



Identifying financially illiterate groups: An international comparison

Kenneth De Beckker¹ | Kristof De Witte^{1,2} | Geert Van Campenhout^{1,3}

¹Leuven Economics of Education Research, Faculty of Economics and Business, KU Leuven, Leuven, Belgium

²UNU-MERIT, Maastricht University, Maastricht, The Netherlands

³European Commission, Brussels, Belgium

Correspondence

Kenneth De Beckker, Leuven Economics of Education Research (LEER), Faculty of Economics and Business, KU Leuven, Warmoesberg 26, 1000 Brussels, Belgium.
Email: kenneth.debeckker@kuleuven.be

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Abstract

Targeted policy interventions are more effective than one-size-fits-all initiatives. This paper proposes the use of k-means cluster analysis to identify vulnerable groups with respect to financial literacy. Using a rich sample of 12 countries, we distinguish 4 groups with varying financial literacy levels, and examine their socio-economic characteristics. The results suggest that individuals in the most vulnerable financially illiterate groups are on average, single, less-educated and unemployed with low incomes. This contrasts with those in the strongest group: individuals with the highest financial knowledge, financial behaviour and financial attitudes scores are on average highly educated males who live together with a partner. They earn a high income and hold several financial products. Integrating these insights into national strategies which promote financial literacy will not only lead to more effective but also to more efficient policy initiatives by focusing on the particular weaknesses of certain subgroups and using the appropriate transmission channels.

KEYWORDS

cluster analysis, financial attitudes, financial behaviour, financial knowledge, financial literacy

1 | INTRODUCTION

The social and financial environment consumers face has changed dramatically in recent years. Individuals are increasingly responsible for their own personal well-being (e.g., health and retirement provision), while financial products become increasingly complex. While this requires a higher level of financial literacy of individuals, it also sharpens the differences between groups with high and low levels of financial literacy, making the latter increasingly more vulnerable.

Low levels of financial literacy have been linked to suboptimal financial behaviour. In particular, individuals with low levels of financial literacy are less likely to save for unexpected expenses (Henager

& Mauldin, 2015), have larger debts and engage more in high-cost borrowing (Disney & Gathergood, 2013; Huston, 2012; Lusardi & Tufano, 2015). Moreover, a lack of financial literacy prevents individuals from preparing for retirement, making them vulnerable for future income shocks (Lusardi & Mitchell, 2011a, 2017).

Despite the increased importance of financial literacy in today's society, financial illiteracy is widespread (Lusardi & Mitchell, 2011b; Stolper & Walter, 2017). Some subgroups in the population are more vulnerable. For instance, there is evidence that knowledge of basic financial concepts is particularly low among women (Bucher-Koenen; , Lusardi, Alessie, & Rooij, 2017; Chen & Volpe, 2002; Fonseca, Mullen, Zamarro, & Zissimopoulos, 2012; Lusardi & Mitchell, 2008; Mahdavi & Horton, 2014), the less-educated (Lusardi, 2012), the youth (Lusardi, Mitchell, & Curto, 2010) and the elderly (Finke, Howe, & Huston, 2017; Lusardi, Mitchell, & Curto, 2014). While earlier literature focused on identifying the characteristics of financial (il)literate individuals, there are, to the best of our knowledge, only few insights in how these different

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characteristics interact and create vulnerable subgroups in our society.

This paper identifies financial vulnerable groups and explores their characteristics. To do so, we apply a k-means cluster analysis, which is an established method used before in many other fields to classify individuals into homogeneous groups (Everitt, Landau, Leese, & Stahl, 2011). In our analysis, we extend the literature by analysing financial literacy in a comprehensive way using a joint model that incorporates financial knowledge, behaviour and attitudes. This approach differs from previous studies as existing measures of financial literacy are often limited to specific financial knowledge questions (e.g., Bucher-Koenen et al., 2017; Lusardi & Mitchell, 2011b; Lusardi et al., 2010). While financial knowledge is a necessary condition, it is not a sufficient condition for financial well-being (García, 2013; Klapper, Lusardi, & Panos, 2013; Serido, Shim, & Tang, 2013).

For our empirical application, we construct a rich cross-country data set. In particular, we combine survey data from 12 countries around the world. The questionnaire was developed and coordinated by the OECD International Network on Financial Education (OECD/INFE, 2011, 2015), which ensures validity of the questionnaire across countries. Hence, this study improves upon previous work by Nicolini, Cude, and Chatterjee (2013).

The remainder of this paper is organized as follows. Section 2 discusses the methodology employed in this paper. Section 3 presents the results of our estimation. Finally, section 4 concludes, discussing implications of this paper for policymakers and researchers.

2 | METHOD

2.1 | Data and survey design

The paper relies on a unique database including survey data from 12 member countries of the OECD International Network on Financial Education (OECD/INFE): Belgium, Canada, Croatia, Estonia, Hong Kong, Jordan, Latvia, Malaysia, The Netherlands, New Zealand, Thailand and the United Kingdom.¹ The OECD questionnaire consists of mainly closed-end questions with multiple numerically coded answering options but also includes some open-ended questions to gauge certain aspects of financial knowledge (OECD/INFE, 2011, 2015). The survey was fielded in 2015 and responses of 24,509 adults were collected through telephone and face-to-face interviews. The data collected concern self-reported socio-economic characteristics, levels of financial inclusion as well as the answers on the financial literacy questions. We apply sampling weights to the data to ensure our sample is representative in terms of region, gender and age profile within a country and population across countries.²

¹The sample distribution across countries is provided in Table A1 in appendix.

²Within- and between-country weights are calculated separately but sequentially. First, within country weights are calculated in such a way that the sample of each country is representative in terms of region, gender and age profile. Second, we generate the sample distribution for the number of citizens in each country after the data are weighted by the within-country weight. Now, we calculate the between-country weight by comparing the cross-country distribution in the population with the distribution in the sample.

Summary statistics are presented in Table 1. About 51% of the sample is female, 24% of the sample lives in a rural area and 76% in a more urban environment. Around 55% lives with a partner or spouse, 14% lives alone and 42% of the respondents report having children. Most respondents are younger than 49 years (61%). Around 43% of the people in the sample has attended higher education and 29% completed secondary school. Around 46% of the respondents are in paid employment, while almost 16% are unemployed and 14% are retired. The income³ distribution is as follows: 42% is situated in the lowest income category, 33% in the average income category and almost 25% has a high income. Most of the respondents hold one or more financial products, with almost 80% having a saving or retirement product, 61% a payment product, 45% a credit product and 54% an insurance product.

2.2 | Measurement of financial literacy

Financial literacy is often narrowed down to financial knowledge (Remund, 2010), which implicitly assumes that an increase in financial knowledge results in improved financial behaviour and attitudes. However, the relationship between these three components of financial literacy is more complex. Financial literacy is now generally considered as “a combination of awareness, knowledge, skill, attitude and behaviour necessary to make sound financial decisions and ultimately achieve individual financial well-being” (OECD/INFE, 2011, p. 3). This definition refers to a combination of knowledge, behaviours and attitudes that support financial decision making, ultimately leading to improved financial well-being (Atkinson & Messy, 2011).

The level of financial knowledge is measured using seven financial knowledge questions, covering time value of money, interest payment on a loan, simple and compounded interest, risk and return, the concept of inflation and the benefits of diversification. Every correct answer is attributed a score of one. Financial behaviour is measured by incorporating questions identifying how individuals deal with money in their daily lives. The focus is on eight behavioural items such as monitoring household budget, saving, thinking before making a purchase, paying bills on time, keeping watch on financial affairs, practicing long-term financial planning, saving and borrowing to make ends meet, and looking for information or seeking for independent advice. The response to every item is scored one if it implies desirable financial behaviour; zero otherwise. The only exception is the last item, where a score of one is attributed if the respondent shows only some attempt to make an informed decision and two when he seeks independent advice. The maximum score for financial behaviour is nine. The financial attitude of respondents is measured using three attitude statements that take into account the respondents' belief in planning, saving for the future and spending. Answers are measured

³Up to 75% of the median household income a month is defined as low income; between 75% and 125% of the median household income a month as average income and 125% or more a month as high income. The median income is calculated on a country level.

TABLE 1 Sample characteristics (N = 24,509)

	Frequency	Percentage
Gender		
Male	11,964	48.82
Female	12,545	51.18
Urban		
A village or small town (fewer than 15,000 people)	5,946	24.35
A town (15,000 to about 100,000 people)	7,902	32.35
A city (100,000 to about 1,000,000 people)	7,011	28.71
A large city (with over 1,000,000 people)	3,563	14.59
Household		
Entirely alone	3,511	14.33
With a partner/spouse	13,436	54.82
Other	7,562	30.85
Children	10,398	42.42
Age		
18–29	5,451	22.25
30–39	4,951	20.21
40–49	4,617	18.85
50–59	4,149	16.93
60–69	3,314	13.53
70–79	2,019	8.24
Educational Level		
University-level education	6,045	24.75
Technical/vocational education beyond secondary school level	4,572	18.72
Complete secondary school	6,963	28.51
Some secondary school	2,708	11.08
Complete primary school	2,618	10.72
Some primary school	1,245	5.10
No formal education	277	1.13
Employment		
Self-employed	4,558	18.66
In paid employment	11,289	46.21
Unemployed	3,881	15.89
Student	1,402	5.74
Retired	3,297	13.50
Income		
Low	9,738	42.13
Average	7,629	33.00
High	5,750	24.87
Financial inclusion		
Holds saving or retirement product	19,603	79.98
Holds payment product	14,906	60.82
Holds insurance	11,114	45.34
Holds credit product	13,228	53.97

Note: Data are weighted to be representative in terms of region, gender and age profile within a country and population across countries.

using a 5-point scale of agreement. The attitude score is the average of the three 5-point scales.

2.3 | Methodology

To identify financially vulnerable groups, we segment our sample into a relatively small number of groups based on the level of financial literacy. Dimensionality reduction can be achieved by means of principal component analysis, factor analysis or cluster analysis. While principal component analysis and factor analysis are useful to reduce the number of variables in a data set (Duda, Hart, & Stark, 2001), cluster analysis is more appropriate to divide a heterogeneous population into homogeneous groups (Mooi & Sarstedt, 2011).

The applied cluster analysis proceeds in two steps. First, we select the clustering variables. These consist of the scores on each of the three financial literacy domains. In a second step, we apply k-means as a clustering algorithm, which is a partitioning method that creates clusters by segmenting the data in such a way that the within variance is minimized. Prior to the analysis, we have to decide on the number of clusters. By relying on the Calinski–Harabasz pseudo-F-index (Caliński & Harabasz, 1974), we opt for four clusters. K-means has some clear advantages over hierarchical clustering algorithms (e.g., complete linkage, simple linkage, average linkage, centroid and Ward's linkage). The k-mean procedure is not only less affected by outliers, it can also be used with very large data sets, as the procedure is less computational demanding than hierarchical methods (Everitt, Landau, Leese, & Stahl, 2011).

Next, we run logistic regressions⁴ to examine the correlation between the clusters and the socio-economic characteristics. The dependent variable, a dummy variable indicating whether a respondent belongs to a specific cluster is regressed against a set of socio-economic characteristics (i.e., gender, urban, household, children, age, educational level, employment, income and financial inclusion). Using country fixed effects, we control for country-specific heterogeneity (e.g., cultural, institutional, educational or economic differences) and unobserved heterogeneity between countries.

3 | RESULTS

Applying the cluster analysis, we obtain four groups with different financial literacy levels as presented in Table 2. The socio-economic distribution across clusters is provided in Table A2 in appendix. Across all countries, around 34% of the respondents score, on average, very well on two out of three financial literacy domains and sufficient on a third [Cluster 1]. People in this cluster combine a profound financial knowledge with responsible financial behaviour and in most cases long-term financial attitudes. At the other extreme [Cluster 4], 16%

underperform on financial knowledge as well as on financial behaviour. Individuals in this cluster are not only lacking the skills to make simple interest calculations, they also do not understand the concept of time value of money and the benefits of diversification. Moreover, they are less likely to have a household budget, to set long-term financial goals, to use independent information and advice when making an investment and are more likely to borrow money to make ends meet. In addition, many of them are living day-to-day and are thus not making provisions for the future. This group of people can be labelled as “financial illiterate”. Between these two extremes are two groups that score low on one particular domain and sometimes show some weaknesses on one or two of the other domains. Around 26% [Cluster 2] score low on financial behaviour and somewhat weaker on financial knowledge and financial attitudes. Almost 24% [Cluster 3] score poorly on financial knowledge and show some weakness on financial attitudes.

Next, we explore the country-specific differences related to financial literacy. Individuals in Belgium, Canada, Hong Kong and New Zealand are more represented in the best performing segment [Cluster 1]; The opposite holds for Croatia, Jordan, Malaysia, the Netherlands, Thailand and the United Kingdom. The documented cross-country heterogeneity for adults in our study is in line with results for 15-year-old students examined in the PISA survey (OECD, 2017). The share of students belonging to the group of top performers (i.e., those able to make complex financial decisions) and the group of low performers (i.e., those who can only make decisions on everyday spending) differs also between countries. For instance, while in China,⁵ Belgium and Canada, respectively 33, 24 and 22% of the 15-year-old students belong to the top performers, less than 5% of the student population in Chile, Peru and Brazil belong to this category. The latter countries have with 38, 48 and 53% also the highest share of students belonging to the group of low performers. This contrasts with China, Belgium and Canada where, respectively, only 9, 12 and 13% of the 15-year-old student population belong to the low performers. The OECD average share of low performers and top performers is, respectively, 12 and 22%. The differences between countries may be related to cultural as well as institutional factors (Brown, Henchoz, & Spycher, 2018; Cupak, Fessler, Silgoner, & Ulbrich, 2018). A one-size-fits-all approach across and within countries would thus not be appropriate.

Having described the clusters, we proceed by examining the socio-economic determinants and financial literacy characteristics that are associated with each cluster. Each column in Table 4 shows the results of the logistic regression with one of the four clusters as dependent variable, and the socio-economic characteristics and financial inclusion indicators as independent variables. The results are presented as odd ratios which are defined as the ratio of the probability of belonging to a certain cluster and the probability of belonging to any of the three other clusters. More specifically, a number higher than 1 for a certain characteristic indicates that the

⁴We test the robustness of our models using probit regressions. The main conclusions from the probit models are the same (available upon request).

⁵Only four Chinese provinces participated in the PISA study: Beijing, Shanghai, Jiangsu and Guangdong.

TABLE 2 Clusters

	Cluster 1	Cluster 2	Cluster 3	Cluster 4
<i>Panel A: Average score on each financial literacy domain</i>				
Financial knowledge	5.82	5.23	3.09	1.97
Financial behaviour	7.06	4.11	6.88	3.89
Financial attitudes	3.39	3.14	3.10	3.02
<i>Panel B: Scoring low on a certain domain (in %)</i>				
Low financial knowledge score	0.00	29.02	100.00	100.00
Low financial behaviour score	0.00	100.00	0.00	97.69
Low financial attitudes score	19.37	25.08	31.22	28.16
<i>Panel C: Cluster size (in %)</i>				
All sample	34.29	26.16	23.72	15.83
On country level				
Belgium	44.38	21.24	25.93	8.44
Canada	49.76	24.94	17.87	7.44
Croatia	21.97	38.96	17.86	21.21
Estonia	31.00	51.89	6.92	10.19
Hong Kong	55.76	34.52	5.46	4.27
Jordan	33.83	24.17	24.25	17.75
Latvia	26.20	36.16	22.04	15.60
Malaysia	24.06	22.95	31.64	21.36
Netherlands	33.66	39.07	10.88	16.38
New Zealand	40.52	34.16	18.37	6.94
Thailand	29.32	22.17	31.52	16.99
United Kingdom	32.60	27.16	21.06	19.18

Note: Panel A reports the average score for, respectively, financial knowledge, financial behaviour and financial attitudes by clusters. Panel B reports the percentage of people scoring low on financial knowledge, financial behaviour and financial attitudes. The threshold values for scoring low on financial knowledge, financial behaviour and financial attitudes are, respectively, 5, 6 and 4 out of 7, 9 and 5. Panel C reports the distribution of the sample by clusters and across countries. Data are weighted to be representative in terms of region, gender and age profile within a country and population across countries.

probability that someone belongs to a particular cluster is higher than the probability that he or she belongs to any of the other clusters. The reverse holds when the odds ratio is lower than 1. We discuss the results along the four clusters.

3.1 | Cluster 1

People in the first cluster [Cluster 1] are the most financially capable, they combine a solid financial knowledge with good financial behaviour and in general a preference for long-term financial planning. They are most likely male, and living together with a partner in a small village. Most of them tend to be highly educated. It is less likely that people in this cluster are not working or student. Financially speaking, they earn an income that is above average and hold all kinds of financial products. Most of them are younger than 59 years old.

3.2 | Cluster 2

People in the second cluster [Cluster 2] score poorly on financial behaviour, but perform on average well on financial knowledge and financial attitudes. Specifically, this cluster is characterized by the lowest proportion of individuals that manage properly their own household budget that set long-term financial goals and inform themselves well when making financial decisions. Most respondents in this cluster are men. The likelihood of belonging to this cluster and not to another one is 1.3 times higher for people living in large cities compared with those living in more rural areas. Individuals belonging to this cluster seem also less likely to be living together with a partner or spouse and having children. Looking at age, we see that most of them are older than 40 years. Notwithstanding their relatively older age, they are less likely to hold a saving or retirement product. Most of the people in this cluster have as highest degree secondary education.

TABLE 3 Components of financial literacy domains by cluster

	Cluster 1	Cluster 2	Cluster 3	Cluster 4
<i>Panel A: Correct answers to financial knowledge questions (in %)</i>				
Time value of money	72.70	60.73	31.13	19.84
Interest paid on a loan	97.03	91.83	71.54	54.24
Interest plus principal	83.05	68.22	29.09	14.21
Compound interest	60.59	51.44	18.55	10.87
Risk and return	95.14	92.79	70.50	43.69
Definition of inflation	95.49	91.26	58.15	39.32
Diversification	77.92	66.90	30.05	14.98
<i>Panel B: Positive financial behaviours (in %)</i>				
Budget responsibility and has a household budget	71.04	39.30	75.90	46.00
Active saver	90.45	61.42	89.08	58.95
Considered purchase	90.33	60.56	92.51	56.07
Timely bill payment	93.95	59.16	88.88	47.02
Keeping watch on financial affairs	92.75	48.79	89.94	43.22
Long-term financial goal setting	76.97	23.20	76.41	23.74
Some attempt to make informed decision	50.38	36.67	55.79	36.45
Used independent info or advice	27.10	5.31	17.93	3.80
Has not borrowed to make ends meet	85.55	71.06	84.09	70.22
<i>Panel C: Positive financial attitudes (in %)</i>				
Disagreed with the following statements				
Living for today, tomorrow will take care of itself	63.26	44.41	50.06	37.02
Money is there to spent	49.62	37.37	41.01	32.49
More satisfaction from spending than saving	29.18	25.12	24.26	25.39

Note: Each number in this table represents a percentage. Panel A reports the percentage of correct answers on each financial knowledge question. Panel B reports the percentage of respondents showing a particular positive financial behaviour. Panel C reports the percentage of respondents disagreeing with the attitude statements. Data are weighted to be representative in terms of region, gender and age profile within a country and population across countries.

The likelihood of having a high income is lower compared with other clusters.

3.3 | Cluster 3

People in the third cluster [Cluster 3] score very well on financial behaviour and perform good on financial attitudes, but poor on financial knowledge. Individuals in this cluster are generally between 18 and 29 years old, female parents, living alone in urban areas. Most of them have a job, but often they earn a lower income suggesting that individuals belonging to this cluster have only part-time and/or are less well paid. The lower income is compensated by a careful financial money management. Compared with other clusters, we notice in panel B of Table 3 that individuals belonging to this cluster have the highest proportion of people with a household budget and of those that carefully consider a purchase.

3.4 | Cluster 4

People in the fourth cluster [Cluster 4] have the lowest average scores on each of the three domains. Especially on financial knowledge and financial behaviour, they are performing very poor. Of all the clusters, this one has the lowest proportion of people that are able to make proper interest calculations and who understand concepts like time value of money and the benefits of diversification. In addition, there is a smaller proportion of people in this cluster who are personally or jointly responsible for money management and have a household budget. This cluster contains more people who are living alone, being low educated and unemployed. Consequently, the probability to have an income lower than the average is also higher. In addition, people in this cluster hold less financial products.

TABLE 4 Logit regression results for financial literacy clusters

	Cluster 1 <i>n</i> = 8,405		Cluster 2 <i>n</i> = 6,411		Cluster 3 <i>n</i> = 5,814		Cluster 4 <i>n</i> = 3,879	
	Coefficient	Odds ratio	Coefficient	Odds ratio	Coefficient	Odds ratio	Coefficient	Odds ratio
Gender (ref: female)	0.205*** (0.028)	1.227	0.202*** (0.029)	1.223	-0.383*** (0.030)	0.682	-0.091** (0.038)	0.913
Urban (ref: a village or small town (<15,000 people))								
A town (15,000 to about 100,000 people)	-0.142*** (0.041)	0.868	0.097** (0.043)	1.102	0.224*** (0.047)	1.251	-0.228*** (0.057)	0.796
A city (100,000 to about 1 000 000 people)	-0.201*** (0.042)	0.818	0.123*** (0.043)	1.131	0.192*** (0.046)	1.212	-0.145*** (0.055)	0.865
A large city (with over 1,000,000 people)	-0.486*** (0.054)	0.615	0.287*** (0.053)	1.332	0.340*** (0.056)	1.405	-0.124* (0.071)	0.883
Household (ref: entirely alone)								
With a partner/spouse	0.169*** (0.047)	1.184	-0.081* (0.046)	0.922	-0.049 (0.051)	0.952	-0.115* (0.061)	0.892
Other	0.056 (0.051)	1.058	0.100** (0.050)	1.105	-0.109** (0.055)	0.897	-0.072 (0.065)	0.931
Children (ref: no children)	-0.051 (0.034)	0.951	-0.110** (0.035)	0.896	0.145*** (0.036)	1.156	0.025 (0.045)	1.026
Age (ref: 18–29)								
30–39	0.095** (0.046)	1.099	-0.051 (0.049)	0.950	-0.079* (0.048)	0.924	-0.023 (0.061)	0.977
40–49	-0.004 (0.049)	0.996	0.215*** (0.051)	1.240	-0.153*** (0.051)	0.858	-0.186*** (0.065)	0.830
50–59	0.102** (0.051)	1.107	0.273*** (0.052)	1.314	-0.211*** (0.054)	0.810	-0.386*** (0.069)	0.680
60–69	-0.033 (0.062)	0.967	0.229*** (0.062)	1.258	-0.217*** (0.065)	0.805	-0.125 (0.077)	0.883
70–79	-0.402*** (0.084)	0.669	0.178** (0.080)	1.195	-0.135 (0.083)	0.873	0.320*** (0.095)	1.378
Educational level (ref: Complete secondary school)								
University-level education	0.629*** (0.041)	1.876	-0.187*** (0.044)	0.829	-0.181*** (0.047)	0.834	-1.057*** (0.070)	0.347
Technical/vocational education beyond secondary school level	0.088** (0.042)	1.092	-0.043 (0.043)	0.958	0.114** (0.046)	1.121	-0.281*** (0.059)	0.755
Some secondary school	-0.063 (0.051)	0.939	0.065 (0.050)	1.067	-0.079 (0.051)	0.924	0.148** (0.060)	1.159

(Continues)

TABLE 4 (Continued)

	Cluster 1 <i>n</i> = 8,405		Cluster 2 <i>n</i> = 6,411		Cluster 3 <i>n</i> = 5,814		Cluster 4 <i>n</i> = 3,879	
	Coefficient	Odds ratio	Coefficient	Odds ratio	Coefficient	Odds ratio	Coefficient	Odds ratio
Complete primary school	-0.140** (0.056)	0.869	-0.172*** (0.057)	0.842	0.129** (0.055)	1.138	0.291*** (0.066)	1.338
Some primary school	-0.642*** (0.084)	0.526	-0.264*** (0.077)	0.768	0.067 (0.072)	1.072	0.903*** (0.080)	2.466
No formal education	-0.689*** (0.181)	0.502	-0.158 (0.141)	0.854	-0.122 (0.148)	0.885	0.800*** (0.141)	2.225
Employment (ref: in paid employment)								
Self-employed	0.104*** (0.040)	1.110	0.022 (0.042)	1.023	-0.042 (0.041)	0.959	-0.134** (0.054)	0.874
Not working	-0.123*** (0.045)	0.885	-0.045 (0.045)	0.956	-0.053 (0.046)	0.948	0.184*** (0.053)	1.202
Student	-0.254*** (0.073)	0.776	0.182*** (0.070)	1.199	-0.032 (0.075)	0.969	0.206** (0.089)	1.229
Retired	0.271*** (0.064)	1.312	-0.058 (0.063)	0.944	0.077 (0.069)	1.079	-0.478*** (0.087)	0.620
Income (ref: average income)								
Low	-0.183*** (0.034)	0.833	0.034 (0.035)	1.035	0.061* (0.035)	1.062	0.155*** (0.044)	1.168
High	0.400*** (0.038)	1.491	-0.293*** (0.042)	0.746	-0.088** (0.043)	0.916	-0.380*** (0.063)	0.684
Holds saving or retirement product (ref: does not hold)	0.698*** (0.045)	2.011	-0.075* (0.041)	0.927	0.142*** (0.042)	1.152	-0.777*** (0.045)	0.460
Holds payment product (ref: does not hold)	0.233*** (0.043)	1.262	0.175*** (0.042)	1.192	-0.014 (0.043)	0.986	-0.464*** (0.049)	0.629
Insurance (ref: does not hold)	0.367*** (0.031)	1.443	-0.250*** (0.033)	0.779	-0.006 (0.034)	0.994	-0.320*** (0.045)	0.726
Credit product (ref: does not hold)	0.323*** (0.033)	1.381	-0.068** (0.034)	0.934	-0.015 (0.035)	0.985	-0.413*** (0.043)	0.661
Constant	-1.724*** (0.107)	0.178	-1.370*** (0.112)	0.254	-1.048*** (0.113)	0.351	-0.480*** (0.155)	0.619
Country-specific effects	YES		YES		YES		YES	

Note: Standard errors in parentheses. Data are weighted to be representative in terms of region, gender and age profile within a country and population across countries.
 p* < 0.05; *p* < 0.01; ****p* < 0.001.

4 | CONCLUSIONS AND POLICY IMPLICATIONS

This paper uses k-means cluster analysis to segment the population into groups with comparable levels of financial literacy and analyses the socio-economic characteristics of each group. Based on a comprehensive and unique sample of 12 countries, we observe that 34% of the respondents score high on financial knowledge as well as on financial behaviours, and 16% underperform in these two domains. Moreover, individuals in the first group perform, on average, better on financial attitudes. While the first group combines thorough financial knowledge with responsible financial behaviour and relatively long-term financial attitudes, the latter is completely lacking most literacy skills making them more vulnerable for adverse financial decisions that could have negative long-term financial consequences (Boisclair, Lusardi, & Michaud, 2017; Disney & Gathergood, 2013; Lusardi, Michaud, & Mitchell, 2017; Lusardi & Tufano, 2015).

The same cluster procedure applied to each of the 12 countries separately reveals some heterogeneity in the distribution of individuals across clusters. Respondents living in Belgium, Canada, Hong Kong and New Zealand are more likely to belong to the best performing segments while the reverse is true for inhabitants of Croatia, Jordan, Malaysia, the Netherlands, Thailand and the United Kingdom. This calls for a country-specific approach when identifying different subgroups.

Identifying vulnerable subgroups that show weaknesses in one or more financial literacy domain is interesting for several reasons. First, it will be easier for policymakers to set up more targeted policy initiatives to improve financial literacy if we can identify those specific group in the population (e.g., women, younger people, single individuals with low income, etc.) that score low on one or more of the financial literacy domains. Targeted policy initiatives will not only be more effective but will also be more efficient than a one-size-fits-all approach (Chang & Lyons, 2008; Lusardi & Mitchell, 2014; Lusardi et al., 2010). For example, setting up a large financial literacy campaign to improve financial knowledge for the entire population will only generate small marginal benefits to those who already have a high level of financial knowledge and will therefore be an inefficient use of scarce policy resources. Second, the identification of subgroups provides policymakers with the socio-demographic profile of those individuals they aim to target with their policy. This creates the opportunity to use the most appropriate media channel for each specific group. While a social media campaign can be very useful when targeting students, it is unlikely that the same applies when retired individuals are the main focus.

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ORCID

Kenneth De Beckker  <https://orcid.org/0000-0003-2110-8398>

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APPENDIX

TABLE A1 Sample distribution across countries

Country	Frequency	Percentage
Belgium	1,075	4.38
Canada	3,417	13.94
Croatia	401	1.63
Estonia	125	0.51
Hong Kong	696	2.84
Jordan	873	3.56
Latvia	188	0.77
Malaysia	2,928	11.95
Netherlands	1,615	6.59
New Zealand	438	1.79
Thailand	6,544	26.70
United Kingdom	6,208	25.33
Total	24,509	100.00

Note: Data are weighted to be representative in terms of region, gender and age profile within a country and population across countries.

TABLE A2 Socio-economic distribution across clusters

	Cluster 1		Cluster 2		Cluster 3		Cluster 4	
	<i>n</i> = 8 405	% = 34.29	<i>n</i> = 6,411	% = 26.16	<i>n</i> = 5,814	% = 23.72	<i>n</i> = 3,879	% = 15.83
Gender								
Male	3,719	46.12	3,167	47.36	3,570	59.05	2,104	56.69
Female	4,346	53.88	3,520	52.64	2,475	40.95	1,608	43.31
Urban								
A village or small town (fewer than 15,000 people)	2,053	25.50	1,671	25.09	1,194	19.79	1,011	27.48
A town (15,000 to about 100,000 people)	2,527	31.39	2,074	31.15	2,136	35.41	1,173	31.87
A city (100,000 to about 1,000,000 people)	2,259	28.05	1,838	27.61	1,882	31.20	1,038	28.20
A large city (with over 1,000,000 people)	1,213	15.06	1,075	16.15	820	13.60	459	12.46
Household								
Entirely alone	1,006	12.47	1,133	16.95	780	12.91	599	16.13
With a partner/spouse	4,803	59.56	3,352	50.13	3,379	55.90	1,882	50.71
Other	2,256	27.97	2,201	32.92	1,886	31.19	1,231	33.16
Children								
No	4,585	56.86	4,183	62.55	3,128	51.75	2,214	59.65
Yes	3,480	43.14	2,504	37.45	2,917	48.25	1,498	40.35
Age								
18–29	1,578	19.57	1,496	22.37	1,437	23.77	947	25.58
30–39	1,874	23.24	1,140	17.05	1,280	21.17	645	17.41
40–49	1,620	20.08	1,264	18.91	1,144	18.92	591	15.95
50–59	1,419	17.60	1,233	18.44	959	15.87	541	14.60
60–69	1,093	13.56	983	14.71	723	11.95	514	13.87
70–79	480	5.96	571	8.53	503	8.32	467	12.60
Educational Level								
University-level education	2,933	36.43	1,538	23.04	1,152	19.15	378	10.26
Technical/vocational education beyond secondary school level	1,601	19.88	1,332	19.96	1,068	17.75	571	15.50
Complete secondary school	1,943	24.14	2,035	30.49	1,771	29.44	1,232	33.42
Some secondary school	708	8.79	757	11.35	746	12.40	506	13.73
Complete primary school	633	7.86	652	9.78	828	13.77	515	13.98
Some primary school	189	2.35	286	4.28	391	6.50	385	10.44
No formal education	44	0.55	74	1.11	60	1.00	99	2.68
Employment								
Self-employed	1,501	18.63	1,140	17.05	1,294	21.48	628	17.15
In paid employment	4,211	52.25	3,011	45.05	2,702	44.86	1,352	36.92
Unemployed	912	11.32	1,077	16.10	995	16.52	902	24.64
Student	348	4.32	457	6.84	337	5.59	265	7.24
Retired	1,086	13.48	1,000	14.96	695	11.54	514	14.05
Income								
Low	2,389	30.82	2,833	45.80	2,590	44.68	1,976	58.40
Average	2,571	33.17	2,013	32.54	2,049	35.33	1,002	29.61

(Continues)

TABLE A2 (Continued)

	Cluster 1		Cluster 2		Cluster 3		Cluster 4	
	<i>n</i> = 8 405	% = 34.29	<i>n</i> = 6,411	% = 26.16	<i>n</i> = 5,814	% = 23.72	<i>n</i> = 3,879	% = 15.83
High	2,790	36.00	1,340	21.66	1,159	19.99	406	11.99
Financial inclusion								
Holds saving or retirement product	7,265	90.08	5,232	78.25	4,914	81.29	2,191	59.02
Holds payment product	5,761	71.43	4,296	64.24	3,242	53.63	1,593	42.92
Holds insurance	4,792	59.42	2,774	41.49	2,537	41.97	975	26.28
Holds credit product	5,513	68.36	3,489	52.18	3,016	49.89	1,183	31.88

Note: Data are weighted to be representative in terms of region, gender and age profile within a country and population across countries.