Financial Literacy and Education: Lessons from the German Reunification*

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Preliminary Working Draft Please do not quote or cite.

Abstract

A growing body of literature shows the importance of financial literacy in affecting households' choices. However, few studies focus on understanding the determinants of different levels of financial literacy within a country. Our paper wishes to contribute filling this gap by analyzing the heterogeneity in financial literacy scores across Germany. By exploiting the unique set-up of German reunification, we suggest that the gap is not only to attribute to a geographical heterogeneity within Germany, rather to a different institutional framework, which reflected onto the educational system of the GDR and thus, on the possibility to acquire financial education at the individual level. We suggest that education can be a channel through which institutions and financial literacy are related in this specific context and we find evidence in support of this hypothesis.

Keywords: *financial literacy determinants, socialist education, German reunification, DiD*

*We wish to thank Horst Entorf for suggestions and comments. We are also grateful to participants at the joint SAFE-Bundesbank seminar, where earlier results were presented. We wish to thank all the participants in the 11^{th} Workshop of Political Economy (Dresden), the Equity in Education Workshop (KU Leuven).

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1 Introduction

Increasingly complex pension plans, credit products and financial services have amplified the role of individuals' literacy in financial matters. Because of the growing number of financial instruments readily available to households in their daily life-decisions, it comes with no surprise the attention that scholars and policy makers currently address to financial literacy. Early initiatives of OECD (INFE (2012)), followed by national surveys and training programs sponsored by the World Bank among others, have registered a, sometimes sizable, low level of financial knowledge around the world, especially in specific subgroups of the population. Parallel to that, there are evidence of financial ignorance highly correlating and possibly affecting poor financial behaviors at the individual level (see Lusardi and Mitchell (2014), among others).

Despite the importance of the topic and the quite heterogeneous variation in financial literacy levels within and across countries, few studies have successfully explained the origin of such different degrees of understanding in financial matters. We contribute to such question by analyzing the East-West German gap in financial literacy. The different financial literacy scores in East and West Germany are not a new finding, as reported by B-Koenen and Lamla (2014), and these have been proven to impact decisions relative to retirement planning (B-Koenen and Lusardi (2011)). The reason for such gap, however, is not clear. Our hypothesis, empirically tested with a Bundesbank collected household survey, is that the levels of financial literacy are determined by both the standard set of household/individual's characteristics and the institutional setting of a country, more specifically by the characteristics of the educational system. We exploit the unique set-up of German reunification, which provides an exogenous variation in the institutional setting of two countries by forcing the eastern part to quickly adapt to the political and economic structure of West Germany. The claim we make is that the institutional frameworks in place in the GDR and FDR from 1949 to 1990 provided different incentives to acquire financial education at the individual level, also affecting the current gap between East and West Germany. The inequality between financial literacy scores is not only to attribute to a geographical heterogeneity within Germany, rather to a different institutional framework, which reflected on the educational system of the GDR and thus, on the possibility to acquire financial education at the individual level. Hence, we focus our attention to education to be the channel through which institutions and financial literacy are related in this specific context.

Our identification strategy consists in comparing financial literacy scores of those who lived and got schooling in East Germany (the treated) to a control group who always lived in the West or to those who lived in the East but where affected by the unification process during their school path. Exploiting the wide range of birth cohorts included in the sample and the information on their region of residence in 1989, we investigate on whether there exists a significant difference in financial knowledge for those households living in the East

in scholar age, as compared to others. In particular, the individuals born in 1971 or earlier, in East Germany, were young enough to complete compulsory education under the socialist regime, and represent the group of treated individuals. Those born afterward in the East (hence, too young), as well as all the West Germany households, were not exposed (or only partially) to socialist education because of the exogenous shock of reunification.
The contribution of the paper is twofold. First, we employ a quite unexploited dataset, the Panel Household Finances, part of a wider European project coordinated by the European Central Banks on household finance. To our knowledge, no work on financial literacy has been done yet on the segment of population surveyed in the PHF. Second, we try to provide an explanation of an already documented gap between East and West Germany, by exploiting the exogenous variation in the institutional (and educational) framework of East Germany following the fall of the Berlin Wall.
We find that, in line with previous literature, variables capturing the socio-demographic and economic background of the respondents have the expected impact, but a consistent and significant gap between East and West Germany persists in the results. Among the determinants of financial literacy, education appears to be the factor that has the biggest positive effect, both on West and East Germany, and the one that may help the most in closing the gap between the two regions. Finally, we find evidence that the institutional setting of Germany, reflecting onto the educational system, plays a role in explaining the East/West division in financial literacy.
The rest of the paper is structured as follows. Section 2 briefly reviews the different strands of literature related to our paper. Section 3 and 4 present the empirical analysis. First, we introduce the PHF dataset and subsequently, we discuss our identification strategy and the main estimation results, in the attempt to explain regional differences in literacy levels across Germany. Section **??** concludes.

2 Literature Review

Our study is nested into three different lines of existing literature. The first one is about the consequences of financial literacy. The path-breaking initiative from Lusardi and Mitchell in 2004, who introduced for the first time a financial literacy module in the U.S. Health and Retirement Study, opened the path to a financial literacy literature. From then on, a growing body of studies have been analyzing costs, benefit and consequences of different levels of financial knowledge across various segments of the population. The questions written by Lusardi and Mitchell backed the development of a uniform way of assessing financial literacy, based on an index that tests individuals' knowledge about inflation, compound interest and diversification. The basic questions have then been further developed by scholars such as van Rooij et al. (2011), adding new items to capture more complicated aspects of

individuals' financial sophistication[1].

Several studies have shown financial literacy to correlate with a wide array of financial behaviors and outcomes[2]. Bernheim et al. (2001), exploiting the exogenous variation in financial curricula across U.S. and over time, find a link between exposure to financial information and savings. In more recent works, Behrman et al. (2012), Bernheim and Garrett (2003) and Lusardi and Mitchell (2007) suggest, more robustly, the existence of a causal relationship between financial literacy and assets or wealth accumulation in different population subgroups. Also Jappelli and Padula (2013) predict, both theoretically and empirically, a correlation between wealth and portfolio allocation choices and the individual stock of financial knowledge. van Rooij et al. (2011) show a link between literacy and stock market participation in a Dutch survey, employing a broader set of questions on financial sophistication as compared to the classical three-questions approach from Lusardi and Mitchell. Further, an higher degree of retirement planning is found among households with higher financial literacy (Lusardi and Mitchell (2007) and Fornero and Monticone (2011)) and these results are consistent with those of B-Koenen and Lusardi (2011) in East Germany, especially for households with low education and low income. For a detailed survey of financial behaviors associated with lower levels of financial literacy, such as mortgage decisions, personal debt and portfolio diversification, see Lusardi and Mitchell (2014)[3] [4].

A second line of research relates to the determinants of financial literacy. In spite of the increasing body of research on financial literacy and financial behavior correlations, the evidence on the determinants of financial literacy inequalities are still scarce. Current theories on the accumulation of financial literacy propose a production function for financial literacy (Delavande et al. (2008)) or a framework where financial literacy is an endogenous variable (Jappelli and Padula (2013), Lusardi et al. (2017)), dependent on the cost and return of it. While it is not clear yet the proper accumulation process of financial literacy, empirical studies have shown a number of correlations between financial knowledge and specific socioeconomic and demographic characteristics. In general, women exhibit lower levels of financial literacy (Lusardi and Mitchell (2008)), and this is consistently true regardless from the marital status and the country considered (Xu and Zia (2012)). Even though in cross-sectional studies it is quite difficult to disentangle age and cohort effects, Lusardi and Mitchell (2014) notice that financial literacy follows an inverted U-shape with respect to age, with the youngest and the elderly ones having lower literacy rates. Chen and Volpe (1998) and Chen and Volpe (2002) argue that education and experience have an important impact on the financial literacy of younger population. Other variables taken into consid-

[1] Please see Lusardi and Mitchell (2014) and Hastings et al. (2013) for more exhaustive review on the measurement of financial literacy.

[2] See Cole et al. (2016) and Gustman et al. (2012) for an alternative position on the topic.

[3] See Xu and Zia (2012) among others, for an overview of the issue around the world

[4] Note, as well, that there is a growing body of experimental evidence on the causal effect of financial literacy on financial behavior. See, Brugiavini et al. (2015), among others.

erations are wealth, marital status, number of children and employment (van Rooij et al. (2011)). The existing evidence shows generally low levels of literacy, and quite consistently so across population groups and surveys, but in most cases only descriptive results are available. The challenges in identifying financial literacy determinants are related to the presence of unobservable factors, such as cognitive or mathematical ability, and to the existence of possible reverse causality, which can bias the estimation results and make it difficult to claim the existence of a causal link (Behrman et al. (2012)).

Finally, our work also relates to the strand of literature on the long-lasting effect of communism on economic outcomes and, more specifically, on the effects of German reunification on individual outcomes. The international comparison of economic literacy by Jappelli (2010) suggests how more developed financial markets provide incentives to acquire financial knowledge and this fact is at the root of the lower literacy registered in former socialist countries. East and West Germany are found to differ on a variety of aspects, and many studies have looked for causal links between such differences and the divergent socio-economic framework experienced by the two regions for over 40 years. Fuchs-Schundeln and Haliassos (2015) reports a different degree of product participation among the two areas, and exploit the quasi-"experiment‘ of reunification to assess the impact of availability of new and unfamiliar products on Eastern citizens participation. Among others, Bonin and Euwals (2002) focus on the effect of reunification on different rates of women labor force participation, Fuchs-Schündeln and Schündeln (2015) on political preferences and Brosig-Koch et al. (2011) on solidarity behavior.

Our paper is most close to B-Koenen and Lamla (2014), which is also exploiting the exogeneity of German reunification to investigate the determinants of financial literacy. The authors find a significant gap in financial literacy between East and West, gap which remains mostly unexplained once they include in the model a broad set of control variables and perform a Blinder-Oaxaca decomposition. We can improve on their analysis by employing a nationally representative dataset, th Bundesbank PHF, which includes an higher number of observations and a broader range of cohorts exposed to the treatment of German reunification. This, together with the information on households' residence in 1989, allows us to increase the precision of the estimates and to better define the identification strategy.

3 The Data

Before describing the data, a short introduction of the German historical and political framework is provided. Then, we present the first descriptive results and some general findings about the dataset.

3.1 Historical Background

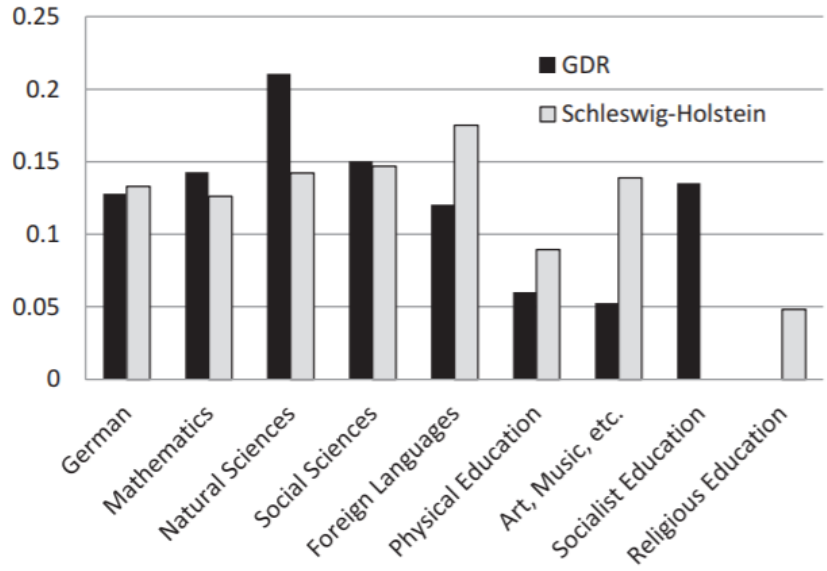
In the period between 1949 and 1990, Germany was divided in two states, as a result of the post World War II occupation. One in the East, the German Democratic Republic (GDR), characterized by a planned economy and a socialist political regime, and the other in the West of Germany, the Federal Republic of Germany (FRG), characterized by a market economy and a democratic political structure. The two regions had shared a common cultural and political-economic heritage, up to the end of World War II, they experienced for the subsequent 40 years radically different socio-economic paths, and were then unified again in the 90*s*, with the East quickly adapting to the Western socio-economic and political framework. The event of the reunification following the Berlin Wall fall represents an interesting exogenous shock to the institutional and political settings of East Germany, as this part of the country was forcibly assimilated to the West German system.

Fuchs-Schündeln and Masella (2016) concretely summarize the educational system in the GDR and FDR, as well as the reunification process after 1989. Figure 1 shows the curricula difference in the former two regions of Germany. The GDR allocates more than 10% of the school time to socialist education, which is supposed not to help improve financial literacy, however, slightly more time is allocated to mathematics, natural sciences and social sciences, as compared to the FDR. Those subjects, numeracy especially, have been proven to highly correlate with financial literacy outcomes. For example, mathematical ability might improve people's understanding of compound interest rate, since it requires the ability of calculation.

The reform of the educational system was one among the many reforms the East experienced shortly after the reunification, and consisted in the Eastern system assimilating the main features of the Western schools. According to Fuchs-Schündeln and Masella (2016), "The educational system in the GDR was transformed rapidly after the fall of the Berlin Wall in November 1989", especially the immediate remove of socialist content of education. The changes in the system were affecting both the structure of the schools and the content of the programs.

First, the pre-1990 East was not adopting a tracking system, as opposed to West Germany, where students were stratified into different schools according to their early-school achievement levels. Second, compulsory schooling was lasting 10 years in the GDR, the so-called *Polytechnische Oberschule* (A6), period after which the students could have access to higher educational tracks, like universities, or to applied studies, combining hours of education and apprenticeships. However, the acceptance criteria into apprenticeships or higher education were centrally planned, and not necessarily based on academic merits. In addition, there was a clear goal in the East German system to support the formation of a so-called socialist personality (*allseits entwickelte sozialistische Personlichkeif*), giving importance not to individuals' ability levels, rather to overcoming disparities across individuals through unitary

Figure 1: Curricula in East and West Germany



Source: Fuchs-Schündeln and Masella (2016), Figure 1. It shows the share of overall teaching time devoted to certain subject areas in East Germany and the western state of Schleswig-Holstein, averaged across grades 7 to 10.

and highly centralized teaching strategies and curricula (Marsh et al. (2001)).

3.2 The Panel Household Finances Survey

Our dataset consists of the nationally representative 2010 and 2014 waves of the PHF (Panel Household Finances), a new household level survey, conducted by the Deutsche Bundesbank. The survey covers information on balance sheets, pensions, income, work-life and other households' demographic characteristics and was collected as an integral part of the Household Finance and Consumption Survey (HFCS), taking place in all euro areas countries[5].

In order to exploit the most recent information on financial literacy patterns in Germany, the main sample employed in our empirical analysis consists of all the households from the second wave, for a net of 4,461 observations[6].

The PHF dataset is characterized by a stratified multi-stage sampling design method, and, unless otherwise stated, we employ survey weights to adjust for the oversampling of wealthy households and get consistent inference for the whole population. Moreover, in

[5]For more detailed information on PHF dataset, see: `www.bundesbank.de/Navigation/EN/Bundesbank/Research/Panel_on_household_finances/panel_on_household_finances.html`

[6]The German PHF survey has a large panel component: all households are re-contacted, all individuals tracked, split households are taken into accounts. About 2,300 households participated in both waves

order to mitigate the issue of missing response items, an iterative multiple imputation (MI) procedure is used in the PHF survey. More specifically, five multiple imputed datasets are generated following Rubin's method (Rubin (1987), Rubin (1996)). We include all the five imputed datasets for our descriptive results in order to increase the efficiency of the analysis, but in the empirical section we perform the analysis exclusively on the first set of imputations, since for our variables of interest very few values were missing [7](appendix table A1 presents the ratio of missing observations for the key variables.).

As of now, the PHF is the biggest and most comprehensive household level survey data in Germany, which allows us to check both cross-sectional and time dimensional evidence for financial literacy drivers.

3.3 Measures of Financial Literacy

The survey employs the three standard questions on financial literacy which were firstly used in the US 2004 Health and Retirement Study (HRS). This set of questions has been widely used in national and international surveys to investigate household financial literacy, e.g., U.S. 2007-2008 National Longitudinal Survey of Youth. The information has been collected exclusively from the financial knowledgeable person (FKP in the following) at the household level. The three questions are as follows:

- Let us assume you have a balance of €100 in your savings account. This balance bears interest at an annual rate of 2%, and you leave it there for 5 years. What do you think: how high is your balance after 5 years? [Higher than €102; Exactly €102; Lower than €102.]
- Let us assume that the interest paid on your savings account is 1% per year and the inflation rate is 2% per year. What do you think: After a year, will you be able to buy just as much, more or less than today with the balance in your savings account? [More; Just as much; Less than today.]
- Do you agree with the following statement: "The investment in the stock of a single company is less risky than investing in a fund with stock in similar companies"? [I agree; I do not agree.]

Table 1 below reports the financial literacy patterns in Germany using the sample of interest described above, as well as the first wave separately.

[7]Results are not qualitatively different when we make use of the other imputed datasets, or when we perform the analysis using the "mi estimate' command in STATA. Results are available upon request.

Table 1: Financial Literacy Patterns in Germany

Panel A: Distribution of Answers to each Financial Literacy Question

	Correct	Incorrect	DK	Refuse
Wave 1				
Compound Interest	82.28%	14.02%	2.69%	0.95%
Inflation	87.32%	8.60%	2.59%	1.43%
Risk Diversification	70.05%	15.08%	12.90%	1.96%
Wave 2				
Compound Interest	85.94%	10.02%	2.72%	1.28%
Inflation	87.32%	8.16%	2.03%	1.37%
Risk Diversification	71.90%	12.05%	14.38%	1.67%

Panel B:Distribution of Correct Answers

	All 3 responses correct	Only 2 responses correct	Only 1 response correct	No response correct
Wave 1	58.98%	26.35%	10.01%	4.66%
Wave 2	62.32%	24.47%	9.26%	3.96%

Source: PHF-Bundesbank (own calculations based on the first of the imputed datasets). Results are weighted. "DK‘ stands for "I don't know‘.

We observe higher levels of financial literacy for the 2014 survey as compared to those resulting from B-Koenen and Lusardi (2011) using 2009 SAVE dataset. There, the correct answer ratio for the questions of compound interest, inflation, risk diversification is 82.4%, 78.4% and 61.8% respectively, while here we get 84.01%, 87.43%, 70.39%, correspondingly. The 2010-2011 wave PHF data also indicates higher financial literacy, especially on risk diversification than B-Koenen and Lusardi (2011). Overall, financial literacy levels for German households are quite high also when we compare them with other countries[8]. At a disaggregated level, we see a 3.66% increase for the ratio of answering compound interest question correctly from wave 1 to wave 2, and a moderate rise of 1.85% of correct answers on the risk diversification question.

Panel B shows the distribution of correct answers: The share of household answering all three questions correctly has increased by about 3.5% across waves and the question on compound interest rate has contributed the most to such improvement. In spite of an increase of almost 2.0% from wave 1 to wave 2, the ratio of FKP who can answer risk diversification question correctly stays the lowest among the three.

We define an individual as financially literate if she answers all three questions correctly, and, in line with other studies on the topic (see, e.g., B-Koenen and Lusardi (2011),Lusardi and Mitchell (2008)), we employ a dummy to capture such information. This is the main dependent variable of the paper. In future development of the analysis of the specifications, we will make use as well of disaggregated dummies, one for each correct answer.

We implemented a Cronbach's alpha test to examine the internal consistency of our financial literacy measure [9], and we find our index to have a modest reliability, with an estimated correlation of about $0,775$. The item-test correlation is similar for the three financial literacy questions, and we find that removing any of the items from the index would decrease the Cronbach's α, meaning that the scale would become less reliable, which is an argument for keeping all the current items in our scale.

3.4 A Glance at the West/East Divide Financial Literacy

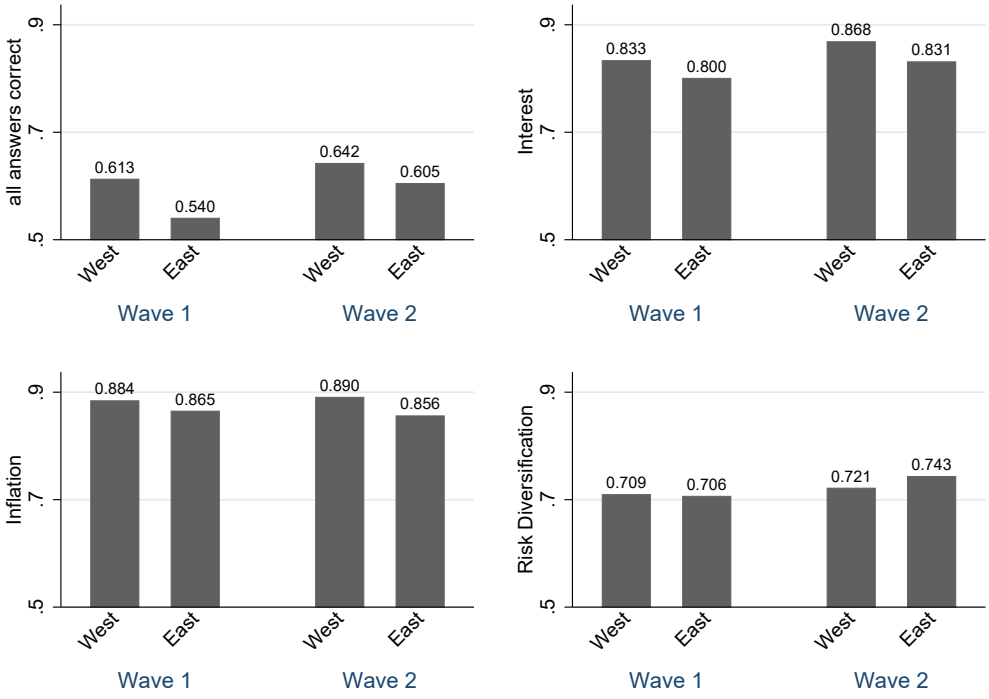
The survey questions on individual's residence in 1990 and today allow us to track where, in Germany, the financially knowledgeable person grew up and, likely, got education from. Figure 2 and the descriptive results in appendix A2 underline the existence of a regional divide for financial literacy patterns. Households living in West Germany exhibit consistently higher correct-answer-rate over the two waves, even though this discrepancy decreases over time. The only exception is represented by the answer to the risk diversification question, where East German households perform better in both waves.

The generally higher correct-response ratio to the inflation question might be caused by the

[8] See, among others, Agnew et al. (2012) for Australia, Sekita (2011) for Japan, Lusardi and Mitchell (2011) for USA. Table 2 of **?** presents a summary table on financial literacy around the world

[9] Restults available upon request.

Figure 2: Financial Literacy and The Residential Location



Source: PHF-Bundesbank, own calculations.
Note: Financial literacy question correctly answered for both waves, plotted according to current residence of the household in 2014. We drop the observations who were not resident in Germany in 1989, which accounts for 5% of the sample. The first histogram reports the percentage of households answering correctly to all questions, the remaining three reports the three questions at a disaggregated level. Data are weighted and only the first imputation has been taken into account.

fact that inflation affects households' daily life more poignantly. The lower improvement from wave 2 to wave 1 on the inflation question as compared to the other items indicates the possible impact from the low inflation rates of Germany through 2010 to 2014 [10]. Households living in East Germany have higher ratio of correct answers on risk diversification, possibly because of their greater exposure to the economic shock of reunification and their more conservative attitude towards risks due to historical reasons[11]. Note, however, that East-West financial literacy differences are not statistically significant, when using current residence as a relevant variable.

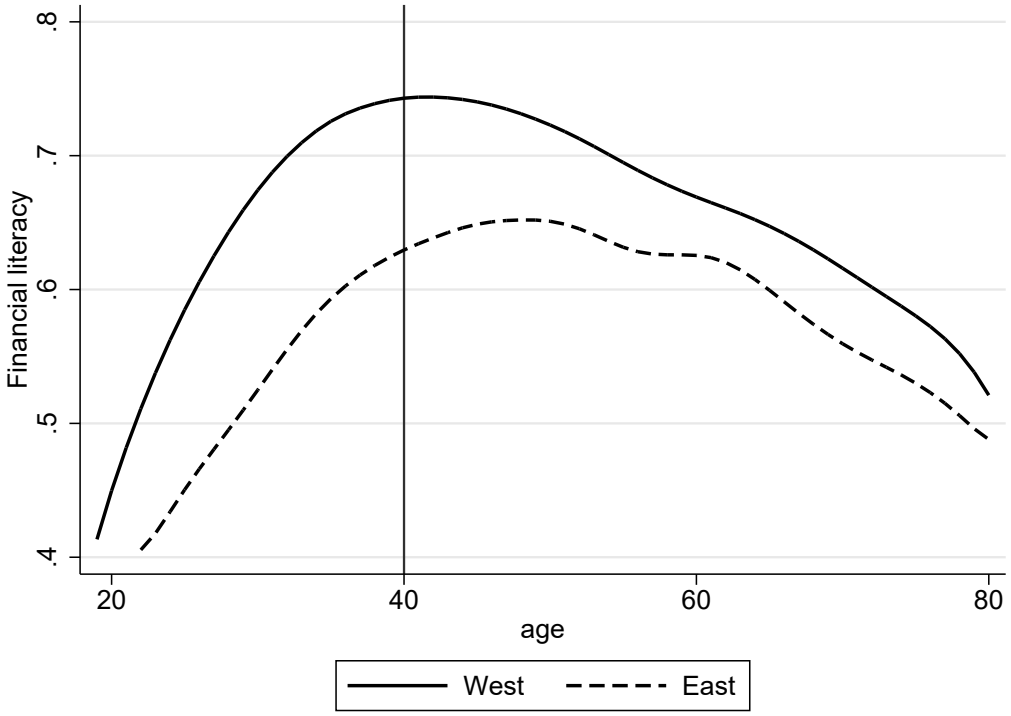
Figure **??** shows clear differences in the gap between East and West across different cohorts. In line with previous findings (see Xu and Zia (2012) for an overview), both regions exhibit an inverted U-shape of financial literacy with respect to age, but the gap between East and West appears to be wider for the age group around 40. Younger and older households were less -or not at all- exposed to the different educational systems, while the age group 36 to 50, indeed, is made by those households who fully completed their school during the Cold War. Hence, Figure **??** suggests, at least from a descriptive perspective, a positive correlation of the unified educational system.

Table A2 in the appendix reports summary statistics of the East/West divide in financial literacy over other demographic characteristics. West Germany scores better than East Germany over most of the demographic characteristics, with the exception of the female subgroup. Education seems to be a particularly strong determinant of financial literacy in the East.

[10] During this period, the highest annual inflation rate of Germany is 2.04% in 2012, while 3.29% in Italy in 2011, and 2.47% in France in 2011. Source: `http://www.inflation.eu/inflation-rates/germany/historic-inflation/cpi-inflation-germany.aspx`.

[11] However, Fuchs-Schündeln and Schündeln (2005) suggest a higher degree of risk aversion among civil servants in the West than in the East, which is mainly due to the low labor income risk in the former GDR (pp1087, pp1101).

Figure 3: Financial Literacy Over Age



Source: PHF-Bundesbank, own calculations.
Note: The first wave of the PHF dataset is employed. Residence refers to respondents' residence at the time of survey. The figure is smoothed by lowess filter.

4 Empirical Evidence

Given the endogeneity of most socio-economic variables, it is often hard to disentangle different drivers of financial literacy. The reunification, however, can be seen as exogenous shock to financial literacy, based on the assumption that this political event was not affected by the financial literacy of people back to that time (B-Koenen and Lamla (2014)). As B-Koenen and Lamla (2014) have pointed out, the reunification in 1989 had considerable effects in Germany, especially in the East, because "a large series of policy reforms followed the political reunification", and "West German institutions were adopted in East Germany".
Given the descriptive evidence for the East/West divide in financial literacy, we first try to identify whether residence is a significant correlate of financial literacy scores, and how do other individual-level determinants differ by region of residence. We employ probit as our main empirical model, following Lusardi et al. (2010) among others, but we still implement linear probability model and/or logit model as comparisons. We then implement a difference-in-difference strategy in order to check more specifically the role played by institutions through different educational systems. In the robustness check, we investigate further how stable the effect of regional division is when using different samples. Our main dependent variable is a dummy for answering all the three questions correctly, but estimations for disaggregated FL are selectively reported whenever necessary for providing further insights. In the DID approach and robustness check, we focus on the aggregated measure of financial literacy.
As mentioned in the previous section, our results are based on the sample of the second wave unless otherwise stated, which can provide us a most recent picture of the financial literacy in Germany. We only report regression results from using one of the five imputed data sets, but results are consistent when using MI estimate methods.[12].

4.1 The East/West Divide Determinants of Financial Literacy: A Benchmark

Following the previous literature, the main sets of explanatory variables for financial literacy include socio-demographic characteristics, such as age, gender, marital status and education, preference parameters, such as risk preferences, and economic-related variables, such as employment status.
Following Lusardi et al. (2010), our baseline model is a probit model, allowing us to capture the feature of the binary response design of the financial literacy index. For the sake of completeness, we also report results from OLS and/or logit, whenever applicable. Our

[12]Which is not surprising, given that there is no missing value for the financial literacy questions variables and there are very few for other key variables of interest

model is as follows:

$$y_i^* = \boldsymbol{X_i^T}\boldsymbol{\beta} + \epsilon_i, \quad y_i = \begin{cases} 1 & if \quad y_i^* > 0 \\ 0 & otherwise \end{cases}$$

$$P(y = 1|\mathbf{X}) = \Phi(\boldsymbol{X_i^T}\boldsymbol{\beta}),$$

where $\boldsymbol{X_i^T}\boldsymbol{\beta} = \alpha + \sum_{k=1}^{K} \beta_k X_{ki} + \epsilon_i$, and Φ is the cumulative distribution function (CDF) of the standard normal distribution. The parameters are estimated by maximum likelihood. If the independent variable is binary, as it is the case for the residence location dummy *East*, the effect of a 0 to 1 change in x_{ki} on the probability of success, i.e. the probability of correctly answering one or more of the financial literacy questions, is given by

$$\Phi(\alpha + \beta_1 x_{1i} + \beta_2 x_{2i} + ...\beta_j * 1 + \beta_k x_{ki}) - \Phi(\alpha + \beta_1 x_{1i} + \beta_2 x_{2i} + ...\beta_j * 0 + \beta_k x_{ki}).$$

Table 2 below reports the estimated effect of residence in the East at the time of the survey on financial literacy and it includes all the independent variables which can be categorized into the above-mentioned sets of determinants. Further analysis in the chapter will limit the independent variables to the most relevant ones, but in the Appendix table A4 you can find the estimated coefficient for a complete set of regressors for OLS and Probit. In the estimation results presented from table 2 onward, we decided to discard several economics regressors, to avoid issues with 'bad control' covariates, and the preference parameters since they had a negligible impact both in quantitative and qualitative terms.
Unlike the results displayed in table 3 of B-Koenen and Lamla (2014), being an Eastern resident does not always significantly correlates with financial literacy levels. The R squared obtained from OLS regression model lies in the range of around 10% to 18%, which is quite comparable to those from B-Koenen and Lamla (2014). The results are presented after controlling for immigration between East and West Germany.
The table suggests that the residence dummy significantly drives literacy as far as concerns risk diversification and interest rate items, but not inflation. At aggregated level, current residence has no significant effect on financial literacy. It is possible that households exposed to different environment diverted their attention to different aspects of financial literacy, while at the aggregated level the differences in single items compensate each other.

Clearly, residence itself cannot capture the complete picture of the regional divide in financial literacy. Looking at the determinants of financial literacy by East/West will help us to check further which ones might be regionally dependent. Table 3 presents an East/West divide determinants of financial literacy [13]. The summary statistic on the selected key vari-

[13]Please check the following reference about why it is meaningless to conduct significance check on the difference by groups. `http://www.statalist.org/forums/forum/general-stata-discussion/general/1302193-logit-probit-how-to-compare-coeficients-between-groups-n-and-m-size`

Table 2: The Effect of Residence in the East on Financial Literacy

	(1) Joint	(2) All Correct	(3) FL1	(4) FL2	(5) FL3
OLS	-0.025	-0.017	-0.026	-0.047**	0.048*
	(-0.537)	(-0.586)	(-1.108)	(-2.154)	(1.753)
Logit	0.001	-0.015	-0.021	-0.039**	0.053**
	(0.398)	(-0.479)	(-1.054)	(-2.052)	(1.972)
Probit	0.001	-0.017	-0.023	-0.041**	0.053*
	(0.317)	(-0.546)	(-1.100)	(-2.078)	(1.952)
N	4111	4111	4111	4111	4111
R2(For OLS)	0.181	0.139	0.108	0.092	0.120

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: "Joint" indicates the number of correct answers to the three FL questions. "All Correct" indicates whether the respondent answers all the three FL questions correctly or not. The marginal effects are reported for the logit/probit model. Only the first set of imputed data for the second wave is used. Unless otherwise indicated, we drop the households who were not resident in Germany in 1989. Those observations account for 5% of the whole sample.

ables by the east-west divide are given in the appendix by table A3.

The coefficients presented in table 3 are marginal effects from Probit model. A few determinants, including gender and education, have consistently significant effects on different aspects of financial literacy. Being a female will decrease the household's financial literacy, while education will always increase it, regardless for the level. Also respondents' age is highly correlated with financial literacy, both in the East and in the West; being unemployed is relevant to financial literacy scores only for households living in the West.

Due to the non-linear features of the Probit model, it is hard to compare the significance of differences across groups, hence, we report the significance of mean differences between West and East in tableA5 in the appendix from OLS estimation. The results of comparison is only reported for the estimations for aggregated level FL [14]. We can see that *Age, Gender, Middle-level secondary school, and being unemployed* play very different roles in driving the aggregated level of financial literacy scores in East and West Germany.

Among all the covariates, education plays an important positive role, and it seems to do so especially for Western households. We see different possible explanations to this fact. First, it is possible that even 30 years after the reunification, the educational system still present inequalities, so that education only plays significantly positive role in financial literacy in the West. Second, the regional gap in financial literacy was even bigger back to the time before the reunification. Third, since the reunification, it costs people from the East to adapt to the new system to compensate the positive effect of the reunification on financial literacy.

[14] Estimations are also conducted for disaggregated level FL, but not reported for the reason of simplicity. The results can be seen upon request.

In any case, education plays regionally different roles on individual's financial literacy.
Given the large impact of institutional arrangements in East Germany after the reunification, including the change in the educational system, we tend to believe that the adoption of the educational system from the West after the reunification helps the East to improve their financial literacy, which has partially closed the gap along the integration process. Indeed, at the disaggregated level, education from the two regions of Germany plays similar roles on people's literacy on interest rate and risk aversion.
One possibility that might harm our conclusion is that even nowadays the educational system in the East is quite similar to the old system before the reunification. Then we should interpret the above results not in favor of the positive effects of educational. However, the well-known integration process of Germany since 1989 suggests it not likely to be the case. Another issue in the analysis would be given by too many FKPs getting education from one side of Germany, while resident in the side of Germany, which we cannot identify in our dataset. For example, the coefficients of education for the east will be upward biased if too many people get their education from the West, while set down in the East. As a result, a higher positive effects of education system of the West to FL will be confirmed, and thus the positive effect of the reunification. However, in our sample, only 8.3% have immigrated from one side to another side of Germany, between 1989 and the time of survey, so that we hope that a large ratio of residence mobility is not a concern of our sample even before 1989.

Table 3: West/East Divide Determinants of Financial Literacy

	West	East	West	East	West	East	West	East
	All correct		FL1		FL2		FL3	
Age	0.012*	0.021*	0.003	0.004	0.006***	0.008***	0.012***	0.016***
	(1.935)	(1.881)	(0.668)	(0.471)	(6.085)	(3.926)	(7.067)	(5.101)
Female (d)	-0.116***	-0.247***	-0.073***	-0.088**	-0.059***	-0.069***	-0.080***	-0.143***
	(-4.040)	(-4.834)	(-3.806)	(-2.363)	(-10.479)	(-6.839)	(-9.486)	(-9.305)
Lower level secondary school (d)	0.197**	-0.019	0.175***	0.216**	0.113***	0.125***	0.166***	0.176***
	(2.112)	(-0.068)	(4.045)	(2.195)	(8.401)	(6.063)	(6.499)	(4.156)
Mid-level secondary school (d)	0.281***	0.281	0.174***	0.307**	0.136***	0.254***	0.226***	0.275***
	(3.730)	(1.097)	(6.188)	(2.138)	(15.796)	(9.000)	(11.204)	(6.091)
Secondary school with diploma (d)	0.289***	0.174	0.135***	0.134***	0.107***	0.102***	0.233***	0.226***
	(5.256)	(0.736)	(9.696)	(3.188)	(25.831)	(10.749)	(17.277)	(11.371)
Upper level secondary school (d)	0.389***	0.304	0.192***	0.233***	0.167***	0.189***	0.309***	0.274***
	(6.661)	(1.482)	(7.498)	(3.501)	(21.729)	(14.527)	(19.503)	(9.389)
Self-employed (d)	0.082	0.086	0.038	0.099***	0.034***	0.049***	0.056***	-0.031
	(1.599)	(0.829)	(1.537)	(2.900)	(4.310)	(3.287)	(3.672)	(-0.819)
Unemployed (d)	-0.193**	-0.105	0.017	-0.105	-0.028*	-0.040*	-0.122***	-0.070**
	(-2.190)	(-1.127)	(0.403)	(-1.074)	(-1.840)	(-1.807)	(-4.435)	(-2.345)
Retired (d)	-0.037	0.029	0.006	-0.012	-0.024**	-0.024	-0.016	-0.035
	(-0.779)	(0.308)	(0.207)	(-0.175)	(-2.309)	(-1.223)	(-1.133)	(-1.251)
1 if there is migration (d)	-0.038	0.080	0.012	0.039	-0.020	0.079***	-0.080***	-0.011
	(-0.507)	(1.200)	(0.283)	(0.867)	(-1.422)	(7.791)	(-3.541)	(-0.509)
N	3317	796	3317	796	30380	6930	30380	6930

Marginal effects; t statistics in parentheses

Results are weighted.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The first wave data is used to estimate the regression on FL1 for the East, as the estimation doesn't converge when using the second wave data. There is no significant nonlinear effects of age.

4.2 Education As a Channel of the Reunification Affecting Financial Literacy: the DID Approach

As suggested by B-Koenen and Lamla (2014), the division of Germany into the FDR and the GDR and the subsequent fall of the Berlin wall in 1989 can be considered as events exogenous to the levels of financial knowledge prior to the division and to unobserved variables at the household levels. We thus apply a difference-in-differences estimation as our main empirical specification to further uncover the causal effect of education under the socialist regime on financial literacy. The idea is that the Berlin Wall fall can be taken as a quasi-natural experiment which hugely impacted the East: we expect financial literacy of Eastern households to exhibit different patterns from Western households over cohort because of the reunification process, after controlling for the common factors impacting both the West and the East.

We use residence of households in 1989 (the older households) or in the time of survey (the younger households) to define the treatment and control groups. Only those who received more or less education from the east after the reunification are treated[15]. The remaining households are in the control group. The estimation equation is as follows:

$$P(Y_i = 1|\mathbf{X}) = \Phi(\alpha + \beta X_i + \gamma_1 East_i + \gamma_2 Treat_i + \delta East_s * Treat_i + e_i)$$

where the independent variable Y_i is household i, answering all three financial literacy questions correctly. X_i is the set of independent variables as mentioned in section 4.1, and δ is the coefficient of interest. $East_i$ equals to 1 if an individual was resident in East in 1989, and $Treat_i$ equals to 1 if an individual is younger than a threshold as described later. $East_i * Treat_i$ defines those received the treatment.

In the first specification, we assume that primary school education is the one with the biggest impact on later-in-life outcomes (in this case, financial literacy as measured by the 2014 survey). Those people who have finished their primary school before 1989 (i.e. when Germany was still divided as a country) and are expected to exhibit lower levels of financial literacy, as compared to other cohorts in the East and to all the cohorts in the West.

Considering that the official end of primary school is at 12 years of age, those who are affected by reunified educational systems are at most 37 years old (or younger), at the time of the survey. In this case, we generate cohort dummy equal to 1 if the age of a FKP is younger than 37 years, and equals zero otherwise. This is the time variable for the treatment in a standard DID model. *East* equals to one if the residence of a FKP in 1989 is the East, zero otherwise. If one FKP is younger than 37 years old in 2014 and was living in the East, which means the difference-in-difference term is equal to one, then she is treated by the exogenous

[15] As it has been argued in section 4.1, we use the location of residence as a proxy for where did the respondent hope this assumption will not affect our conclusion, even though we only use the age cohort and residence, while not obtaining education or not, to define the treated group.

shock of the reunification.

If δ is significant, being treated by the unification of Germany has significant effect on household's financial literacy as we suggest through the effect of the educational system. Two other specifications assume that either high school education or college education are critical to household's financial literacy, and we adjust the threshold accordingly in the two cases, i.e. 42 (or younger) and 46 (or younger) years old in 2014, respectively. It is worth of noting that our specification can only identify the overall effect of exposure to the reunified education system on financial literacy. For example, an individual from the East with university degree who is 43 years old in 2014 (i.e. 18 years old in 1989) is exposed to the reunified education system for 4 years and to the FDR education for 4 years. We can only estimate the combine effect of the 18 years education, but not the net effect of the education received after the reunification.

Before the reunification, the educational system in the eastern part was organized as can be seen in Table A6 in the Appendix. Although the school age is quite similar between the two states, the emphasis within systems was posed on different subjects. For example, full employment was said to be one of the main aims of education in the East, which also had a heavier focus on math and science. This, in principle, could favour households to answer the financial literacy survey.

Table 4 reports the weighted mean of the key variables by the regional and treatment variables. The region is defined by the residence of the respondent in 1989. As variables such as retirement are closely related to age, based on which we define the treatment, we do not report summary statistics on those variables. The main systematic difference comes from the mean of migration rate, which is over 10% in the East and around 6% in the West. By our definition, migration dummy equals to 1 if an observation resident in two regions in 1989 and the time of residence.

Table 4: The Sample Mean by Groups

	Full	West		East	
		Treated	Control	Treated	Control
Female	0.481	0.490	0.467	0.484	0.524
Migration	0.075	0.060	0.058	0.206	0.104
Self-employment	0.071	0.054	0.079	0.048	0.074
Unemployed	0.043	0.069	0.023	0.076	0.077
Observations	4,113	583	2,836	193	501

Note: Results are weighted.

4.2.1 The Benchmark

Table 5 below presents the positively significant effect of the treatment on financial literacy measured by answering all three FL questions correctly. Residence in the East in 1989 appears to have a negative effect on financial literacy in all the three scenarios. Being exposed to the treatment of reunification, younger residence in the east, increases the financial literacy of the respondent, with an effect between 13% and 17% for the first two specifications. In the third specification, those who are younger than 24 in 1989 and resident in the east by then are those received the treatment. The insignificance of the coefficients might arise from stronger effects of other unobserved variables. The bigger coefficients for the DID term in regression (2) as compared to (1) suggests possibly some positive role of receiving higher education in the East on financial literacy.

When we compare the results in table 5, we see the marginal effects estimated by the Probit model are very close to the estimation from OLS estimation, which confirms the reliability of our results. One issue of Probit model we need to be aware of, is the marginal effects for interaction terms. As Norton et al. (2004) have pointed out, the marginal effects of the interaction term in Probit model depends on other independent variables. As a result, we should get a curve, instead of a point estimate for the marginal effects of the interaction term. In order to compare the results, we report the real marginal effects of the $East * Treat(2)$ in figure 4 using the command introduced byNorton et al. (2004). The positive effects of the treatment on the exposed people are still significant.

Figure 4: Real Marginal Effects of $East * Treat(2)$ Term on Financial Literacy

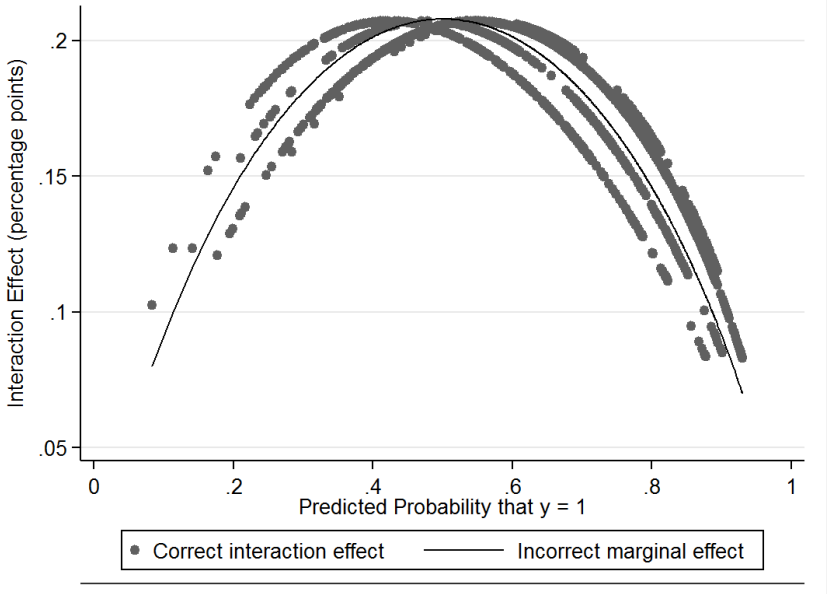


Table 5: Education as a Channel Through which the Reunification Affected FL

	< 12 in 1989		< 18 in 1989		< 22 in 1989	
	Probit	OLS	Probit	OLS	Probit	OLS
Age	0.011	0.010	0.012	0.012	0.014**	0.014**
	(1.208)	(1.220)	(1.469)	(1.604)	(2.065)	(2.147)
Female	-0.145***	-0.137***	-0.145***	-0.137***	-0.146***	-0.138***
	(-5.789)	(-5.872)	(-5.798)	(-5.881)	(-5.806)	(-5.898)
Lower level secondary school	0.170*	0.170**	0.171**	0.170**	0.168*	0.169**
	(1.955)	(2.039)	(1.975)	(2.058)	(1.941)	(2.031)
Mid-level secondary school	0.308***	0.339***	0.309***	0.339***	0.306***	0.337***
	(4.305)	(4.041)	(4.343)	(4.074)	(4.286)	(4.037)
Secondary school with diploma	0.283***	0.357***	0.285***	0.360***	0.282***	0.356***
	(5.379)	(4.000)	(5.493)	(4.066)	(5.341)	(4.004)
Upper level secondary school	0.385***	0.452***	0.386***	0.453***	0.383***	0.450***
	(7.001)	(5.380)	(7.083)	(5.439)	(6.949)	(5.382)
Self-employed	0.086*	0.072*	0.085*	0.072*	0.085*	0.072*
	(1.845)	(1.925)	(1.865)	(1.942)	(1.837)	(1.920)
Currently unemployed	-0.150**	-0.141**	-0.150**	-0.140**	-0.153**	-0.143**
	(-2.332)	(-2.376)	(-2.307)	(-2.345)	(-2.362)	(-2.392)
Retired	-0.026	-0.022	-0.027	-0.024	-0.030	-0.027
	(-0.598)	(-0.547)	(-0.638)	(-0.602)	(-0.712)	(-0.658)
Migrated	-0.006	-0.008	-0.011	-0.012	-0.010	-0.011
	(-0.131)	(-0.172)	(-0.227)	(-0.271)	(-0.194)	(-0.241)
East	-0.086**	-0.078**	-0.117***	-0.107***	-0.107***	-0.099***
	(-2.474)	(-2.484)	(-3.202)	(-3.236)	(-2.793)	(-2.886)
Treat (1)	-0.065	-0.058				
	(-0.805)	(-0.836)				
East*Treat(1)	0.128**	0.126**				
	(2.193)	(1.979)				
Treat (2)			-0.065	-0.049		
			(-0.908)	(-0.790)		
East*Treat(2)			0.172***	0.177***		
			(3.515)	(3.102)		
Treat (3)					-0.023	-0.018
					(-0.386)	(-0.345)
East*Treat(3)					0.125**	0.130**
					(2.382)	(2.350)
N	4113	4113	4113	4113	4113	4113
r2		0.119		0.122		0.120

Marginal effects; t statistics in parentheses.

Results are weighted.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4.2.2 Robustness Checks

The result in table 5 might be biased by several reasons. First...In the robustness check, we implement mainly three checks...

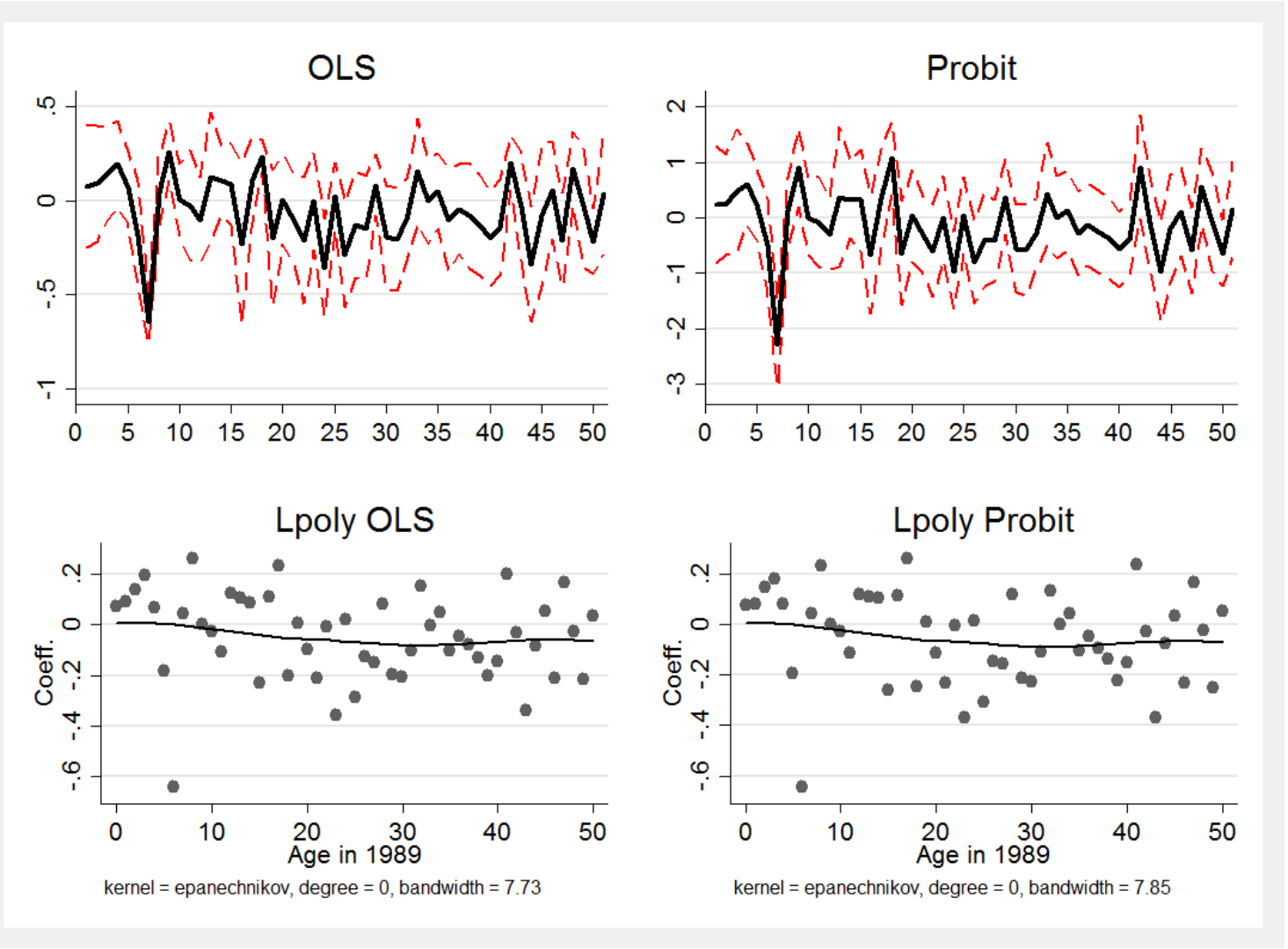
- *Estimates for Each Cohort*

If we maintain the assumption that education is a main channel through which the reunification affects financial knowledge, we should expect increased scores for the younger eastern cohorts. The younger the eastern FKP, the more she is exposed to the reformed educational system after the reunification and the higher the expected positive effect on her financial literacy. We employ again the probit modification, as follows:

$$P(Y_{ic} = 1|\mathbf{X}) = \Phi(\alpha + \beta X_i + \gamma_1 East_{ic} + \sum_{c=1}^{48} \gamma_c Treat_c + \sum_{c=1}^{48} \delta_c East_i * Treat_c + e_{ic})$$

We consider cohorts aged 1 to 50 in 1989, i.e. aged 26 to 75 years old in 2014. Because of the difficulty of interpreting the coefficients of interaction terms in Probit model, as mentioned above, we also estimate the marginal effects using OLS specification.
Figure 5 presents the estimation of δ_c from both the Probit and OLS model.The Kernel-weighted local polynomial smoothing in the lower panel shows a decreasing trend of the coefficients over age, as expected. One thing to notice is that the financial literacy of older cohorts who have completed their education in 1989 (i.e. 22 years old or older) is supposed to be affected by the reunification through other channels like culture, rather than the educational channel. As there is a negative effect of the reunification on the older cohorts in the East, the positive effect of reunification on younger cohorts through education might be underestimated. The trend is robust to wider bins of cohorts and to dependent variable of the number of correct answers (figure **??**).

Figure 5: Effects of the Treatment for Each *Cohort* and *East*



Given the important role of cohort,i.e. age, in our identification strategy, we implement the DID method on different sub-samples corresponding to different age groups who were likely to be in higher education in 1989.
Table 6 shows consistently positive effects of the reunification treatment on financial literacy for observations aged 26 to 74 in 2014, which is consistent with what we mentioned above. The significant coefficients in column 2 indicates again a more important role of higher education than mid-high school education. OLS estimation in column 2 suggests a 16% increase on the probability of answering all FL questions correctly if one eastern German has finished the lower education in the former GDR upon 18 years old in 1989, and receives the education in the unified country. When we further restrict our sample to observation who were 13 to 23 years old in 1989, the results shown by table 7 suggest an even higher positive effect, i.e. above 20% higher probability of the reunification on closing the gap of east/west divide financial literacy.

Table 6: Observation of the Age of 26 Through 74 Years Old

Dep.Var	(1)		(2)		(3)	
Dumm.for All Correct	12 Years Old in 1989		18 Years Old in 1989		24 Years Old in 1989	
	Probit	OLS	Probit	OLS	Probit	OLS
Age	0.018	0.016	0.018*	0.017*	0.018**	0.017**
	(1.456)	(1.368)	(1.668)	(1.668)	(2.259)	(2.171)
Mid-level secondary school (d)	0.138***	0.150***	0.139***	0.151***	0.135***	0.148***
	(4.427)	(4.414)	(4.456)	(4.449)	(4.332)	(4.337)
Secondary school with diploma (d)	0.175***	0.201***	0.177***	0.205***	0.174***	0.201***
	(4.891)	(4.611)	(4.971)	(4.676)	(4.849)	(4.589)
Upper level secondary school (d)	0.238***	0.249***	0.240***	0.251***	0.236***	0.247***
	(7.796)	(7.106)	(7.831)	(7.153)	(7.679)	(7.024)
East*Cohort(1)	0.111*	0.106				
	(1.774)	(1.586)				
East*Cohort(2)			0.149***	0.153**		
			(2.870)	(2.569)		
East*Cohort(3)					0.064	0.068
					(1.105)	(1.181)
N	3743	3743	3743	3743	3743	3743
r2		0.124		0.126		0.123

Marginal effects; t statistics in parentheses

(d) for discrete change of dummy variable from 0 to 1

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Observation of the Age of 13 Through 23 in 1989

Dep.Var:	(1)	(2)
Dumm.for All Correct	Probit	OLS
age	0.255	0.238
	(0.976)	(0.991)
Mid-level secondary school (d)	0.135*	0.155*
	(1.952)	(1.907)
Secondary school with diploma (d)	0.234***	0.292***
	(4.461)	(3.376)
Upper level secondary school (d)	0.185***	0.210**
	(2.687)	(2.493)
East*Cohort(2)	0.218***	0.292**
	(3.561)	(2.506)
N	750	761
r2		0.165

Marginal effects; t statistics in parentheses

(d) for discrete change of dummy variable from 0 to 1

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4.2.3 Evidence from the Balanced Panel

Although evidence from the balanced panel in 8 cannot provide us with the effects of reunification on FL through education, it can still show the critical role of education in determining financial literacy. Higher level education has large positive effects on financial literacy. In addition, being married, being a male, the elder the FKP, have positive effects on financial literacy, consistent with results from earlier literature.

5 Conclusion

In this study, we explore the determinants of financial literacy. Consistent with the literature, the age of the household and the gender are highly correlated with financial literacy scores. However, education, regardless for the level, has a much larger significantly positive effects than all the other determinants.

In addition, by taking advantage of the reunification of Germany in 1989 and exploiting it as a "natural experiment', we explore the role of institutional changes, more specifically, changes in the educational system, in shaping the financial literacy of German households. We find evidence that the more an eastern household has been exposed to the education in a unified Germany, the lower her financial literacy. We suggest a possible positive role of the high school education in the former GDR in driving financial literacy.

Further robustness checks will be performed in order to disentangle possible confounding

Table 8: Evidence from the Balanced Panel Sample

Dep.Var:	(1)	(2)	(3)	(4)
Dumm.for All Correct	FE OLS	RE OLS	XtProbit	XtLogit
age	0.005	0.009***	0.033***	0.056***
	(0.400)	(2.794)	(2.694)	(2.705)
agesqr	-0.000	-0.000***	-0.000***	-0.001***
	(-0.486)	(-3.397)	(-3.299)	(-3.296)
Married	0.059	0.039**	0.138**	0.232**
	(1.051)	(2.243)	(2.138)	(2.108)
Female	-0.091	-0.090***	-0.323***	-0.550***
	(-1.257)	(-5.848)	(-5.645)	(-5.625)
Mid-level secondary school	0.047	0.100***	0.313***	0.524***
	(0.986)	(5.084)	(4.412)	(4.355)
Secondary school with diploma	0.035	0.185***	0.646***	1.096***
	(0.575)	(6.639)	(6.211)	(6.113)
Upper level secondary school	-0.000	0.189***	0.667***	1.138***
	(-0.004)	(9.108)	(8.491)	(8.427)
Other Education	-0.091	-0.111*	-0.366*	-0.601
	(-0.831)	(-1.747)	(-1.668)	(-1.638)
Self-employed	0.057	0.044*	0.176*	0.322*
	(0.962)	(1.704)	(1.685)	(1.760)
Unemployment Benefits	-0.056	-0.051	-0.151	-0.253
	(-1.176)	(-1.512)	(-1.331)	(-1.324)
N	4248	4248	4248	4248

Marginal effects; t statistics in parentheses

Results are wighted.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

effects, such as cohort or age influences and a propensity score matching will be employed to build a more comparable control group.

Appendices

Table A1: Missing and imputed observations for key variables

Variable	Description	No. of missing values
dhnm0100	inflation question	0
dhnm0200	interest rate question	0
dhnm0300	risk-diversification question	0
dpe0100a	employment status	6
dpe1275	number of children	6
dra0400	residence in 1989	6
ra0400	country of birth	0
ra0500	lenght of staying in Germany	1
bland	region of current residence	0
ra0300	age	0
dpa0100	married	2
dpa0300	education	3
dpe9040	male	0

Source: PHF-Bundesbank (own calculations based on the first of the imputed datasets. The number of missing values refers to the second wave, 4,461 observations.

Table A2: Aggregated Financial Literacy over Other Demographic Characteristics

	West		East	
	All Correct	No. of Obs.	All Correct	No. of Obs.
Lower-level secondary school (Hauptschule)	50%	863	36%	158
Mid-level secondary school (Realschule)	63%	908	67%	336
Oberschule	61%	366	69%	51
Gymnasium	80%	1,133	77%	244
Other Education	22%	40	44%	7
Male	67%	1,957	72%	423
Female	56%	1,360	48%	373
Not in Marriage	65%	1,114	59%	328
Married	59%	2,203	65%	468
Self-employed	77%	314	78%	52
Not self-employed	60%	3,003	59%	744
Unemployed	38%	86	52%	54
Retired	54%	1,264	46%	327

Source: PHF-Bundesbank (own calculations based on the first of the imputed datasets).
Second wave is employed in this table and we refer to current residence of the respondents.
Households who were not in Germany in 1989 were dropped. Results are weighted.

Table A3: Summary of Key Variables

	Mean	Std.	Min	Max
All questions correct	0.63	0.016	0	1
FL1	0.86	0.011	0	1
FL2	0.88	0.011	0	1
FL3	0.72	0.016	0	1
FL1	0.62	0.011	0	1
East	0.22	0.029	0	1
East in 1989	0.20	0.025	0	1
Age	52,46	0.441	18	90
Female	0.47	0.013	0	1
Married	0.47	0.014	0	1
Self-employed	0.08	0.007	0	1
Unemployed	0.04	0.004	0	1
Retired	0.35	0.012	0	1
Migration from East to West	0.08	0.012	0	1
Hauptschule	0.39	0.014	0	1
Realschule	0.29	0.012	0	1
Oberschule	0.08	0.006	0	1
Gymnasium	0.22	0.011	0	1
No education	0.02	0.004	0	1
No. of kids	0,79	0.030	0	5
N	22305			

Source: PHF-Bundesbank (own calculations based on the first of the imputed datasets).

Wave 2, 4, 133 observations; households who where not in Germany in 1989 have been dropped. Results are weighted.

Table A4: The Effect of Residence in the East on Financial Literacy: all Regressors

	(Probit)	(OLS)
	All correct	All correct
East (d)	-0.017	-0.017
	(-0.546)	(-0.586)
Age	0.009*	0.008*
	(1.717)	(1.689)
Age squared	-0.000*	-0.000*
	(-1.869)	(-1.826)
Married and living together (d)	0.002	0.002
	(0.059)	(0.068)
Female (d)	-0.124***	-0.115***
	(-4.807)	(-4.791)
Lower level secondary school (d)	0.138	0.139
	(1.498)	(1.602)
Mid-level secondary school (d)	0.248***	0.271***
	(3.070)	(3.079)
Secondary school with diploma (d)	0.222***	0.264***
	(3.203)	(2.840)
Upper level secondary school (d)	0.316***	0.349***
	(4.672)	(3.928)
Investment Behavior Risk Preference	-0.000	0.001
	(-0.012)	(0.083)
Self-assessment: Risk	-0.000	0.000
	(-0.064)	(0.040)
Self-assessment: Trust	-0.001	-0.000
	(-0.085)	(-0.049)
Self-assessment: Patience	-0.004	-0.003
	(-0.756)	(-0.693)
Regular Saving (d)	0.043	0.041
	(1.485)	(1.526)
Log income	0.062**	0.052**
	(2.227)	(2.117)
Self-employment Income (d)	-0.084	-0.061
	(-1.265)	(-1.128)
Saving for Funds	0.009	0.007
	(1.101)	(1.039)
Income from Financial Assets (d)	0.091***	0.081***
	(3.188)	(3.152)
Application for a Loan/Credit (d)	0.023	0.018
	(0.771)	(0.665)
Self-employed (d)	0.112*	0.093
	(1.739)	(1.540)
Ownership of Private Business (d)	0.132	0.104
	(1.512)	(1.545)
Active Role in Management (d)	-0.086	-0.059
	(-0.749)	(-0.812)
Current Employment Status	-0.009	-0.008
	(-1.611)	(-1.489)
Unemployment Benefits (d)	-0.045	-0.049
	(-0.813)	(-0.929)
Migration from East to West (d)	0.009	0.007
	(0.184)	(0.157)
Observations	4111	4111
R^2		0.139

Source: PHF-Bundesbank (own calculations based on the first of the imputed datasets). Marginal effects; t statistics in parentheses
Results are weighted and wave two is employed. The variable 'East' refers to residence at the time of the survey.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A5: East/West Divide Determinants of Aggregated Level FL: OLS Model

	All Correct		
	West	East	West VS. East
Age	0.011*	0.018**	
	(1.864)	(1.980)	
Female	-0.111***	-0.220***	**
	(-4.091)	(-4.874)	
Lower level secondary school	0.203**	-0.042	
	(2.263)	(-0.168)	
Mid-level secondary school	0.320***	0.253	
	(3.554)	(0.994)	
Secondary school with diploma	0.374***	0.165	
	(3.925)	(0.608)	
Upper level secondary school	0.465***	0.301	
	(5.177)	(1.183)	
Self-employed	0.072*	0.059	
	(1.704)	(0.809)	
Unemployed	-0.183**	-0.090	
	(-2.207)	(-1.170)	
Retirement	-0.033	0.026	
	(-0.710)	(0.312)	
East to West migration	-0.033	0.067	
	(-0.489)	(1.185)	
Constant	0.153	0.170	
	(0.944)	(0.548)	
N	3317	796	
r2	0.098	0.221	

Source: PHF-Bundesbank (own calculations based on the first of the imputed datasets for the second wave).
Marginal effects are presented; t statistics in parentheses.
(d) for discrete change of dummy variable from 0 to 1
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

References

Agnew, J. R., H. Bateman, and S. Thorp (2012). Financial literacy and retirement planning in australian.

B-Koenen, T. and B. Lamla (2014). The long shadow of socialism: On east-west german differences in financial literacy. MEA discussion paper series 201405, Munich Center for the Economics of Aging (MEA) at the Max Planck Institute for Social Law and Social Policy.

B-Koenen, T. and A. Lusardi (2011). Financial literacy and retirement planning in germany. Technical report, National Bureau of Economic Research.

Behrman, J. R., O. S. Mitchell, C. Soo, and D. Bravo (2012). Financial Literacy, Schooling, and Wealth Accumulation. *American Economic Review 102*(3), 303–304.

Bernheim, B. D. and D. M. Garrett (2003). The effects of financial education in the workplace: evidence from a survey of households. *Journal of public Economics 87*(7), 1487–1519.

Bernheim, B. D., D. M. Garrett, and D. M. Maki (2001). Education and saving:: The long-term effects of high school financial curriculum mandates. *Journal of public Economics 80*(3), 435–465.

Bonin, H. and R. Euwals (2002). Participation behavior of east german women after german unification. 10th International Conference on Panel Data, Berlin, July 5-6, 2002 D1-1, International Conferences on Panel Data.

Brosig-Koch, J., C. Helbach, A. Ockenfels, and J. Weimann (2011). Still different after all these years: Solidarity behavior in east and west germany. *Journal of Public Economics 95*(11), 1373–1376.

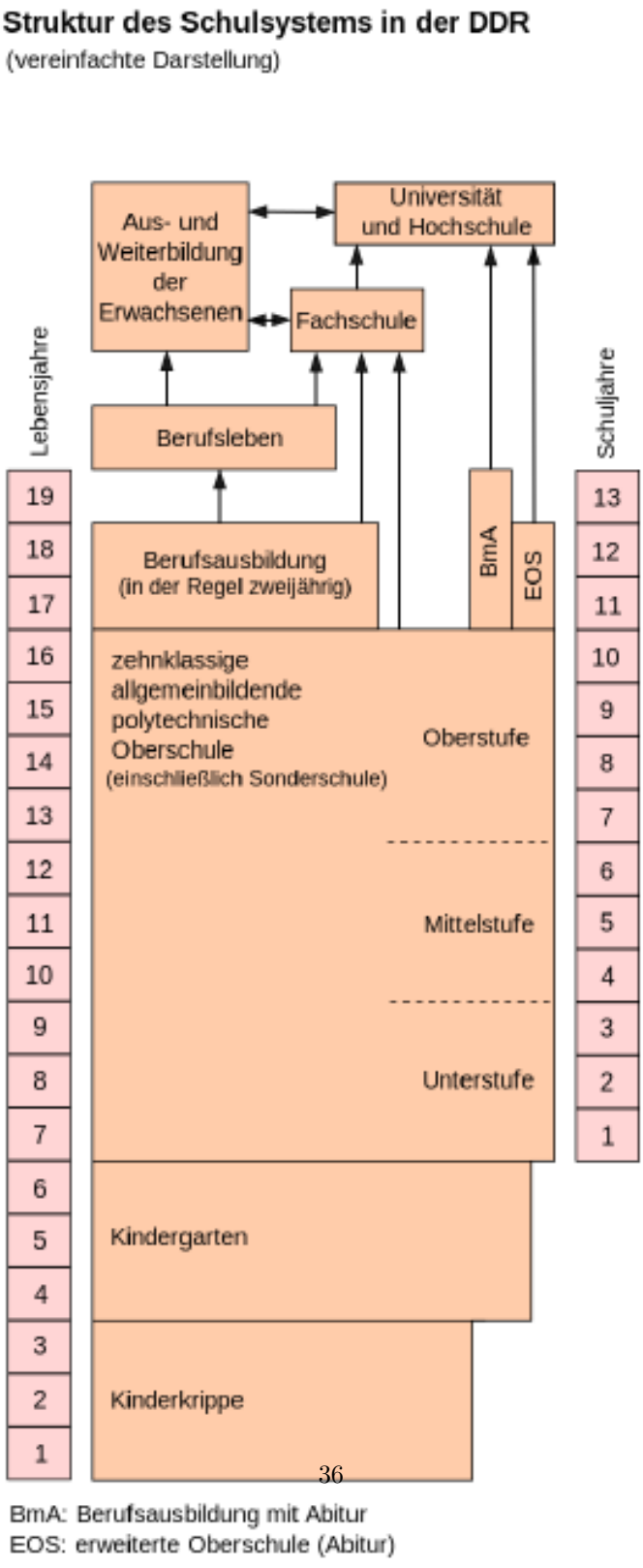
Brugiavini, A., D. Cavapozzi, M. Padula, and Y. Pettinicchi (2015). Financial education, literacy and investment attitudes. Technical report.

Chen, H. and R. P. Volpe (1998). An analysis of personal financial literacy among college students. *Financial services review 7*(2), 107–128.

Chen, H. and R. P. Volpe (2002). Gender differences in personal financial literacy among college students. *Financial services review 11*(3), 289.

Cole, S., A. Paulson, and G. K. Shastry (2016). High school curriculum and financial outcomes: The impact of mandated personal finance and mathematics courses. *Journal of Human Resources 51*(3), 656–698.

Table A6: Educational system in the East before reunification



Delavande, A., S. Rohwedder, and R. Willis (2008, September). Preparation for Retirement, Financial Literacy and Cognitive Resources. Working Papers wp190, University of Michigan, Michigan Retirement Research Center.

Fornero, E. and C. Monticone (2011). Financial literacy and pension plan participation in italy. *Journal of Pension Economics and Finance 10*(04), 547–564.

Fuchs-Schündeln, N. and M. Schündeln (2005). Precautionary savings and self-selection: Evidence from the german reunification "experiment". *The Quarterly Journal of Economics 120*(3), 1085–1120.

Fuchs-Schundeln, N. and M. Haliassos (2015). Does product familiarity matter for participation?

Fuchs-Schündeln, N. and P. Masella (2016). Long-lasting effects of socialist education. *Review of Economics and Statistics 98*(3), 428–441.

Fuchs-Schündeln, N. and M. Schündeln (2015). On the endogeneity of political preferences: Evidence from individual experience with democracy. *Science 347*(6226), 1145–1148.

Gustman, A., T. L. Steinmeier, and N. Tabatabai (2012). Financial knowledge and financial literacy at the household level. *American Economic Review 102*(3), 309–13.

Hastings, J. S., B. C. Madrian, and W. L. Skimmyhorn (2013). Financial literacy, financial education, and economic outcomes.

INFE, O. (2012). Oecd/infe high-level principles on national strategies for financial education.

Jappelli, T. (2010). Economic literacy: An international comparison*. *The Economic Journal 120*(548), F429–F451.

Jappelli, T. and M. Padula (2013). Investment in financial literacy and saving decisions. *Journal of Banking & Finance 37*(8), 2779–2792.

Lusardi, A., P.-C. Michaud, and O. S. Mitchell (2017). Optimal financial knowledge and wealth inequality. *Journal of Political Economy 125*(2), 431–477.

Lusardi, A. and O. S. Mitchell (2007). Financial literacy and retirement planning: New evidence from the rand american life panel.

Lusardi, A. and O. S. Mitchell (2008, May). Planning and financial literacy: How do women fare? *American Economic Review 98*(2), 413–17.

Lusardi, A. and O. S. Mitchell (2011). Financial literacy and planning: Implications for retirement wellbeing. Technical report, National Bureau of Economic Research.

Lusardi, A. and O. S. Mitchell (2014). The economic importance of financial literacy: Theory and evidence. *Journal of economic literature 52*(1), 5–44.

Lusardi, A., O. S. Mitchell, and V. Curto (2010). Financial literacy among the young. *Journal of Consumer Affairs 44*(2), 358–380.

Marsh, H. W., O. Köller, and J. Baumert (2001). Reunification of east and west german school systems: Longitudinal multilevel modeling study of the big-fish-little-pond effect on academic self-concept. *American Educational Research Journal 38*(2), 321–350.

Norton, E. C., H. Wang, and C. Ai (2004, June). Computing interaction effects and standard errors in logit and probit models. *Stata Journal 4*(2), 154–167.

Rubin, D. B. (1987). Multiple imputation for nonresponse in surveys (wiley series in probability and statistics).

Rubin, D. B. (1996). Multiple imputation after 18+ years. *Journal of the American statistical Association 91*(434), 473–489.

Sekita, S. (2011). Financial literacy and retirement planning in japan. *Journal of Pension Economics and Finance 10*(04), 637–656.

van Rooij, M., A. Lusardi, and R. Alessie (2011). Financial literacy and stock market participation. *Journal of Financial Economics 101*(2), 449 – 472.

Xu, L. and B. Zia (2012). Financial literacy around the world. *Policy Research Working Paper 6107*.