NÁRODNÁ BANKA SLOVENSKA
EUROSYSTÉM

Financial literacy and voluntary savings for retirement in Slovakia

Zuzana Brokešová, Andrej Cupák, Gueorgui Kolev

Working Paper

10/2017

Financial literacy and voluntary savings for retirement in Slovakia[1]

Working paper NBS

Zuzana Brokešová, Andrej Cupák, Gueorgui Kolev[2]

Abstract

We utilise recent Household Finance and Consumption Survey microdata to report first causal effects of financial literacy on voluntary private pension schemes participation for Slovakia. Savings for retirement in the supplementary pension schemes are positively associated with financial literacy after controlling for a set of relevant socio-economic variables. One additional correctly answered financial literacy question leads to a 6 percentage points increase in the probability of having a voluntary pension savings plan in our ordinary least squares estimates. The causal impact of financial literacy increases to 16 percentage points when we address potential endogeneity problem by novel to the literature instrumental variables. Interestingly, we find less significant effects of financial literacy on the probability of individuals having employer-supported private pension savings plans. Our findings inform policy and suggest how policymakers can promote the voluntary retirement savings behaviour of individuals in Slovakia and in other Central and Eastern European countries in times of decreasing benefits of state pensions.

JEL classification: D14; D91; I2.
Key words: Financial literacy; Retirement savings; Survey data; Endogeneity; Instrumental variables; Slovakia.

NON-TECHNICAL SUMMARY

The adverse development of demography has been challenging traditional conservative pension systems in many developed and transition countries, including Slovakia. As a reaction, reforms of pension systems have been launched by adopting more liberal schemes, in which complete or partial responsibility for old age well-being is transferred onto individuals. However, even after two decades of existence of the private pension savings schemes, the participation rates in Slovakia have remained rather low.

Accumulating sufficient wealth for retirement is among the most challenging decisions in personal finance. Previous research has identified a variety of socio-economic factors determining active retirement savings decisions including, for example, income, age, education, marital and employment status, and other factors. However, making sound financial decisions and achieving optimal outcomes in personal finance including accumulation of sufficient wealth for retirement also requires adequate levels of financial literacy as shown in the extant literature.

Whereas the results of recent descriptive studies on financial literacy document considerably lower levels of financial knowledge of individuals in Central and Eastern European countries compared to more developed Western European countries, its effect on the financial decision-making of households and individuals has not been well documented in the empirical literature yet. This paper contributes to this domain by utilising the recent Slovak Household Finance and Consumption Survey data from 2014. First, we study heterogeneity in financial literacy across non-retired individuals in Slovakia. However, our ultimate goal is to estimate the link between financial literacy of individuals and participation in the voluntary retirement savings schemes, controlling for a large set of other relevant socio-economic variables. To do so, we first estimate linear probability models. Then, we estimate the causal link by the instrumental variable approach and employ novel to the literature instrumental variables.

Our data demonstrate that financial literacy in Slovakia is quite low compared to other developed countries as only 17% of the non-retired respondents were able to answer all questions asked in the survey correctly. While respondents were able to correctly answer questions on interest rates, inflation, and diversification, they struggled to understand the concept of riskiness. The lowest financial literacy is observed among low-educated, low-income and unemployed respondents.

We also show that the extensive margin of retirement savings in the supplementary pension schemes is fairly low in Slovakia. Only 16% of the non-retired respondents participate in the supplementary savings schemes on their own, while 19% of the non-retired individuals have employer-supported private pension savings plans.

The results of our multivariate analysis show a positive and statistically significant association between financial literacy and participation of individuals in the voluntary retirement savings schemes, controlling for relevant socio-economic factors impacting financial behaviour in general. Higher financial literacy (measured in several ways) increases an individual's propensity to save in the supplementary pension schemes by 6 to 10 percentage points when individuals save in the schemes purely on their own. The effect is smaller and in some cases not even significant, when individuals participate in the employer-supported private pension savings schemes.

The effect of financial literacy strengthens after addressing the potential endogeneity problem of financial literacy. To do so, we employ novel to the literature instrumental variables which have not been used in the previous literature. Our two instrumental variables, which are assessments

of interviewers on the survey outcomes, are the ability of individuals to understand financial questions in the survey, and the ability of individuals to convert monetary values from Slovak crowns to euros, which turn out to be highly correlated with the level of financial literacy. The robustness of our results has been checked by estimating the relationship on different age sub-samples.

The ambition of shifting responsibility for retirement well-being to individuals is a long-term challenge. Encouraging individuals towards desired financial behavior presents a difficult task for policymakers. Our results can help policymakers in their efforts to promote voluntary retirement savings behaviour of individuals in Slovakia and also in other Central and Eastern European countries in times of decreasing benefits of state pensions.

1. INTRODUCTION

The post-productive age period represents a substantial part of an individual's life in the majority of developed countries, where retirees on average spend around two decades in their retirement (OECD, 2015). Moreover, life expectancy is estimated to increase further in the future. Increasing longevity along with decreasing fertility will likely challenge the sustainability of unfunded pay-as-you-go (PAYG) pension systems in the majority of developed economies (e.g. Aslanyan, 2014). Due to the reduced benefits of state pensions, wealth accumulation for retirement in private pension schemes is of increasing importance.[3]

Shifting the responsibility for retirement well-being to individuals presents a long-term challenge and a difficult task for policymakers. Voluntary saving in supplementary private pension schemes has been a relatively new concept for individuals in the majority of Central and Eastern European (CEE) countries. In the case of Slovakia, even after two decades of its existence, participation rates of individuals in this pillar have remained rather low.[4] Better understanding of determinants of the individuals' participation in such schemes based on a microdata analysis is therefore essential.

Extant literature has identified financial literacy as an important factor impacting personal finance and wealth accumulation in general, and individual pension savings behaviour in particular. In this article we study what determines individuals' private pension savings schemes participation in Slovakia. Following leads from the extant literature, which does not cover CEE countries, we pay particular attention to the importance of financial literacy. To do so, we utilise recent Household Finance and Consumption Survey microdata specifically assembled by the National Bank of Slovakia to answer questions such as the ones we are addressing in this article.

We are the first study to harness survey paradata to generate instrumental variables (IVs) for financial literacy due to its endogeneity as shown in the literature. Researchers in the previous studies have instrumented financial literacy mostly by financial experience and education of relatives/peers, education in the field of economics or finance, or total number of universities/schools per region (see Lusardi and Mitchell, 2014, for a comprehensive overview). We instrument the financial literacy of survey respondents with interviewers' assessments of respondents' abilities to understand financial questions in the survey and with interviewers' assessments of respondents' abilities to translate monetary values from Slovak crowns to recently introduced euros.[5] Particularly, the second instrument is relevant for the Slovak case, as many households acquired their assets prior to 2009, when the Euro was launched as a new currency and still tend to express values in the former currency. We show that individuals with lower levels of financial literacy have a worse ability to make such conversion as well as to understand questions in the survey.

Our IVs are mostly designed to deal with measurement error biases. Measurement error is the most important econometric problem marring the causal estimates of the impact of financial literacy on pension savings behaviour (Lusardi and Mitchell, 2014). Studies using instrumental variables techniques to estimate the effect of financial literacy on outcomes such as pension

---

[3]Reforming pensions in developing and transition countries is comprehensively reviewed by Hujo (2014).

[4]As a reaction, Slovak government carried out another pension reform in 2005 by introducing a mandatory second pillar – the occupational pension scheme because of the deficit of the public pay-as-you-go system. We describe the Slovak pension system in more detail in Appendix A.

[5]In fact, we are aware of only one particular study recently conducted by Crossley et al. (2017) suggesting using interviewers' paradata to correct for bias in financial literacy in surveys, however, not in the instrumental variable framework.

savings observe that the IV estimates of the effect of financial literacy are typically much larger than the ordinary least squares (OLS) estimates. In regressions estimating the impact of financial literacy on outcomes such as pension savings decisions, there are broadly speaking three types of potential endogeneity each leading to its own bias with a *different* sign. Measurement error in financial literacy leads to attenuation bias (bias toward 0) in the OLS estimates of the effects of financial literacy on behaviours and outcomes. Reverse causality running from outcomes to financial literacy, e.g., people making more (and presumably better) financial decisions acquiring more financial literacy, would lead OLS regressions to *overstate* the causal effect of financial literacy. Omitted variables that are positively correlated with both financial literacy and outcomes would similarly lead to *upward* bias in the estimates. Observing that IV estimates are typically much larger compared to OLS estimates puts forward measurement error as the major culprit for bias in OLS regressions.

Our data demonstrate that only 17% of the non-retired adult individuals can correctly answer all financial literacy questions asked in the survey. While respondents generally understand the concepts of interest rates, inflation, and portfolio diversification, they mostly struggle with the question on riskiness. The lowest levels of financial literacy can be observed among low-income, unemployed and old-aged respondents. In the same sample, 16% and 19% of individuals voluntarily save for their retirement in the supplementary private pension schemes without and with employers' contributions, respectively.

Saving for retirement in the supplementary pension schemes is positively related to the individual's financial literacy after controlling for a set of relevant socio-economic variables. One additional correctly answered financial literacy question (equal to roughly one standard deviation increase, the standard deviation of our financial literacy score measuring the total number of correctly answered question is equal to 0.86) leads to a 6 percentage points increase in the probability of having a voluntary pension savings plan without employers' contributions in our ordinary least squares estimates. The causal impact of financial literacy increases to 16 percentage points when we address potential endogeneity by novel to the literature instrumental variables in our instrumental variable regressions. The positive and statistically significant causal impacts of financial literacy on voluntary retirement savings schemes participation of individuals is robust to estimations using different age sub-samples and also to different specifications of financial literacy. Interestingly, we find weaker effects of financial literacy on the probability of having a private pension savings plan when individuals are motivated to save in such schemes by employers' contributions.

Our study is the first to report the causal effects of financial literacy on voluntary pension scheme participation rates for a CEE country. Our findings inform policy and suggest how policymakers can promote the voluntary retirement saving behaviour of individuals in Slovakia and in CEE countries. The rest of the paper unfolds as follows. Previous literature is summarised in Section 2. Section 3 offers a description of the microdata employed including the measure of financial literacy and its distribution across individuals. In Section 4, econometric estimation and empirical results are presented while the last, Section 5, concludes and discusses policy implications.

2. PREVIOUS LITERATURE

Besides standard socio-economic factors important for the life-cycle profiles of wealth such as age, education, income, or labour status[6], financial literacy has been shown in the literature as an important ingredient of informed choices and sound financial behaviour of households and individuals. For example, the causal impact of financial literacy on household wealth accumulation has been shown by Behrman et al. (2012). Researchers have also shown that financial literacy and exposure to financial education or training is positively associated with retirement saving and planning (e.g. Lusardi and Mitchell, 2007; Bernheim and Garrett, 2003; Banks, 2010; Van Rooij et al., 2012; Brown and Weisbenner, 2014). In another stream of the literature Cardak and Wilkins (2009), Christelis et al. (2010), Van Rooij et al. (2011), or Guiso and Viviano (2015) study the importance of financial literacy and cognitive abilities in stock market participation and risky asset holdings. Furthermore, Gaudecker (2015) shows that financially literate households and investors tend to have better diversified portfolios and suffer smaller loses from underdiversification. Regarding the debt side, borrowers with poor financial literacy tend to hold higher shares of high cost credit compared to more literate borrowers (e.g. Disney and Gathergood, 2013).[7]

One could argue that financial advisors could substitute for the financial literacy. However, research shows that individuals with low financial literacy are less likely to consult with financial intermediaries. Financial advisors can be biased and can have conflicting goals imperfectly aligned with, or outright orthogonal to the investors' interests (Carmel et al., 2015). Therefore, a certain level of financial knowledge of individuals is necessary even in the presence of financial advisors (e.g. Van Rooij et al., 2012; Guiso and Viviano, 2015).

There are substantial differences in the level of financial literacy and pension systems across countries (e.g. Atkinson and Messy, 2011; Lusardi and Mitchell, 2011b; Badarinza et al., 2016). The link between financial knowledge and active retirement saving behaviour of individuals has been explicitly studied in a few empirical studies. Existing literature supports the hypothesis that a higher level of financial literacy is associated with a higher propensity to save or plan for retirement (see Figure 1). This relationship is stronger in countries with limited public pension systems compared to countries with extensive public pension systems. This pattern can be partially explained by Jappelli and Padula's (2013) human capital model for financial literacy arguing that individuals in countries with an extensive social security system might have little incentive to invest in developing their financial literacy. This can translate to lower levels of voluntary retirement saving.

Whereas the link between financial literacy and retirement savings has been predominantly analysed in regions of North and South America, West and South Europe, or Australia, the relationship has not been widely studied for CEE countries using representative microdata yet. In fact, we are aware of only one particular study conducted by Beckmann (2013) for Romania analysing household saving behaviour (including some aspects of retirement savings) with respect to financial literacy. This presents a significant omission in the literature, as the CEE households and individuals as well as economic environments of these countries differ in many aspects from those of the more developed countries, including general level of income and savings, quality of education, demographic situation, or development of pension systems.

---

[6]A non-exhaustive list of examples include Bernheim et al. (2001), Browning and Crossley (2001), or Ameriks et al. (2003).

[7]For an interested reader, the importance of financial literacy and education in consumers' financial decisions is comprehensively reviewed by Campbell (2006), Fernandes et al. (2014), Jappelli (2010) and Lusardi and Mitchell (2014).

Figure 1: Financial literacy and saving/planning for retirement across countries
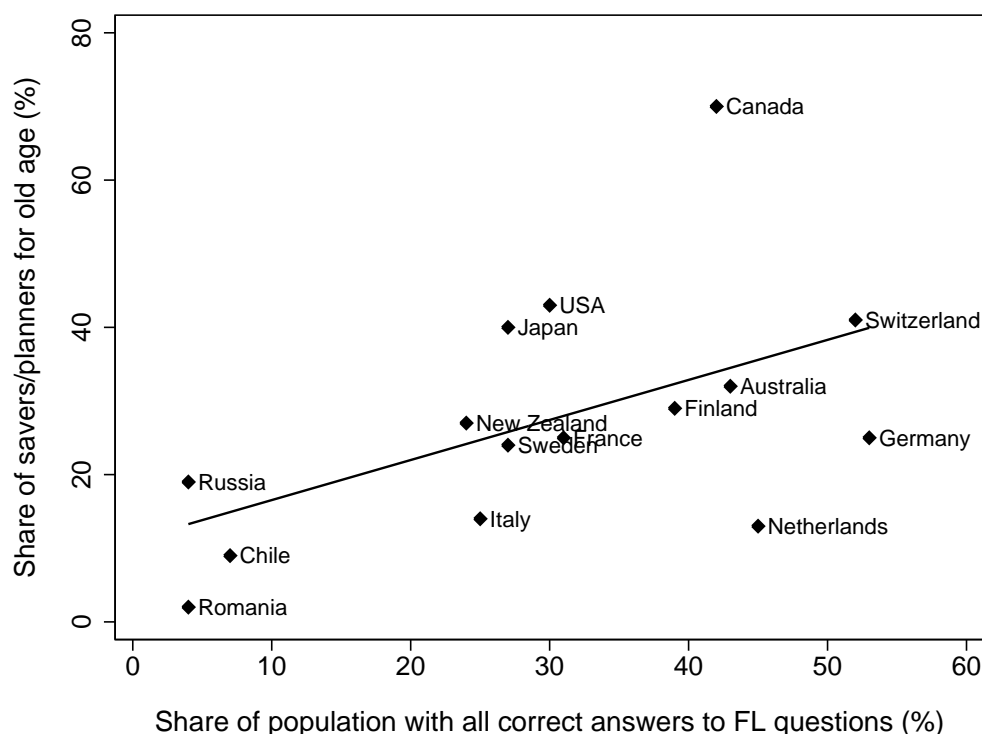
Source: Empirical studies on financial literacy and retirement saving/planning (see Table B.1 for the list of studies)

Our contribution to the literature is an analysis of heterogeneity of financial literacy across individuals and estimation of the link between financial literacy and the propensity to save for retirement in the supplementary private pension savings schemes in Slovakia. For this purpose we utilise recent, representative Household Finance and Consumption Survey data collected in 2014. We also exploit novel to the literature instrumental variables to address potential endogeneity of financial literacy.

3. DATA

We analyse voluntary retirement savings decisions and financial literacy of Slovak individuals using the newest wave of the Slovak Household Finance and Consumption Survey (HFCS) data collected by the National Bank of Slovakia in 2014.[8] The main aim of the survey is to gather structural information on assets (real and financial), liabilities (mortgage and non-mortgage debt) and consumption of households. The data also contain detailed information on individual household members such as their employment status, income, retirement savings as well as a number of demographic characteristics including age, gender, marital status, education, etc.. The Slovak HFCS data is representative both at national and regional levels.[9]

---

[8]Household Finance and Consumption Survey is carried out in all euro-area countries (except Lithuania) as well as in Hungary and Poland. Unfortunately, only two countries (Luxembourg and Slovakia) included financial literacy questions in their national HFCS wave 2. Therefore, an international comparison of financial literacy and retirement savings patterns is not feasible with this data.

[9]Survey weights were calibrated to margins such as age structure, sex, household size, and employment status in each region.

Although two rounds of the Slovak HFCS data (from 2010 and 2014) are available, the surveyed households (individuals) were not monitored over time; hence we cannot treat the two rounds as a panel and analyse dynamics of the retirement savings. Moreover, the first wave of the HFCS data does not contain information on the financial literacy of respondents. Therefore, we utilise only the latest available dataset. The final net sample of the Slovak HFCS data consists of 2,135 households along with 4,658 individual members aged over 16. Since the questions on financial literacy were asked only to the reference persons of households, we discard information on the other household members. Assessment of the level of financial literacy and participation in the voluntary pension savings is carried out on the sample of non-retired respondents.

3.1 Measuring financial literacy

In the survey, each household represented by the reference person is asked a set of questions on financial literacy. Inspired by the previous literature (e.g. Lusardi and Mitchell, 2014), questions are formed in order to discover the ability of respondents to understand fundamental concepts in personal finance including interest rates, inflation, riskiness and diversification of portfolios.[10] The full list of financial literacy questions asked in the Slovak HFCS is presented in Appendix C.

Following previous studies, we create the first measure of financial literacy as a sum of binary variables taking value of 1 if the particular financial literacy question is answered correctly and 0 otherwise. Our financial literacy index ranges between 0 and 4 for each individual. As an alternative measure of financial literacy, we create a dummy variable taking value 1 if all financial literacy questions are answered correctly and 0 otherwise. These two measures of financial literacy are the most commonly used in the extant empirical literature.

The distribution of correctly answered questions in the constructed financial literacy measure is presented in Figure 2. In Slovakia, only 17% of all the interviewed non-retired respondents were able to correctly answer all four financial literacy questions, which is a substantially lower score compared to the results from other countries. For example, around 30% of surveyed respondents were able to correctly answer similar financial literacy questions in the US, 40% in Canada and 50% in Germany (see Lusardi and Mitchell, 2011b; Bucher-Koenen and Lusardi, 2011; Boisclair et al., 2017). The detailed distribution of answers to the particular financial literacy questions across different individual characteristics is presented in Table 1. The highest financial literacy is observed among the young, high-income and individuals with higher education. On the other hand, respondents in older age cohorts, with low incomes and unemployed tend to know the least. These results are in line with previous research outcomes (e.g. Atkinson and Messy, 2011; Lusardi and Mitchell, 2014). Another interesting result is that no financial literacy gap exists between men and women in Slovakia (the last column of Table 1). This result differs from the extant empirical literature – the extant literature overall finds a gender gap in financial literacy (e.g. Bucher-Koenen et al., 2017).

Overall, the general observation from the financial literacy assessment is that Slovak respondents are quite familiar with the concepts of interest rates, inflation and portfolio diversification. In contrast, the question on riskiness has the lowest share of correct answers across different

---

[10]Note that question were asked in a gradually increasing difficulty level. First, basic questions related to interest rates and inflation were asked, which were followed by more sophisticated questions on portfolio diversification and riskiness of financial products.

socio-economic groups of individuals. This could be partially explained by almost no experience with risky financial assets of households in Slovakia. While almost 90% of households own their residence, ownership of sophisticated financial assets (i.e. stocks, bonds, or mutual funds) is very low in Slovakia compared to the other euro-area countries as barely 4% of households hold such assets in their portfolios (Bover et al., 2016).

Figure 2: Distribution of correct answers in financial literacy index
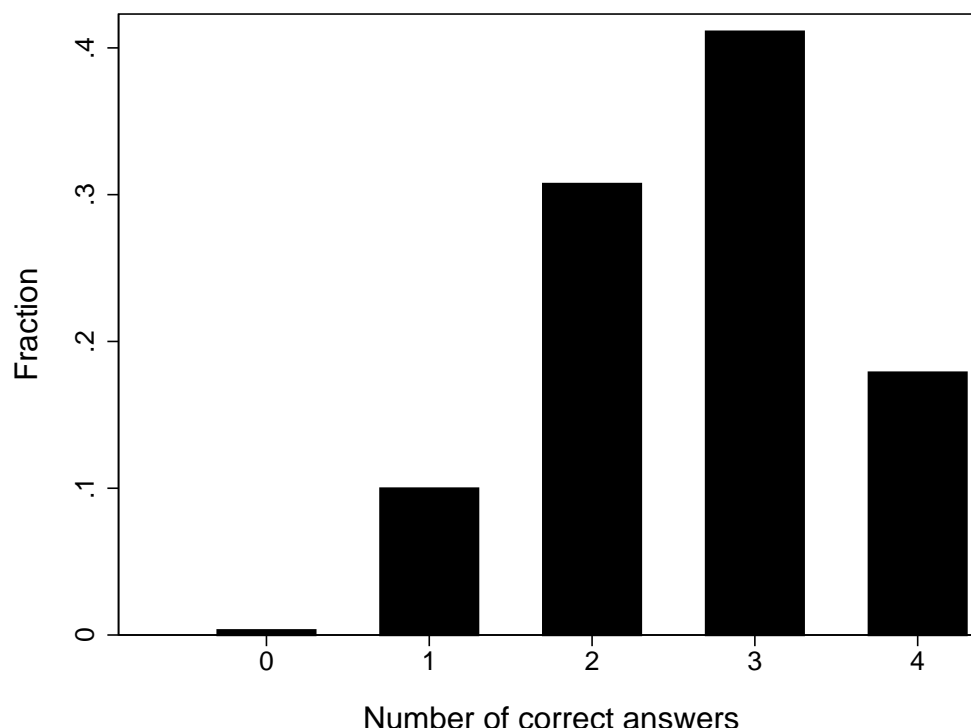
Note: Based on the sample of non-retired individuals.
Source: HFCS 2014, National Bank of Slovakia

3.2 VARIABLES DESCRIPTION

In our empirical analysis the dependent variable is a dummy variable taking the value of 1 if a non-retired individual saves in the voluntary private pension savings schemes on his/her own (i.e. savings in private pension funds or whole life insurance contracts). We distinguish between two cases, when the participation in such savings schemes is purely voluntary, and when the participation is supported by employers' contributions. Our two dependent variables capture savings in the third pillar of the Slovak pension system, which is described in more detail in Appendix A. Note that we use current savings rather than a retirement planning indicator that is a measure of whether a respondent has thought about his/her financial needs in retirement. In the literature, both retirement planning (e.g. Alessie et al., 2011; Sekita, 2011; Agnew et al., 2013; Moure, 2016) and current retirement savings (e.g. Fornero and Monticone, 2011; Brown and Graf, 2013; Boisclair et al., 2017) have been used as proxies for the retirement financial security of individuals.

Our main explanatory variable of interest, the level of financial literacy, is measured in two ways: number of correct answers on financial literacy questions (FL_1), and a dummy variable taking

Table 1: Financial literacy across individuals

| | Financial literacy question | | | | | |
	Interest rates	Inflation	Diversification	Riskiness	# of correct answers	All correct
Overall	0.79	0.90	0.78	0.24	2.68	0.17
Income quintile						
1st	0.75	0.86	0.75	0.15	2.51	0.11
2nd	0.85	0.88	0.72	0.17	2.63	0.11
3rd	0.80	0.93	0.73	0.24	2.70	0.18
4th	0.83	0.90	0.76	0.25	2.73	0.16
5th	0.76	0.91	0.77	0.30	2.73	0.22
Gender						
Male	0.81	0.89	0.74	0.24	2.68	0.17
Female	0.75	0.92	0.80	0.22	2.68	0.17
Age group						
16-34	0.80	0.94	0.77	0.32	2.84	0.23
35-44	0.81	0.88	0.72	0.25	2.66	0.18
45-54	0.73	0.88	0.76	0.24	2.61	0.18
55-62	0.85	0.91	0.77	0.18	2.71	0.12
63+	0.74	0.98	0.93	0.11	2.76	0.09
Working status						
Employee	0.80	0.91	0.75	0.26	2.71	0.19
Self-employed	0.76	0.91	0.76	0.27	2.70	0.15
Unemployed	0.76	0.76	0.73	0.14	2.40	0.09
Other	0.86	0.91	0.81	0.07	2.66	0.06
Education						
Primary or no education	NA	NA	NA	NA	NA	NA
Secondary	0.80	0.91	0.75	0.21	2.66	0.15
Tertiary	0.80	0.87	0.76	0.35	2.78	0.24

Note: Average financial literacy scores computed using survey weights. Retired respondents have been excluded from the sample. Descriptive statistics labeled with *NA* could not be computed due to lack of observations (less than 20 in the sample). The first four columns show the share of population being able to correctly answer the particular financial literacy question. The fifth column shows the total average number of correctly answered questions while the very last column exhibits the share of population being able to correctly answer all 4 financial literacy questions.
Source: HFCS 2014, National Bank of Slovakia; own calculations

the value of 1 if all questions are correctly answered (FL_2).

Individual income has been identified in the majority of empirical studies as an important driver of retirement savings. In our regressions, we use 5 dummy variables for the particular income quintile. We also include a set of control variables such as a dummy variable for respondent's gender, a dummy variable for living in a single-member household, dummy variables for 5 age categories (16-34, 35-44, 55-54, 55-62, and 63+), a dummy variable for having children, a dummy variable for completed university degree, a dummy variable for a risk-loving attitude, and dummy variables capturing the employment status. We also include a dummy variable capturing whether a respondent lives in a city and dummy variables for ownership of household main residence and other real estate property. Controlling for real estate ownership is particularly important in the case of Slovakia. Recent microdata shows that almost 90% of Slovak households own their main residence, which is by far the highest rate in the euro-area (Bover et al., 2016). This can have an important impact on voluntary retirement savings as it has been argued in the literature that real estate ownership presents a possible substitute for retirement savings in pension funds (Nakajima and Telyukova, 2011). Finally, we include a set of regional dummy variables to account for heterogeneity across regions. These variables have

been commonly used in other empirical studies to analyse determinants of savings for retirement. Summary statistics of variables used in the empirical analysis are presented in Table 2. Variables' labels and description can be found in Table D.1.

Table 2: Descriptive statistics ($N = 1,235$)

Variable	Mean	SD	Min	Max
Savings without employers' contributions	0.16	0.36	0	1
Savings with employers' contributions	0.19	0.39	0	1
Financial literacy: number of correct answers	2.68	0.86	0	4
Financial literacy: all answers correct	0.17	0.37	0	1
1st income quintile	0.15	0.36	0	1
2nd income quintile	0.12	0.33	0	1
3rd income quintile	0.14	0.35	0	1
4th income quintile	0.30	0.46	0	1
5th income quintile	0.29	0.45	0	1
Male	0.79	0.41	0	1
Having children	0.39	0.49	0	1
Single-member household	0.17	0.37	0	1
Age category (16-34)	0.12	0.33	0	1
Age category (35-44)	0.34	0.47	0	1
Age category (45-54)	0.29	0.45	0	1
Age category (55-62)	0.23	0.42	0	1
Age category (63+)	0.03	0.17	0	1
University degree	0.22	0.41	0	1
Positive risk attitude	0.05	0.21	0	1
Employed	0.67	0.47	0	1
Self-employed	0.19	0.39	0	1
Not working	0.14	0.35	0	1
Living in a city	0.30	0.46	0	1
Owning household main residence	0.83	0.37	0	1
Owning other real estate	0.20	0.40	0	1
Instrument: ability to understand questions in the survey	3.02	0.69	1	4
Instrument: ability to convert monetary values from Slovak crowns to euros	3.05	0.73	1	4

Note: Descriptive statistics computed using survey weights. Based on the sample of non-retired individuals. There are eight regions in Slovakia (Bratislava, Trnava, Trenčín, Nitra, Žilina, Banská Bystrica, Prešov, and Košice) which are approximately equally represented in the survey.
Source: HFCS 2014, National Bank of Slovakia; own calculations

Detailed participation rates in the supplementary private pension schemes based on different demographic characteristics are shown in Table 3. Results from the univariate analysis demonstrate that only 16% of non-retired individuals voluntarily save on their own for their retirement in the supplementary private pension schemes and 19% of individuals save in such savings schemes, but with employers' contributions. In both cases, we can see a clear trend of rising participation with rising levels of financial literacy and income. The difference in retirement savings patterns is not very pronounced between the male and female population in the case of purely voluntary savings, but is substantial in the case of the savings promoted by employers' contributions. Participation in voluntary savings for retirement falls with rising age. This observation can be explained by the fact that older households in Slovakia have a higher marginal propensity to consume compared to younger ones (Fidrmuc and Senaj, 2014). Participation in the voluntary private pension savings schemes differs across working status and education level, too. Employed individuals, and individuals with tertiary education have the highest propensity to save for old age in the private pension savings schemes.

Table 3: Participation in the voluntary private pension schemes

	Participation rate without employers' contributions	Participation rate with employers' contributions
Overall	0.16	0.19
Financial literacy		
0 or 1 correct	0.12	0.17
2 correct	0.08	0.17
3 correct	0.18	0.20
All correct	0.26	0.22
Income quintile		
1st	0.08	0.05
2nd	0.14	0.19
3rd	0.08	0.09
4th	0.16	0.27
5th	0.24	0.23
Gender		
Male	0.16	0.21
Female	0.15	0.14
Age category		
16-34	0.24	0.19
35-44	0.22	0.22
45-54	0.10	0.21
55-62	0.11	0.15
63+	0.01	0.04
Employment status		
Employed	0.17	0.26
Self-employed	0.17	0.06
Not working	0.08	0.03
Education		
Primary or no education	*NA*	*NA*
Secondary education	0.14	0.19
Tertiary education	0.21	0.22

Note: Descriptive statistics computed using survey weights. Descriptive statistics labeled with *NA* could not be computed due to lack of observations (less than 20 in the sample). Retired respondents have been excluded from the analysis.
Source: HFCS 2014, National Bank of Slovakia; own calculations

4. ESTIMATION AND RESULTS

4.1 BASELINE

We estimate the relationship between financial literacy and the propensity to save for retirement in private pension savings schemes controlling for other individual socio-economic characteristics by running the baseline linear probability model:

$$SAVING_i = \beta_0 + \beta_1 FL_i + \beta_2 X_i + u_i, \tag{1}$$

where $SAVING_i$ is the dependent dummy variable equal to 1 if the *i*-th individual voluntarily saves for his/her retirement, FL_i is the level of financial literacy measured by a number of correct answers or by a dummy variable if all questions were correctly answered, X_i is the vector of control variables influencing individual financial decision-making, such as income, gender, education, age, employment status, attitude towards risk, having children as well as regional

dummy variables, and u_i is the error term. All explanatory variables entering regressions are explained in detail in Table D.1. Based on the existing literature, we hypothesise the effect of financial literacy to be positive ($\beta_1 > 0$) and statistically different from 0.

The results of our baseline linear probability models estimated by OLS, models (1) and (3), are presented in Table 4.[11] Regarding our main variable of interest, there is a significant and positive association between financial literacy and participation in voluntary retirement savings plans. This finding is in line with previous empirical research on financial literacy and retirement savings from other countries (Table B.1). Estimated effects of financial literacy range from 6 to 10 percentage points, depending on the financial literacy measure. Interestingly, we find no statistically significant relationship between financial literacy and participation in the employer-supported voluntary private pension savings schemes, as shown in models (5) and (7) in Table 4.

Besides the level of financial literacy, participation in voluntary retirement savings schemes, both without and with employers' contributions, is also positively correlated with the individual income. The estimated positive association between income and propensity to save is in line with results from other countries. The association between age and retirement savings has an inverted U shape. The relationship is more intense for the younger age categories (16-34, and 35-44) compared to the older age cohorts. The association between voluntary retirement savings decision and education is positive, albeit insignificant.

Females spend a longer time in their retirement compared to the male population in Slovakia. In Slovakia, the average time in retirement was 23.8 years for females and 16.5 years for the male population (OECD, 2015). Yet we do not find a substantial difference between men and women regarding their retirement savings behaviour. Similar results have been found in studies from other countries as well (e.g. Arrondel et al., 2013; Bucher-Koenen and Lusardi, 2011).

There is a positive and significant association between the ownership of other real estate property and propensity to save for retirement. This result suggests that the two can be viewed more as complements rather than substitutes in the retirement wealth accumulation. Propensity to save is higher in urban areas compared to rural ones which can be attributed to the better infrastructure of financial services in cities. However, this holds only for the purely voluntary retirement savings plans. Finally, there is a positive and significant relationship between employment status (employed for wage) and participation in the voluntary retirement savings schemes with employers' subsidies.

4.2 ENDOGENOUS FINANCIAL LITERACY

The potential endogeneity of financial literacy has been considered in a number of theoretical and empirical studies (e.g. Fornero and Monticone, 2011; Jappelli and Padula, 2013; Crossley

---

[11] In principle a nonlinear model, such as probit, is more appropriate for our application as our outcome variable is binary. However, a linear probability model is completely general when the model is saturated, that is, the explanatory variables are indicators flagging a set of mutually exclusive and exhaustive categories (Wooldridge, 2010, p. 564). Our model is not strictly speaking saturated (because there are other control variables), but our main explanatory variables of interest are dummy variables that flag a set of mutually exclusive and exhaustive categories. So we might say that our model is "nearly saturated", and as such the linear probability model is an appropriate estimation method for our application. Empirically speaking, none of the predicted probabilities fall out of the [0,1] range. In addition, a specific feature of the HFCS data is that missing values for some important variables are multiple-imputed with $M = 5$ (see ECB, 2013). Since our analysed variables contain just a small share of missing values that needed to be multiple-imputed, we restrict our analyses only to one set of implicates. We have estimated our models separately for all five imputed datasets, but the results do not differ considerably.

et al., 2017). In our framework, endogeneity of financial literacy could be caused by a possible reverse causality between financial literacy and retirement savings (i.e. acquiring financial literacy by participating in pension plans), omitted (unobserved) factors simultaneously driving both participation in retirement savings and the level of financial literacy, as well as measurement error associated with measuring literacy in surveys (e.g. Fornero and Monticone, 2011; Crossley et al., 2017). It has been argued that the effect of financial literacy will be likely biased in the standard OLS compared to the instrumental variable approach (see Lusardi and Mitchell, 2014; Fernandes et al., 2014). Note that only several empirical studies have accounted for the potential endogeneity of financial literacy (see Table B.1 for an overview).

To address the possible endogeneity problem of financial literacy, we employ instrumental variable (IV) approach and estimate the linear probability model by using the generalized methods of moments (GMM) estimator. In a simultaneous-equation framework, this can be written as:

$$SAVING_i = \beta_0 + \beta_1 FL_i + \beta_2 X_i + u_i \tag{2}$$

and

$$FL_i = \pi_0 + \pi_1 X_i + \pi_2 Z_i + v_i, \tag{3}$$

where notation remains the same as in equation (1), except the vector of instrumental variables for financial literacy, Z_i, and the error term v_i. In this model we assume validity of instruments – i.e. we assume the correlation between Z_i and u_i to be equal to zero. Furthermore, we verify through our first-stage regressions, that the instruments are predictive of our financial literacy measures. FL_i is correlated with Z_i, thereby fulfilling the second condition for a valid instrument, that is, that the instrument should be correlated with the endogenous variable being instrumented.

The use of IV approach is often hindered by a lack of suitable instruments in a data set. While several empirical studies have used instruments for financial literacy such as education in the field of finance or economics, literacy, and education of relatives/peers, employment in the field of finance or economics, number of universities per region, or use of the internet at home (e.g. Fornero and Monticone, 2011; Alessie et al., 2011; Lusardi and Mitchell, 2014), the Slovak HFCS data does not contain such information. On the other hand, the survey contains a detailed paradata, that is, a section with questions/comments on each household and detailed assessment of interviewees done by the interviewers. Out of such questions we have chosen as instruments the general ability of respondents to understand questions in the survey, and the ability of respondents to express monetary values in a legacy currency in terms of euros. These abilities are assessed by interviewers after finishing the interview in each household. Respondents themselves have no influence on the assessment and therefore we assume such variables are not correlated with the error term u_i. At the same time, the above abilities might be closely linked to literacy in general (including financial).

The choice of the mentioned variables for instruments is relevant for the Slovak case. Especially because many people have acquired their real assets (e.g. houses, cars, etc.) before 2009, when the euro was introduced as a new currency, and they still tend to express the monetary values in terms of the former currency, Slovak crowns. The variable on the ability to express amounts in euros should be a direct proxy for financial literacy and we a-priori expect a positive correlation between the financial literacy and this instrument (see Table D.1 for definition). Impact of the second instrument, general ability to understand questions, is expected to be positive, too. In fact, we show in the first-stage of our IV regressions that the considered

instrumental variables are positively correlated with financial literacy (see table D.2).[12]

The results of second-stage of the IV regressions estimated by the GMM approach are presented in Table 4 – models (2), (4), (6) and (8). First, P-values of the C (difference-in-Sargan) statistic are 0.091 and 0.027 for FL_1 and 0.016 and 0.049 for FL_2, respectively, hence the null hypothesis of exogeneity of the regressors is rejected. This confirms that financial literacy is endogenous in our framework. The results further suggest that our proposed instruments for financial literacy are indeed valid for both FL specifications as they survive several statistical tests about the validity of instruments. For example, P-values of the Hansen's J test statistic are 0.152 and 0.659 for FL_1 and 0.562 and 0.223 for FL_2, and therefore the null hypothesis of the instrument validity cannot be rejected. Validity of instruments is also confirmed by the F-test results being larger than 10 in the case of FL_1 (15.084), and close to 10 in the case of FL_2 (8.389). Correlations of the proposed instruments with financial literacy measures in the first-stage of the IV regressions are presented in Table D.2. The results show that the ability to express monetary values in a legacy currency in terms of euros and the ability to understand questions in the survey are positively correlated with the level of financial literacy. After addressing endogeneity of financial literacy through the IV approach, the impact of financial literacy on the propensity to save for retirement increases in all four specifications. For example, answering an additional question correctly in FL_1 increases the propensity to save in the supplementary pension savings schemes by almost 17 percentage points when individuals set up their private pension savings plans on their own, and by 18 percentage points in the case of employer-supported private pension schemes.

---

[12]We have also considered a variable on the frequency of respondents to use consulting documents (e.g. income records, tax bills, pension documents, etc.) as an instrument for financial literacy. However, its association with the level of financial literacy is a-priori not clear. On the one hand, more financially literate people are aware of their financial situation and thus do not need to use consulting documents for answering questions in the survey. On the other hand, literate respondents might want to provide as precise answers as possible, and therefore use such consulting materials.

Table 4: OLS and IV estimates of the participation in voluntary private pension schemes

	Participation without employers' contributions				Participation with employers' contributions			
	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV	(7) OLS	(8) IV
Financial literacy: number of correct answers	0.056***	0.165**			0.018	0.180**		
	[0.011]	[0.068]			[0.012]	[0.078]		
Financial literacy: all answers correct			0.100***	0.607**			0.039	0.499*
			[0.031]	[0.242]			[0.030]	[0.259]
2nd income quintile	0.088**	0.090**	0.092**	0.120***	0.016	0.017	0.018	0.040
	[0.037]	[0.039]	[0.037]	[0.043]	[0.034]	[0.038]	[0.034]	[0.039]
3rd income quintile	0.034	0.029	0.036	0.037	0.043	0.034	0.043	0.042
	[0.035]	[0.037]	[0.035]	[0.041]	[0.036]	[0.041]	[0.036]	[0.041]
4th income quintile	0.097***	0.087**	0.101***	0.105**	0.143***	0.134***	0.144***	0.148***
	[0.034]	[0.037]	[0.034]	[0.041]	[0.037]	[0.042]	[0.037]	[0.041]
5th income quintile	0.136***	0.123***	0.139***	0.125***	0.132***	0.118***	0.133***	0.121***
	[0.037]	[0.040]	[0.037]	[0.045]	[0.037]	[0.042]	[0.037]	[0.042]
Age category (16-34)	0.187***	0.198***	0.187***	0.209***	0.057	0.070	0.058	0.077
	[0.051]	[0.055]	[0.051]	[0.066]	[0.057]	[0.062]	[0.057]	[0.069]
Age category (35-44)	0.202***	0.228***	0.199***	0.243***	0.133**	0.167***	0.133**	0.169**
	[0.046]	[0.051]	[0.046]	[0.062]	[0.054]	[0.061]	[0.054]	[0.069]
Age category (45-54)	0.148***	0.179***	0.141***	0.187***	0.146***	0.191***	0.144***	0.185***
	[0.041]	[0.048]	[0.040]	[0.058]	[0.049]	[0.059]	[0.049]	[0.065]
Age category (55-62)	0.149***	0.171***	0.150***	0.211***	0.119**	0.153***	0.120**	0.175**
	[0.041]	[0.047]	[0.041]	[0.061]	[0.050]	[0.058]	[0.050]	[0.069]
Having children	-0.005	0.005	-0.005	0.029	0.045	0.066**	0.045	0.078**
	[0.026]	[0.028]	[0.026]	[0.034]	[0.028]	[0.031]	[0.028]	[0.035]
Male	-0.008	-0.006	-0.007	0.002	-0.040	-0.039	-0.040	-0.033
	[0.025]	[0.026]	[0.025]	[0.029]	[0.026]	[0.028]	[0.026]	[0.029]
Single-member household	-0.033	-0.026	-0.034	-0.013	0.065**	0.078**	0.065**	0.083**
	[0.028]	[0.031]	[0.029]	[0.036]	[0.030]	[0.034]	[0.030]	[0.037]
Employed	0.019	-0.009	0.024	-0.025	0.148***	0.106***	0.149***	0.104***
	[0.031]	[0.038]	[0.030]	[0.043]	[0.030]	[0.037]	[0.030]	[0.040]
Self-employed	0.007	-0.010	0.012	-0.012	-0.048	-0.077**	-0.047	-0.071*
	[0.038]	[0.043]	[0.038]	[0.046]	[0.031]	[0.037]	[0.031]	[0.037]
University degree	0.046	0.030	0.047*	0.007	0.009	-0.017	0.008	-0.028
	[0.028]	[0.031]	[0.028]	[0.038]	[0.029]	[0.033]	[0.029]	[0.038]
Positive risk attitude	0.034	0.061	0.022	0.042	0.041	0.090	0.038	0.061
	[0.049]	[0.053]	[0.049]	[0.053]	[0.053]	[0.062]	[0.053]	[0.057]
Living in a city	0.058**	0.064**	0.059**	0.076**	0.018	0.025	0.018	0.033
	[0.029]	[0.029]	[0.029]	[0.034]	[0.031]	[0.033]	[0.031]	[0.035]
Owning household main residence	0.006	0.006	0.001	-0.017	0.041	0.043	0.040	0.022
	[0.027]	[0.027]	[0.027]	[0.031]	[0.027]	[0.028]	[0.027]	[0.032]
Owning other real estate	0.057**	0.044	0.062**	0.053*	0.059**	0.040	0.061**	0.054*
	[0.028]	[0.030]	[0.028]	[0.032]	[0.030]	[0.032]	[0.029]	[0.032]
Constant	-0.336***	-0.639***	-0.205***	-0.324***	-0.157**	-0.605***	-0.116*	-0.220**
	[0.068]	[0.198]	[0.061]	[0.092]	[0.076]	[0.229]	[0.070]	[0.099]
Regional dummy variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.076		0.069		0.112		0.112	
F of instruments		15.181		8.389		15.181		8.389
Hansen's J χ^2		2.053		0.336		0.195		1.485
P-value of Hansen's J test		0.152		0.562		0.659		0.223
P-value of exogeneity test		0.091		0.016		0.027		0.049
N	1,253	1,253	1,253	1,253	1,253	1,253	1,253	1,253

Note: Robust standard errors are presented in brackets. Regressions are estimated on the sample of non-retired individuals. Dummy variables for not working, first income quintile, age category over 63 years, and the region of Košice are the reference categories for the respective dummy sets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: HFCS 2014, National Bank of Slovakia; own calculations

4.3 ROBUSTNESS CHECK

As a robustness check, we re-estimate the relationship between financial literacy and participation in the voluntary retirement savings schemes on a different age sub-sample of individuals. The voluntary retirement savings scheme in Slovakia is (unfortunately) designed so that it generates low annual yields, but on the other hand there are generous tax incentives and employers' contributions. Individuals with many decades until retirement may find the low yields more important and find it optimal to save privately in other vehicles – especially individuals with very high financial literacy. On the other hand, individuals with a shorter time until retirement may find the tax incentives and employer contributions more important and find it optimal to participate in the scheme. We therefore re-estimate the relationship for the non-retired individuals aged from 35 to 62 years. The results of robustness check part (both stages) are presented in Tables D.3 and D.4, respectively and support our previous findings from the baseline models. The association remains positive and significant, and even strengthens in the IV models for both specifications of financial literacy compared to the baseline estimations. Likewise in the baseline models, we can reject the null hypothesis of exogeneity of financial literacy.

5. CONCLUDING REMARKS

Despite of decreasing benefits of state pensions in the majority of developed economies, individuals do not save adequately for their old age in private pension schemes as shown by the recent literature. Among important factors for retirement wealth accumulation, research has identified financial literacy to be an important ingredient of informed choices and sound financial and economic behaviour of individuals, including retirement savings. However, a gap in the literature remains for CEE countries in this regard.

The aim of this study was to cast light on the voluntary retirement saving behaviour of Slovak individuals with the main focus on financial literacy, as this topic has not been widely studied with representative microdata in CEE countries yet. Utilising recent data from the Slovak Household Finance and Consumption Survey, we find that the share of non-retired individuals voluntarily saving for their retirement is only about 16%. The share of non-retired individuals saving for old age in the employer-supported voluntary private pension schemes is around 19%. All in all, saving for retirement in the voluntary private pension schemes is still quite low in Slovakia, compared to other developed countries.

Only 17% of all the respondents surveyed were able to correctly answer all questions on financial literacy. Compared to the results from similar surveys for other developed countries (e.g. Germany, Netherlands, or Switzerland), this presents a gap in financial literacy of around 30 percentage points. While respondents typically understand concepts of interest rates, inflation and portfolio diversification, they tend to struggle with the riskiness concept. The lowest financial literacy is observed among low-educated, low-income and unemployed respondents. On the other hand, young individuals with university education and high incomes are the most financially literate. This can play an important role when individuals set up portfolios of their pension funds.

Our main result indicates that individuals' propensity to save for retirement in the supplementary private pension schemes is positively associated with financial literacy, controlling for a large set of socio-economic characteristics. Based on our empirical results we can conclude that the impact of financial literacy is stronger / more significant on individuals' decisions to participate in the voluntary private pension savings schemes compared to participation in schemes where

individuals are rather motivated to participate by (generous) employers' contributions.

We have addressed possible endogeneity of financial literacy with a novel set of instrumental variables in instrumental variable approach. The effect of financial literacy remains positive and statistically significant, and becomes about three times larger in the IV estimates compared to OLS estimates. Furthermore, results are robust for different specifications of financial literacy and different age sub-samples.

Our findings, being the first study covering a CEE country, contribute to the growing body of empirical research on the relationship between financial literacy and retirement savings. We also contribute to the literature by using novel instrumental variables for financial literacy, which have not been used in the empirical research on household and personal finance yet. Our results can help policymakers in their efforts to promote voluntary saving behaviour of individuals by improving their financial literacy, especially the most vulnerable groups of the population including low-educated, low-income and unemployed individuals. Such policies are important, as shortfalls of financial literacy can have a strong effect on the financial security of individuals during their whole life.

It is important to emphasise that our research focuses solely on decisions of individuals to voluntarily save in the supplementary private pension schemes. There also exist other vehicles to accumulate wealth for old age. It has been argued that net yields (adjusted for relatively high fees) from investing in these pension schemes are limited compared to returns from investing in more sophisticated financial products. On the other hand, investing in such financial assets where individuals are not limited to premature withdrawals can have short-term benefits, but long-term consequences and might not be the best proxy for the retirement financial security. Nevertheless, we leave the question about the importance of financial literacy in demand for sophisticated financial products open for further research.

REFERENCES

Agnew, J. R., H. Bateman, and S. Thorp (2013). Financial literacy and retirement planning in Australia. *Numeracy 6*(2), 7.

Alessie, R., M. Van Rooij, and A. Lusardi (2011). Financial literacy and retirement preparation in the Netherlands. *Journal of Pension Economics and Finance 10*(04), 527–545.

Almenberg, J. and J. Säve-Söderbergh (2011). Financial literacy and retirement planning in Sweden. *Journal of Pension Economics and Finance 10*(04), 585–598.

Ameriks, J., A. Caplin, and J. Leahy (2003). Wealth accumulation and the propensity to plan. *The Quarterly Journal of Economics 118*(3), 1007–1047.

Arrondel, L., M. Debbich, and F. Savignac (2013). Financial Literacy and Financial Planning in France. *Numeracy 6*(2), 8.

Aslanyan, G. (2014). The migration challenge for PAYG. *Journal of Population Economics 27*(4), 1023–1038.

Atkinson, A. and F.-A. Messy (2011). Assessing financial literacy in 12 countries: an OECD/INFE international pilot exercise. *Journal of Pension Economics and Finance 10*(04), 657–665.

Badarinza, C., J. Y. Campbell, and T. Ramadorai (2016). International comparative household finance. *Annual Review of Economics 8*, 111–144.

Banks, J. (2010). Cognitive Function, Financial Literacy and Financial Outcomes at Older Ages: Introduction. *The Economic Journal 120*(548), F357–F362.

Beckmann, E. (2013). Financial literacy and household savings in Romania. *Numeracy 6*(2), 9.

Behrman, J. R., O. S. Mitchell, C. K. Soo, and D. Brava (2012). How financial literacy affects household wealth accumulation. *American Economic Review 102*(3), 300–304.

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., J. Skinner, and S. Weinberg (2001). What accounts for the variation in retirement wealth among US households? *American Economic Review 91*(4), 832–857.

Boisclair, D., A. Lusardi, and P.-C. Michaud (2017). Financial literacy and retirement planning in Canada. *Journal of Pension Economics and Finance 16*(3), 277–296.

Bover, O., M. Schürz, J. Slacalek, and F. Teppa (2016). Eurosystem Household Finance and Consumption Survey: Main Results on Assets, Debt, and Saving. *International Journal of Central Banking 12*(2), 1–13.

Brown, J. R. and S. J. Weisbenner (2014). Why do individuals choose defined contribution plans? evidence from participants in a large public plan. *Journal of Public Economics 116*, 35–46.

Brown, M. and R. Graf (2013). Financial literacy and retirement planning in Switzerland. *Numeracy 6*(2), 6.

Browning, M. and T. F. Crossley (2001). The life-cycle model of consumption and saving. *The Journal of Economic Perspectives 15*(3), 3–22.

Bucher-Koenen, T. and A. Lusardi (2011). Financial literacy and retirement planning in Germany. *Journal of Pension Economics and Finance 10*(04), 565–584.

Bucher-Koenen, T., A. Lusardi, R. Alessie, and M. van Rooij (2017). How Financially Literate Are Women? An Overview and New Insights. *Journal of Consumer Affairs 51*(2), 255–283.

Campbell, J. Y. (2006). Household finance. *The Journal of Finance 61*(4), 1553–1604.

Cardak, B. A. and R. Wilkins (2009). The determinants of household risky asset holdings: Australian evidence on background risk and other factors. *Journal of Banking and Finance 33*(5), 850–860.

Carmel, E., D. Carmel, D. Leiser, and A. Spivak (2015). Facing a biased adviser while choosing a retirement plan: the impact of financial literacy and fair disclosure. *Journal of Consumer Affairs 49*(3), 576–595.

Christelis, D., T. Jappelli, and M. Padula (2010). Cognitive abilities and portfolio choice. *European Economic Review 54*(1), 18–38.

Crossan, D., D. Feslier, and R. Hurnard (2011). Financial literacy and retirement planning in New Zealand. *Journal of Pension Economics and Finance 10*(04), 619–635.

Crossley, T. F., T. Schmidt, P. Tzamourani, and J. K. Winter (2017). Interviewer effects and the measurement of financial literacy. Technical report, Institute for Social and Economic Research.

Disney, R. and J. Gathergood (2013). Financial literacy and consumer credit portfolios. *Journal of Banking and Finance 37*(7), 2246–2254.

ECB (2013). The Eurosystem Household Finance and Consumption Survey-Methodological report. Technical report, European Central Bank.

Fernandes, D., J. G. Lynch Jr, and R. G. Netemeyer (2014). Financial literacy, financial education, and downstream financial behaviors. *Management Science 60*(8), 1861–1883.

Fidrmuc, J. and M. Senaj (2014). Income, Schooling and Housing Wealth during Economic Reforms. *Czech Journal of Economics and Finance 64*(2), 160–176.

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

Gaudecker, H.-M. V. (2015). How does household portfolio diversification vary with financial literacy and financial advice? *The Journal of Finance 70*(2), 489–507.

Guiso, L. and E. Viviano (2015). How much can financial literacy help? *Review of Finance 19*(4), 1347–1382.

Hujo, K. (2014). *Reforming Pensions in Developing and Transition Countries*. Springer.

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

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

Kalmi, P. and O.-P. Ruuskanen (2015). Financial Literacy and Retirement Planning in Finland.

Klapper, L. and G. A. Panos (2011). Financial literacy and retirement planning: the Russian case. *Journal of Pension Economics and Finance 10*(04), 599–618.

Lusardi, A. and O. S. Mitchell (2007). Baby boomer retirement security: The roles of planning, financial literacy, and housing wealth. *Journal of Monetary Economics 54*(1), 205–224.

Lusardi, A. and O. S. Mitchell (2011a). Financial literacy and retirement planning in the United States. *Journal of Pension Economics and Finance 10*(04), 509–525.

Lusardi, A. and O. S. Mitchell (2011b). Financial literacy around the world: an overview. *Journal of Pension Economics and Finance 10*(04), 497–508.

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

Moure, N. G. (2016). Financial literacy and retirement planning in Chile. *Journal of Pension Economics and Finance 15*(02), 203–223.

Nakajima, M. and I. A. Telyukova (2011). Home equity in retirement. *Age 65*(75), 85.

OECD (2015). *Pensions at a Glance 2015: OECD and G20 indicators*. Organisation for Economic Co-operation and Development.

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.

Van Rooij, M. C., A. Lusardi, and R. J. Alessie (2012). Financial literacy, retirement planning and household wealth. *The Economic Journal 122*(560), 449–478.

Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. MIT press.

APPENDIX

A. DESCRIPTION OF THE SLOVAK PENSION SYSTEM

The pension system in Slovakia is a multi-tier system based on the Chilean system with three tiers. The system was introduced in 2005 after the structural reform was launched.[13] The first tier is represented by the former PAYG system, the second tier is a contribution-based pension savings system and the third tier represents a supplementary pension scheme.

The first, PAYG, tier is a continuation of the previously implemented pension system and this pension scheme is compulsory for all of the active working population. Pensions for current retirees are continuously financed by contributions paid by the active working population. This tier represents a defined-benefit plan. Benefits for retirees are based on the period of individuals' economic activity and the level of income. Even though the amount of contributions is linked to the amount of the benefits provided, there is a strong element of intergenerational solidarity. This tier is administered by the Social Insurance Agency, a public institution. There are two types of sub-schemes operated by this tier: pension insurance that provides income for the retired population and insurance in the event of death, and disability insurance for individuals whose earning capacity has declined due to long-term illness or health issues.

As an innovation of the new pension system, a fully-funded defined-contribution tier was established. This tier represents a contribution-based plan that is financed by capitalization of pension funds managed by private pension fund management companies and with mandatory participation for those who have once entered. The amount of pension benefits depends on the capitalized contributions paid, which are collected in the personal accounts of individuals. These funds are invested according to the strategy chosen by a client of the private pension fund company. Since the establishment of this tier up until now, the obligation to participate in this tier has varied substantially.[14]

Individuals participating in both tiers will receive a combined pension from both sources. The first part will be a proportionally reduced pension from the first tier which is paid by the Social Insurance Agency and the other part of the pension will depend on the contributions paid and

---

[13]Before the reform took place, the pension system had been functioning mainly as a mono-tier pay-as-you-go system (PAYG) with deeply implemented elements of intergenerational solidarity. Adverse development of demography has revealed the weak spots of such a system, as the ratio of contributors to beneficiaries started to decrease dramatically and the sustainability of the system was pushed to the limit. For example, in 2015, the old-age dependency ratio (i.e. number of people of retirement age per 100 people of working age) was 20.6% and this share is estimated to further increase to 55.4% in 2050 (OECD, 2015). Based on these trends, Slovak government prepared legislative changes to transfer part of the responsibility for future retirement income and wealth onto individuals.

[14]After the adoption of this scheme, participation in the system was compulsory for individuals who became active for the first time in their life after 1st January 2005 and voluntary for the others. However, it was not recommended for those who should retire earlier than 10 years after enrolling in the system. In 2008, participation in this system changed to voluntary for all participants. In 2012, participation for the new working population in the system was again made obligatory and in 2013 and 2015 the system was changed again. Currently, individuals may voluntarily choose if they want to participate in this saving scheme. However, they should be younger than 35 years and once they decide for the participation then the saving becomes mandatory.

investment returns from the chosen investment strategy.[15] Currently in Slovakia, the mandatory contributions to pension schemes are 18% of gross income, from which 13.75% is dedicated to the first pillar and the remaining 4.25% to the second tier.[16]

The last part of the pension system, the third tier, is a fully-funded defined-contribution pension scheme managed by supplementary pension management companies.[17] Participation in this form of pension scheme is optional except for employees in hazardous professions (e.g. miners, pilots and others) who must participate by law. The third tier is virtually a hybrid between personal pension schemes and employment-based schemes typical for Western European countries such as the UK, Ireland or the Netherlands. Employees have two options how to participate in this system, either individually or with their employers' contributions. These contributions are usually a part of the compensation benefits and not all employers offer this benefit. The government supports voluntary savings and since 2014 participants (employees as well as employers) can subtract contributions into the third tier from their income tax base.[18]

The existing pension system in Slovakia is fairly young and has overcome many hurdles from its establishment. One of the most serious is political and system instability concerning especially the second contribution-based tier. Retirement saving presents a long-term investment decision. However, in the enrolment system, participation as well as the amount of contributions have changed several times during the last decade. After continuous debates about sustainability of the PAYG system and volatility of the second tier, non-mandatory saving for retirement seems to be a superior strategy for individuals to accumulate sufficient wealth for their retirement period.

---

[15]According to the Slovak legislation, participants could choose among at least two different types of investment funds (a fund focused on investments in bonds and a fund focused on investments in shares) that differ based on the level of risk and return. In reality, private pension fund management companies offer more than these two funds, typically also a combination of the two as well as an index fund.

[16]Note that this proportion has varied during the existence of the new system. Since 2005 to 2011, the contributions were half to half (i.e. 9% to the first pillar and 9% to the second pillar). Since 2012 to 2016, 14% of the contributions were dedicated to the first pillar, and the remaining 4% to the second pillar. Since 2017, 4.25% of the contributions are dedicated to the second pillar. The share of contributions to the first and second pillar will stabilise in 2024 at the ratio of 12:6%.

[17]Note that prior to 2005, when the major reform of the pension system occurred, there was an insurance saving scheme with insurance savings contracts lasting until retirement of the insured person which were operated by supplementary pension insurance companies.

[18]This benefit was canceled by law for physical entities in 2011 and introduced again from 2014 but with a substantially lower amount.

B. STUDIES ON FINANCIAL LITERACY AND RETIREMENT SAVINGS

Table B.1: Overview of empirical studies on financial literacy and saving/planning for retirement

Study	Country	Level of financial literacy (all correct)	Share of planners/savers for retirement	Impact of financial literacy on retirement planning/saving	Endogeneity of FL addressed
Agnew et al. (2013)	Australia	43%	Planning (32%)	(+)	YES
Boisclair et al. (2017)	Canada	42%	Actual saving (70%)	(+)	NO
Moure (2016)	Chile	7%	Planning (9%)	(+)	NO
Kalmi and Ruuskanen (2015)	Finland	39%	Planning (29%)	(+)	NO
Arrondel et al. (2013)	France	31%	Planning (25%)	(+)	NO
Bucher-Koenen and Lusardi (2011)	Germany	53%	Planning (25%)	(+)	YES
Fornero and Monticone (2011)	Italy	25%	Actual saving (14%)	(+)	YES
Sekita (2011)	Japan	27%	Planning (40%)	(+)	YES
Alessie et al. (2011)	Netherlands	45%	Planning (13%)	(+)	YES
Crossan et al. (2011)	New Zealand	24%	Planning (27%)	(-/+)	NO
Beckmann (2013)	Romania	4%	Actual saving (2%)	(+)	NO
Klapper and Panos (2011)	Russia	4%	Actual saving (19%)	(+)	YES
Almenberg and Säve-Söderbergh (2011)	Sweden	27%	Planning (24%)	(+)	NO
Brown and Graf (2013)	Switzerland	52%	Actual saving (41%)	(+)	NO
Lusardi and Mitchell (2011a)	USA	30%	Planning (43%)	(+)	YES

Note: The level of financial literacy in particular studies is assessed based on the basic three financial literacy questions (i.e. capacity to do calculus with interest rates, understanding of inflation, and understanding of risk diversification) except Finland with nine financial literacy questions asked.
Source: Own processing based on the available literature

NÁRODNÁ BANKA SLOVENSKA
EUROSYSTEM

C. FINANCIAL LITERACY QUESTIONS IN THE SLOVAK HFCS

This appendix contains detailed description of questions on financial literacy in the Slovak HFCS. Correct answers are marked in bold.

Q1) Fixed interest rates: Of the following types of mortgages which one do you think will allow you from the start to fix both the amount and the number of instalments needed to pay off the loan?

   a) Floating-rate mortgage

   b) **Fixed-rate mortgage**

   c) Do not know

   d) No answer

Q2) Inflation: Imagine leaving 1,000 euros in a current account that pays 1% interest and has no charges. Imagine also that prices increase by 2%. Do you think that if you withdraw the money in a year's time you will be able to buy the same amount of goods as if you spent the 1,000 euros today?

   a) Yes

   b) **No, I will be able to buy less**

   c) No, I will be able to buy more

   d) Do not know

   e) No answer

Q3) Portfolio diversification: In your opinion, which of the following investment strategies entails a greater risk of losing money?

   a) **Invest all savings in the securities issued by a single company**

   b) Invest all savings in the securities issued by a wide range of unrelated companies

   c) Do not know

   d) No answer

Q4) Risk: A company can obtain financing either issuing shares or bonds. In your opinion, which financial instrument entails a greater risk of losing money from the investor's point of view?

   a) **Shares**

   b) Bonds

   c) Equally risky

   d) I do not know the difference between bonds and shares

   e) Do not know

   f) No answer

D. ADDITIONAL TABLES

Table D.1: Description of variables used in regressions

Variable	Definition
Savings without employers' contributions	Dummy: 1 if respondent saves for retirement in a form of private pension funds or whole life insurance contracts without employers' contributions
Savings with employers' contributions	Dummy: 1 if respondent saves for retirement in a form of private pension funds or whole life insurance contracts with employers' contributions
Financial literacy: number of correct answers	Number of correctly answered financial literacy questions
Financial literacy: all answers correct	Dummy: 1 if all financial literacy questions answered correctly
Income quintiles	Dummy variables set for 5 (individual) income quantiles
Male	Dummy: 1 if male
Having children	Dummy: 1 if respondent has at least one child
Single-member household	Dummy: 1 if respondent lives in a single member household
Age categories	Dummy variables set for 5 age categories (16-34, 35-44, 45-54, 55-62, and 63+)
University degree	Dummy: 1 if respondent gained university education
Positive risk attitude	Dummy: 1 if respondent declares positive attitude towards risk
Employed	Dummy: 1 if respondent is employed for wage
Self-employed	Dummy: 1 if respondent is self-employed
Not working	Dummy: 1 if respondent is unemployed (including unemployed people, students, and homemakers)
Living in a city	Dummy: 1 if respondent lives in a city (population above 50,000)
Owning household main residence	Dummy: 1 if respondent lives in a household owning household main residence
Owning other real estate	Dummy: 1 if respondent lives in a household owning other real estate properties (e.g. house, apartment, garage, land, etc.)
Regions	Dummy variables set for regions of Bratislava, Trnava, Trenčín, Nitra, Žilina, Banská Bystrica, Prešov, and Košice
Instrumental variable	Ability to understand questions in the survey; from poor (1) to excellent (4)
Instrumental variable	Ability to convert monetary values from Slovak crowns to euros; from poor (1) to excellent (4)

Source: HFCS 2014, National Bank of Slovakia

Table D.2: First-stage regression estimates of financial literacy

	Financial literacy: number of correct answers	Financial literacy: all answers correct
Instrument: ability to understand questions in the survey	0.106**	0.058***
	[0.048]	[0.020]
Instrument: ability to convert monetary values from Slovak crowns to euros	0.130***	0.013
	[0.045]	[0.018]
Exogenous socio-economic control variables	Yes	Yes
Regional dummy variables	Yes	Yes
Adjusted R^2	0.058	0.036
N	1,253	1,253

Note: Robust standard errors are presented in brackets. Regressions are estimated on the sample of non-retired individuals. Dummy variables for not working, first income quintile, age category over 63 years, and the region of Košice are the reference categories for the respective dummy sets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: HFCS 2014, National Bank of Slovakia; own calculations

Table D.3: OLS and IV estimates of the participation in voluntary private pension schemes (robustness check)

	Participation without employers' contributions				Participation with employers' contributions			
	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV	(7) OLS	(8) IV
Financial literacy: number of correct answers	0.057***	0.191**			0.015	0.220**		
	[0.012]	[0.076]			[0.013]	[0.090]		
Financial literacy: all answers correct			0.104***	0.725**			0.024	0.693**
			[0.034]	[0.291]			[0.033]	[0.329]
2nd income quintile	0.068*	0.068	0.070*	0.087*	0.013	0.014	0.014	0.028
	[0.039]	[0.043]	[0.039]	[0.047]	[0.037]	[0.043]	[0.037]	[0.045]
3rd income quintile	0.026	0.020	0.026	0.005	0.050	0.037	0.050	0.025
	[0.038]	[0.041]	[0.038]	[0.047]	[0.039]	[0.048]	[0.039]	[0.053]
4th income quintile	0.069*	0.049	0.072**	0.054	0.146***	0.124**	0.147***	0.129**
	[0.037]	[0.040]	[0.037]	[0.046]	[0.039]	[0.049]	[0.039]	[0.050]
5th income quintile	0.136***	0.118***	0.137***	0.108**	0.147***	0.127***	0.147***	0.116**
	[0.041]	[0.044]	[0.041]	[0.050]	[0.040]	[0.048]	[0.040]	[0.052]
Age category (35-44)	0.057*	0.063*	0.053*	0.033	0.013	0.015	0.012	-0.014
	[0.032]	[0.033]	[0.032]	[0.040]	[0.034]	[0.036]	[0.034]	[0.041]
Age category (45-54)	-0.000	0.012	-0.008	-0.026	0.026	0.042	0.025	0.003
	[0.025]	[0.027]	[0.025]	[0.031]	[0.027]	[0.031]	[0.027]	[0.035]
Having children	-0.010	0.000	-0.009	0.033	0.037	0.062*	0.037	0.087**
	[0.027]	[0.031]	[0.028]	[0.040]	[0.030]	[0.035]	[0.030]	[0.043]
Male	-0.011	-0.011	-0.009	-0.005	-0.047*	-0.051	-0.047*	-0.044
	[0.027]	[0.028]	[0.027]	[0.032]	[0.029]	[0.031]	[0.029]	[0.033]
Single-member household	-0.033	-0.025	-0.031	-0.004	0.067**	0.079**	0.067**	0.097**
	[0.030]	[0.033]	[0.030]	[0.040]	[0.033]	[0.039]	[0.033]	[0.045]
Employed	0.022	-0.012	0.028	-0.023	0.157***	0.103**	0.159***	0.103**
	[0.033]	[0.042]	[0.033]	[0.046]	[0.034]	[0.043]	[0.033]	[0.047]
Self-employed	0.019	-0.006	0.027	0.006	-0.051	-0.091**	-0.049	-0.072
	[0.042]	[0.049]	[0.042]	[0.051]	[0.035]	[0.044]	[0.035]	[0.045]
University degree	0.037	0.018	0.038	-0.012	0.014	-0.024	0.015	-0.042
	[0.031]	[0.035]	[0.032]	[0.046]	[0.033]	[0.040]	[0.033]	[0.048]
Positive risk attitude	0.044	0.084	0.028	0.043	0.023	0.091	0.019	0.040
	[0.053]	[0.061]	[0.053]	[0.059]	[0.057]	[0.073]	[0.057]	[0.064]
Living in a city	0.082**	0.099***	0.082**	0.122***	0.014	0.035	0.014	0.053
	[0.032]	[0.034]	[0.032]	[0.042]	[0.033]	[0.039]	[0.033]	[0.046]
Owning household main residence	0.012	0.018	0.007	-0.011	0.015	0.023	0.013	-0.006
	[0.029]	[0.031]	[0.029]	[0.035]	[0.031]	[0.034]	[0.031]	[0.039]
Owning other real estate	0.060**	0.043	0.066**	0.065*	0.058*	0.034	0.060*	0.059
	[0.030]	[0.033]	[0.030]	[0.035]	[0.032]	[0.035]	[0.031]	[0.036]
Constant	-0.199***	-0.549***	-0.062	-0.131*	-0.007	-0.537**	0.028	-0.039
	[0.060]	[0.202]	[0.052]	[0.071]	[0.067]	[0.238]	[0.058]	[0.076]
Regional dummy variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.081		0.073		0.117		0.116	
F of instruments		12.357		6.573		12.357		6.573
Hansen's J χ^2		2.610		0.645		0.016		0.749
P-value of Hansen's J test		0.106		0.422		0.900		0.387
P-value of exogeneity test		0.060		0.008		0.011		0.014
N	1,072	1,072	1,072	1,072	1,072	1,072	1,072	1,072

Note: Robust standard errors are presented in brackets. Regressions are estimated on the sample of non-retired individuals aged 35-62. Dummy variables for not working, first income quintile, age category from 55 to 62 years, and the region of Košice are the reference categories for the respective dummy sets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: HFCS 2014, National Bank of Slovakia; own calculations

31

Table D.4: First-stage regression estimates of financial literacy (robustness check)

	Financial literacy: number of correct answers	Financial literacy: all answers correct
Instrument: ability to understand questions in the survey	0.080	0.046**
	[0.054]	[0.022]
Instrument: ability to convert monetary values from Slovak crowns to euros	0.148***	0.022
	[0.049]	[0.020]
Exogenous socio-economic control variables	Yes	Yes
Regional dummy variables	Yes	Yes
Adjusted R^2	0.062	0.034
N	1,072	1,072

Note: Robust standard errors are presented in brackets. Regressions are estimated on the sample of non-retired individuals aged 35-62. Dummy variables for not working, first income quintile, age category from 55 to 62 years, and the region of Košice are the reference categories for the respective dummy sets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: HFCS 2014, National Bank of Slovakia; own calculations