ARTICLE

The role of national culture in financial literacy: Cross-country evidence

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Abstract

This paper examines the effect of national culture on adult financial literacy levels in 12 countries. Contrary to earlier financial literacy studies, our results are directly comparable across countries given that we use the standardized OECD/INFE financial literacy survey data and Hofstede's, 2001, cultural dimensions to capture financial literacy and national culture. In line with the financial socialization theory, we find that uncertainty avoidance positively influences financial literacy, while individualism negatively influences financial literacy. We conclude that national culture affects financial literacy and that it is important to account for cultural dimensions in future international financial literacy research.

KEYWORDS

cross-country analysis, financial literacy, national culture

1 | INTRODUCTION

Financial literacy plays an important role in consumer financial decision making. An increasing amount of studies associates financial literacy with better personal financial decisions. Financially, literate individuals are more likely to plan for retirement (Lusardi and Mitchell, 2011a) and save for future (unexpected) expenses (Brounen *et al.*, 2016). In addition, they are less prone to overindebtedness (Huston, 2012). They also participate more often in financial markets (van Rooij *et al.*, 2011) and hold better diversified portfolios (Von Gaudecker, 2015). As a result, financial literate individuals accumulate more net wealth throughout their life (van Rooij *et al.*, 2012).

This paper examines the influence of national culture on individuals' financial literacy levels. In particular, we employ Hofstede's (1980, 2001) cultural dimensions to investigate whether the degree of uncertainty avoidance (capturing feeling at ease in unstructured situations), and individualism (a proxy for whether individuals are integrated into groups) can explain variation in individuals' financial literacy. Using a unique data set of 24,512 individuals across 12 countries, we observe that uncertainty avoidance relates positively to financial literacy and that individualism negatively influences financial literacy.

This paper contributes to the literature on financial literacy in three ways. First, we focus on the influence of national culture on financial literacy. This contrasts with earlier literature, which focuses mainly on the role of different socioeconomic characteristics (Lusardi and Mitchell, 2011b; Xiao *et al.*, 2015; Xiao and O'Neill, 2016; Bucher-Koenen *et al.*, 2017). In an overview article, Gudmunson *et al.* (2016) argue that it is important to consider the international dimension in future financial socialization research and suggest that future studies take into account cultural factors.[1] By including variables for both individual socioeconomic characteristics and national culture in our statistical tests, we further validate the financial socialization theory. This theory examines the process of acquiring and developing values, attitudes, standards, norms, knowledge, and behaviors that contribute to the financial viability and well-being of individuals (Danes, 1994, 128). Second, our cross-country analysis exploits unique standardized data, ensuring that the effect of culture on financial literacy can be compared across countries. This leads to more general and robust results compared to existing literature, which examines cultural effects on financial literacy only at country level (Brown *et al.*, 2018), or performs cross-country analyses based on a sample constructed by matching different national databases (Nicolini *et al.*, 2013). In addition, the dataset with individual-level observations enables us to disentangle the link between culture and financial literacy. This is a clear advantage compared to the aggregated financial literacy data used in recent cross-country studies establishing a link between national culture and financial literacy (Ahunov and Van Hove, 2020). Third, we employ multilevel models to estimate predictors of financial literacy. By using this approach, we are able to estimate unbiased coefficients for models that combine individual- and country-level data (Rabe-Hesketh and Skrondal, 2008).

More generally, our findings on the impact of culture on financial literacy contribute to the literature which investigates the effect of culture on economic outcomes (Guiso *et al.*, 2006; Tabellini, 2010; Mathers and Williamson, 2011; Davis, 2016; Gorodnichenko and Roland, 2017). While previous literature focuses on the mediating role of culture on economic institutions critical for economic development (Mathers and Williamson, 2011), we are one of the first to look into the influence of culture on financial literacy. Adequate levels of financial literacy may also be crucial for economic development (Lusardi and Mitchell, 2014).

2 | LITERATURE REVIEW

Culture is defined by Guiso *et al.* (2006) as "*those customary beliefs and values that ethnic, religious, and social groups transmit fairly unchanged from generation to generation*." The impact of culture on economic outcomes has received considerable attention in the literature. Banfield (1958) and Putnam (1993) were the first to connect culture to economic outcomes. They argue that differences in performance across Italian regions are due to persistent differences in levels of "social capital" originating from the free city-states experience during the late Middle Ages. Free-cities had a form of early democracy with protection from aggression and provision of public goods. As a consequence, citizens of free cities developed stronger civic and cooperative behavior. This cultural trait, transmitted from generation to generation, is still present in today's Italian society (Guiso *et al.*, 2016).

Recently, the role of culture has been examined extensively. Culture does not only affect the effectiveness of institutions (Licht *et al.*, 2007; Tabellini, 2008). It also influences economic development (Guiso *et al.*, 2006; Tabellini, 2010; Mathers and Williamson, 2011; Davis, 2016; Gorodnichenko and Roland, 2017) and has an impact on household financial behavior (Haliassos *et al.,* 2017). However, little is known about the extent to which culture could explain the observed heterogeneity in financial literacy levels.

Current studies that examine heterogeneity in financial literacy levels are mainly focused on socioeconomic determinants. Previous work finds evidence that age (Lusardi *et al.*, 2014; Finke *et al.*, 2017), education (Lusardi and Mitchell, 2007, 2014; Lusardi, 2012), employment (Lusardi and Mitchell, 2014), and gender differences (Chen and Volpe, 2002; Bucher-Koenen *et al.*, 2017; Cupák *et al.*, 2018a) are significant determinants. However, as argued by Cupák *et al.* (2018b), country-specific factors may also account for individual differences in financial literacy. Recently, Cucinelli *et al.* (2019) examined whether the level of adult financial literacy in 14 different Italian regions is related to regional contextual factors. They conclude that financial literacy is not only associated with individual sociodemographic traits but is also impacted by the socioeconomic context of individuals.

In the past, cultural factors explaining differences in financial literacy have often been ignored. Related research focuses mostly on the role of culture in financial decisions. For instance, Petersen *et al.* (2015) show that individuals from countries with a culture characterized by high uncertainty avoidance are less likely to use credit. Chui and Kwok (2008) conclude that individualism positively affects the decision to buy life insurance products: individuals make more use of life insurance in countries where citizens are on average more self-oriented than group-oriented. National culture also plays a role in investment decisions. Beugelsdijk and Frijns (2010) show that national culture affects the level of home bias in investment portfolios. Investors from countries associated with a high level of uncertainty avoidance overweigh the securities of their home country in their portfolio (positive home bias), while those from countries characterized by individualism hold portfolios with a negative home bias.

In the current paper, we restrict our attention to the financial knowledge component of financial literacy.[2] There are multiple reasons to do so. First, the OECD/INFE definition of financial literacy (consisting of knowledge, behavior and attitudes) recently received criticism in the literature (di Salvatore *et al.*, 2018). One of the criticisms relates to the fact that a composite indicator of the three sub-dimensions of financial literacy might be prone to double counting as knowledge and behavior are usually strongly correlated. Another point of criticism is that a static definition of good financial behavior for all respondents ignores that a respondent's optimal behavior depends on his/her current stage of life. For instance, the OECD/INFE framework

always considers saving as positive, regardless of the respondents′ age. This contradicts with the standard life-cycle theory. Second, in a composite indicator all components are treated in the same way, while there are differences in the type of assessment. Knowledge is an objective test-based assessment, while behavior and attitudes are subjective assessments.

Very little is known on the impact of culture on financial literacy. Brown *et al.* (2018) are among the few scholars who focus on this particular aspect. They compare secondary-school students along the German-French language border within Switzerland and show that Swiss students in the French-speaking region score lower on a financial knowledge test than those in the German-speaking region. The authors argue that these differences are driven by cultural differences embedded in each language group. While this is an interesting study, culture is not made explicit nor does it examines the effect of culture across countries. Recently, Ahunov and Van Hove (2020) combine the 2014 Standard & Poor's Global Financial Literacy survey with Hofstede's cultural dimensions for a sample of 92 countries. Their results show that some cultural dimensions such as individualism and uncertainty avoidance help to explain variation in financial literacy across countries. However, the empirical analysis in Ahunov and Van Hove (2020) is based only on aggregated financial literacy data. In order to disentangle the link between culture and financial literacy, individual-level financial literacy data would be more insightful.

Finally, we look at the specific cultural dimensions from Hofstede's (2001) cultural framework that could help to explain financial literacy levels. This framework is widely used in the economic literature (including in finance) to measure culture (for an overview see Karolyi, 2016). Based on previous research mentioned above, we identify *uncertainty avoidance* and *individualism* as two cultural dimensions that could be related with the efforts that individuals undertake to raise their level of financial literacy.

3 | HYPOTHESIS DEVELOPMENT

3.1 | Uncertainty avoidance

Uncertainty avoidance deals with a society's tolerance for uncertainty and ambiguity. It captures to what extent its members feel comfortable or uncomfortable in unstructured situations, defined as novel, unknown, surprising, or different from usual (Hofstede, 2001). Uncertainty avoidance is not the same as risk aversion, although recent research suggests the concepts are related. At the individual level, Rieger *et al.* (2015) observe that risk attitudes do not only depend on economic conditions but also on uncertainty avoidance. At the country level, Kwok and Tadesse (2006) and Aggarwal and Goodell (2010) show that (relatively risk-averse) bank-based financial systems occur more in countries characterized by a higher level of uncertainty avoidance; while market-based financial systems are more likely to be present in countries with a low level of uncertainty avoidance. Li *et al.* (2013) further demonstrate that national levels of uncertainty avoidance are negatively related to corporate risk-taking at the firm level. In sum, we expect that individuals in more uncertainty-avoiding cultures will invest more in financial literacy. A higher level of financial literacy would make it easier to deal with unexpected financial events.

Hypothesis 1 (H1). *Adults′ financial literacy levels are higher in countries with a high uncertainty-avoiding culture and vice versa.*

3.2 | Individualism versus collectivism

Individualism and collectivism act as proxies for the degree to which individuals are integrated into groups (Hofstede, 2001). In individualistic cultures, people are 'I'-conscious and focus mainly on self-actualization (de Mooij and Hofstede, 2010); while in collectivistic cultures people are 'we-conscious and will try to avoid loss of face. In more individualistic societies, decisions are mainly taken at the individual level and tend to be more subject to overconfidence bias (Van den Steen, 2004; Chui *et al.*, 2010). As a result, people in individualistic cultures are less likely to seek financial advice (Mihaylov *et al.*, 2015) and to participate in initiatives which improve their financial literacy (García, 2013). In contrast, people from collectivistic cultures exhibit higher levels of self-monitoring, which reduces the occurrence of cognitive biases related to overconfidence (Biais *et al.*, 2005). Therefore, we expect a negative relation between individualism and financial literacy.

Hypothesis 2 (H2). *Adults' financial literacy levels are higher in countries with a collectivistic culture and vice versa.*

4 | METHODOLOGY

4.1 | Data

The data used to explore the influence of culture on financial literacy across countries originates from the 2015 OECD/INFE International survey on adult financial literacy competencies (OECD, 2011, 2016). Responses were collected through a combination of face-to-face and telephone interviews with adults in 30 countries. We obtained data of 24,512 individuals from 12 participating countries (Belgium, Canada, Croatia, Estonia, Hong Kong, Jordan, Latvia, Malaysia, The Netherlands, New Zeeland, Thailand, and the United Kingdom). Importantly, the data collection was based on a set of standardized questions. The coordinated approach by the OECD ensures comparability across countries, a major advantage compared to previous studies (Nicolini *et al.*, 2013; Bucher-Koenen *et al.*, 2017). The survey includes a set of financial literacy questions and a broad range of questions on socioeconomic characteristics.[3] In contrast to previous studies, the definition of financial knowledge is broader and not limited to the understanding of three economic concepts related to interest rates, inflation, and risk diversification (Lusardi and Mitchell, 2011b).

4.2 | Measures

4.2.1 | Financial literacy index

The financial literacy index is calculated as the weighted average of the sum the correct answers on a set of financial literacy questions. These questions cover the understanding of time-value of money [QK1]; interest payment on a loan [QK2]; simple and compound interest [QK3 and QK4]; the relationship between risk and return [QK5]; the concept of inflation [QK6]; and the benefits of diversification [QK7].[4] Each correct answer is given a score of one. Following Potrich *et al.* (2018) we perform a principal component analysis to obtain the factor loading weights.

Next, the financial literacy index of a respondent is obtained by multiplying the factor loading weights of the given answer with each of the seven financial literacy questions: [$0.314 \times QK1 + 0.157 \times QK2 + 0.135 \times QK3 + 0.116 \times QK4 + 0.098 \times QK5 + 0.094 \times QK6 + 0.087 \times QK7$]. The result is rescaled to a value of 100. Figure 1 shows the distribution of the financial literacy index across countries. It ranges from 52 in Malaysia to 83 in Hong Kong, with an average of 65 across all 12 countries.

4.2.2 | Culture

In line with recent literature on national culture (Taras *et al.*, 2009; Aggarwal *et al.*, 2016; Nadler and Breuer, 2019) we capture culture by two of Hofstede's cultural dimensions: *uncertainty avoidance* and *individualism*.[5] Each of these dimensions is measured on a scale from 0 to 100. Panel A of Table 1 presents the scores for each country. Belgium (Hong Kong) scores the highest (lowest) on uncertainty avoidance. The Anglo-Saxon countries (UK and Canada) are the most individualistic, while Thailand is the most collectivistic.

4.2.3 | Control variables

Consistent with prior studies (Brown *et al.*, 2018; Cupák *et al.*, 2018b) we control for several individual and country-specific determinants of financial literacy.[6] At the country level, we control for *math score in PISA*,[7] which is used as a proxy for the quality of the education system. We also include several indicators of the general level of economic development as a robustness check. Cupák *et al.* (2018b) argue that institutional differences related to these factors may partly explain cross-country differences in financial literacy. More specifically, gross domestic product (GDP) per capita, *the share of internet users* and *life expectancy* (Jappelli, 2010) are included in our empirical analysis.
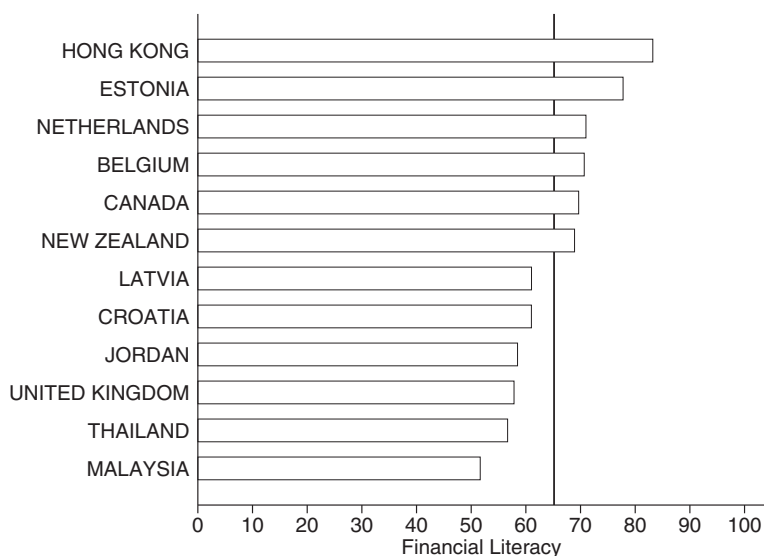

FIGURE 1 Financial literacy across sample countries

TABLE 1 Sample characteristics

	BE (*n* = 1,933)	CA (*n* = 1,002)	HR (*n* = 1,049)	EE (*n* = 1,125)	HK (*n* = 1,000)	JO (*n* = 1,140)	LT (*n* = 1,019)	MY (*n* = 2,890)	NL (*n* = 1,018)	NZ (*n* = 1,336)	TH (*n* = 10,000)	UK (*n* = 1,000)
Panel A: Country-level variables												
Cultural dimensions												
Uncertainty avoidance	94	48	80	60	29	65	63	36	53	49	64	35
Individualism	75	80	33	60	25	30	70	26	80	79	20	89
Math score in PISA	507	516	464	520	548	380	482	421	512	495	415	492
GDP per capita (current USD)	40,441	43,495	11,780	17,412	42,432	4,997	13,640	9,799	45,175	38,560	5,840	44,472
Internet users (% of population)	85.05	88.47	69.80	88.41	84.95	60.11	79.20	81.06	91.72	88.22	39.32	92.00
Life expectancy (years)	81.29	82.13	77.28	77.13	84.28	74.19	74.12	75.22	81.71	81.46	75.07	81.60
Panel B: Individual-level variables (%)												
Gender												
Female	51.26	51.54	52.57	53.10	54.35	44.47	53.17	50.67	50.26	51.67	51.45	51.53
Male	48.74	48.46	47.43	46.90	45.65	55.53	46.83	49.33	49.74	48.33	48.55	48.47
Urban												
Living in a rural area	84.22	52.80	76.40	67.98	0.00	20.69	67.55	35.89	72.63	51.78	56.12	70.26
Living in an urban area	15.78	47.20	23.60	32.02	100.00	79.31	32.45	64.11	27.37	48.22	43.88	29.74
Age												
18–29 years	15.06	18.61	19.55	21.30	19.30	47.08	20.47	30.49	17.81	19.64	23.95	18.24
30–49 years	40.30	34.90	35.39	35.40	39.09	38.96	36.23	44.55	37.05	39.29	44.57	33.61
50–69 years	34.51	37.64	33.37	32.00	34.48	12.99	32.30	23.26	37.08	32.63	26.02	33.72
70+ years	10.13	8.85	11.69	11.30	7.13	0.97	11.01	1.70	8.06	8.45	5.46	14.43
Education												
Primary	8.75	2.16	25.24	11.60	12.04	4.35	10.36	17.12	3.52	1.46	42.32	2.93
Secondary	49.85	24.20	53.38	34.88	47.10	30.70	28.01	67.15	34.19	36.55	40.39	35.66
Tertiary	41.40	73.64	21.37	53.51	40.86	64.95	61.63	15.73	62.29	61.99	17.29	61.41
Employment												
In-paid employment	44.95	50.41	41.57	53.55	55.80	38.25	52.81	48.40	45.94	51.68	37.40	52.07

(Continues)

TABLE 1 (Continued)

	BE (n = 1,933)	CA (n = 1,002)	HR (n = 1,049)	EE (n = 1,125)	HK (n = 1,000)	JO (n = 1,140)	LT (n = 1,019)	MY (n = 2,890)	NL (n = 1,018)	NZ (n = 1,336)	TH (n = 10,000)	UK (n = 1,000)
Self-employed	5.09	10.01	6.98	11.90	3.57	12.96	8.87	22.76	6.98	14.21	40.72	7.46
Retired	24.96	19.86	25.53	18.93	13.43	3.51	21.46	3.79	16.92	12.73	2.01	24.19
Other not working	25.01	19.72	25.92	15.62	27.21	45.27	16.86	25.05	30.16	21.37	19.87	16.28

Note: The country codes represent the following countries: BE: Belgium, CA: Canada, HR: Croatia, EE: Estonia, HK: Hong Kong, JO: Jordan, LT: Latvia, MY: Malaysia, NL.: The Netherlands, NZ: New Zealand, TH: Thailand, and UK: United Kingdom. Following the OECD (2011, 2016), data are weighted to be representative in terms of region, gender, and age profile, except Jordan (JO), Malaysia (MY), and Thailand (TH), where survey weights are not available.

Summary statistics in Panel A of Table 1 show that Hong Kong has the highest average math score in the PISA test, while Jordan scores the lowest. The Netherlands achieves the highest GDP per capita and Jordan has the lowest GDP per capita. With a share of 92%, the United Kingdom has the highest proportion of internet users, while in Thailand barely 40% of the population has internet access. The highest life expectancy is found in Hong Kong (84 years), while Jordan and Latvia are the countries with the lowest life expectancy (74 years).

At the individual level, we include socioeconomic variables such as *gender, urban, age, education, and employment*. In the literature, we find evidence for a gender gap in financial literacy with men generally outperforming women (Bucher-Koenen *et al.*, 2017; Cupák *et al.*, 2018a). In addition, we consider the effect of urbanization on financial literacy. Jappelli (2010) provides evidence for a positive relationship between urbanization and economic literacy. Another factor which plays a role in financial literacy is age. Most evidence points to a hump-shape pattern between age and financial literacy. Financial literacy increases at an early age, thanks to learning effects, but decreases again at an older age, due to a natural decline in both fluid and crystallized intelligence (Finke *et al.*, 2017). Moreover, education positively affects financial literacy because better educated people are more financially knowledgeable (Lusardi and Mitchell, 2011b). Finally, employment has a positive effect on financial literacy because active persons are exposed to finance-related experiences as part of their job or because they take part in financial education initiatives at the workplace (Bayer *et al.*, 2009).

Panel B of Table 1 focuses on individual-level observations and reports the percentage of the respondents per country which exhibit a certain socioeconomic characteristic. In most countries, except for Jordan, there are more female than male respondents. The share of respondents living in an urban area is quite diverse across countries, ranging from 100% in Hong Kong to only 24% in Croatia. Furthermore, most respondents are middle-aged (categories "30–49" and "50–69"). In our sample, the level of education differs significantly across countries with low-educated individuals being more prevalent in Croatia, Malaysia, and Thailand, and a high level of highly educated individuals in Canada, Jordan, and the Netherlands. Considering employment, most respondents are in-paid employment, with a notable exception for Thailand were most individuals are self-employed. Note that, thanks to the OECD sampling weights, the sample is representative for the region, gender and age profile, but not necessarily with respect to the other dimensions.[8] To account for this, we control for various observed characteristics in the empirical analysis.

4.2.4 | Empirical model

Financial literacy is influenced by factors at the country level (culture and institutional variables) and at the individual level (socioeconomic variables). The potential dependency of observations between individuals from the same country violates the OLS regression assumption (Goldstein, 2011). The distinctive levels of aggregation require a multilevel modeling approach (Rabe-Hesketh and Skrondal, 2008). We include survey weights in order to account for unequal probability of selection at the individual level.[9] Using survey weights is a well-established procedure in single-level models. However, for multilevel models, the inclusion of raw survey weights can produce biased parameter estimates (Asparouhov, 2006). Hence, we rescale the weights in such a way that the sum of the new weights equals the country sample size. Simulation work conducted by Carle (2009) shows that this scaling method provides the least biased estimators. In this study, we estimate a (weighted) multilevel model with random intercepts[10]:

$$y_{ij} = \beta_0 + \beta_1 x_{ij} + \beta_2 v_j + u_j + e_{ij}$$

where y_{ij} denotes the financial literacy score for individual i in country j as dependent variable, x_{ij} represents the independent variables at individual level, and v_j the independent variables at country level.[11] In contrast with single-level models, the error term in multilevel models is more complex, since it includes not only an individual error e_{ij}, but also a country error u_j. Thus, the variance between countries is $Var(u_j) = \sigma_u^2$ and the variance between individuals within countries is $Var(e_{ij}) = \sigma_e^2$. Based on these variances, we calculate the *intraclass correlation coefficient* (ICC) as the between-country variance to total variance. It indicates how much of the variance is due to differences between countries (Rabe-Hesketh and Skrondal, 2008).

$$ICC = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_e^2}.$$

5 | RESULTS

This section presents evidence on the influence of individual- and country-level variables on financial literacy. We depart from the null model (Column 2 in Table 2) which only contains the constant and the macrolevel error term. In the baseline model (Column 3 in Table 2), we include individual-level predictors (i.e., gender, urban, age, education, and employment). This model is in line with the current strand of financial literary literature on socioeconomic determinants (see for an overview Lusardi and Mitchell, 2014; Stolper and Walter, 2017). Next, we present models in which country-level variables are added to the baseline model (Models 1–6, Column 4–9 in Table 2). We examine the influence of some cultural dimensions by including variables related to *uncertainty avoidance* and *individualism* separately as well as together. We control for institutional differences in education quality by including *math score in PISA*. In line with Jappelli (2010), we perform some robustness checks by examining the impact of GDP per capita, *internet users, and life expectancy*.

Colum 3 of Table 2 presents the results of our baseline model. In accordance with previous findings we find that age, education, and employment are significantly related to financial literacy. With respect to age we confirm the typical hump-shape pattern with an increase in financial literacy until the age of 70 and a decrease afterwards. Moreover, educational attainment has a positive influence on financial literacy. Regarding employment, we observe that the unemployed score worse than employed or retired people. No significant effects are found for the degree of urbanization.

Next, we add country-level variables to the baseline model. Columns 4 to 6 present evidence of the influence of cultural aspects on financial literacy, once institutional and socioeconomic differences are taken into account. Columns 4 and (5) show the results for each cultural factor separately, while column 6 presents the results with both cultural variables. The results reported in columns 4 to 6 show that an individual's level of financial literacy is positively related to uncertainty avoidance and negatively related to individualism. The coefficient for individualism is statistically significant at the 1% level, while the coefficient for uncertainty avoidance is significant at the 10% level. It is important to note that the coefficients keep their

TABLE 2 Multilevel regression models with individual and country-level variables predicting financial literacy

	Null model	Baseline model	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Uncertainty avoidance (measuring whether individuals feel at ease in unstructured situations)			0.146* (0.0815)		0.091* (0.054)	0.171* (0.092)	0.211** (0.087)	0.163* (0.0903)
Individualism (measuring whether individuals are integrated into groups)				−0.203*** (0.0785)	−0.176** (0.0696)	−0.109 (0.134)	−0.323** (0.129)	−0.052 (0.0875)
Gender (reference category: Female)		6.290*** (1.572)	6.296*** (1.571)	6.301*** (1.571)	6.301*** (1.570)	6.289*** (1.572)	6.294*** (1.572)	6.289*** (1.572)
Urban (reference category: Living in a rural area)		1.409 (1.285)	1.461 (1.276)	1.431 (1.283)	1.452 (1.278)	1.419 (1.282)	1.442 (1.283)	1.419 (1.283)
Age (reference category: 18–29)								
30–49		2.692** (1.278)	2.677** (1.279)	2.679** (1.280)	2.676** (1.279)	2.684** (1.279)	2.682** (1.279)	2.684** (1.279)
50–69		4.586** (2.040)	4.558** (2.043)	4.563** (2.044)	4.562** (2.044)	4.579** (2.041)	4.575** (2.041)	4.578** (2.041)
70+		−0.859 (2.063)	−0.889 (2.064)	−0.883 (2.064)	−0.879 (2.064)	−0.860 (2.061)	−0.867 (2.059)	−0.862 (2.061)
Educational level (reference category: Secondary)								
Primary		−7.562*** (1.131)	−7.551*** (1.129)	−7.577*** (1.129)	−7.584*** (1.132)	−7.557*** (1.127)	−7.555*** (1.134)	−7.557*** (1.127)
Tertiary		7.391*** (0.907)	7.385*** (0.910)	7.417*** (0.907)	7.422*** (0.908)	7.395*** (0.910)	7.415*** (0.911)	7.397*** (0.909)
Employment (reference category: Unemployed)								
In-paid employment		3.588*** (0.644)	3.570*** (0.637)	3.555*** (0.637)	3.555*** (0.636)	3.594*** (0.645)	3.576*** (0.640)	3.593*** (0.646)
Self-employed		5.884*** (0.842)	5.890*** (0.837)	5.868*** (0.840)	5.873*** (0.836)	5.896*** (0.840)	5.896*** (0.844)	5.896*** (0.840)

(Continues)

TABLE 2 (Continued)

	Null model	Baseline model	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Retired		3.588***	3.557***	3.555***	3.542***	3.586***	3.561***	3.585***
		(1.111)	(1.110)	(1.112)	(1.111)	(1.110)	(1.112)	(1.109)
Math score in PISA			0.116***	0.178***	0.175***			
			(0.036)	(0.046)	(0.045)			
GDP per capita						0.315		
						(0.197)		
Internet users							0.932***	
							(0.266)	
Life expectancy								1.334***
								(0.515)
Variance country	7.391	6.906	4.700	4.080	3.839	6.014	4.261	5.792
Variance individuals	25.196	23.941	23.941	23.941	23.941	23.941	23.941	23.941
ICC	0.227	0.224	0.162	0.146	0.138	0.201	0.151	0.195
N	24,512	24,274	24,274	24,274	24,274	24,274	24,274	24,274

Note: Standard errors are in parentheses. Following the OECD (2011, 2016), data are weighted to be representative in terms of region, gender, and age profile, except Jordan (JO), Malaysia (MY), and Thailand (TH), where survey weights are not available.

*$p < .10$; ** $p < .05$; *** $p < .01$.

sign and significance when estimated together, as shown in column 6. The results are consistent with hypotheses H_1 and H_2: individuals are more financially literate in countries with a culture of high uncertainty avoidance and are less financial literate in countries with a culture that promotes individualism.

The coefficient for uncertainty avoidance in column 6 indicates that a one-point increase in this index leads to a 0.091% point increase in financial literacy. Hence, ceteris paribus, an increase of the uncertainty avoidance index of 65 (i.e., the difference between the highest and the lowest rated countries) results in an increase of financial literacy of 5.92 percentage points. The results also suggest that a one-unit increase in individualism decreases financial literacy by 0.176% points. Hence, an increase of the individualism index of 69 (i.e., the difference between the highest and the lowest rated countries) results in a decrease of financial literacy of 12.14 percentage points, keeping everything else constant.

The individual-level predictors that were significant in the baseline model are also significant in the additional models shown in columns 4 to 6. The math score is positively related to financial literacy. The proportion of unknown variance due to country effects denoted by the intra-class correlation (ICC) is 23% in the null model and 22% in the baseline model. This indicates that a highly significant proportion of the total variance is due to the variance between countries. The inclusion of country-level variables in columns 4 to 9 reduces this to 14–20%, indicating that some of the variance is captured by the country-level variables accounted for in the regressions.

As a robustness check, we introduce other institutional variables that measure the general economic condition at the country-level in column (7) to (9). Variables such as *GDP* per capita, *internet users* and *life expectancy* capture the differences in availability and prevalence of economic environments. Most importantly, the effect of culture on financial literacy is robust when we consider uncertainty avoidance. With respect to individualism, the negative effect remains significant only in one out of three cases. The share of internet users and life expectancy are both positively associated with financial literacy. This provides further evidence that, besides individual socioeconomic factors, individuals from countries with better economic conditions have an advantage with respect to financial literacy.

6 | CONCLUSIONS

The importance of financial literacy for individuals' financial well-being has been well-established. Earlier literature focused on the role of socioeconomic characteristics and formal institutional factors, such as the quality of the educational system, as drivers of differences between individuals across countries. In this paper, we contribute to the literature by showing how national culture helps to explain variation in financial literacy. Using a standardized sample of 24,512 individuals from 12 countries, we find support for our hypotheses. Specifically, our results suggest that individuals in countries with a more uncertainty-avoiding culture are more financially literate, while financial literacy is lower for individuals in countries with cultures that are strongly oriented towards individualism.

Our results complement studies on financial behavior and culture which conclude that individuals in countries with an uncertainty-avoiding culture prefer to take less risk and thus invest more in financial literacy as insurance against unexpected events, while individuals in countries that promote individualistic behavior are less inclined to seek financial advice because they are overconfident.

From a policy perspective, our results demonstrate that some determinants of financial literacy are deeply rooted in a country's culture and therefore difficult to change in the short term.

Our findings also have implications for the design of policy measures that aim at improving financial literacy. These initiatives should also consider cultural factors because our results suggest that the effect of financial literacy initiatives will depend partly on the cultural aspects of the society.

Future international financial literacy research could move beyond the national level and refine our results by analyzing how variation in cultural subgroups like immigrants has an impact on financial literacy levels. In recent years, migration has been steadily rising and the influx of immigrants is not equally distributed between countries. Given that immigrants all have their own cultural attitudes, linguistic backgrounds, skills, and knowledge (Bove and Elia, 2017), immigration patterns could advance our understanding of financial literacy trends and prevalent financial literacy levels across countries.

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ENDNOTES

[1]"Future research should more fully consider the meaning of variables in the context of the study population, while considering the context of time and place. Thus, we applaud the internationalization of financial socialization research and urge that context-specific models take into account culture and economic realities that shape financial realties" (Gudmunson *et al.*, 2016, 67).

[2]Despite focusing on financial knowledge, we follow earlier literature and use the term 'financial literacy' interchangeably (Lusardi *et al.*, 2014; Bucher-Koenen *et al.*, 2017).

[3]The OECD data include a weighting factor that ensures data are representative in terms of region, gender, and age profile (OECD, 2011, 2016).

[4]The exact questions are listed in Appendix A.

[5]More information on Hofstede's cultural framework are provided in Appendix B.

[6]Details of the definition of the variables can be found in Table C1 in Appendix C.

[7]The Program for International Student Assessment (PISA) is a large survey coordinated by the OECD that examines the performance of 15-year-old students on mathematics, languages, and sciences.

[8]Data are weighted except for Jordan (JO), Malaysia (MY), and Thailand (TH) where survey weights are not available.

[9]Data for every country is weighted except for Jordan (JO), Malaysia (MY), and Thailand (TH) where survey weights are not available. Following the OECD (2011, 2016), data is weighted to be representative in terms of region, gender, and age profile.

[10]Following the existing literature (Lusardi and Mitchell, 2011b), we assume that the effect sizes of the individual socioeconomic explanatory variables of financial literacy are the same across countries. As a result, we opt for the random intercept model instead of the random slope model. In the random intercept model, the effect of the individual explanatory variables on the outcome variable is assumed to be the same in every group (i.e., country). Using a random slopes model would imply that there are huge differences in effect size of some explanatory variables, which is inconsistent with the literature on financial literacy.

[11]The literature points to potential problems related with maximum likelihood (ML) inference for multilevel models when the number of groups (countries) is small (12 in our cases). Typically, ML needs large samples to be unbiased. However, when comparing the performance of different simulations, Stegmuller (2013) argues that

in the case of a limited number of groups (countries) the random intercepts model is the best-case scenario. Here, ML estimates and confidence intervals are only biased to a limited extent. Hence, we are confident that the results of our estimates are valid.

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APPENDIX A: FINANCIAL LITERACY QUESTIONS IN THE OECD/INFE SURVEY A

In Table A1, we provide an overview of the financial knowledge questions in the OECD/INFE survey on financial literacy which were used to construct our financial literacy index. The index is the result of the weighted sum of the correct answers on these questions. Weights are obtained from a principal component analysis. For the sake of brevity, we do not mention

TABLE A1 Financial literacy questions

Question number	Topic	Question	Answer options
QK1	Time-value of money	Imagine that five brothers are given a gift of €1,000 and have to share the money equally. They have to wait for 1 year to get their money and inflation stays at 1.5%. In 1 year's time will they be able to buy:	a More with their share of the money than they could today b The same amount c **Less than they could buy today**
QK2	Interest paid on a loan	You lend €25 to a friend one evening and he gives you €25 back the next day. How much interest has he paid on this loan?	Open response. Correct answer is zero.
QK3	Simple interest	Suppose you put €100 into a no fee, tax free savings account with a guaranteed interest rate of 2% per year. You do not make any further payments into this account and you do not withdraw any money. How much would be in the account at the end of the first year, once the interest payment is made?	Open response. Correct answer is €102.
QK4	Compound interest	And how much would be in the account at the end of 5 years?	a **More than €110** b Exactly €110 c Less than €110 d It is impossible to tell from the information given
QK5	Risk and return	Is the following statement true or false? An investment with a high return is likely to be high risk.	a **True** b False
QK6	Definition of inflation	Is the following statement true or false? High inflation means that the cost of living is increasing rapidly.	a **True** b False
QK7	Diversification	Is the following statement true or false? It is usually possible to reduce the risk of investing in the stock market by buying a wide range of stock and shares.	a **True** b False

answer options such as "Don't know" or "Refused to answer". Correct answers of multiple-choice questions are in bold.

APPENDIX B: HOFSTEDE'S CULTURAL FRAMEWORK B

Hofstede's book *Culture's Consequences* (1980) is the seminal study on cross-cultural psychology. Based on survey data collected between 1967 and 1973 of 116,000 IBM employees in 72 countries he distinguishes between four dimensions of national culture: *power distance*, *uncertainty avoidance*, *individualism* versus *collectivism*, and *masculinity* versus *femininity*. Later, long-term versus short-term orientation (Hofstede, 2001) and *indulgence* versus *restraint* (Hofstede *et*

al., 2010) were added. We focus on two of these dimensions which might directly influence financial literacy.

APPENDIX C: VARIABLE DEFINITIONS C

TABLE C1 Variable definitions and data sources

Variable	Definition	Source
Panel A: Individual-level variables		
Financial literacy	Financial literacy index composed on seven financial knowledge questions	Authors' calculations based on OECD (2016) data
Gender	0 = Female, 1 = Male	OECD (2016)
Urban	0 = Rural (village or town with fewer than 100,000 people), 1 = urban (city with more than 100,000 people)	OECD (2016)
Age	1 = 18–29 2 = 30–49 3 = 50–69 4 = 70+	OECD (2016)
Educational level	1 = Primary education 2 = Secondary education 3 = Tertiary education	OECD (2016)
Employment	1 = In-paid employment 2 = Self-employed 3 = Retired 4 = Other, not working	OECD (2016)
Panel B: Country-level variables		
Uncertainty avoidance	Hofstede's cultural index on uncertainty avoidance	Hofstede (2001)
Individualism	Hofstede's cultural index on individualism	Hofstede (2001)
Math score in PISA	Math score in the 2015 PISA survey	PISA data
GDP per capita	GDP per capita in current USD (expressed as 1,000 USD)	World Bank Development Indicators
Internet users	Internet users (% of the population)	World Bank Development Indicators
Life expectancy	Life expectancy (years)	World Bank Development Indicators