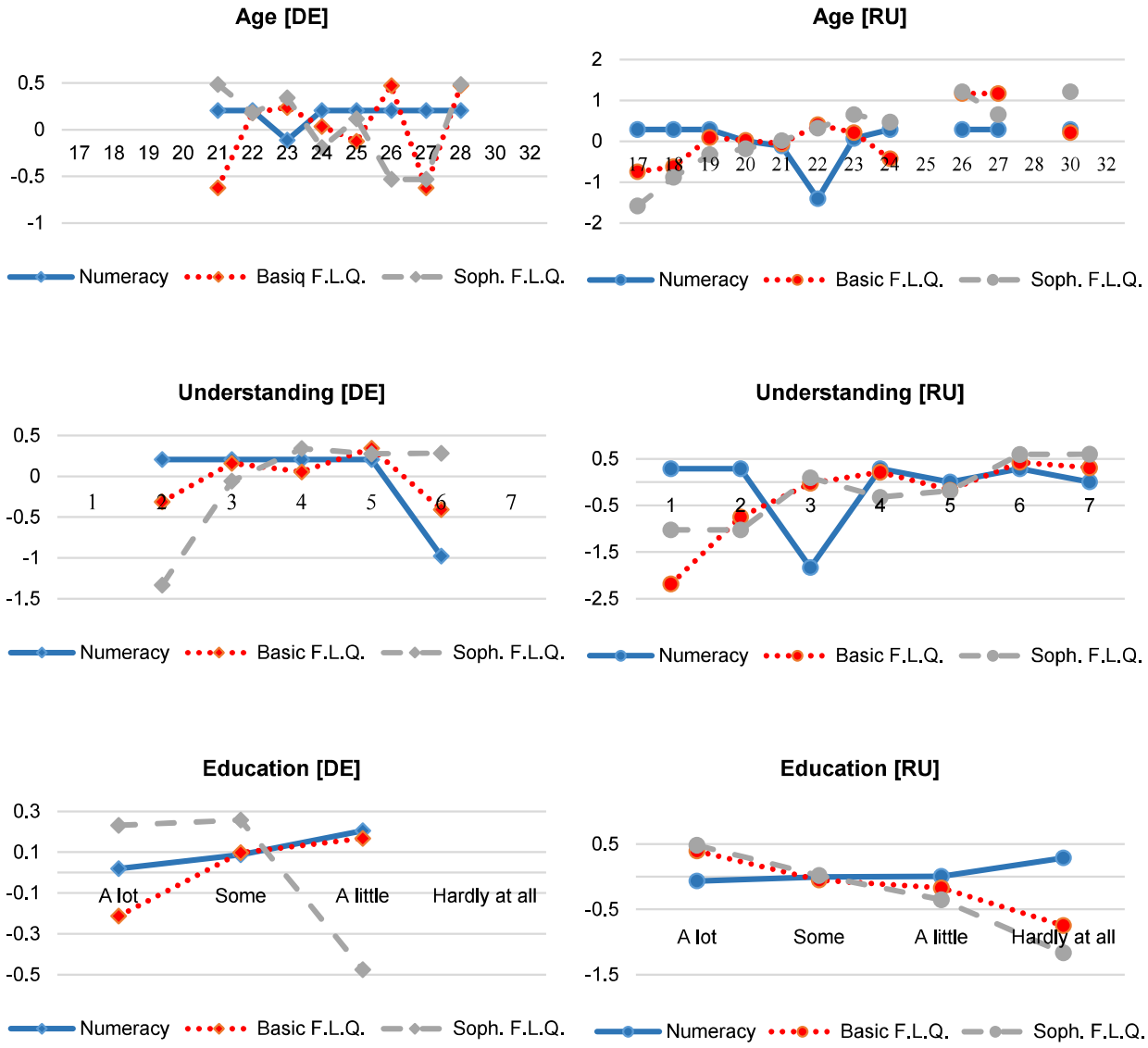
Figure 2 shows five sets of graphs covering demographics, education, self-assessed financial competence and share market expectations. On the left is the German subsample, on the right the Russian. The y-axis shows the average of the numeracy, basic and financial literacy index scores and the horizontal axis the specification of the respective variable. Where there is no natural order for the x-axis variable, we display bars, where the blue bar is average numeracy, the red bar is average basic literacy and the grey bar is average sophisticated literacy. For variables that have an order, we show lines, where the solid blue line displays numeracy scores, the dotted red line the basic financial literacy score and the dashed grey line sophisticated financial literacy scores.

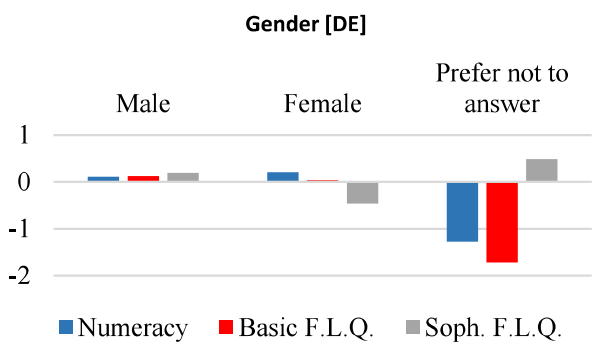
For each graph, we test the influence of the demographic and self-assessed characteristic on each score and report the results in Table 7. In a first step, we test the restriction that in a regression of the numeracy index score (and basic and sophisticated financial literacy score) on a constant and indicator variable, the coefficients on the indicators are jointly zero. These three standard F-tests indicate significant change in average numeracy or literacy score as the horizontal axis category varies. The second step is a Wald test for equality (at each horizontal axis category) of the coefficients of the three regressions for overall differences between the three indices.

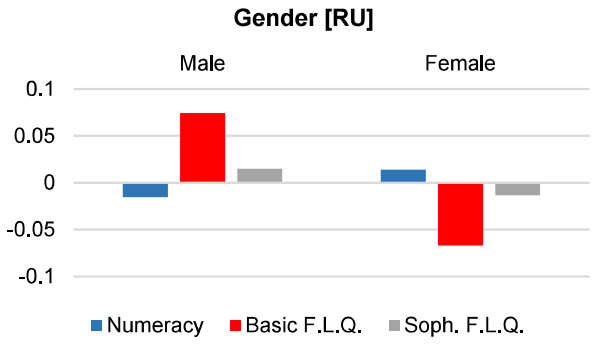
An important feature of the relationship between financial competence and gender is the difference between the sophisticated literacy score and the other two measures. For males the sophisticated literacy score is always positive and for women always negative independent from the numeracy and basic literacy scores. That means that male respondents score better in sophisticated literacy questions, on average, than female respondents. Further numeracy and basic literacy varies significantly per age for the German group whereas the sophisticated financial literacy scores rise significantly with age for the Russian group. The following figures show the scores per level of understanding and education. The understanding is inverted u-shaped and significant for all scores for the German group. That means that respondents with a high self-assessed understanding of finance score worse than respondent with an average understanding. The scores vary for the Russian group and are significant for all index scores. Again, the respondents with the highest scores do not indicate that they also have the best understanding exhibiting the overconfidence in self-assessment which is regularly seen in survey responses (see, e.g. Agnew & Szykman, 2005). (In our survey the self-assessment question comes before the financial literacy questions, so the responses should not be affected by respondents' feelings about how well or badly they answer.) The picture for the education of the German group is similar. Respondents who say that they have "A lot" education in the field of finance score worse than respondent who indicate "Some" education. The Russian group shows the best literacy scores for the students with the most education whereas students with nearly no education in finance score better in the numeracy part. The four graphs in the last row refer to financial competence scores with responses to two survey questions relating to expectations for another financial crisis. This follows the

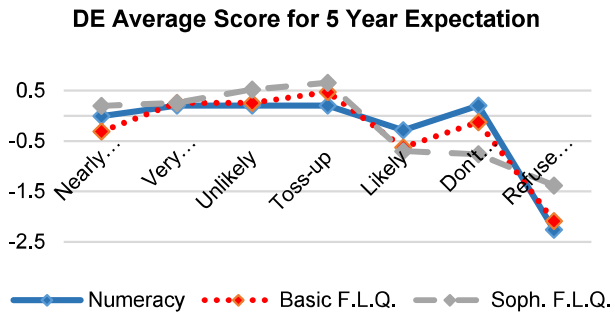
analysis of Bateman et al. (2012) and evaluates in the next section these graphs and explore the relationship between respondent characteristics and expectations using first a standard logit and second an ordered logit model.

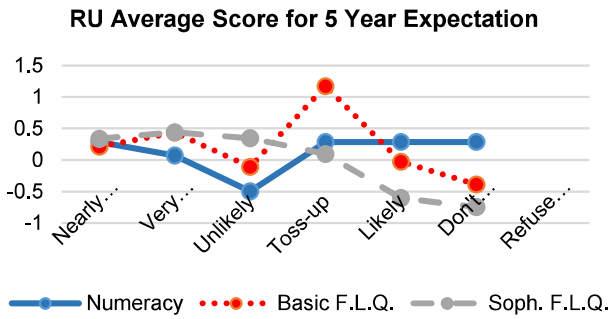
FIGURE 2
AVERAGE FINANCIAL COMPETENCE SCORE BY DEMOGRAPHIC AND SELF-ASSESSED CHARACTERISTICS

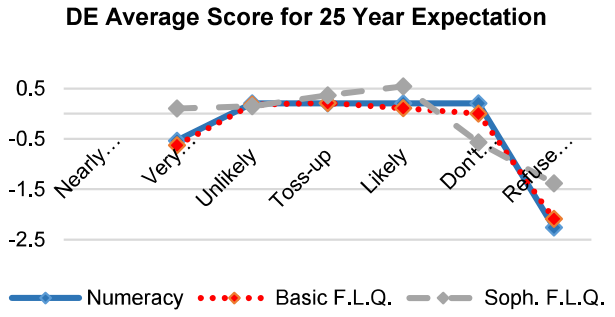


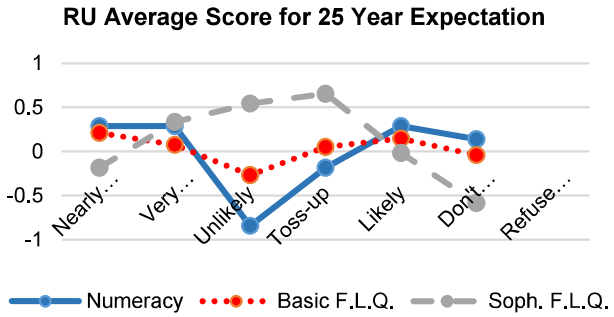












Competence and Crisis Expectations

The global financial crisis of 2007–2009 created many problems for stock holders and thus for many retirement savers, especially for those who were shortly before retirement. At the time of the survey, 13 years after the crisis and after an almost continuous growth for many investors it seemed like another crisis is just a matter of time. This raises the question of how the crisis influences the attitudes and behaviour of future investors. Because of that the last two questions of our survey address respondents' views, on the likelihood of another large stock market crash. We use these answers to evaluate the role of demographics, self-assessed characteristics and financial literacy in expectations formation. Further we are interested in the association of those variables to optimistic or pessimistic views of future markets. We assess expectations about future shocks with two questions. They describe a sharp fall in share prices and then ask how likely it is that share prices will suffer another similar sized loss in the next 5 and 25 years. The answers fall into seven categories, with each category attributing increasing probability to another sharp stock market decline within the next years, and then separate categories for "Don't know" and "Refuse to answer". The respondents could assign probabilities ranging from "Nearly impossible - less than a one in a hundred chance" to "Likely - a greater than one in two chance".

The last graphs in Figure 2 show for the German group that low financial competence is associated with two extreme responses to these questions: extreme optimism and uncertainty ("Don't know"). Respondents with poor basic financial literacy are especially likely to fall into these categories, but poor numeracy is also associated with choosing "Don't know" (uncertainty). For all three scores, we see a significant influence on share market optimism and equality between all three scores (Table 7)

The link between poor financial literacy and optimism matches research into retirement preparation and pension expectations in the Netherlands. Alessie et al. (2011) observe that Dutch respondents with lower financial literacy have difficulty forming realistic expectations of retirement replacement rates and are uncertain of at what age to retire. The Russian students don't show that clear pattern. Instead, students with a poor numeracy score choose often "Unlikely" whereas a poor sophisticated index score is again associated with the two extreme responses.

TABLE 7
VARIATION WITHIN AND BETWEEN FINANCIAL COMPETENCE INDICES

	F-Test			Wald Test
	Numeracy DE/RU	Basic Financial Literacy DE/RU	Sophisticated Financial Literacy DE/RU	Joint Equality DE/RU
Gender	5.85***/0.01	2.81*/0.29	3.07*/0.01	26.77***/0.33
Age	2.15**/1.23	1.22/0.88	0.98/2.98***	38.65**/58.16***
Understanding of finance?	113.59***/3.08**	9.56***/2.79**	7.9***/2.43**	683.03***/51.60***
Education devoted to financial education?	0.61/0.13	0.66/1.72	4.33**/3.91**	15.5**/14.67
Share market crash (5 years)	4.04***/1.39	3.56***/1.37	5.02***/3.87***	59.5***/33.61***
Share market crash (25 years)	5.42***/2.07*	3.71***/0.22	4.09***/2.94**	51.2***/35.26***

Notes: *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. First three columns report F-statistics for the test of the restriction that in a regression of the numeracy (basic, sophisticated) index the coefficients on the indicators are jointly zero for the German and Russian subsample respectively. Final column reports Chi2 statistics for the test that the constants and coefficients of the three regressions, at each horizontal axis category, are equal for the German and Russian subsample respectively.

To further investigate the connections between competence and expectations, we model respondents' subjective evaluations of the likelihood of another severe stock market decline within the next years in a standard logit model and test whether respondents with special characteristics are more likely to make a statement about the future. In a second step we deploy an ordered logit model to test whether respondents with special characteristics are more optimistic or pessimistic about the future. We include age, gender, education devoted to finance, self-assessed understanding of finance, numeracy and the two financial literacy scores, as possible indicator variables.

TABLE 8
LOGIT AND ORDERED LOGIT REGRESSION OF FINANCIAL LITERACY ON STOCK MARKET EXPECTATIONS FOR THE NEXT 5 YEARS FOR THE GERMAN SUBSAMPLE

	I	II					
	Probability	Don't know/ Refuse to answer	Nearly impossible	Very unlikely	Unlikely	Toss-up	Likely
Gender							
Female	71.4%***	28.7%***	13.8%***	31.7%***	19.2%**	3.4%	3.3%
Male	80.0%***	18.6%***	11.0%***	32.5%***	26.8%***	5.5%*	5.6%*
Prefer not to answer	-	42.4%	15.1%***	26.5%	12.2%	1.9%	1.8%
Age							
17	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-
21	-	4.6%	3.6%	20.6%	42.5%***	15.5%	13.2%
22	85.7%***	12.3%**	8.3%**	33.3%***	33.9%***	7.3%	5.0%
23	84.6%***	29.4%***	14.1%***	34.1%***	17.8%***	2.7%	1.7%
24	71.4%***	25.0%**	13.2%**	35.4%***	20.9%**	3.4%	2.2%
25	81.8%***	13.3%*	8.8%**	34.0%***	32.5%***	6.7%	4.6%
26	50.0%***	28.2%	13.9%**	34.5%***	18.7%	2.9%	1.8%
27	-	99.95***	2.01e-5%	1.83e-5%	4.37e-6%	5.31e-7%	3.21e-7%
28	-	20.3%	11.7%	36.0%***	24.9%	4.3%	2.8%
30	-	-	-	-	-	-	-
32	-	1.76e-13%	1.5e-13%	1.14e-12%	7.54e-12%	1.49e-11%	100%***
Understanding of finance?							
1 (very low)	-	99.99%***	1.04e-4%	8.81e-5%	2.22e-5%	2.91e-6%	2.43e-6%
2	50.0%**	49.1%**	15.6%***	23.8%**	9.1%	1.3%	1.1%
3	64.3%***	28.9%***	14.6%***	32.9%***	18.0%**	3.0%	2.7%
4	85.0%***	15.4%**	10.2%**	33.5%***	29.1%***	6.1%	5.7%
5	88.2%***	17.3%**	11.1%**	34.1%***	27.1%***	5.4%	5.0%
6	-	5.8%	4.6%	22.3%	38.9%***	13.2%	15.3%
7 (very high)	-	-	-	-	-	-	-
Education devoted to financial education?							
A lot	-	12.9%*	9.2%*	32.0%***	31.1%***	7.4%	7.5%
Some	83.3%***	16.3%***	10.8%***	33.6%***	27.5%***	5.9%*	5.8%*
A little	58.8%***	37.5%***	16.0%***	29.2%***	13.2%**	2.2%	2.0%
Hardly at all	-	-	-	-	-	-	-

Average change of probability in percent points for an one unit increase in the score							
Numeracy	+7.2%	-6.9%	-2.0%	-1.1%	+5.5%	+1.7%	+1.9%
Basic literacy	+8.9%**	-9.0%**	-2.7%	-0.3%	+7.2%**	+2.2%	+2.5%
Sophisticated literacy	+15.9%***	-14.1%***	-4.3%**	-0.8%	+11.4%***	+3.6%	+4.2%

Notes: *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. Column I reports probabilities of a logit regression whereas Column II shows ordered logit regressions. Demographic and self-assessment characteristics show an absolute probability value and the index scores an increase of probability when the index score increases in one unit.

Table 8 shows the results for the 5 year expectations of the German group. For reasons of space we show at this point only the results for the German group and only for the five year expectations. The other tables for the Russian group show similar results and are in the appendix. The table reports absolute probabilities for the standard logit (column "I") and ordered logit (column "II") estimation of respondents' expectations, where the reference category is "Don't know/refuse to answer". We put the two categories together because there were too few answers to model "Refuse to answer" separately. For example, the probability for making any statement about the future is 71.4 % when you're female and 80% when male. While no clear pattern can be identified for age and no direct comparison is possible due to the different distribution there is a pattern for the variables understanding of finance and education devoted for finance. Both variables show increasing probabilities for an increasing level of understanding and education indicating that students who are more in contact with finance are more likely to assign a probability to future crisis expectations. The same goes for the index scores even though the interpretation is a little bit different. For the index scores the tables show not absolute probabilities but an increase of probabilities when the index scores increases for one unit. That means that a student who increases his basic financial literacy score by one unit is 8.9% more likely to make a statement about the next five years. Students with higher sophisticated financial literacy are even 15.9% more likely to attribute a specific probability to another crash rather than expressing ignorance or uncertainty by choosing "Don't know". This result is in line with Arrondel (2018) who shows a positive correlation between financial literacy and the propensity to formulate a specific financial plan for a French sample.

The column "II" shows the results for an ordered logit model and thus the absolute probabilities for choosing one of the six answers for the demographic characteristics and an increase in probability for the index scores. An overall comparison between the German and Russian group indicates that Russians are more pessimistic. Overall the main category with highest probability is "Unlikely" whereas Germans mainly choose "Very unlikely". In Germany are males more pessimistic whereas in Russia females are mainly pessimistic. Regarding the understanding of finance and education it seems that students with a high level of understanding and education are more pessimistic. As the index scores increase it becomes more likely that one chooses a pessimistic option with the most improvement for the category "Unlikely". The results for the 25 years are similar except that they are more pessimistic for both groups up to the point that no one from the German students who evaluated the future says that it's "Nearly impossible" that there will be no crisis in the next 25 years. Overall, better financial competence, a better understanding of finance and more education in finance reduce uncertainty in favour of risk quantification. This result is in line with previous studies like Epstein (1999) and Halevy (2007) who show that uncertainty averse people are "not probabilistically sophisticated".

CONCLUSION

Our study documents how a formal education in economics affects financial knowledge and how mathematical knowledge is able to forecast financial literacy. The results are derived from a survey asking students from Germany and Russia an internationally established set of questions about numeracy, basic financial literacy, sophisticated financial literacy and future crisis expectations. The German group shows

superior results in four out of five comparable basic financial literacy questions and in two out of four comparable sophisticated financial literacy questions. Overall, economic students perform better than average individuals but even with that background are only few able to answer all eight sophisticated literacy questions correct (Germany: 18.4%; Russia: 1.7%) which is in line with Lusardi and Mitchell (2008) who show that the level of knowledge is even among well educated people quite low. At the same time, we show that good mathematical skills not necessarily indicate superior financial knowledge. The Russian group shows overall better numeracy results but significant worse financial literacy responses compared to the German group.

Female students perform better on the numeracy part. Regarding the financial literacy questions we confirm former studies from Lusardi and Mitchell (2008), Chen and Volpe (2002), Mandell (2008), and Hung et al. (2009) that women are less financially literate than men. Lusardi and Mitchell (2011b) show differences in self-assessed characteristics like understanding or education of finance between countries. We also find these differences in our dataset between Russians and Germans.

If financial literacy is key to a private and responsible retirement planning and considering that our results indicate that even individuals with an economic background have problems answering all questions correctly it is not surprising that the need of improving financial knowledge is gaining momentum. The success of a partly shifting from a far reaching public to a more private retirement planning depends highly on the skills people have or acquire through time going further than a university education in economics.

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APPENDIX

TABLE 9
LOGIT AND ORDERED LOGIT REGRESSION OF FINANCIAL LITERACY ON STOCK MARKET EXPECTATIONS FOR THE NEXT 25 YEARS FOR THE GERMAN SUBSAMPLE

	I	II					
	Probability	Don't know/ Refuse to answer	Nearly impossible	Very unlikely	Unlikely	Toss-up	Likely
Gender							
Female	71.4%***	34.2%***	-	7.5%**	23.8%***	24.0%***	10.5%**
Male	73.3%***	23.2%***	-	6.1%**	23.1%***	30.8%***	16.8%***
Prefer not to answer	-	46.0%	-	7.9%**	21.8%**	17.6%	6.7%
Age							
17	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-
21	-	9.5%	-	3.3%	18.4%	37.6%***	31.2%
22	78.6%***	12.3%**	-	4.0%*	21.3%***	37.0%***	25.4%**
23	76.9%***	27.2%***	-	7.0%**	27.4%***	27.1%***	11.3%*
24	71.4%***	27.2%***	-	7.0%**	27.4%***	27.1%***	11.3%*
25	72.7%***	31.0%***	-	7.5%**	27.4%***	24.5%***	9.6%*
26	50.0%**	36.5%	-	8.0%*	26.7%***	21.1%	7.7%
27	-	100%***	-	1.54e-5%	2.64e-5%	1.01e-5%	2.6e-6%
28	-	9.5%	-	3.3%***	18.4%	37.6%***	31.2%
30	-	-	-	-	-	-	-
32	-	45.9%	-	8.3%**	24.3%**	16.2%	5.3%
Understanding of finance?							
1 (very low)	-	100.0%	-	1.34e-5%	2.16e-5%	8.84e-6%	2.54e-6%
2	-	-	-	-	-	-	-
3	33.3%*	64.0%	-	7.4%	16.5%	9.1%	3.0%
4	64.3%***	22.8%	-	6.6%	25.3%	29.7%	15.7%
5	85.0%***	18.7%	-	5.8%	24.0%	32.4%	19.2%
6	76.5%***	25.5%	-	7.0%	25.8%	27.9%	13.8%
7 (very high)	-	26.5%	-	7.2%	25.9%	27.3%	13.2%

Education devoted to financial education?							
A lot	-	17.3%*	-	5.4%*	23.4%***	32.9%***	21.1%**
Some	77.8%***	22.4%***	-	6.4%**	25.3%***	29.7%***	16.2%***
A little	52.9%***	41.0%***	-	8.4%**	24.6%***	18.6%***	7.4%*
Hardly at all	-	-	-	-	-	-	-
Average change of probability in percent points for an one unit increase in the score							
Numeracy	+7.2%	-13.0%	-	-1.9%	-1.9%	+8.1%	+8.6%
Basic literacy	+7.8%	-8.5%*	-	-1.1%	-1.0%	+5.1%*	+5.6%
Sophisticated literacy	+17.4%***	-16.6%***	-	-2.4%*	-3.4%	+9.8%***	+12.6%***

Notes: *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. Column I reports probabilities of a logit regression whereas Column II shows ordered logit regressions. Demographic and self-assessment characteristics show an absolute probability value and the index scores an increase of probability when the index score increases in one unit.

TABLE 10
LOGIT AND ORDERED LOGIT REGRESSION OF FINANCIAL LITERACY ON STOCK MARKET EXPECTATIONS FOR THE NEXT 5 YEARS FOR THE RUSSIAN SUBSAMPLE

	I	II					
	Probability	Don't know/ Refuse to answer	Nearly impossible	Very unlikely	Unlikely	Toss-up	Likely
Gender							
Female	74.2%***	22.9%***	11.0%***	22.2%***	33.9%***	1.9%	8.0%**
Male	71.4%***	31.4%***	12.8%***	22.2%***	26.9%***	1.4%	5.3%*
Prefer not to answer	-	-	-	-	-	-	-
Age							
17	-	99.9%***	1.49e-5%	1.04e-5%	5.15e-6%	1.66e-7%	4.57e-7%
18	75.0%***	15.8%*	10.7%*	23.7%***	40.1%***	2.4%	7.3%
19	37.5%**	58.2%***	14.6%**	15.4%**	10.4%	0.4%	1.0%
20	90.0%***	19.9%**	12.4%**	24.8%***	35.3%***	1.9%	5.6%
21	57.1%***	26.1%*	14.3%**	25.0%***	29.2%**	1.4%	4.0%
22	80.0%***	23.9%	13.8%**	25.1%***	31.1%**	1.5%	4.5%
23	92.3%***	14.1%**	9.9%**	22.9%***	42.2%***	2.7%	8.2%
24	66.7%**	27.8%	14.7%**	24.9%***	27.7%	1.3%	3.7%
25	-	-	-	-	-	-	-
26	-	23.7%	13.7%	25.1%***	31.4%	1.5%	4.5%
27	-	9.95e-12%	9.17e-12%	3.43e-11%	4.41e-10%	1.8e-10%	100%***
28	-	-	-	-	-	-	-
30	-	41.9%	16.2%***	21.4%*	17.8%	0.7%	2.0%
32	-	-	-	-	-	-	-

Understanding of finance?							
1 (very low)	-	99.9%	1.54e-5%	1.17e-5%	6.48e-6%	2.25e-7%	8.02e-7%
2	50.0%	34.5%	14.2%	22.1%	23.8.%	1.1%	4.2%
3	-	17.8%	10.3%	21.9%	37.9%	2.4%	9.7%
4	75.0%***	16.5%	9.8%	21.4%	39.2%	2.6%	10.5%
5	65.0%***	26.8%	12.9%	23.0%	29.7%	1.5%	5.9%
6	77.8%***	30.4%	13.6%	22.8%	26.8%	1.3%	5.0%
7 (very high)	90.0***	25.0%	12.5%	23.0%	31.2%	1.7%	6.5%
Education devoted to financial education?							
A lot	81.3%***	29.2%***	13.1%	23.1%***	27.8%***	1.4%	5.3%
Some	72.4%***	21.8%***	11.4%	23.0%***	34.2%***	1.9%	7.7%*
A little	80.0%***	18.9%**	10.4%	22.4%***	36.9%***	2.2%	9.1%
Hardly at all	25.0	74.4%***	9.4%	9.2%	5.9%	0.2%	0.8%
Average change of probability in percent points for an one unit increase in the score							
Numeracy	-	6.9%	1.3%	-0.2%	-5.5%	-0.5%	-2.1%
Basic literacy	+9.7%*	-4.8%	-1.0%	+0.1%	+3.9%	+0.4%	+1.5%
Sophisticated literacy	+17.4%** *	-11.0%**	-2.0%*	+0.4%	+8.4%**	+0.8%	+3.5%

Notes: *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. Column I reports probabilities of a logit regression whereas Column II shows ordered logit regressions. Demographic and self-assessment characteristics show an absolute probability value and the index scores an increase of probability when the index score increases in one unit.

TABLE 11
LOGIT AND ORDERED LOGIT REGRESSION OF FINANCIAL LITERACY ON STOCK MARKET EXPECTATIONS FOR THE NEXT 25 YEARS FOR THE RUSSIAN SUBSAMPLE

	I	II					
	Probability	Don't know/ Refuse to answer	Nearly impossible	Very unlikely	Unlikely	Toss-up	Likely
Gender							
Female	74.2%***	26.4%***	3.1%	11.7%***	17.7%***	11.0%**	30.0%***
Male	60.7%***	38.7%***	3.8%	12.8%***	16.4%***	8.8%**	19.6%***
Prefer not to answer	-	-	-	-	-	-	-
Age							
17	-	100%	1.74e-6%	3.74e-6%	2.60e-6%	8.47e-7%	1.09e-6%
18	75.0%***	29.9%	4.1%	14.4%	20.3%	10.8%	20.4%
19	37.5%**	56.2%	4.6%	13.1%	13.0%	5.3%	7.8%
20	80.0%***	19.8%	3.2%	12.2%	20.8%	13.3%	30.7%
21	42.9%**	44.7%	4.7%	14.6%	16.6%	7.4%	11.9%
22	60.0%***	45.8%	4.7%	14.5%	16.3%	7.2%	11.4%
23	92.3%***	15.2%	2.6%	10.5%	19.8%	14.1%	37.8%
24	66.7%**	30.8%	4.2%	14.5%	20.2%	10.6%	19.7%

25	-	-	-	-	-	-	-
26	-	6.33e-7%	1.33e-7%	6.30e-7%	1.87e-6%	2.53e-6%	100%
27	-	6.33e-7%	1.33e-7%	6.30e-7%	1.87e-6%	2.53e-6%	100%
28	-	-	-	-	-	-	-
30	-	38.0%	4.6%	14.9%	18.5%	8.9%	15.1%
32	-	-	-	-	-	-	-
Understanding of finance?							
1 (very low)	-	100%	7.71e-6%	1.73e-5%	1.28e-5%	4.77e-6%	7.20e-6%
2	50,0%	27.5%	3.5%	12.3%	18.0%	11.2%	27.5%
3	-	30.6%	3.7%	12.7%	17.8%	10.6%	24.7%
4	66.7%***	26.6%	3.4%	12.1%	18.0%	11.4%	28.5%
5	60.0%***	32.3%	3.8%	12.8%	17.6%	10.3%	23.3%
6	66.7%***	41.5%	4.1%	13.1%	15.9%	8.4%	16.9%
7 (very high)	90.0***	18.0%	2.6%	10.0%	17.2%	12.6%	39.6%
Education devoted to financial education?							
A lot	62.5%***	38.5%***	3.9%	12.8%***	16.7%***	9.1%**	19.1%**
Some	75.9%***	24.6%***	3.1%	11.3%***	18.1%***	11.8%	31.1%***
A little	70.0%***	27.7%**	3.4%	11.9%***	18.1%***	11.2%**	27.8%**
Hardly at all	25.0%	74.3%***	3.0%	7.8%	7.2%	3.0%	4.9%
Average change of probability in percent points for a one unit increase in the score							
Numeracy	-5.5%	+0.5%	+0.0%	+0.0%	-0,0%	-0.0%	-0.4%
Basic literacy	1.3%	-2.2%	-0.1%	-0,2%	+0.2%	+0.4%	+1.9%
Sophisticated literacy	+17%***	-11.9%**	-0.5%	-0.9%	+1.2%	+2.0%*	+10.2%**

Notes: *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. Column I reports probabilities of a logit regression whereas Column II shows ordered logit regressions. Demographic and self-assessment characteristics show an absolute probability value and the index scores an increase of probability when the index score increases in one unit.