ORIGINAL RESEARCH

Exploring Differences in Financial Literacy Across Countries: The Role of Individual Characteristics and Institutions

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Abstract

We explore microdata from the OECD/INFE survey on financial literacy of adult individuals. We find considerable differences in financial literacy across countries and decompose them into a part explainable by varying individual characteristics and a remainder. We show that individual characteristics matter with regard to differences in average financial literacy, but do not fully explain the gaps. We decompose financial literacy across its distribution and directly relate it to different policies. We then correlate the unexplained differences to institutional macroeconomic variables. We find strong correlations between unexplained differences and life expectancy, social contributions rate, PISA math scores, and internet usage, suggesting room for harmonization of environments across countries to close the financial literacy gap.

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1 Introduction

The importance of financial literacy and education as a main ingredient of informed choices and sound financial behavior of consumers has been recognized in the literature (see e.g. Campbell 2006; Jappelli 2010; Hastings et al. 2013; Lusardi and Mitchell 2014; Urban et al. 2018; Berry et al. 2018). The meta-analyses by Kaiser and Menkhoff (2017) and Kaiser et al. (2020) confirmed that financial education significantly affects financial literacy and ultimately financial behavior.[1] As a result, financial literacy improves financial inclusion of individuals and households (see e.g. Grohmann et al. 2018) as well as their ability to accumulate more wealth (see e.g. Behrman et al. 2012). Financial literacy is crucial for financial behavior and therefore decisive for major contemporary economic problems such as the rise of inequality (e.g. Lusardi et al. 2017). Even though several studies have analyzed financial literacy with respect to household economic and financial outcomes, little research has been done exploring the possible causes of substantial differences in financial literacy across countries and population groups.

In the previous empirical literature, researchers have analyzed differences in financial literacy across countries and groups of individuals typically in a descriptive way. For example, according to the Standard and Poor's (2015) survey, the average percentage of adults that answered three out of four financial literacy questions correctly is 56% in the old EU member states; 63% in Australia, the USA, and Canada; and 45% in the Central and Eastern European (CEE) new EU member states. Likewise, results of the OECD PISA survey show worse results for high-school students from CEE countries compared to other Western European countries (OECD 2014). Recently, the OECD (2016) showed substantial differences in the financial literacy of the adult population across the world as well as across European countries. Other examples of descriptive studies on cross-country financial literacy gaps include Atkinson and Messy (2011), Lusardi and Mitchell (2011), Nicolini et al. (2013), Lusardi and Mitchell (2014) or Bucher-Koenen et al. (2017). Recently, Karakurum-Ozdemir et al.'s (2019) study provides empirical evidence on the evolution of financial literacy in five middle-income countries, namely Mexico, Lebanon, Uruguay, Colombia and Turkey.

Beyond descriptive research, there is only a handful of studies that attempt to provide an explanation of varying levels of financial literacy across countries. For example, Jappelli (2010) analyses the relationship between macroeconomic contextual variables and population's economic literacy using international panel data on 44 countries over the period 1998–2008. Despite the identification of important factors driving differences in economic literacy across countries (e.g. economic development, digitalization, etc.), the main shortcoming of Jappelli's (2010) study is that the level of economic literacy of the particular country is proxied by the economic literacy of interviewed business leaders, hence offering a potentially biased picture since business leaders can be expected to have above-average interest and routine in financial matters and thus a higher incentive to invest in financial literacy. Another example is a recent work of Ahunov and Van Hove (2020) finding that variations in the national culture (proxied by individualism and power distance) are another powerful determinant of financial literacy at the country level.[2] Yet again, the authors could

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[1] Kaiser and Menkhoff (2020) find similar results for financial education programs at schools.

[2] At the country level, Brown et al. (2018) show that students in the French-speaking part of Switzerland have much lower level of financial literacy that students in the German-speaking parts and relate this finding to differences in financial socialization by parents.

not provide this kind of analysis for different population sub-groups, given the absence of microdata. Perhaps the closest study to ours in terms of applied dataset and microeconometric analysis is by De Beckker et al. (2020), who estimate the influence of culture and institutions on individual financial literacy levels in a multilevel setting.

While the observed differences in financial literacy arguably influence policies, the populations in different countries are not homogeneous. It remains unknown how much of the observed difference is country-specific and how much is driven by varying individual characteristics of the (sampled) population.

By employing microeconometric tools from the decomposition and policy-evaluation literature, we attempt to deliver estimates of how much of the observed difference is due to differences in the characteristics of the population. We seek to answer the following research questions:

1. how large are financial literacy gaps across countries?;
2. are the observed differences in financial literacy mainly due to differences in observable individual characteristics?; and
3. do institutional factors play a role in explaining financial literacy gaps across countries?

These fundamental questions are relevant for potential policies aimed at increasing financial awareness. There are two important mechanisms at work which need to be taken into account to go beyond the type of overall mean comparisons in cross country research on financial literacy. To illustrate the first one, we point to an example with regard to educational attainment. On the one hand, a gap in average financial literacy may exist across countries within education groups; this would be the case if financial literacy differed among the highly educated in country A versus country B. On the other hand, a gap could exist across countries even if the financial literacy within education groups is the same across countries: if the share of, say, highly educated individuals is higher in country A than in country B. From a policy perspective these gaps need to be dealt with differently. Whereas the first raises the question of why similarly educated groups have different financial literacy across countries, the second case can be addressed by increasing educational attainment.

The second mechanism has to do with different levels of literacy and the resulting additive structure of the financial literacy indices. Whereas educational attainment might be key to basic financial literacy, its relevance might be less important in the case of more advanced financial literacy. We argue that it is crucial to take this additive structure of financial literacy and therefore the shape of the distribution into account. At the bottom of the pyramid there are simple questions based on school knowledge; more up the ladder higher education, learning by doing or on the job training which all may alike provide the necessary knowledge to correctly answer the more difficult literacy questions. How common learning by doing or on the job training are depends on the institutional setting in countries. In a country with a larger financial sector the share of people who have on the job training will be higher. In a country with a less comprehensive social security net the need to invest in private wealth and therefore learning by doing will be more prevalent.

Differences in these patterns have important policy implications: a gap at the bottom indicates a lack in basic knowledge which is usually acquired in primary education. The policy advice would in this case be to improve the quality of primary education. A gap at the top, by contrast, rather points at weaknesses in secondary and higher education or at structural institutional issues, for example due to an abundant public pension system with

limited need to invest in private pension wealth. Those who have high financial resources are more likely to be interested in more complex financial products and therefore more likely to acquire the specific knowledge. To close gaps in the upper part, policies need to focus on the quality of higher education, including also specific financial literacy content within schools or for the general public. Our finding that individual characteristics explain more at the upper end of the distribution is suggestive evidence supporting this view.

That is why we proceed by asking which differences in institutions are correlated with cross-country gaps in financial literacy unexplained by individual characteristics. Characteristics might explain part of the gap, but their interplay with different environments across countries is potentially relevant when explaining financial literacy gaps. One potentially relevant institutional difference related to financial literacy may be different welfare state regimes. In some countries (such as Brazil, Russia, or the UK), investing privately for old age provision or other precautionary motives is more important than in others (such as Austria, Finland, or Germany). Moreover, the supply of financial services varies across countries. The intermediation of banks is stronger in some countries (such as in continental Europe) than in others (such as the UK).

In a nutshell, we devise a two-step empirical strategy to first decompose the differences in financial literacy into a part related purely to different individual characteristics across countries, and the remainder. Then, we use these remaining parts to analyze the potential linkage to institutions and a country's macroeconomic environment. Our methodological framework builds on the existing literature of Christelis et al. (2013), Bover et al. (2016a), and Sierminska and Doorley (2018).

Our study makes several important contributions to the empirical literature on financial literacy and household finances. Following up on the first insights using the 2014–2016 wave of the OECD/INFE database on financial competencies of individuals (Cupák et al. 2018; De Beckker et al. 2019, 2020), we are among the first to deliver a complex cross-country analysis of these data. The advantage of this database is its broad set of questions (focusing on an extended set of financial knowledge questions as well as aspects of financial attitudes and behavior) as well as country coverage as compared to the previous studies. This broad set of questions allows us to exploit the information content of the distribution of the financial literacy indices across countries and to derive policy conclusions. We are also among the first to employ counterfactual decomposition techniques to analyze the observed differences in financial literacy in a cross-country perspective. In our framework, we consider individuals from Finland as a benchmark (reference) for financial literacy of individuals from other countries in our dataset (Austria, Brazil, Canada, Croatia, Hong Kong, Hungary, Germany, Jordan, The Netherlands, Russia, and the UK).[3] We extend the analysis in OECD (2016) substantially by providing a detailed cross-country comparison accounting for differences in the underlying socio-economic structure. Therefore, our findings help to better understand the potential determinants of gaps in financial literacy between countries, which are as high as 20% in some cases (e.g. Finland vs. Croatia or Russia).

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[3] We chose Finland as a reference category not only because of data availability, but also for other reasons. For example, the Finnish population (both adults and high-school students) ranks among the best in different financial literacy surveys (e.g. OECD 2014, 2016) compared to the population from other European countries. Furthermore, Finnish households show an intense interaction with financial markets, as 39% of households hold risky financial assets in their portfolios (Bover et al. 2016b).

The rest of this paper is structured as follows. Section 2 describes the dataset and the employed microeconomic and institutional variables. Section 3 outlines the applied methodological framework. Section 4 presents empirical results together with several robustness checks. Section 5 concludes and offers policy implications.

2 Data

The data used for the analysis of financial literacy gaps across countries come from the OECD/INFE (International Network for Financial Education) survey of adult financial literacy competencies, collected in the years 2014–2016. While the survey was conducted in more than 30 countries around the world, only a few countries made the data available for research purposes. Hence, we got access to individual-level data from Austria, Brazil, Canada, Croatia, Finland, Germany, Hong Kong, Hungary, Jordan, The Netherlands, Russia, and the UK, accounting together for more than 15,000 observations. A unique feature of this survey is that the questions are asked in a harmonized way across countries, making the results comparable—major advantage as compared to previous surveys on financial literacy. Also, the set of financial literacy questions is much broader than in previous studies. Other cross-country surveys typically focus on a small set of three/four basic financial literacy questions on interest rates, inflation and diversification/riskiness (Lusardi and Mitchell 2014). In the OECD/INFE survey, questions include concepts such as time value of money, interest paid on loans, interest and principal, compound interest, risk and return, inflation, and risk diversification. The data also contains standard socio-economic characteristics.

Table 1 shows basic information about the data collection in the countries were data is accessible. In 8 of the 12 countries face-to-face personal computer assisted interviews were conducted. Two countries used telephone interviews (Canada and Germany) whereas two gathered the data via online interviews or as a combination of telephone and online interviews (The Netherlands and the United Kingdom). The sample size ranges from 1000 (Hong Kong, Hungary and the United Kingdom) to 2002 (Brazil). In many countries the national central banks were responsible for gathering the data and delivering it to the OECD/INFE. In others also universities, ministries or other governmental institutions conducted the harmonized survey developed by the OECD/INFE.

For our analysis we use a set of variables which is fully harmonized in all countries (Table 2). Our main variable of interest, the financial literacy score, is calculated from the answers given to a set of seven knowledge questions examining the financial literacy of respondents. They deal with the understanding of inflation, interest, interest plus principal, compound interest, the relationship between risk and return and risk diversification. The detailed questions are listed in Appendix A. The financial literacy score of individuals is computed similarly to the extant literature on financial literacy (e.g. Lusardi and Mitchell 2014). Hence, the financial literacy score (as also used by the OECD/INFE) is computed as a sum of all correctly answered of the seven questions asked in the survey.

In our empirical analysis, we first use a set of exogenous socio-economic individual characteristics as predictors for the stock of financial literacy. In Sect. 4.4, we also consider a set of endogenous variables capturing the experience of respondents with financial products and financial planning. As individual characteristics we use dummies for age category, gender, marital status, university education and employment status. Furthermore, and as suggested by Monticone (2010), we use a variable on the income buffer, indicating that the individual has a financial buffer of at least three times the

Table 1 Survey details. *Source*: OECD/INFE international survey of adult financial literacy competencies

Country	Institution	Date of survey	Type of survey	Sampling method	Sample size
Austria	Oesterreichische Nationalbank	2014	Face-to-face	Stratified sampling	1994
Brazil	Banco Central do Brasil	2015	Face-to-face	Stratified cluster sampling	2002
Canada	Financial Consumer Agency of Canada	2015	Telephone interviews	Nested quotas using random digit dialing	1002
Croatia	Croatian National Bank and Croatian Financial Services Agency	2015	Face-to-face	Stratified sampling	1049
Finland	University of Tampere and University of Vaasa	2014	Face-to-face	Stratified cluster sampling	1533
Germany	Deutsche Bundesbank	2016	Telephone interviews	Stratified sampling	1001
Hong Kong	Investor Education Center	2015	Face-to-face	Stratified sampling	1000
Hungary	Magyar Nemzeti Bank	2015	Face-to-face	Quota sample from stratified probability starting point	1000
Jordan	INJAZ	2016	Face-to-face	Stratified sampling	1140
The Netherlands	Money Wise	2015	Online interviews	N.A.	1018
Russia	Ministry of Finance of the Russian Federation	2015	Face-to-face	Stratified sampling	1649
UK	Money Advice Service	2015	30% telephone, 70% online interviews	Stratified random sampling	1000
					15,388

Table 2 Description of variables used in empirical analysis. *Source*: OECD/INFE international survey of adult financial literacy competencies

Variable	Description
Financial literacy score	Number of correctly answered financial literacy questions (see Appendix A for details); score ranging from 0 to 7
Income buffer	Dummy variable: 1 if an individual has a financial buffer for at least three months in case he/she loses his/her job (a proxy for wellbeing)
Gender	Dummy variable: 1 if female and 0 otherwise
Single	Dummy variable: 1 if an individual lives alone and 0 otherwise
University education	Dummy variable: 1 if university education is the highest attained and 0 otherwise
Age category (18–29)	Dummy variable: 1 if an individual aged from 18 to 29 and 0 otherwise
Age category (30–49)	Dummy variable: 1 if an individual aged from 30 to 49 and 0 otherwise
Age category (50–69)	Dummy variable: 1 if an individual aged from 50 to 69 and 0 otherwise
Age category (70+)	Dummy variable: 1 if an individual aged 70 + and 0 otherwise
Employed	Dummy variable: 1 if paid employment (working for someone else) and 0 otherwise
Self-employed	Dummy variable: 1 if self-employed (working for him/herself) and 0 otherwise
Retired	Dummy variable: 1 if retired and 0 otherwise
Other, not-working	Dummy variable: 1 if unemployed or not-working (e.g. apprentice, looking for work, looking after home, unable to work due to sickness, student) and 0 otherwise
Having budget	Dummy variable: 1 if an individual is responsible for budget and has a budget and 0 otherwise
Active saver	Dummy variable: 1 if an individual actively saves in one of the following schemes (cash at home, savings account, informal savings club, investment products) and 0 otherwise
Holding risky financial assets	Dummy variable: 1 if an individual holds shares or bonds in his/her financial portfolio and 0 otherwise
Financial planning	Dummy variable: 1 if an individual sets long-term financial goals and 0 otherwise

monthly net income, which therefore is also a crude measure of financial wealth. To cover experience, we use dummies on having a budget plan, being an active saver, holding risky assets and engaging in long-term financial planning.

Figure 1 shows the distributions of the financial literacy score across all countries covered in our analysis. In most countries the majority of individuals are able to answer 5 or more questions correctly, and in some countries the distribution is more skewed than in others. Furthermore, in Table 3 we show average financial literacy scores broken down by socio-economic characteristics and countries. In all countries, men—on average—obtained higher financial literacy scores than women, a finding common in the literature (e.g. Lusardi and Mitchell 2014). Higher education goes along with higher financial literacy scores in all countries as well, which is not surprising given that Christelis et al. (2010) find that numeracy in general increases with education. Financial literacy seems to increase initially with age and to decrease again for the elderly, in line with previous research (e.g. Finke et al. 2017; Lusardi and Mitchell 2014). However, this pattern does not prevail in all countries (Brazil and Jordan). Regarding employment, in
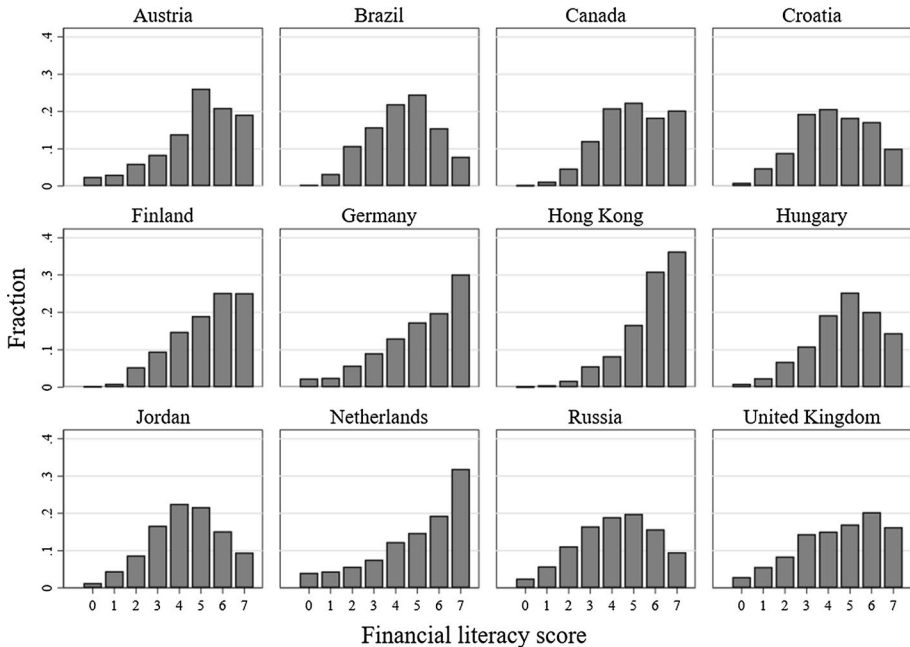
Fig. 1 Distribution of financial literacy score across countries. *Source*: OECD/INFE international survey of adult financial literacy competencies

many countries (8 out of 12) the self-employed have marginally higher financial literacy than the employed.

Table 4 shows descriptive statistics (means and standard deviations) for all countries and all variables used in our empirical analysis. Note that while the mean financial literacy score varies substantially across countries, it still lies between 4.1 and 5.8 (out of 7) correctly answered questions in all countries. Also, individual characteristics X vary substantially. In some countries (Brazil) less than 10% of the population have university degrees while in others (Canada, Jordan, The Netherlands and the UK) the share is above 30%. Similarly, the proxy for financial wealth, i.e. the income buffer variable identifying individuals with at least 3 months of their monthly income in financial assets, varies substantially. While in Russia only 24% report having such a financial buffer, 69% of Canadians do so. Also shares of singles and employment status show remarkable differences. Regarding the measure we use in order to capture experience, we find that the shares of individuals holding risky assets is rather different across countries. But also, the softer measures, such as having a budget, being an active saver as well as financial planning, reveal substantial cross-country variations which might potentially explain differences in financial literacy scores.

Table 3 Distribution of financial literacy score across selected socio-economic characteristics. *Source*: OECD/INFE international survey of adult financial literacy competencies

	AT	BR	CA	HR	FI	DE	HK	HU	JO	NL	RU	UK
Overall	4.8	4.3	4.9	4.3	5.2	4.8	5.8	4.7	4.3	4.9	4.1	4.2
Gender												
Male	5.1	4.4	5.4	4.3	5.4	5.3	6.0	4.8	4.7	5.5	4.2	4.6
Female	4.5	4.2	4.5	4.2	4.9	4.3	5.6	4.6	3.8	4.3	4.1	3.8
Education												
Primary	3.8	3.9	3.8	3.9	N.A.	4.1	4.6	4.3	3.4	4.0	3.4	3.1
Secondary	4.9	4.5	4.6	4.3	5.0	5.0	5.9	4.7	3.9	4.5	4.1	4.0
Tertiary	5.6	5.2	5.4	4.8	5.8	5.7	6.1	5.4	4.6	5.6	4.5	5.0
Age category												
18–29 years	4.6	4.4	4.5	4.1	5.0	4.4	5.5	4.7	3.5	4.3	3.8	3.7
30–49 years	4.8	4.4	5.0	4.4	5.4	4.7	5.9	4.8	4.1	4.9	4.2	4.6
50–69 years	5.0	4.2	5.1	4.4	5.2	5.0	5.8	4.7	4.6	5.2	4.3	4.4
70 + years	4.6	4.1	4.7	3.7	4.9	4.5	5.2	4.5	4.7	5.0	4.2	3.4
Employment status												
Employed	4.9	4.6	5.0	4.4	5.4	5.1	6.0	4.8	4.8	5.1	4.3	4.5
Self-employed	5.1	4.3	5.4	4.6	5.6	5.6	5.7	5.2	4.8	5.6	4.2	4.6
Retired	4.8	4.0	5.1	4.0	4.9	4.7	5.4	4.4	4.6	5.2	3.8	3.9
Other not working	4.3	4.2	4.3	4.2	5.2	4.1	5.5	4.8	3.8	4.5	4.0	3.5

Austria (AT), Brazil (BR), Canada (CA), Croatia (HR), Finland (FI), Germany (DE), Hong Kong (HK), Hungary (HU), Jordan (JO), The Netherlands (NL), Russia (RU), the United Kingdom (UK). Means are presented based on the sample of adult individuals aged 18–79. Summary statistics computed using survey weights

3 Empirical Strategy

To study differences in financial literacy we employ different empirical tools. In this section we lay out our empirical approach. We first estimate a conditional expectation function of financial literacy, controlling for country-level fixed effects. To do so we use a weighted[4] linear regression to estimate the population conditional expectation function:

$$L = \alpha + \beta X' + \gamma I + \varepsilon, \tag{1}$$

where L stands for financial literacy, α denotes a constant, X contains the predictors (socio-economic characteristics), β the slope parameters, I includes country fixed effects with parameter vector γ and ε is the error term. The estimates for the predictive effects β of different socio-economic characteristics on financial literacy are discussed in Sect. 4.1.

As a next step we decompose observed differences in financial literacy across countries and types of individuals by employing standard counterfactual decomposition techniques

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[4] The OECD/INFE datasets provides survey weights to take into account the specific survey design as well as to reweight the sample to the overall population. This ensures that results can be interpreted as refering to the sampled target population and not the sample itself.

Table 4 Summary statistics of variables used in empirical analysis. *Source*: OECD/INFE international survey of adult financial literacy competencies

Variable	AT	BR	CA	HR	FI	DE	HK	HU	JO	NL	RU	UK
Financial literacy Score	4.79	4.31	4.93	4.27	5.19	4.75	5.76	4.72	4.28	4.89	4.14	4.21
	(1.80)	(1.55)	(1.54)	(1.67)	(1.56)	(1.95)	(1.32)	(1.62)	(1.65)	(2.06)	(1.79)	(1.86)
Basic socio-economic characteristics												
Income buffer	0.52	0.27	0.69	0.32	0.57	0.69	0.68	0.32	0.26	0.57	0.24	0.58
	(0.50)	(0.45)	(0.46)	(0.47)	(0.50)	(0.46)	(0.47)	(0.47)	(0.44)	(0.50)	(0.43)	(0.49)
Gender	0.52	0.52	0.52	0.53	0.50	0.54	0.54	0.53	0.44	0.50	0.53	0.52
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)
Single	0.34	0.09	0.18	0.17	0.30	0.22	0.06	0.16	0.09	0.21	0.16	0.23
	(0.47)	(0.28)	(0.38)	(0.38)	(0.46)	(0.42)	(0.24)	(0.37)	(0.29)	(0.41)	(0.36)	(0.42)
University education	0.10	0.09	0.45	0.18	0.27	0.16	0.20	0.19	0.62	0.38	0.28	0.31
	(0.30)	(0.29)	(0.50)	(0.38)	(0.44)	(0.37)	(0.40)	(0.39)	(0.49)	(0.49)	(0.45)	(0.46)
Age category (18–29)	0.21	0.26	0.19	0.20	0.24	0.18	0.19	0.20	0.47	0.18	0.24	0.18
	(0.41)	(0.44)	(0.39)	(0.40)	(0.43)	(0.38)	(0.39)	(0.40)	(0.50)	(0.38)	(0.43)	(0.39)
Age category (30–49)	0.35	0.43	0.35	0.35	0.38	0.35	0.39	0.36	0.39	0.37	0.36	0.34
	(0.48)	(0.49)	(0.48)	(0.48)	(0.48)	(0.48)	(0.49)	(0.48)	(0.49)	(0.48)	(0.48)	(0.47)
Age category (50–69)	0.29	0.27	0.38	0.33	0.30	0.32	0.34	0.33	0.13	0.37	0.36	0.34
	(0.45)	(0.45)	(0.48)	(0.47)	(0.46)	(0.47)	(0.48)	(0.47)	(0.34)	(0.48)	(0.48)	(0.47)
Age category (70+)	0.15	0.04	0.09	0.12	0.09	0.15	0.07	0.10	0.01	0.08	0.03	0.14
	(0.36)	(0.20)	(0.28)	(0.32)	(0.28)	(0.36)	(0.26)	(0.30)	(0.09)	(0.27)	(0.17)	(0.35)
Employed	0.49	0.30	0.50	0.42	0.40	0.47	0.56	0.51	0.38	0.46	0.61	0.52
	(0.50)	(0.46)	(0.50)	(0.49)	(0.49)	(0.50)	(0.50)	(0.50)	(0.49)	(0.50)	(0.49)	(0.50)
Self-employed	0.07	0.33	0.10	0.07	0.06	0.08	0.04	0.05	0.13	0.07	0.08	0.07
	(0.25)	(0.47)	(0.30)	(0.25)	(0.24)	(0.27)	(0.19)	(0.22)	(0.34)	(0.25)	(0.27)	(0.26)
Retired	0.28	0.12	0.20	0.26	0.25	0.27	0.13	0.25	0.04	0.17	0.19	0.24
	(0.45)	(0.32)	(0.40)	(0.44)	(0.43)	(0.44)	(0.34)	(0.43)	(0.18)	(0.38)	(0.39)	(0.43)
Other, not-working	0.17	0.24	0.20	0.26	0.29	0.18	0.27	0.19	0.45	0.30	0.13	0.16
	(0.38)	(0.43)	(0.40)	(0.44)	(0.45)	(0.39)	(0.45)	(0.39)	(0.50)	(0.46)	(0.33)	(0.37)

Table 4 (continued)

Variable	AT	BR	CA	HR	FI	DE	HK	HU	JO	NL	RU	UK
Additional variables capturing experience												
Having budget	0.28	0.36	0.58	0.63	0.61	0.32	0.55	0.24	0.48	0.39	0.47	0.51
	(0.45)	(0.48)	(0.49)	(0.48)	(0.49)	(0.47)	(0.50)	(0.43)	(0.50)	(0.49)	(0.50)	(0.50)
Active saver	0.68	0.30	0.79	0.63	0.61	0.67	0.73	0.27	0.71	0.71	0.55	0.72
	(0.47)	(0.46)	(0.40)	(0.48)	(0.49)	(0.47)	(0.44)	(0.44)	(0.45)	(0.45)	(0.50)	(0.45)
Holding risky financial assets	0.12	0.01	0.46	0.13	0.30	0.29	0.38	0.05	0.14	0.09	0.02	0.37
	(0.33)	(0.09)	(0.50)	(0.33)	(0.46)	(0.46)	(0.48)	(0.22)	(0.34)	(0.28)	(0.14)	(0.48)
Financial planning	0.63	0.45	0.58	0.45	0.74	0.59	0.58	0.43	0.61	0.39	0.47	0.45
	(0.48)	(0.50)	(0.49)	(0.50)	(0.44)	(0.49)	(0.49)	(0.49)	(0.49)	(0.49)	(0.50)	(0.50)

Austria (AT), Brazil (BR), Canada (CA), Croatia (HR), Finland (FI), Germany (DE), Hong Kong (HK), Hungary (HU), Jordan (JO), The Netherlands (NL), Russia (RU), the United Kingdom (UK). Summary statistics computed using survey weights. Standard deviations presented in parentheses

(Blinder [1973]; Oaxaca[1973]; B–O).[5] In our case, the B-O decomposition defines the mean difference in financial literacy scores of individuals from the particular country studied and individuals from the reference group, Finland. The mean difference is divided into two main parts—one explained by group differences in observable individual characteristics under consideration, and another that cannot be accounted for by differences in observed individual characteristics—i.e. differences in coefficients, or how literacy is "produced" in the country.

Formally, we want to answer the question of how much of the mean difference in financial literacy is accounted for by differences in characteristics of individuals between a benchmark country $c = j$ (Finland) and countries $c \in C$. The mean difference can be written as $\Delta \mu L_c = \mathbb{E}(L_{c=j}) - \mathbb{E}(L_c)$. Using the B–O framework, $\Delta \hat{\mu} L_c$ can then be estimated as

$$\Delta \hat{\mu} L_c = \underbrace{\left(\overline{X}_{c=j} - \overline{X}_c\right)' \hat{\beta}_{c=j}}_{\text{explained}} + \underbrace{\overline{X}_c' \left(\hat{\beta}_{c=j} - \hat{\beta}_c\right)}_{\text{unexplained}}. \tag{2}$$

where $\overline{X}_{c=j}$ and $\overline{X}_c$ are covariate group averages and $\hat{\beta}_{c=j}$ and $\hat{\beta}_c$ are coefficient vectors from regressions including only individuals of the reference country $c = j$ and country c, respectively.

We also employ the framework of unconditional quantile regressions (Firpo et al. [2007], [2009]) to extend our approach beyond the mean. Reasons for differences in average financial literacy might be different for those in the lower or higher parts of the distribution. Whereas in the lower part it is mostly about very basic math (cognitive) skills (e.g. interest calculation) which are covered in the curricula of primary and lower secondary schools, it is rather knowledge about the functioning of certain sophisticated financial products at the top of the distribution. Basic schooling might help in the lower, but not so much in the upper part, where higher education, learning by doing and on the job training might be decisive to gain more advanced financial literacy. As we explained in the introduction, this additive nature of the financial literature index can be exploited to link financial literacy and different gaps across the distribution directly to potential policies to improve overall literacy.

We decompose distributions in the financial literacy scores between individuals from the benchmark country $c = j$ (Finland) and country c by using recentered influence function (RIF) regressions along with the B-O technique (Firpo et al. [2007], [2009]). To do so, we basically replace the country-level regressions underlying our approach with RIF-regressions. A RIF regression is similar to a standard regression, except that the dependent variable is replaced by the recentered influence function of the statistic of interest (see Firpo et al. [2009]).[6] Similarly to the standard B-O decomposition, we can decompose the difference in the quantile of financial literacy score (in our case 10th, 25th, 50th, 75th, and 90th percentile) into two additive parts, the explained and the unexplained:

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[5] The B-O decomposition technique has been predominantly used in the labor economics literature to study gaps in wages and employment. Recently, this method has also been applied in the field of household finance to study differences in stock-holdings between US and euro-area households (Christelis et al. [2013]), wealth differences across countries (Mathä et al. [2017]; Sierminska and Doorley [2018]), or to study financial literacy gaps between male and female populations in the US and across countries (e.g. Cupák et al. [2018]; Fonseca et al. [2012]).

[6] For readers interested in the details of the approach, we summarize the basic approach in the Appendix B.

Table 5 Selected country-level indicators relevant for financial literacy. *Source:* World Bank indicators; OECD 2012 PISA data (OECD 2014)

Country	Math score in the PISA survey (2012)	Internet users (% of the population, 2015)	Enrolment ratio, upper secondary (%, 2012)	Stock market total value to GDP (%, 2012)	Social contributions (% of revenue, 2015)	Life expectancy (years, 2015)	GDP per capita (current USD, 2015)
Austria	497	83.93	95.75	7.33	32.33	81.84	43,665
Brazil	377	59.08	90.97	31.19	31.68	74.68	8757
Canada	516	88.47	119.30	77.59	23.70	82.14	43,316
Croatia	464	69.80	97.66	1.25	35.32	77.28	11,580
Finland	511	92.65	115.23	56.61	33.67	81.39	42,405
Germany	506	87.59	106.68	38.25	54.61	81.09	41,177
Hong Kong	548	84.95	113.22	478.70	N.A.	84.28	42,351
Hungary	477	72.83	102.67	10.00	30.10	75.96	12,366
Jordan	380	53.40	77.88	10.73	0.27	74.20	4096
The Netherlands	512	93.10	124.47	54.45	36.69	81.70	44,293
Russia	494	70.10	98.77	20.26	21.00	70.91	9329
UK	492	92.00	83.20	103.06	21.23	81.60	43,930

The social contributions figure for Croatia refers to 2014 instead of 2015. Upper secondary school enrolment ratios can exceed 100% as it measures total enrollment in upper secondary education, regardless of age, expressed as a percentage of the total population of official upper secondary education age

$$\Delta \hat{L}_c^{Q\tau} = \underbrace{\left(\overline{X}_{c=j} - \overline{X}_c \right)' \hat{\beta}_{c=j}^{Q\tau}}_{\text{explained}} + \underbrace{\overline{X}_c' \left(\hat{\beta}_{c=j}^{Q\tau} - \hat{\beta}_c^{Q\tau} \right)}_{\text{unexplained}}. \tag{3}$$

Finally, we correlate the unexplained parts of the gaps in financial literacy with selected aggregate macroeconomic indicators which have been shown to influence financial literacy at the country-level. This last step of our empirical framework builds on the previous studies of Christelis et al. (2013), Bover et al. (2016), and Sierminska and Doorley (2018). Here we correlate the unexplained parts of the gaps with selected macroeconomic indicators that have been shown to be relevant for the financial literacy at the country-level (Jappelli 2010). Our chosen aggregate indicators include PISA math test scores, the share of internet users, (gross) enrolment ratio to secondary school, stock market capitalization, social contributions rate (a proxy for welfare state), life expectancy, and GDP per capita. For a detailed description, see Table 5.

4 Results

In this section we present our estimates of the conditional expectation function of financial literacy, controlling for country-level fixed effects in Sect. 4.1. Sect. 4.2 includes the core of our analysis, the decomposition of cross-country differences in financial literacy into parts explainable by individual characteristics and an unexplained part. We also decompose the gaps beyond the mean at the 10th, 25th, 50th, 75th, and 90th percentile of the financial literacy distribution. We employ the unexplained parts to correlate them with macroeconomic and institutional variables to shed further light on potential drivers of differences in financial literacy in Sect. 4.3. We also deliver an exercise, in which we add the potentially endogenous variables capturing experience to the analysis.

4.1 Determinants of Financial Literacy

Table 6 shows different estimates of the conditional expectation function (CEF) of financial literacy. It can be interpreted as a predictive production function of financial literacy. We estimate two specifications with basic socio-economic characteristics (see Table 4) as explanatory variables: (1) without country fixed effects, (2) with country fixed effects. Note, that due to missing values in some of the explanatory variables our sample shrinks from 15,388 observations to 12,298.

The results about the predictive effects of individual characteristics are robust to adding country fixed effects. The income buffer dummy, which is a raw measure of financial wealth is positively related to financial literacy (see, e.g. Monticone 2010) and translates to (depending on specification) about 0.4–0.6 (out of the 7) correct answers more for individuals with a financial buffer of at least 3 monthly incomes. The gender gap commonly found in the literature is clearly visible. Women score on average about 0.5 points less. Singles also tend to have slightly lower scores. Individuals with university

Table 6 Baseline OLS estimates of determinants of financial literacy. *Source*: OECD/INFE international survey of adult financial literacy competencies

	(1)	(2)
Income buffer	0.594***	0.433***
	(0.033)	(0.035)
Gender	−0.456***	−0.468***
	(0.032)	(0.031)
Single	−0.077*	−0.120***
	(0.043)	(0.043)
University education	0.569***	0.686***
	(0.034)	(0.035)
Age category (18–29)	−0.107	−0.065
	(0.081)	(0.080)
Age category (30–49)	0.124	0.113
	(0.076)	(0.076)
Age category (50–69)	0.268***	0.265***
	(0.065)	(0.064)
Employed	0.167***	0.204***
	(0.046)	(0.045)
Self-employed	−0.002	0.154**
	(0.059)	(0.061)
Retired	−0.126**	−0.062
	(0.064)	(0.064)
Constant	4.493***	4.911***
	(0.085)	(0.101)
Country fixed effects	No	Yes
Adjusted R^2	0.097	0.144
Observations	12,298	12,298

Robust standard errors presented in parentheses. Regressions estimated using survey weights. Dummy variables for Age category 70+, Other employment status, and Finland are the baseline categories for the respective dummy variable sets

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

degrees score about 0.6–0.7 questions better. The hump shaped age pattern we found in the descriptive tables is confirmed in the estimation of the CEF: The lowest age category scores lower than the oldest, but the age category between 50 and 69 scores even higher. Whereas the employed perform significantly higher than people not working (in line with e.g. Cupák et al. 2019), this is less clear for the self-employed and the retired. However, the coefficients of employed and self-employed are not significantly different from each other.

Table 7 Blinder-Oaxaca decomposition at mean (baseline). *Source*: OECD/INFE international survey of adult financial literacy competencies

	AT	BR	CA	CR	DE	HK	HU	JO	NL	RU	UK
I. Differential											
Benchmark (FI)	5.222***	5.222***	5.222***	5.222***	5.222***	5.222***	5.222***	5.222***	5.222***	5.222***	5.222***
	(0.056)	(0.056)	(0.056)	(0.056)	(0.056)	(0.056)	(0.056)	(0.056)	(0.056)	(0.056)	(0.056)
Compared country	4.908***	4.510***	4.968***	4.348***	4.951***	5.773***	4.743***	4.483***	5.221***	4.430***	4.340***
	(0.044)	(0.045)	(0.044)	(0.054)	(0.066)	(0.040)	(0.052)	(0.048)	(0.061)	(0.054)	(0.061)
Difference (raw)	0.314***	0.712***	0.254***	0.874***	0.271***	−0.551***	0.479***	0.740***	0.002	0.792***	0.883***
	(0.071)	(0.071)	(0.071)	(0.077)	(0.086)	(0.069)	(0.076)	(0.073)	(0.082)	(0.077)	(0.082)
Difference (%)	6.20	14.63	4.99	18.26	5.33	−10.01	9.62	15.25	0.03	16.41	18.46
II. Decomposition											
Explained	0.160***	0.154**	−0.265***	0.188***	−0.004	−0.084	0.189***	−0.248***	−0.202***	0.166***	−0.061
	(0.039)	(0.069)	(0.057)	(0.052)	(0.042)	(0.063)	(0.056)	(0.080)	(0.060)	(0.057)	(0.051)
Unexplained	0.154*	0.558***	0.519***	0.686***	0.275***	−0.467***	0.290***	0.987***	0.204**	0.626***	0.944***
	(0.080)	(0.092)	(0.084)	(0.091)	(0.092)	(0.090)	(0.093)	(0.108)	(0.097)	(0.098)	(0.092)
N obs. (FI)	1131	1131	1131	1131	1131	1131	1131	1131	1131	1131	1131
N obs. (country)	1737	1158	952	950	915	970	914	858	853	962	898

Results for benchmark country are highlighted in grey. Austria (AT), Brazil (BR), Canada (CA), Croatia (HR), Finland (FI), Germany (DE), Hong Kong (HK), Hungary (HU), Jordan (JO), The Netherlands (NL), Russia (RU), the United Kingdom (UK). Decomposition using survey weights. "Age category 70+", and "Other employment status" are reference categories of the respective dummy variable sets. Only basic socio-economic characteristics (i.e. income buffer, gender, age, education, and working status) used as explanatory variables in the underlying regressions. Robust standard errors presented in parentheses

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

4.2 Decomposition Analysis

Results from the Blinder–Oaxaca (B–O) decomposition analysis are shown in Table 7.[7] As outlined in Sect. 3, we use Finland as a reference country. The largest gaps in financial literacy (about 15% or above) are observed in Brazil, Croatia, Jordan, Russia, and the UK. Hungary also shows relatively large gaps compared to Finland (almost 10%). Austria, Germany and Canada still show gaps of 5–6%, whereas The Netherlands hardly shows relevant deviation. Hong Kong exceeds average financial literacy in Finland.

In some countries, differences in observable individual characteristics with Finland significantly dampen the gap (Canada, Jordan and the Netherlands), while for other countries the gap is significantly larger because of differences in individual characteristics (Austria, Brazil, Croatia, Hungary and Russia). That means that if differences due to variations in the share of characteristics in the population are filtered out and only within-characteristic differences are considered, the gap reduces by this amount. In the same way the gap widens for countries where characteristics dampen the unconditional observed differences. In Germany the part of the lower score explained by these individual characteristics is not significantly different from Finland, whereas in Hong Kong individual characteristics do not significantly explain part of the higher score in Hong Kong.

All in all, it is rather obvious that individual characteristics matter when comparing financial literacy across countries. It is important to have 'apples to apples' comparison to design policies in an informed way. In the case of differences in educational attainment this is rather obvious. The policy recommendation would be completely different if financial literacy of the highly educated in one country falls short of that in other countries, as compared to the case where overall education attainment is lower than in other countries.

Given the different distributions of the financial literacy score across countries (Fig. 1), we decompose these distributions by means of RIF-regressions, as outlined in Sect. 3. That is important as higher levels of financial literacy build on basic financial literacy. It can well be that in some countries everybody has at least basic financial literacy but hardly anyone has the type of complex financial literacy needed to invest in more complex financial products such as shares or bonds. Behind the same mean many distributions of the financial literacy score are possible—all pointing to different situations and different ways to tackle certain literacy deficits. To design efficient policies to improve financial literacy, one needs to know the complete pattern across the full distribution of financial literacy and not only the mean. RIF-regression allows us to examine differences across countries at different points in the respective distributions and decompose them instead of average

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[7] Note that the means of financial literacy are slightly different from the unconditional means due to the missing information on individual characteristics and experience. However, given the fact that the total sample size is still 12,298 observations in the case of individual characteristics and 10,810 observations in the case of individual characteristics and experience (see Sect. 4.4), the missing pattern is not highly correlated with our covariate set. Furthermore, our covariate set contains exclusively dummy variables, which means that we do not have a large amount of linear extrapolation but rather look at a set of conditional group specific means of combinations of dummies. We are therefore confident using the standard listwise deletion approach. Our RIF-regression based approach for the median serves as a robustness check as the median is a robust statistic in the sense that it has a bounded influence function, which means that it is less exposed to missing observations.

Table 8 RIF Blinder-Oaxaca quantile decomposition (baseline). *Source*: OECD/INFE international survey of adult financial literacy competencies

	AT	BR	CA	CR	DE	HK	HU	JO	NL	RU	UK
RIF B-O decomposition for 10th percentile											
I. Differential											
Benchmark (FI)	3.327***	3.327***	3.327***	3.327***	3.327***	3.327***	3.327***	3.327***	3.327***	3.327***	3.327***
	(0.084)	(0.084)	(0.084)	(0.084)	(0.084)	(0.084)	(0.084)	(0.084)	(0.084)	(0.084)	(0.084)
Compared country	2.571***	2.438***	3.302***	2.479***	2.949***	4.194***	2.797***	2.696***	2.753***	2.344***	2.314***
	(0.075)	(0.037)	(0.050)	(0.072)	(0.132)	(0.077)	(0.075)	(0.048)	(0.145)	(0.058)	(0.102)
Difference (raw)	0.756***	0.889***	0.024	0.848***	0.378**	−0.867***	0.530***	0.631***	0.574***	0.983***	1.013***
	(0.112)	(0.091)	(0.098)	(0.110)	(0.157)	(0.113)	(0.112)	(0.096)	(0.167)	(0.102)	(0.132)
Difference (%)	25.64	30.85	0.73	29.21	12.03	−23.06	17.31	20.94	18.88	34.65	35.91
II. Decomposition											
Explained	0.048	0.048	−0.149*	0.031	−0.042	−0.084	0.059	−0.059	−0.149	0.141	−0.061
	(0.056)	(0.094)	(0.088)	(0.083)	(0.060)	(0.093)	(0.091)	(0.107)	(0.098)	(0.089)	(0.080)
Unexplained	0.708***	0.841***	0.174	0.817***	0.420***	−0.783***	0.471***	0.690***	0.723***	0.842***	1.073***
	(0.127)	(0.122)	(0.111)	(0.133)	(0.162)	(0.138)	(0.143)	(0.136)	(0.181)	(0.144)	(0.145)
RIF B-O decomposition for 50th percentile											
I. Differential											
Benchmark (FI)	6.017***	6.017***	6.017***	6.017***	6.017***	6.017***	6.017***	6.017***	6.017***	6.017***	6.017***
	(0.058)	(0.058)	(0.058)	(0.058)	(0.058)	(0.058)	(0.058)	(0.058)	(0.058)	(0.058)	(0.058)
Compared country	5.483***	4.840***	5.417***	4.733***	5.728***	6.419***	5.328***	4.825***	6.228***	4.999***	4.951***
	(0.034)	(0.041)	(0.055)	(0.067)	(0.099)	(0.035)	(0.053)	(0.051)	(0.081)	(0.067)	(0.101)
Difference (raw)	0.535***	1.177***	0.600***	1.285***	0.290***	−0.402***	0.690***	1.193***	−0.211**	1.018***	1.066***
	(0.067)	(0.072)	(0.080)	(0.089)	(0.115)	(0.068)	(0.079)	(0.077)	(0.100)	(0.089)	(0.116)
Difference (%)	9.30	21.68	10.50	23.90	4.94	−6.46	12.16	22.00	−3.44	18.49	19.44
II. Decomposition											
Explained	0.140***	0.135*	−0.236***	0.176***	0.005	−0.073	0.174***	−0.261***	−0.189***	0.134**	−0.058
	(0.039)	(0.073)	(0.051)	(0.049)	(0.041)	(0.058)	(0.053)	(0.085)	(0.051)	(0.058)	(0.045)

Table 8 (continued)

	AT	BR	CA	CR	DE	HK	HU	JO	NL	RU	UK
Unexplained	0.394***	1.042***	0.837***	1.109***	0.285**	−0.329***	0.516***	1.454***	−0.022	0.884***	1.124***
	(0.077)	(0.093)	(0.088)	(0.100)	(0.120)	(0.088)	(0.094)	(0.112)	(0.108)	(0.106)	(0.121)
RIF B-O decomposition for 90th percentile											
I. Differential											
Benchmark (FI)	7.441***	7.441***	7.441***	7.441***	7.441***	7.441***	7.441***	7.441***	7.441***	7.441***	7.441***
	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)
Compared country	7.364***	6.825***	7.442***	6.987***	7.528***	7.544***	7.255***	6.883***	7.805***	7.050***	7.104***
	(0.037)	(0.061)	(0.050)	(0.087)	(0.050)	(0.031)	(0.067)	(0.076)	(0.052)	(0.081)	(0.065)
Difference (raw)	0.077	0.616***	−0.001	0.454***	−0.087	−0.103*	0.186**	0.558***	−0.364***	0.391***	0.337***
	(0.060)	(0.077)	(0.069)	(0.099)	(0.069)	(0.056)	(0.082)	(0.090)	(0.070)	(0.094)	(0.081)
Difference (%)	1.04	8.63	−0.01	6.29	−1.16	−1.38	2.54	7.79	−4.77	5.39	4.64
II. Decomposition											
Explained	0.211***	0.121*	−0.198***	0.180***	0.072**	−0.023	0.177***	−0.373***	−0.144***	0.076*	0.003
	(0.036)	(0.064)	(0.043)	(0.040)	(0.035)	(0.047)	(0.042)	(0.068)	(0.042)	(0.043)	(0.037)
Unexplained	−0.134**	0.495***	0.197**	0.274***	−0.158**	−0.080	0.009	0.931***	−0.220***	0.315***	0.334***
	(0.064)	(0.090)	(0.082)	(0.102)	(0.074)	(0.075)	(0.088)	(0.116)	(0.083)	(0.102)	(0.087)
N obs. (FI)	1131	1131	1131	1131	1131	1131	1131	1131	1131	1131	1131
N obs. (country)	1737	1158	952	950	915	970	914	858	853	962	898

Results for benchmark country are highlighted in grey. Austria (AT), Brazil (BR), Canada (CA), Croatia (HR), Finland (FI), Germany (DE), Hong Kong (HK), Hungary (HU), Jordan (JO), The Netherlands (NL), Russia (RU), the United Kingdom (UK). Decomposition using survey weights. "Age category 70+", and "Other employment status" are reference categories of the respective dummy variable sets. Only basic socio-economic characteristics (i.e. income buffer, gender, age, education, and working status) used as explanatory variables in the underlying regressions. Robust standard errors presented in parentheses

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

differences. Results of the RIF-regression based B-O quantile decomposition analysis (for the 10th, 50th, and 90th percentile) are presented in Table 8.[8] The RIF-regression based approach for the median serves also as a robustness check for the standard B–O decomposition at the mean, as the median is a robust statistic in the sense that it has a bounded influence function, which means that it is less exposed to missing observations.

The B–O decomposition analysis at the median of financial literacy (Table 8) confirms the results of the decomposition at the mean (Table 7). However, results differ substantially for the upper (90th percentile) and lower (10th percentile) part of the distributions of the financial literacy score, pointing towards different mechanisms in place at different points of the distribution. Gaps in percentage are larger and individual characteristics can explain fewer of these observed gaps at the bottom (p10) than at the top (p90).

These findings clearly point to the importance of schooling for financial literacy. Basic financial literacy skills such as percentage or interest calculation are part of school curricula. Almost everybody has access to this basic education. These gaps coming from the school system show up already at the lower ends of the literacy distribution and personal characteristics cannot explain them very well as a large part of the population is exposed to the quality of primary education the same way. At the upper end of the financial literacy ladder, more complex and specific knowledge makes the difference. Gaps being smaller here shows that fewer individuals are closely concerned with financially complex issues and that especially in countries that are lagging behind in general these differences are better explainable through individual characteristics. That makes sense as it is certainly higher education, jobs, interests and experiences which form this type of knowledge.

This finding has strong policy implications. While the large gaps at the bottom, which also make up a large amount of differences at the mean, can be tackled with a better general primary education system, the gaps at the top which relate to more sophisticated knowledge call for policies which are more targeted towards knowledge specific to financial literacy. They could be tackled through specific financial literacy programs in secondary schools or general information campaigns. Otherwise these gaps will persist as they are related to certain higher education, specific jobs and personal interests.

4.3 Unexplained Gaps of Financial Literacy and the Role of Institutions

In this section we examine the role of institutions in explaining the unexplained parts of the gaps in financial literacy score across the countries compared. Following Christelis et al. (2013) and Sierminska and Doorley (2018), we correlate the unexplained parts (coefficient effects) obtained from the mean and quantile B–O decomposition analysis with the selected macroeconomic indicators influencing populations' financial literacy. We consider a set of aggregate indicators which have been shown as important determinants of financial literacy at country-level. Following Jappelli (2010), we consider PISA math test scores, the share of internet users, (gross) enrolment ratio to secondary school, stock market capitalization, social contributions rate, life expectancy, and GDP per capita.

Similarly to Christelis et al. (2013), we argue that the unexplained component of the gap in financial literacy might be attributed to different economic environments of countries. As an example, one could think of the education system's quality in the particular country

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[8] See the online Appendix C for additional analysis for the 25th and 75th percentile, which confirms that the pattern found extends to the full distribution and is not just present in the tail regions.
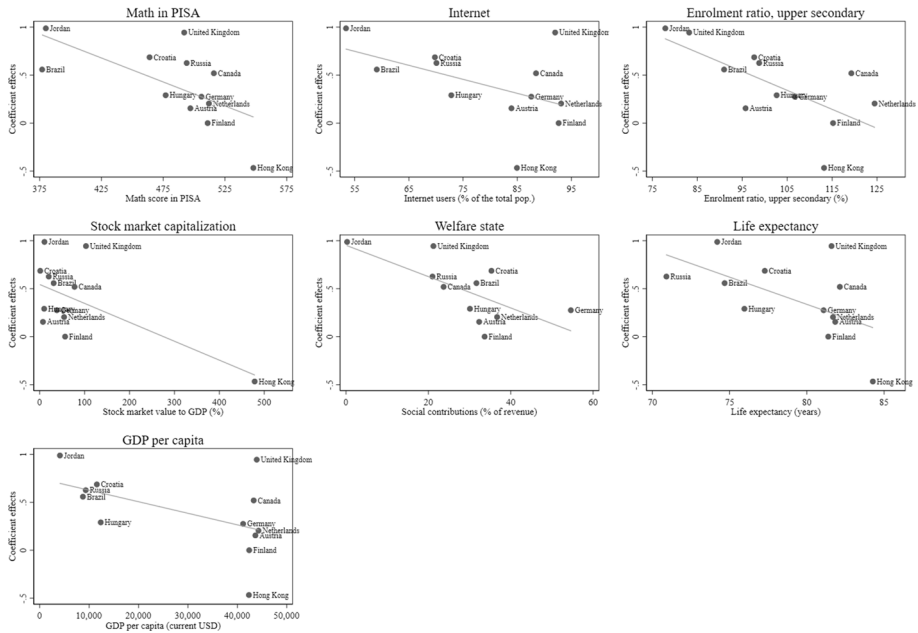
Fig. 2 Estimated coefficient effects from the mean B-O decomposition versus selected macroeconomic indicators (baseline). *Source*: OECD/INFE international survey of adult financial literacy competencies; World Bank data

which can have important implications for the population's financial literacy, which we proxy by an indicator on the PISA math test. According to Ciaian and Pokrivčák (2005), crucial sectors for economic development and human capital accumulation including the development of education systems in many transition countries have been lagging behind compared to Western European countries during the transition from a centrally-planned to a market economy. Furthermore, we may hypothesize that accumulating financial literacy does not only depend on personal characteristics such as the educational background, but also on whether it is easy to gather relevant information (proxied by the share of internet users in the country, which is below 60% in Brazil or Jordan) or whether there is a supportive intellectual environment (proxied by the enrolment ratio to secondary education). At the same time the enrolment ratio relates to individual education as it shows the relative value of individual education. The higher the enrolment ratio in secondary is, the less relative value has secondary education in a given country.

The unexplained part could also be interpreted as impacts of historic (behavioral) experiences of the market economy, which in turn could influence the financial literacy of individuals—proxied by an indicator on the stock market capitalization (e.g. Jappelli 2010). Finally, the incentive to invest in financial literacy may depend on the comprehensiveness of the welfare state (proxied by the social contributions as a share of total government revenues) and on life expectancy. Life expectancy, as well as GDP per

Table 9 Which institutions matter the most? (baseline). *Source*: OECD/INFE international survey of adult financial literacy competencies; World Bank data

Indicator	Mean		10th percentile		90th percentile	
	Std. effect	Rank	Std. effect	Rank	Std. effect	Rank
Math score in PISA	− 0.261**	2	− 0.267*	3	− 0.268***	2
Internet users	− 0.199*	7	− 0.161	6	− 0.257***	3
Gross enrolment ratio	− 0.283***	1	− 0.286*	2	− 0.248***	4
Stock market capitalization	− 0.258***	3	− 0.400***	1	− 0.084*	7
Social contributions rate	− 0.217***	5	− 0.077	7	− 0.273***	1
Life expectancy	− 0.235*	4	− 0.265*	4	− 0.214**	6
GDP per capita	− 0.211*	6	− 0.196	5	− 0.232**	5

Country-level regressions of the unexplained parts of the gap (coefficient effects) estimated from the mean and quantile decomposition analysis on a set of aggregate indicators (one by one) which have been standardized (i.e. values demeaned and divided by their standard deviations)

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

capita, are often considered as indicators for the general level of development, health and well-being of a society. Our results suggest that besides the individual factors which explain financial literacy such as age, gender or education other institutional factors positively related to general development and well-being exist which also are positively related to financial literacy.

Having a glance at Fig. 2 one can observe the main finding from the decomposition analysis (see Sect. 4.2) and its relation to institutional differences. Overall, the unexplained part of the gaps estimated from the B–O analysis at the mean decreases with countries being institutionally closer to our benchmark category, Finland. This finding holds for the whole distribution of the financial literacy score, the 10th, 50th, and 90th percentile (see Figure D.2 in Appendix D). For a detailed discussion on how experience with financial products, financial planing and potential learning-by-doing might matter differently across the distribution of financial literacy see Appendix D.

As the last step of our empirical analysis, we examine which institutions matter the most for explaining the coefficient effects (the unexplained part of the gaps) estimated from the B-O analysis. To do so, we regress the unexplained part of the gaps estimated from the mean and quantile decomposition analysis, on a set of macroeconomic indicators (one-by-one) whose values have been standardized (i.e. de-meaned and divided by their standard deviations).[9]

A ranking of the importance of different institutions with regard to explaining the coefficient effects is presented in Table 9. Overall, we can see that all the macroeconomic and institutional variables under consideration are negatively correlated with unexplained differences in financial literacy. The higher the PISA math results, the share of internet users, enrolment to secondary school ratio, stock market capitalization, social contributions, life expectancy, and GDP per capita, the lower the unexplained differences with Finland. As

[9] As institutional characteristics are measured in different units, standardization of them is essential in order to be able to access their impact in a comparable way. A similar approach has been used by Bover et al. (2016a) to assess the role of institutions for the household debt behavior in Europe.

Finland also ranks among the highest in all these country level indicators, one can also interpret this result as unexplained differences in financial literacy being lower if institutional differences are smaller.

In most of the cases, indicators related to the level and quality of education (captured by enrolment ratio to upper-secondary schools and results of the PISA math tests) show the largest (standardized) correlation with the unexplained part of the financial literacy gaps. Similarly, the stock market capitalization is highly predictive for the size of the unexplained gaps. The life expectancy indicator—that we might consider as a proxy for a need to accumulate more pension wealth—also turns out to be highly important for explaining financial literacy gaps. Note that we added the correlations at the tails for the sake of completeness and as a way to check robustness. All correlations show the same negative sign.

All in all, these results point to the importance of the institutional environment when discussing cross-country differences in financial literacy. Environment not only matters in a direct way, by influencing financial literacy or creating more need—in the case of a smaller welfare state—for financial literacy, but also indirectly, by allowing individual characteristics to translate in different ways to financial literacy. Both, the direct and indirect importance of the personal and institutional environment are well documented in the literature (see De Beckker et al. 2020; Grohmann et al. 2018; Brown et al. 2018; Jappelli 2010).

As an example, one can imagine that an individual with higher educational attainment might be able to acquire financial literacy at lower cost with internet access rather than without. Or as another example, the incentive to engage in financial markets might be higher in a country where the need for private pension savings is higher. As discussed above, also policies to increase financial literacy can take these patterns into account and focus on the most promising policies depending on where the gaps are. Policies targeted at motivating individuals to participate in the stock market or to increase their share of risky asset holdings are a classic example of policies directly linked to a certain level of financial literacy. While the goal of such policies is often to increase benefits of the higher returns of the stock market to middle class households and their implementation is often done via tax incentives, they are also linked to financial literacy. The more financially literate individuals are, the easier it is for them to participate in these markets. Therefore, increasing the advanced forms of financial literacy may increase participation in stock markets and through learning by doing will in turn increase financial literacy. But also other policies such as different welfare state activities can increase or decrease the incentive to invest in financial literacy as they change the marginal return of additional financial literacy. Saving "for a rainy day" in some liquid savings account is different from saving for acquiring a home, old age provision or future health or education costs. If insurance against certain contingencies in life, which would call for a long-term organized savings plan, are organized by the state, people will have less need to invest in additional financial knowledge.

4.4 The Importance of Experience for Financial Literacy

So far, we have considered only basic socio-economic characteristics as predictors of financial literacy. We extend our multivariate and decomposition analysis by considering a set of variables capturing experience with finance (see Table 2, for exact definition). The inclusion of these (possibly) endogenous variables to further explain financial literacy gaps across countries is justified by the prior literature suggesting a potentially reverse causality between financial knowledge and financial outcomes of households and individuals (e.g. Fernandes et al. 2014; Jappelli and Padula 2013).

Table 10 OLS estimates of determinants of financial literacy (extension). *Source*: OECD/INFE international survey of adult financial literacy competencies

	(1)	(2)	(3)	(4)
Income buffer	0.594***	0.433***	0.465***	0.321***
	(0.033)	(0.035)	(0.036)	(0.037)
Gender	−0.456***	−0.468***	−0.410***	−0.432***
	(0.032)	(0.031)	(0.033)	(0.032)
Single	−0.077*	−0.120***	−0.036	−0.098**
	(0.043)	(0.043)	(0.045)	(0.045)
University education	0.569***	0.686***	0.483***	0.607***
	(0.034)	(0.035)	(0.035)	(0.036)
Age category (18–29)	−0.107	−0.065	−0.191**	−0.091
	(0.081)	(0.080)	(0.084)	(0.083)
Age category (30–49)	0.124	0.113	−0.015	0.027
	(0.076)	(0.076)	(0.080)	(0.079)
Age category (50–69)	0.268***	0.265***	0.103	0.136**
	(0.065)	(0.064)	(0.068)	(0.067)
Employed	0.167***	0.204***	0.090*	0.113**
	(0.046)	(0.045)	(0.046)	(0.046)
Self-employed	−0.002	0.154**	−0.109*	0.055
	(0.059)	(0.061)	(0.060)	(0.062)
Retired	−0.126**	−0.062	−0.183***	−0.120*
	(0.064)	(0.064)	(0.066)	(0.066)
Having budget			−0.059*	−0.009
			(0.033)	(0.034)
Active saver			0.070*	0.064*
			(0.036)	(0.037)
Financial planning			0.190***	0.147***
			(0.034)	(0.034)
Holding risky financial assets			0.375***	0.270***
			(0.040)	(0.042)
Constant	4.493***	4.911***	4.653***	4.881***
	(0.085)	(0.101)	(0.091)	(0.106)
Country fixed effects	No	Yes	No	Yes
Adjusted R^2	0.097	0.144	0.103	0.146
Observations	12,298	12,298	10,810	10,810

Robust standard errors presented in parentheses. Regressions estimated using survey weights. Dummy variables for Age category 70+, Other employment status, and Finland are the baseline categories for the respective dummy variable sets

*$p < 0.10$; **$p < 0.05$; *** $p < 0.01$

The multivariate analysis results on the effects of experience variables (Table 10, (3) without country fixed effects, (4) with country fixed effects) are remarkable in two dimensions. First, with regard to having a budget: This dummy variable indicates whether an individual is responsible for the budget. However, it interestingly relates to

Table 11 B-O decomposition at mean (extension). *Source:* OECD/INFE international survey of adult financial literacy competencies

	AT	BR	CA	CR	DE	HK	HU	JO	NL	RU	UK
I. Differential											
Benchmark (FI)	5.235***	5.235***	5.235***	5.235***	5.235***	5.235***	5.235***	5.235***	5.235***	5.235***	5.235***
	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)
Compared country	5.219***	4.510***	5.259***	4.536***	5.238***	5.773***	4.973***	4.603***	5.221***	4.437***	4.616***
	(0.043)	(0.044)	(0.047)	(0.057)	(0.068)	(0.039)	(0.057)	(0.049)	(0.060)	(0.053)	(0.067)
Difference (raw)	0.016	0.725***	−0.024	0.699***	−0.003	−0.538***	0.262***	0.632***	0.014	0.798***	0.619***
	(0.069)	(0.070)	(0.072)	(0.079)	(0.087)	(0.067)	(0.079)	(0.073)	(0.081)	(0.076)	(0.086)
Difference (%)	0.31	14.87	−0.46	14.30	−0.05	−9.77	5.14	12.84	0.27	16.51	12.56
II. Decomposition											
Explained	0.130**	0.274***	−0.428***	0.152**	−0.089	−0.197***	0.257***	−0.222***	−0.188**	0.231***	−0.179***
	(0.062)	(0.082)	(0.062)	(0.063)	(0.056)	(0.062)	(0.074)	(0.079)	(0.074)	(0.064)	(0.065)
Unexplained	−0.114	0.450***	0.404***	0.547***	0.086	−0.341***	0.005	0.853***	0.202*	0.568***	0.798***
	(0.094)	(0.100)	(0.085)	(0.096)	(0.100)	(0.086)	(0.104)	(0.107)	(0.105)	(0.101)	(0.102)
N obs. (FI)	1113	1113	1113	1113	1113	1113	1113	1113	1113	1113	1113
N obs. (country)	1344	1158	719	802	759	970	699	774	853	946	673

Results for benchmark country are highlighted in grey. Austria (AT), Brazil (BR), Canada (CA), Croatia (HR), Finland (FI), Germany (DE), Hong Kong (HK), Hungary (HU), Jordan (JO), The Netherlands (NL), Russia (RU), the United Kingdom (UK). Decomposition using survey weights. "Age category 70+", and "Other employment status" are reference categories of the respective dummy variable sets. In addition to basic socio-economic characteristics, variables capturing experience with finance (i.e. having budget, active saver, financial planning and holding risky financial assets) are considered in the underlying regressions. Robust standard errors presented in parentheses

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

marginally lower financial literacy (although not significant with country fixed effects). This could be for two reasons. Either low-income, low-educated households have a higher probability of having a budget because they make more cash transactions or because they have more urge to do so, for example as a precondition for getting a loan. Or the least financially literate person in a household typically is responsible for the households' budget. That would be worrisome as it would lead to less efficient budgeting. Second, all other experience variables are associated with higher financial literacy. Actively saving could be expected to positively contribute to financial literacy because of learning by doing effects, however the coefficient is only marginally/not significant. By contrast, holding risky financial assets and financial planning have economically significant effects of about 0.2 (financial planning) and 0.3–0.4 (holding risky assets) and these patterns are in line with the prior literature (e.g. Monticone 2010). Of course, these coefficients should not be interpreted as causal effects but rather as predictive effects or conditional correlations. We consider it likely that individuals learn before and while they are dealing with certain financial products and thereby increase their financial knowledge which is partly covered by our observed financial literacy scores.

One might also ask to what degree learning by doing, which we capture by experience, might further explain the observed gaps between countries. We investigate this by adding the experience covariates to our decomposition analysis. The results of this part are summarized in Table 11. In Canada, Hong Kong, Jordan, The Netherlands and the UK individual characteristics and experience still significantly dampen the observed differences, while for Austria, Brazil, Croatia, Hungary and Russia the gap appears still larger. The robustness of these results points towards the fact that different missing patterns of individual characteristics and experiences do not distort our analysis. Once experience is added, the gap is closed for Austria, Germany, and almost closed (92% explained) for Hungary. It also reduces strongly for Brazil (from 22 to 38% explained) and Russia (from 11 to 29% explained), while it stays almost the same for Croatia (about 12% explained). Canada is driven even further away, implying that when comparing individuals with similar 'experience' and characteristics in Canada and Finland, the within-group gap to Finland is even larger. The same, but to a lesser degree is true for the UK. The Netherlands and Jordan almost stay the same. Finally, in Hong Kong about 37% of the gap is explained by experience.

All in all, we can see that experience matters in the case of financial literacy. With our observational framework, we cannot clearly identify the causal pathway: Does experience lead people to learn more about financial products or do they learn more and then decide to apply the knowledge they learned by changing their investment behavior? However, it is important to know that some of the differences between countries are explainable by varying experience of individuals with financial products. One reason could be different welfare state regimes. In some countries (e.g. Brazil, Russia or the UK) private investment for old age provision or other precautionary motives is more important than in other countries (e.g. Austria, Finland or Germany). Also, supply of financial services varies across countries. In some countries, intermediation of banks is stronger (continental Europe) than in others (e.g. UK). All of these might induce more experience and therefore change financial literacy as well as the need for financial literacy. Additional results (quantile decompositions, and the role of institutions and their ranking) considering the role of experience are presented in Appendix D and confirm the findings from the baseline analysis.

5 Conclusion

The literature observes large differences in average financial literacy across countries (Lusardi and Mitchell 2014; Standard and Poor's 2015). While these observed differences arguably influence policies, the populations in different countries are not homogenous. So far, it had been unknown to what extent the observed differences are country-specific or driven by differences in the individual characteristics of the (sampled) population. To design the right policies, it is of the utmost importance to understand the reasons for observed differences of cross-country financial literacy gaps. By examining recently compiled harmonized OECD/INFE microdata on the financial literacy of individuals in 12 countries along with country level indicators, we delivered estimates of how much of these observed differences are due to differences in the characteristics of the population.

Our results indicate that differences in individual characteristics matter considerably. In some countries, differences in observable individual characteristics dampen much of the gap compared to Finland (in particular, Canada, Jordan and the Netherlands). For other countries, the gap is significantly larger because of differences in individual characteristics (in this case, Finland versus Austria, Brazil, Croatia, Hungary, and Russia). In the latter set of countries, between about 11% (Russia) and 59% (Austria) of the gap is explained by differences in individual characteristics. That means that if differences in financial literacy due to differences in the population's characteristics were filtered out and only within-characteristic differences were considered, the gap would be reduced by this amount.

A variety of robustness checks including extensions of the set of controls by potentially endogenous variables covering experience as well as analyses beyond the mean for different points of the distribution of financial literacy score confirm our results. Furthermore, we exploit the additive structure of the financial literacy score to link different gaps at different parts of the distribution to certain policies. While gaps at the lower end of the distribution call for more basic knowledge provided by high quality primary schooling, gaps at the upper end are related to more sophisticated knowledge which is either acquired in higher schooling or through learning by doing or on the job training. They could also be tackled through specific financial literacy programs in secondary schools or general information campaigns. The finding that individual characteristics explain more at the upper end of the distribution is suggestive evidence supporting this view.

We also correlated these unexplained parts of the financial literacy gaps (not explained by varying individual characteristics) obtained from decomposition analysis with macroeconomic and institutional country-level indicators. Following Jappelli (2010), we considered a set of indicators such as PISA math test scores, the share of internet users, enrolment ratio to secondary school, stock market capitalization, social contributions rate, life expectancy, and GDP per capita. Confirming the findings of Jappelli (2010), our results point to the importance of a country's institutional context when discussing cross-country differences in financial literacy.

It is important to emphasize that the country-level results obtained from the decomposition analysis and consequent linking to different economic environments do not necessarily imply causality. With this caveat in mind, our results offer interesting policy implications. Besides investing in individual-level factors important for human capital development (e.g. education, basic training in finance) it seems that there is room for harmonizing the economic and institutional environment across countries to decrease differences in financial literacy. Gaps at the upper end of financial literacy require different policy approaches than those at the lower end of the distribution.

We conclude that taking differences in population characteristics into account when comparing financial literacy across countries is important. If this is not done, it is difficult to draw useful policy conclusions, as it is impossible to disentangle differences based on country-specific variation from those based on variation in individual-level characteristics. Country rankings such as those presented in the OECD (2016) report are not very informative with regard to policy conclusions if differences stemming from basic individual characteristics cannot be identified.

References

Ahunov, M., & Van Hove, L. (2020). National culture and financial literacy: International evidence. *Applied Economics, 52*(21), 2261–2279

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

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

Berry, J., Karlan, D., & Pradhan, M. (2018). The impact of financial education for youth in Ghana. *World Development, 102*, 71–89

Blinder, A. S. (1973). Wage discrimination: Reduced form and structural estimates. *Journal of Human Resources, 8*(4), 436–455

Bover, O., Casado, J. M., Costa, S., Caju, P. D., McCarthy, Y., Sierminska, E., Tzamourani, P., Villanueva, E., & Zavadil, T. (2016a). The distribution of debt across euro-area countries: The role of individual characteristics, institutions, and credit conditions. *International Journal of Central Banking, 12*(2), 71–128

Bover, O., Schürz, M., Slacalek, J., & Teppa, F. (2016b). Eurosystem household finance and consumption survey: Main results on assets, debt, and saving. *International Journal of Central Banking, 12*(2), 1–13

Brown, M., Henchoz, C., & Spycher, T. (2018). Culture and financial literacy: Evidence from a within-country language border. *Journal of Economic Behavior & Organization, 150*, 62–85

Bucher-Koenen, T., Lusardi, A., Alessie, R., & van Rooij, M. (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

Christelis, D., Georgarakos, D., & Haliassos, M. (2013). Differences in portfolios across countries: Economic environment versus household characteristics. *Review of Economics and Statistics, 95*(1), 220–236

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

Ciaian, P., & Pokrivčák, J. (2005). Why some sectors of transition economies are less reformed than others? The case of research and education. *Technical Report EERI Research Paper Series, 2*, 1–34

Cupák, A., Fessler, P., Schneebaum, A., & Silgoner, M. (2018). Decomposing gender gaps in financial literacy: New international evidence. *Economics Letters, 168*, 102–106

Cupák, A., Kolev, G. I., & Brokešová, Z. (2019). Financial literacy and voluntary savings for retirement: Novel causal evidence. *The European Journal of Finance, 25*(16), 1606–1625

De Beckker, K., De Witte, K., & Van Campenhout, G. (2019). Identifying financially illiterate groups: An international comparison. *International Journal of Consumer Studies, 43*(5), 490–501

De Beckker, K., De Witte, K., & Van Campenhout, G. (2020). The role of national culture in financial literacy: Cross-country evidence. *The Journal of Consumer Affairs, 54*(3), 912–930

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

Finke, M. S., Howe, J. S., & Huston, S. J. (2017). Old age and the decline in financial literacy. *Management Science, 63*(1), 213–230

Firpo, S., Fortin, N. M., & Lemieux, T. (2007). Decomposing wage distributions using recentered influence function regression (pp. 1–60). Mimeo.

Firpo, S., Fortin, N. M., & Lemieux, T. (2009). Unconditional quantile regressions. *Econometrica, 77*(3), 953–973

Fonseca, R., Mullen, K. J., Zamarro, G., & Zissimopoulos, J. (2012). What explains the gender gap in financial literacy? The role of household decision making. *Journal of Consumer Affairs, 46*(1), 90–106

Grohmann, A., Klühs, T., & Menkhoff, L. (2018). Does financial literacy improve financial inclusion? Cross country evidence. *World Development, 111*, 84–96

Hastings, J. S., Madrian, B. C., & Skimmyhorn, W. L. (2013). Financial literacy, financial education, and economic outcomes. *Annual Review of Economics, 5*(1), 347–373

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

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

Kaiser, T., Lusardi, A., Menkhoff, L., & Urban, C. J. (2020). Financial education affects financial knowledge and downstream behaviors. NBER working paper 27057.

Kaiser, T., & Menkhoff, L. (2017). Does financial education impact financial literacy and financial behavior, and if so, when? *The World Bank Economic Review, 31*(3), 611–630

Kaiser, T., & Menkhoff, L. (2020). Financial education in schools: A meta-analysis of experimental studies. *Economics of Education Review, 78*, 101930

Karakurum-Ozdemir, K., Kokkizil, M., & Uysal, G. (2019). Financial literacy in developing countries. *Social Indicators Research, 143*(1), 325–353

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

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

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

Mathä, T. Y., Porpiglia, A., & Ziegelmeyer, M. (2017). Household wealth in the euro area: The importance of intergenerational transfers, homeownership and house price dynamics. *Journal of Housing Economics, 35*, 1–12

Monticone, C. (2010). How much does wealth matter in the acquisition of financial literacy? *Journal of Consumer Affairs, 44*(2), 403–422

Nicolini, G., Cude, B. J., & Chatterjee, S. (2013). Financial literacy: A comparative study across four countries. *International Journal of Consumer Studies, 37*(6), 689–705

Oaxaca, R. (1973). Male-female wage differentials in urban labor markets. *International Economic Review, 14*(3), 693–709

OECD (2014) PISA 2012 results: Students and money: Financial literacy skills for the 21st century (Vol. 6), PISA, OECD Publishing.

OECD (2016). OECD/INFE international survey of adult financial literacy competencies. Organisation for Economic Co-operation and Development.

Sierminska, E., & Doorley, K. (2018). To own or not to own? Household portfolios, demographics and institutions in a cross-national perspective. *Journal of Income Distribution, 25*(1), 1–43

Standard and Poor's (2015). Global Financial Literacy Survey.

Urban, C., Schmeiser, M., Collins, J. M., & Brown, A. (2018). The effects of high school personal financial education policies on financial behavior. *Economics of Education Review, 78*, 101786