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Financial literacy: different indicator, different insights?

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ABSTRACT

Despite questions surrounding their reliability, much of the financial literacy literature continues to rely on simple metrics – without checking whether using an alternative might yield different findings. The present paper does just that: we replicate two prior studies and substitute the Standard & Poor's indicator originally used with the Big Three and OECD/INFE metrics. The results are disconcerting. In the first study, many of the relationships between national culture and country-level financial literacy become weakly significant or disappear altogether. The second study is also of a cross-country nature but analyses the impact of financial literacy on financial inclusion. Here, the magnitude of the coefficient on financial literacy in the OLS regressions decreases substantially once we use alternative metrics. In one case, the coefficient drops by no less than 69 per cent with the OECD/INFE metric, and by between one-third and half with the Big Three. Even more concerning, the Instrumental Variable regressions show no causal relationship anymore. These findings are a strong signal that the literature would benefit from revisiting several key papers, especially those relying on cross-country data.

IMPACT STATEMENT

While research employing short financial literacy tests has expanded almost exponentially over recent decades, studies questioning whether these tests are overly simplistic remain relatively scarce. Our work contributes to this emerging literature. Specifically, we replicate two existing studies—one examining the antecedents of financial literacy and another its consequences—and replace the original literacy indicators with metrics that are supposed to be similar. We find that many results either vanish entirely or weaken considerably. We hope this paper inspires further scrutiny of financial literacy tests.

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1. Introduction

We have focused considerable attention on measurement of financial literacy, in the belief that good measurement is critically important to understand a [...] topic and identify potential problems (Lusardi & Mitchell, 2023, p. 145)

The 2008 financial crisis made it painfully clear that individuals with low financial literacy are more vulnerable to economic downturns, as they often lack the knowledge to make informed financial decisions. For example, in the US, Gerardi et al. (2010) find a significant correlation between poor numerical ability and subprime mortgage delinquency.

It is thus not surprising that, in the wake of the crisis, financial literacy became a closely scrutinised social indicator. As a result, the literature on its antecedents and consequences has grown tremendously; see Figure 1 in Kaiser et al. (2022, p. 258).¹ Much of this literature is policy oriented. Obviously, for policies to be effective, it is of utmost importance that the empirical findings in the academic literature are robust and that the policy prescriptions are sound. Yet, the vast majority of the existing studies rely on a single (and often simple) indicator of financial literacy (Ouachani et al., 2021). Hardly any paper verifies whether using a different metric might not alter the conclusions.

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The present paper aims to fill this gap by replicating two existing studies and replacing the financial literacy indicator with alternative, similarly inspired metrics. The first paper that we replicate is an article by Ahunov and Van Hove (2020), hereafter A&VH, who find that two of Hofstede's (1980) dimensions of national culture – namely 'power distance' and 'individualism' – explain a substantial part of cross-country variation in financial literacy. The other paper is an article by Grohmann et al. (2018), who show – also in a cross-country setting – that financial literacy improves financial inclusion.

Both papers measure financial literacy (or, more precisely, financial knowledge) using the 2014 Standard & Poor's Global Financial Literacy Survey, hereafter referred to as the S&P survey (Klapper et al., 2015). For direct comparison, we also use the S&P metric, but in our replication efforts we replace it with two alternative measures: the so-called Big Three and the OECD/INFE.

The results are disconcerting. Many of the significant relationships found by A&VH disappear or become weakly significant. Where the Grohmann et al. paper is concerned, in the OLS regressions the magnitude of the coefficient on financial literacy decreases substantially. Even more problematic, the Instrumental Variable (IV) regressions show no causal relationship between financial literacy and financial inclusion anymore.

These findings are a strong signal that the literature would benefit from a closer examination of the reliability and validity of financial literacy metrics, and that it would be prudent to revisit key papers. The literature has shown that financial literacy affects a wide range of financial decisions – from debt management to saving for retirement (Ouachani et al. 2021, p. 272-275) – with important implications for individuals as well as society as a whole. Hence, policies to improve literacy are essential, and in order to be actionable, they must be based on the best possible measurements.

Our paper makes three contributions. For one, several of the data sources that we exploit have never been used before in academic research, or not in the way we do. Second, although other studies have raised concerns about simple financial literacy metrics (see Section 3), they all use individual-level data. To the best of our knowledge, we are the first to provide a cross-country perspective. This is the key distinction from Nicolini and Haupt (2019), the study that comes closest to ours. Third, we provide the first large-scale, joint test of the Big Three, S&P, and OECD/INFE metrics – the three financial literacy indicators that have become informal standards in the literature.

The remainder of the paper is organised as follows. After a detailed explanation of the Big Three, S&P, and OECD/INFE metrics, Section 3 reviews the relevant literature. The core of our paper consists of Sections 4 and 5, where we introduce all the datasets and present our regression results, respectively. Finally, Section 6 provides a discussion, and Section 7 concludes.

2. Big Three, S&P, and OECD/INFE: quid?

As is explained in detail in Section 4.1, we compile our data from four sources (besides the S&P survey used in the original studies). Three of these – the Allianz, Aegon, and FLat World surveys (which we will merge) – all employ the Big Three, which is by far the most heavily used metric in the literature. The Big Three is a set of three questions initially developed in 2004 by Lusardi and Mitchell (Lusardi, 2019, p. 2). The questions test individuals' knowledge of compound interest, inflation, and risk diversification.

The S&P survey used by A&VH and Grohmann et al. contains the same concepts, but in addition tests respondents' basic numeracy. Moreover, there are two questions on compound interest rather than one, and the wording of the overlapping questions differs. The precise differences between the five S&P questions and the Big Three can be ascertained in the first two columns of Table A1 in the Appendix.

According to Grohmann et al. (2018, p. 86), '[w]hile Klapper et al. (2015) do not explicitly discuss the exact origins of their [S&P] survey questions, it is quite obvious that the three questions on risk diversification, inflation, and interest compounding are slight variations of the standard items used in the literature'; that is, the Big Three. Note that the S&P measure should not be confused with Lusardi and Mitchell's 'Big Five' questions; that is, the Big Three (in the exact same wording) supplemented with a question on bond prices and one on mortgages.²

A fifth dataset that we will use stems from the OECD/INFE (International Network on Financial Education) international data collection effort. The OECD/INFE defines financial literacy as a 'complex phenomenon, made up of a combination of knowledge, attitudes and behaviours' (OECD, 2016, p. 52).

The so-called OECD/INFE Toolkit – a survey blueprint – therefore contains questions on all three dimensions. However, for comparability, we will use only the (seven) questions on financial knowledge (OECD, 2016, p. 20). Three of these – on compound interest, inflation, and risk diversification – are comparable or very comparable to both the Big Three and S&P measures; see column 3 in Table A1. However, the OECD/INFE Toolkit has a second item on inflation (which tests respondents' understanding of the meaning of the term); there is an item on the concept of interest ('To test understanding of interest without difficult arithmetic'); just like in the S&P survey there is a numeracy question ('To test [the] ability to calculate simple interest on savings'); and, finally, there is an item on the relationship between risk and return that has no equivalent in either the Big Three or S&P measures.

A crucial observation at this point is that while, as documented, the questionnaires behind the respective metrics differ in terms of the number of questions and their wording, the topics that are covered overlap to a large extent. Also, all surveys claim to be able to ultimately classify a given respondent as financially literate or illiterate, and the metrics are, implicitly or explicitly, seen as alternatives in the literature.³ One would therefore expect the conclusions of papers that make use of one metric to be relatively robust to the use of an alternative. This is the idea that inspired our paper and shaped our contribution to the extant literature, which we will now discuss.

3. Prior literature

As mentioned in the Introduction, only a handful of papers examine the reliability and validity of the commonly used Big Three, S&P, and OECD/INFE measures (Bucher-Koenen et al., 2021, p. 4).⁴

In a first paper, Nicolini and Haupt (2019) use data from five national surveys that all used the same questionnaire – with no less than 50 items on financial literacy, including the Big Five. The authors' test consists in comparing the explanatory power of different measures – respondents' overall score on 50, their score on the Big Five, etc. – in regressions for five different financial behaviours. Nicolini and Haupt's paper is thus of a similar inspiration to ours, but we use aggregate, country-level data and examine other metrics.

In Nicolini and Haupt's 120 regressions, financial literacy proved insignificant only 17 times. However, the coefficients of the (normalised) measures do vary substantially. Crucially, the Big Five outperforms the other measures only six times, and accounts for six of the 17 cases where financial literacy is insignificant. Nicolini and Haupt (o.c., p. 10) conclude that 'this result can be read as the need (in some cases) not to limit the analysis [...] to the "big-5"'.

Turning to the first of two papers that perform outright psychometric tests, de Clercq (2019) evaluates the financial knowledge domain of the OECD/INFE Toolkit. Her analysis, with data for 11 countries, confirms the applicability of the instrument for country-specific analysis (be it that the test is not sensitive enough to distinguish high and low performers everywhere). But, importantly, the item difficulties proved to be heterogeneous across countries. de Clercq concludes that international comparability is not guaranteed, and that the 'traditional league tables' (o.c., p. 7) – of the sort that we will use – should be treated with caution.

Gignac and Ooi (2022), for their part, assess the internal consistency reliability – i.e. the Cronbach's α or a comparable measure – of 52 different sets of financial literacy scores that are based on a variety of tests (with the number of questions ranging between 3 and as many as 45). They find that studies that use the Big Three and the Big Five questions have reliabilities between 0.30 and 0.47, and between 0.35 and 0.61, respectively. Many samples based on fewer than 10 test items – including studies that use the 7-item OECD/INFE test – also yielded reliability values below the 0.70 that is recommended. By contrast, for all tests/samples with 11 or more items the reliability was greater than or equal to 0.70.

Gignac and Ooi (o.c., p. 948) conclude that 'researchers should, if at all possible, avoid using a financial literacy test with only three items, or even five items, despite the popularity of the Big Three and Big Five'. They also argue that, as low test-score reliability limits the magnitude of validity coefficients, many previous investigations showing financial literacy as a predictor of important outcome variables must have substantially underestimated its impact. Gignac and Ooi (o.c., p. 950) underpin this for a number of single-country studies as well as for a meta-analysis – by Santini et al. (2019). This makes it all the more interesting to examine how different financial literacy measures perform in a cross-country setting, as we do in the present paper.

As an intermediate conclusion, it is safe to state that the papers discussed so far advocate a critical stance towards the way financial knowledge is measured in much of the extant research. This is fully in line with the inspiration for our paper.

Let us also mention two papers whose main purpose is not to test financial literacy indicators. We include them nevertheless because, along the road, they do raise questions about the validity of the metrics. For one, Behrman et al. (2010b) exploit household data for Chile to examine the impact of financial literacy and schooling on wealth accumulation. They measure financial literacy with a set of 12 questions: three ‘core’ financial literacy queries, the Big Three, and six questions about the Chilean retirement system. Responses are aggregated into a single score using a two-step weighting approach. Interestingly, Behrman et al. find that the ‘core’ questions – e.g. about the division of a lottery prize among five people (Behrman et al., 2010a, p. 9) – receive the greatest weights, implying that they are more informative regarding financial literacy than, for example, the Big Three. Behrman et al. also find that knowing the correct answers to the ‘core’ questions has a nearly 1.5 times greater impact compared to the Big Three.

Finally, Clark et al. (2021) examine the financial fragility of older Americans during the COVID-19 pandemic. To measure respondents’ financial literacy, they use not only the Big Three but also a 12-question index that comprises the Big Three plus nine ‘new financial literacy questions specifically designed for [the 45-75] age group’ (o.c., p. 293). Regardless of the measure, Clark et al. find that being more financially literate lessens the probability of being financially fragile. For our purposes, the key observation is that the correlation between the number of correct answers to the Big Three questions and the other nine is (only) 0.6.

4. Data

As explained in the Introduction, our aim in this paper is to examine the reliability of three popular financial literacy measures, and this by replicating two existing studies. In doing so, we use the exact same method as in the original studies; see Section 5 for details. However, where the financial literacy indicator is concerned, we use not only S&P data as in A&VH and Grohmann et al. (to construct overlapping samples), but we also exploit other datasets. In what follows, we first introduce all datasets (subsection 4.1). In Subsection 4.2, we then explain the construction of our samples.

4.1. The datasets

Table 1 provides an overview of the five datasets that we use.⁵ With 143 countries, the S&P survey is by far the largest. An advantage is also that, unlike the other sources, the data were collected in one effort and relate to the same year. As can be seen, datasets #2-#4 rely on Lusardi and Mitchell’s Big Three questions. The fifth dataset uses the OECD/INFE metric and is compiled from OECD publications.

Let us now discuss the specifics of the datasets – other than the S&P survey – one by one. Dataset #2 was collected by financial services company Allianz (2017). In November 2016, Allianz surveyed a representative sample of 1,000 people in each of ten Western European countries. Column (6) of Table A2 reports the percentage of respondents who correctly answered all three of the Big Three questions.⁶

Dataset #3 is taken from the Retirement Readiness Survey conducted annually among 16,000 people across 15 countries by Aegon, an international provider of life insurance, pensions, and asset management. As of 2018, the survey includes the Big Three questions (Aegon Center for Longevity & Retirement, 2018). Columns (3)-(5) of Table A2 again report the percentage of respondents who correctly answered all three questions.

Table 1. Datasets.

	Survey	Financial literacy metric	Number of countries	Source(s)
#1	Standard & Poor’s Global Financial Literacy Survey	S&P	143	Klapper et al. (2015)
#2	Allianz	Big Three	10	Allianz (2017)
#3	Retirement Readiness Survey (Aegon)	Big Three	15	Aegon Center for Longevity and Retirement (2018)
#4	FFlat World Project	Big Three	15	Lusardi (2019)
#5	Survey of Adult Financial Literacy Competencies	OECD/INFE	50	See Table A3

Description: Lists the five datasets that we use, together with the source(s).

Dataset #4, albeit disparate (and older), stems from the FLat World project. As Lusardi (2019, p. 2) explains, between 2009 and 2014, the Big Three questions were added to national surveys in 15 countries; see column (7) of [Table A2](#).

Dataset #5 stems from the Survey of Adult Financial Literacy Competencies. This is an international effort, coordinated by the OECD, to assess financial literacy in a standardised way, by means of the OECD/INFE Toolkit. Initially, 38 countries participated – in two waves; see OECD (2016) and OECD (2017).⁷ Later, the toolkit was also used in regional surveys in Eurasia (OECD, 2018) and Southeast Europe (OECD, 2020a), as well as in a third and fourth global wave (OECD, 2020b, 2023). As mentioned, for comparability with the other measures, we only use the seven questions of the OECD/INFE Toolkit that relate to financial knowledge (see [Table A1](#)). The OECD reports the results for these questions in two ways: as a per-country average score on 7 and as the proportion of adults who achieved a minimum target score of at least 5 out of 7⁸; see columns (9)-(10) in [Table A2](#). For comparability with the other two metrics, we will use only the second indicator.

An interesting preliminary observation is that the cross-country correlations between the S&P, Big Three and OECD/INFE financial literacy estimates proved to be far from perfect, as can be seen in [Table A6](#) in the [Appendix](#). In other words, it is not merely a matter of one measure consistently yielding higher estimates than the other; the relative positions of the countries also differ (see [Tables A4](#) and [A5](#)). Given this, it is not surprising that our regression analyses in [Section 5](#) show that using a different indicator of financial literacy can indeed impact the results.

4.2. Construction of samples

Now that we have described all the datasets,⁹ let us emphasise that we do not use sets #2 to #4 separately, as they cover only 10 to 15 countries. Rather, we merge them into larger samples. This is where the Aegon and Allianz surveys demonstrate their added value, despite being non-academic: together with FLat World data, they allow to construct a dataset with Big Three estimates for a satisfactory number of countries, which is a first.

Merging the samples is possible because the underlying surveys share the same methodology¹⁰ and because there is variation in country coverage. However, while the Aegon and Allianz estimates for the overlapping countries are relatively similar, the FLat World results tend to be higher – and sometimes substantially so. This raises the question which of the datasets is the more reliable (and should thus be prioritised when merging). However, as explained in [Section 3](#) of the [Appendix](#), after a thorough analysis, we found no strong reason to prefer any of the surveys. We therefore decided to give all possible combinations a try.

[Table A7](#) illustrates just how we have created the merged samples. The names reflect the sequence in which we drew on the three surveys. The ‘AL+FW+AE’ sample, for example, contains all 10 countries from the Allianz (AL) survey, the 10 non-overlapping countries from the FLat World (FW) project, and (only) 6 from the Aegon (AE) survey. All ‘merged Big Three samples’ thus consist of 26 observations (but in the regressions the number can be lower, due to missing observations; see below).

The composition of our OECD/INFE sample is reported in column (10) of [Table A2](#). For the countries for which we have two data points – typically for 2015 and 2019 – we consistently used the older estimate to stay as close as possible to the dates when the S&P and FLat World surveys were administered.¹¹ As can be seen in [Table A3](#), our OECD/INFE sample consists of 50 countries. (As a reminder, we use only the ‘Min 5 out of 7’ measure.)

In addition to the above samples, we also created S&P subsamples (see [Table 2](#)) – so as to avoid that the comparison of the different metrics would be affected by the country-composition of the samples. The maximum overlap between, on the one hand, the S&P-92 sample used in A&VH and the S&P-143 sample of Grohmann et al. and, on the other hand, our OECD/INFE dataset is dictated by the latter (as it is the smaller of the three). Fortunately, all OECD/INFE countries also appear in the S&P dataset; therefore, our overlapping sample, S&P-50, consists of 50 countries. (In practice, because of missing variables, the number of observations drops to 25-38 in the A&VH replication and to 43 in the replication of Grohman et al.)

The overlapping sample between the S&P dataset and the Big Three merged samples (S&P-26) consists of the 26 countries for which we have a Big Three score (see [Table A7](#)). Finally, let us mention that

Table 2. Overlapping samples.

Sample	Number of countries	Description
S&P-50	50	Overlapping sample between the S&P and OECD/INFE datasets (when using the OECD/INFE 'Min 5 out of 7' score).
S&P-26	26	Overlapping sample between the S&P and Big Three datasets – 26 being the number of unique countries with a Big Three score obtained by combining Aegon, Allianz, and FLat World data.

Description: Lists the S&P subsamples that we constructed to compare, for the same sets of countries, the results obtained with S&P, OECD/INFE, and Big Three financial literacy estimates.

Table 3. Financial literacy scores: descriptive statistics, % of population.

Metric Sample	Count	Mean	s.d.	Min	Max
Standard and Poor's					
S&P-143	143	36.61	14	13	71
S&P-92	92	39.74	15	14	71
S&P-50	50	39.07	16	14	71
S&P-26	26	48.59	16	22	71
OECD/INFE, Min 5 out of 7					
OECD/INFE	50	48.76	16	10	84
Big Three					
Aegon 2020	15	28.27	6	15	41
Aegon 2019	15	29.13	7	14	42
Aegon 2018	15	29.73	6	17	45
Allianz	10	33.22	8	25	47
FLat World Project	15	29.50	16	4	53
AL+FW+AE	26	28.07	11	4	47
AL+AE+FW	26	27.40	11	4	47
FW+AL+AE	26	29.30	13	4	53
FW+AE+AL	26	29.47	13	4	53
AE+FW+AL	26	27.77	11	4	50
AE+AL+FW	26	27.38	11	4	47

Description: Presents country-level descriptive statistics for the three financial literacy metrics used. This is done for the original datasets (S&P-143, Aegon 2020, etc.), for the samples used by Grohmann et al. (S&P-143) and A&VH (S&P-92), for the merged Big Three samples (AL+FW+AE, etc.), as well as for the overlapping samples described in Table 2 (S&P-50 and S&P-26).

Interpretation: The percentage of the population that is considered financially literate can differ substantially not only between the different metrics but also depending on the country composition of the samples.

the overlap between the OECD/INFE dataset and our Big Three samples is limited to 19 countries (when using the 'Min 5 out of 7' measure). We judged this number too low to perform a reliable statistical analysis. We therefore do not use an OECD/INFE-19 subsample and thus do not directly compare the OECD/INFE and Big Three metrics. Descriptive statistics on all (sub)samples are presented in Table 3.

5. Methods and regression results

This section presents the results of our replication efforts, first for A&VH (Section 5.1), and subsequently for Grohmann et al. (Section 5.2). Each subsection begins with a brief summary of the approach used in the original study, along with further details when needed.

But let us first explain why we have opted to replicate the A&VH and Grohmann et al. studies. For one, the 'substitution exercise' we had in mind cannot be performed with studies that use only individual-level data. It is not feasible to ask the respondents of a given original study to, after the fact, take an alternative financial literacy test. In other words, we had to focus on studies that use aggregate, country-level data. Second, it seemed judicious to select one article on the antecedents of financial literacy (A&VH) and another on its consequences (Grohmann et al.). The latter also happens to be a high-impact article; as of November 2024, it had received more than 770 citations according to Google Scholar. A final key feature that makes the two papers particularly suitable for our replication exercise is that they have large datasets, covering 92 and 143 countries, respectively. *Ceteris paribus*, this minimises the loss of observations when constructing overlapping samples, as explained in Section 4.2.

5.1. Ahunov and Van Hove (2020): national culture and financial literacy

To examine the impact of national culture on country-level financial literacy, A&VH (2020 p. 2266) estimate the following model:

$$\text{Financial literacy}_i = \alpha + \beta_1 \text{Country-level controls}_i + \beta_2 \text{National culture}_i + \varepsilon_i, \quad (1)$$

where subscript i refers to country i . The dependent variable is based on the S&P survey and consists of the percentage of individuals who have correctly answered three out of the four questions (Klapper et al., 2015). The scores for national culture are obtained from Hofstede.¹² Because there are significant correlations between certain of these cultural dimensions, A&VH mostly include them interchangeably rather than all at the same time. As control variables, A&VH use GDP per capita (as a proxy for a country's level of development), typically in combination with one additional country-level factor that varies from one model to the next.¹³

We have estimated model (1) for all six of Hofstede's cultural dimensions. However, we report only the results for power distance, individualism, and uncertainty avoidance. We focus on these three because these are the dimensions where A&VH find significant results.¹⁴

All specifications are estimated using both ordinary least squares (OLS) and weighted least squares (WLS). For the OECD/INFE and Big Three regressions, errors are clustered by, respectively, the publication from which we sourced the financial literacy estimates¹⁵ and the dataset (Aegon, Allianz, and FLatWorld). All specifications for the Big Three samples include two survey dummies to control for survey-specific factors such as differences in representativeness (as discussed in Section 3 of the Appendix).¹⁶

Table 4 shows the full results for one specific sample, one cultural dimension, and one estimation method – as an example. Table 5 provides an overview of all the (OLS) results.¹⁷ For each of the samples and for each of the dimensions, the table indicates in how many of the 10 different specifications (see Table 4) the coefficient of the respective cultural dimension is significant and, if so, at what level. In other words, the cell in row (5) and column (1) of Table 5 summarises the results presented in Table 4 for power distance and for the AL+FW+AE sample: power distance is significant at 1% in 3 specifications, and at 5% in the remaining 7.

A first observation about the results in Table 5 derives from comparing the three S&P samples, in rows (1) to (3), with S&P-92 being the sample used by A&VH. As can be seen, even though none of A&VH's conclusions are contradicted, for power distance the results are weaker for the S&P-26 and S&P-50 samples than for the S&P-92 sample.¹⁸ For uncertainty avoidance, there is no clear pattern. This indicates that the country composition of the sample can matter.¹⁹

If we then focus on the comparison of A&VH's S&P results with those obtained with the alternative metrics, a first observation is that, by and large, A&VH's result for power distance – in column (1) – is confirmed when using the Big Three metric. The results are less significant compared to the S&P-92 and S&P-50 samples, but this can be due to the smaller sample size. As a matter of fact, the results in rows (5)-(10) are stronger than those for the overlapping S&P-26 sample. The picture is completely different for the OECD/INFE metric: here, A&VH's finding for power distance falls apart.

The results in columns (2) and (3) of Table 5 reinforce this observation. As can be seen, the differences between the results obtained with the S&P metric and those for the alternative measures are stark. This is especially true for individualism: with the S&P data, the results are very significant, but with the other two indicators, the vast majority are insignificant. For uncertainty avoidance, the differences are somewhat less striking; nevertheless, it is safe to state that the S&P results are not confirmed.

Crucially, given that in the above comparisons, we have taken care to work with overlapping samples, the differences in the results for individualism and uncertainty avoidance must be caused by differences in the financial literacy estimates; in other words, by the measurement tool. We come back to this in the Discussion section.

5.2. Grohmann et al. (2018): financial literacy and financial inclusion

Grohmann et al., in their paper, aim to explain financial inclusion by both demand- and supply-side variables. For their dependent variable, they examine both access to and usage of financial services. To measure access, they look at the proportion of the population that has a simple bank account at a formal financial institution, as well as at the proportion of adults who own a debit card. For usage, the two

Table 4. A&VH – Financial literacy: OLS model with clustered errors, AL+FW+AE sample.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Power distance	-0.63*** (0.00)	-0.58** (0.01)	-0.70** (0.01)	-0.69** (0.01)	-0.86*** (0.00)	-0.72** (0.01)	-0.70*** (0.01)	-0.68** (0.02)	-0.70** (0.01)	-0.67** (0.03)
Log(GDP per capita)		-0.22 (0.33)	-0.09 (0.75)	-0.14 (0.56)	0.04 (0.91)	-0.20 (0.49)	-0.08 (0.82)	-0.09 (0.73)	-0.11 (0.71)	-0.13 (0.68)
Credit to GDP		0.33** (0.02)								
Female to male labour force participation			-0.01 (0.96)							
Gini				-0.11 (0.60)						
Economic freedom					-0.34 (0.33)					
IQ						0.12 (0.56)				
Human Capital Index							-0.03 (0.91)			
Bank-based financial system								0.15 (0.44)		
Political Stability 2014									0.01 (0.98)	
Rule of Law										0.06 (0.87)
Observations	26	26	26	26	26	26	26	22	26	26
Adjusted R ²	0.37	0.39	0.32	0.33	0.36	0.33	0.32	0.28	0.32	0.32

Description: Replication of A&VH's OLS regressions for the 'power distance' cultural dimension, for the AL+FW+AE sample (see Table A7), and with Big Three (rather than S&P) financial literacy scores. Errors are clustered by dataset (Allianz, FLatWorld, or Aegon). All specifications include two survey dummies to control for survey-specific factors (Allianz = base category).

Interpretation: In line with A&VH, power distance has the expected sign and is statistically significant in all specifications. Beta coefficients are standardised; p-values are in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5. A&VH – Overview of results, OLS.

Metric	Sample	Observations	Power distance (-) (1)				Individualism (+) (2)				Uncertainty avoidance (-) (3)						
			n.s.	*	**	***	n.s.	*	**	***	n.s.	*	**	***			
Standard & Poor's																	
(1)	S&P-92 [†]	52-92	-	-	1	9	-	-	-	10	-	1	1	8			
(2)	S&P-50	25-38	-	-	2	8	-	-	-	10	1	1	3	5			
(3)	S&P-26	22-26	1	2	6	1	-	-	-	10	-	1	0	9			
OECD/INFE – Min 5 out of 7																	
(4)	OECD/INFE	25-38	9	-	-	1	8	-	1	1	10	-	-	-			
Big Three																	
(5)	AL+FW+AE	22-26	-	-	7	3	9	-	1	-	6	4	-	-			
(6)	AL+AE+FW	22-26	-	-	7	3	9	1	-	-	8	2	-	-			
(7)	FW+AL+AE	22-26	-	-	8	2	9	-	1	-	7	3	-	-			
(8)	FW+AE+AL	22-26	-	-	8	2	9	-	1	-	3	6	1	-			
(9)	AE+FW+AL	22-26	-	1	7	2	9	1	-	-	9	1	-	-			
(10)	AE+AL+FW	22-26	-	1	7	2	9	1	-	-	8	2	-	-			

[†]Taken from A&VH (Southeast Europe (OECD 2020a), Table 5. n.s. = statistically insignificant, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

outcome variables are the proportion of respondents who, respectively, save on a bank account and used a debit card during the previous year.

Where the explanatory variables are concerned, demand for financial services is proxied by the degree of financial literacy, while supply is measured by variables such as the size of the financial sector, the strength of legal rights, and the number of bank branches per square kilometre.

Grohmann et al.'s OLS regressions take the following form:

$$Y = \beta_1 FL + \beta_2 X + u. \quad (2)$$

The main variable of interest is FL , the level of financial literacy in the country (as measured by the S&P survey). X is a matrix of country and institutional control variables; for precise definitions and data sources, we refer to Grohmann et al. (2018). Next to this, Grohmann et al. also estimate various IV regressions, all of which we have replicated – with the exception of the regressions where they use the Lewbel IV method.

Before we present our OLS replication results, let us point out that, along the road, we discovered a number of mistakes and peculiarities in the dataset used by Grohmann et al. (2018); see Section 5 of the [Appendix](#). Because we have corrected these, our benchmark regression results diverge slightly from those published in the original article; cf. our replication of Grohmann et al.'s Tables 2 and 3 in [Tables A9](#) and [A10](#) in the [Appendix](#). Notably, for the full models we have 122 countries rather than 119. In addition, while the significance of most of the variables remains unchanged – in particular that of financial literacy – there are some differences.²⁰

This said, our key results are presented in [Tables 6–9](#). This is where we re-estimate Grohmann et al.'s OLS regressions with alternative financial literacy metrics. For ease of interpretation, column (1) of each table always contains Grohmann et al.'s (corrected) results for the full sample – as they appear in our [Tables A9](#) and [A10](#). Columns (2) and (3) present 'Grohmann et al.-style' regressions for samples that overlap with the regressions where we use the OECD/INFE financial literacy metric (44 countries) or the Big Three (24 countries) – respectively, in columns (4) and (5)–(10).

As can be seen, the coefficient of financial literacy only rarely becomes insignificant when alternative metrics are used. However, importantly, the magnitude of the coefficient invariably drops substantially, and in parallel with this, in some cases, also the significance. This is summarized in [Table 10](#), which provides an overview and comparison of the coefficients of the Financial literacy variable in the regressions in [Tables 6–9](#).

Worryingly, when using the alternative financial literacy metrics, the coefficient drops by at least 19 per cent but typically by substantially more. For example, in the regressions for the proportion of the population that saved at a formal financial institution, the coefficient of financial literacy drops by no less than 69 per cent when using the OECD/INFE metric, and by between one-third and half when using the Big Three. Note that we have also replicated Grohmann et al.'s regressions where they introduce an interaction term between financial literacy and financial infrastructure, as well as their IV regressions. We discuss these in the next section.

6. Discussion

This paper uses the same methods as A&VH (2020) and Grohmann et al. (2018) to examine, respectively, specific antecedents and consequences of financial literacy. However, whereas the original studies employ the S&P metric for their financial literacy variable, we alternately use the Big Three and OECD/INFE metrics.

Our regression analyses – for overlapping samples of countries – show that the use of a different measure of financial literacy has a substantial impact on the results. For the A&VH study, many of the relationships between national culture and financial literacy become weakly significant or disappear altogether. Where Grohmann et al. is concerned, the magnitude of the coefficient on financial literacy in the OLS regressions decreases substantially, and the IV regressions even show no causal relationship anymore.

These findings raise at least two points of discussion. First, what do the findings imply for the literatures on, respectively, the link between national culture and financial literacy, and the impact of the latter on financial inclusion – and, by extension, the broader literature on the antecedents and consequences of financial literacy? Second, where might the differences between the metrics come from?

6.1. Implications for the extant literature

To start with the first point, let us stress that there is disagreement in the literature on the relationship between national culture and financial literacy. De Beckker et al. (2020), who use OECD/INFE data, find that uncertainty avoidance positively influences financial literacy, whereas A&VH, as well as Klapper and Lusardi (2020), find (some) evidence for a negative impact. Also, De Beckker et al. find that financial literacy is lower in countries where individualism is high, while A&VH the opposite. The disagreement with De Beckker et al. persists in the present paper, even when using OECD/INFE data as they did.²¹

Table 6. Grohmann et al. – Financial literacy and account ownership – OLS results – Alternative financial literacy metrics.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	S&P-143	S&P-92	S&P-50	OECD/NIFE	S&P-26	AL+FW+AE	AL+AE+FW	FW+AL+AE	FW+AE+AL	AE+FW+AL	AE+AL+FW
Financial literacy	0.51*** (0.00)	0.58*** (0.00)	0.57*** (0.00)	0.32** (0.04)	0.63*** (0.00)	0.50*** (0.00)	0.51*** (0.00)	0.41*** (0.00)	0.41*** (0.00)	0.44*** (0.00)	0.51*** (0.00)
Log GDP p.c. (PPP)	13.22*** (0.00)	9.43** (0.02)	19.42*** (0.00)	24.11*** (0.00)	6.47 (0.44)	12.25 (0.54)	13.08 (0.16)	12.73 (0.21)	12.62 (0.21)	13.81 (0.16)	13.64 (0.14)
Population share btw 15 and 64	-0.24 (0.49)	0.17 (0.67)	-0.43 (0.51)	-0.72 (0.32)	-0.27 (0.70)	-0.54 (0.44)	-0.52 (0.45)	-0.68 (0.38)	-0.69 (0.37)	-0.62 (0.41)	-0.46 (0.49)
Secondary education	0.02 (0.86)	0.08 (0.66)	-0.42** (0.02)	-0.18 (0.34)	-0.24 (0.24)	-0.12 (0.65)	-0.11 (0.66)	-0.12 (0.67)	-0.12 (0.65)	-0.13 (0.63)	-0.13 (0.60)
Tertiary education	-0.15 (0.27)	-0.14 (0.45)	-0.54** (0.02)	-0.41* (0.07)	-0.29* (0.05)	0.00 (0.99)	0.01 (0.94)	-0.02 (0.91)	-0.02 (0.91)	0.00 (0.99)	0.01 (0.95)
Private credit to GDP	0.13*** (0.00)	0.11** (0.02)	0.14*** (0.00)	0.18*** (0.00)	0.08* (0.06)	0.06 (0.18)	0.06 (0.19)	0.06 (0.21)	0.06 (0.21)	0.06 (0.24)	0.06 (0.19)
Bank branches per 1000 sq. km	0.06*** (0.00)	0.05*** (0.01)	0.11 (0.13)	0.14* (0.08)	0.10* (0.06)	0.03 (0.61)	0.02 (0.74)	0.02 (0.72)	0.02 (0.73)	0.01 (0.82)	0.02 (0.70)
Strength of legal rights index	0.31 (0.57)	-0.16 (0.83)	-0.21 (0.77)	1.05 (0.18)	-0.55 (0.41)	-0.18 (0.80)	-0.01 (0.99)	-0.07 (0.93)	-0.07 (0.92)	-0.09 (0.91)	-0.06 (0.94)
Ease of doing business	-0.10** (0.04)	-0.13* (0.06)	-0.22** (0.02)	-0.11 (0.32)	-0.16 (0.12)	-0.14 (0.24)	-0.12 (0.27)	-0.12 (0.28)	-0.13 (0.27)	-0.12 (0.29)	-0.12 (0.26)
Constant	-71.89*** (0.01)	-60.13 (0.12)	-80.95 (0.21)	-133.68 (0.13)	25.54 (0.77)	-12.75 (0.91)	-24.84 (0.81)	-6.78 (0.95)	-4.90 (0.97)	-21.40 (0.85)	-32.96 (0.75)
Observations	119	81	43	43	24	24	24	24	24	24	24
R ²	0.79	0.73	0.84	0.82	0.80	0.80	0.79	0.77	0.77	0.76	0.79

Notes: ***, ** and * denote significance at the 1%, 5%, and 10% levels, respectively; p-values are in parentheses.

Description: Replication of Grohmann et al.'s OLS regressions with the proportion of the population that have a bank account as the outcome variable. Column labels indicate which financial literacy indicator was used as the main independent variable and, when needed, sample size.

Interpretation: The coefficient of financial literacy remains significant when alternative metrics are used. However, for overlapping samples, the magnitude of the coefficient decreases substantially.

Table 7. Grohmann et al. – Financial literacy and debit card ownership – OLS results – Alternative financial literacy metrics.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	S&P-143	S&P-92	S&P-50	OECD/INFE	S&P-26	AL+FW+AE	AL+AE+FW	FW+AL+AE	FW+AE+AL	AE+FW+AL	AE+AL+FW
Financial literacy	0.52*** (0.00)	0.57*** (0.01)	0.87*** (0.00)	0.61*** (0.00)	0.91*** (0.00)	0.36** (0.03)	0.37** (0.03)	0.32** (0.05)	0.33** (0.04)	0.23 (0.22)	0.30* (0.08)
Log GDP p.c. (PPP)	13.94*** (0.00)	14.39*** (0.00)	14.48*** (0.01)	20.10*** (0.00)	15.00 (0.33)	33.88** (0.03)	34.47** (0.03)	33.18** (0.04)	33.05** (0.05)	37.45** (0.02)	36.51** (0.02)
Population share btw 15 and 64	-0.48 (0.12)	-0.07 (0.86)	-1.14* (0.09)	-1.59* (0.06)	-1.54* (0.06)	-2.24** (0.03)	-2.22** (0.03)	-2.32** (0.03)	-2.32** (0.03)	-2.36** (0.03)	-2.24** (0.03)
Secondary education	0.03 (0.78)	0.14 (0.34)	-0.38 (0.10)	0.01 (0.98)	-0.32 (0.11)	-0.22 (0.49)	-0.22 (0.50)	-0.21 (0.52)	-0.22 (0.51)	-0.24 (0.47)	-0.24 (0.45)
Tertiary education	0.03 (0.84)	-0.05 (0.77)	-0.44 (0.14)	-0.24 (0.35)	-0.45* (0.07)	-0.18 (0.61)	-0.17 (0.64)	-0.18 (0.60)	-0.18 (0.60)	-0.21 (0.57)	-0.20 (0.59)
Private credit to GDP	0.09** (0.04)	0.11*** (0.01)	0.08 (0.21)	0.14** (0.04)	0.05 (0.39)	0.03 (0.66)	0.03 (0.65)	0.03 (0.66)	0.03 (0.66)	0.03 (0.66)	0.03 (0.65)
Bank branches per 1000sq. km	0.03** (0.04)	0.02 (0.36)	0.06 (0.60)	0.10 (0.35)	0.05 (0.49)	-0.05 (0.57)	-0.06 (0.52)	-0.06 (0.56)	-0.06 (0.55)	-0.06 (0.53)	-0.06 (0.54)
Strength of legal rights index	-0.00 (1.00)	-0.15 (0.81)	-0.94 (0.40)	0.93 (0.39)	-0.82 (0.24)	0.07 (0.94)	0.20 (0.84)	0.13 (0.90)	0.12 (0.90)	0.22 (0.82)	0.21 (0.83)
Ease of doing business	-0.10* (0.05)	-0.08 (0.26)	-0.24* (0.06)	-0.07 (0.56)	-0.13 (0.42)	0.01 (0.95)	0.02 (0.89)	0.01 (0.96)	0.01 (0.97)	0.05 (0.78)	0.04 (0.82)
Constant	-77.53*** (0.00)	-116.30*** (0.00)	-4.26 (0.96)	-75.02 (0.44)	9.62 (0.94)	-123.14 (0.40)	-131.77 (0.36)	-110.42 (0.48)	-108.58 (0.49)	-147.89 (0.31)	-148.37 (0.30)
Observations	119	81	43	43	24	24	24	24	24	24	24
R ²	0.80	0.78	0.80	0.79	0.87	0.74	0.74	0.74	0.74	0.72	0.73

Notes: ***, **, * and * denote significance at the 1%, 5%, and 10% levels, respectively; p-values are in parentheses.

Description: Replication of Grohmann et al.'s OLS regressions with the proportion of the population that have a debit card as the outcome variable. Column labels indicate which financial literacy indicator was used as the main independent variable and, when needed, sample size.

Interpretation: The coefficient of financial literacy remains significant when alternative metrics are used. However, for overlapping samples, the magnitude of the coefficient decreases substantially, and in parallel, in several cases, also the significance.

Table 8. Grohmann et al. – Financial literacy and proportion of the population that saved at a formal financial institution – OLS results.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	S&P-143	S&P-92	S&P-50	OECD/INFE	S&P-26	AL+FW+AE	AL+AE+FW	FW+AL+AE	FW+AE+AL	AE+FW+AL	AE+AL+FW
Financial literacy	0.53*** (0.00)	0.56*** (0.00)	0.72*** (0.00)	0.22* (0.08)	0.98*** (0.00)	0.64*** (0.00)	0.68*** (0.00)	0.54*** (0.00)	0.55*** (0.00)	0.57*** (0.01)	0.65*** (0.00)
Log GDP p.c. (PPP)	6.24*** (0.00)	6.63*** (0.02)	2.48 (0.50)	10.60** (0.03)	-6.30 (0.65)	6.87 (0.69)	7.10 (0.66)	6.64 (0.69)	6.53 (0.70)	8.62 (0.61)	8.58 (0.61)
Population share btw 15 and 64	-0.62*** (0.01)	-0.52* (0.06)	-0.06 (0.91)	-0.40 (0.55)	-1.04 (0.36)	-1.58 (0.23)	-1.53 (0.24)	-1.75 (0.20)	-1.75 (0.20)	-1.68 (0.22)	-1.48 (0.25)
Secondary education	-0.05 (0.43)	-0.09 (0.39)	-0.14 (0.48)	0.15 (0.46)	-0.27 (0.35)	-0.11 (0.76)	-0.10 (0.79)	-0.11 (0.79)	-0.11 (0.77)	-0.12 (0.75)	-0.13 (0.72)
Tertiary education	0.03 (0.81)	-0.01 (0.95)	-0.06 (0.71)	0.10 (0.64)	-0.03 (0.87)	0.36 (0.20)	0.39 (0.18)	0.33 (0.24)	0.34 (0.24)	0.36 (0.21)	0.37 (0.20)
Private credit to GDP	0.11** (0.01)	0.14*** (0.00)	0.23*** (0.00)	0.28*** (0.00)	0.17** (0.01)	0.14* (0.06)	0.14* (0.06)	0.15* (0.07)	0.14* (0.07)	0.14* (0.08)	0.14* (0.06)
Bank branches per 1000sq. km	0.03* (0.08)	0.03 (0.11)	0.11 (0.10)	0.14* (0.07)	0.06 (0.43)	-0.06 (0.50)	-0.07 (0.41)	-0.06 (0.49)	-0.07 (0.47)	-0.08 (0.38)	-0.07 (0.43)
Strength of legal rights index	0.15 (0.72)	0.69 (0.18)	-0.08 (0.95)	1.58 (0.19)	-0.15 (0.88)	0.56 (0.72)	0.76 (0.61)	0.69 (0.64)	0.68 (0.65)	0.68 (0.65)	0.72 (0.63)
Ease of doing business	-0.03 (0.45)	-0.00 (0.93)	-0.04 (0.68)	0.08 (0.55)	-0.16 (0.40)	-0.08 (0.80)	-0.07 (0.82)	-0.07 (0.81)	-0.08 (0.81)	-0.06 (0.84)	-0.06 (0.84)
Constant	-18.96 (0.32)	-32.89 (0.25)	-28.64 (0.70)	-108.94 (0.27)	133.00 (0.33)	42.80 (0.83)	33.14 (0.86)	57.16 (0.78)	59.32 (0.77)	33.45 (0.87)	17.44 (0.93)
Observations	119	81	43	43	24	24	24	24	24	24	24
R ²	0.72	0.71	0.77	0.68	0.75	0.68	0.69	0.67	0.67	0.65	0.68

Notes: ***, **, * and * denote significance at the 1%, 5%, and 10% levels, respectively; p-values are in parentheses.

Description: Replication of Grohmann et al.'s OLS regressions with the proportion of the population that saved at a formal financial institution in the previous year as the outcome variable. Column labels indicate which financial literacy indicator was used as the main independent variable and, when needed, sample size.

Interpretation: The coefficient of financial literacy remains significant when alternative metrics are used. However, for overlapping samples, the magnitude of the coefficient drops substantially, and, in parallel, in one case also the significance.

Table 9. Grohmann et al. – Financial literacy and proportion of population that used debit card in the last year – OLS results.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	S&P-143	S&P-92	S&P-50	OECD/INFE	S&P-26	AL+FW+AE	AL+AE+FW	FW+AL+AE	FW+AE+AL	AE+FW+AL	AE+AL+FW
Financial literacy	0.69*** (0.00)	0.76*** (0.00)	1.17*** (0.00)	0.68*** (0.01)	1.23*** (0.00)	0.56* (0.05)	0.54* (0.08)	0.53** (0.05)	0.54** (0.04)	0.42 (0.16)	0.46 (0.13)
Log GDP p.c. (PPP)	12.21*** (0.00)	14.69*** (0.00)	7.13 (0.15)	16.34** (0.01)	11.10 (0.45)	34.59** (0.03)	36.16** (0.02)	32.39** (0.04)	32.09** (0.05)	38.25** (0.03)	38.78** (0.02)
Population share btw 15 and 64	-0.72** (0.02)	-0.38 (0.33)	-2.12*** (0.00)	-2.71*** (0.01)	-1.62 (0.13)	-2.51** (0.04)	-2.50** (0.04)	-2.61** (0.03)	-2.61** (0.03)	-2.65** (0.03)	-2.52** (0.04)
Secondary education	-0.03 (0.74)	0.05 (0.71)	-0.38 (0.14)	0.12 (0.62)	-0.33 (0.41)	-0.18 (0.74)	-0.18 (0.74)	-0.16 (0.76)	-0.17 (0.75)	-0.20 (0.71)	-0.21 (0.70)
Tertiary education	0.24* (0.09)	0.10 (0.58)	-0.22 (0.45)	0.04 (0.89)	-0.27 (0.22)	0.13 (0.72)	0.14 (0.72)	0.14 (0.71)	0.14 (0.71)	0.10 (0.80)	0.10 (0.80)
Private credit to GDP	0.05 (0.26)	0.04 (0.45)	0.03 (0.71)	0.10 (0.18)	-0.04 (0.70)	-0.06 (0.62)	-0.06 (0.64)	-0.06 (0.63)	-0.06 (0.62)	-0.06 (0.63)	-0.06 (0.65)
Bank branches per 1000sq. km	0.03 (0.10)	0.02 (0.29)	0.09 (0.44)	0.14 (0.19)	-0.01 (0.91)	-0.16 (0.21)	-0.17 (0.20)	-0.16 (0.22)	-0.16 (0.21)	-0.17 (0.20)	-0.16 (0.21)
Strength of legal rights index	0.33 (0.51)	0.47 (0.48)	-0.97 (0.46)	1.58 (0.19)	-1.19 (0.23)	-0.05 (0.97)	0.16 (0.91)	0.00 (1.00)	-0.01 (0.99)	0.12 (0.93)	0.17 (0.90)
Ease of doing business	-0.07 (0.21)	-0.05 (0.51)	-0.29** (0.03)	-0.07 (0.58)	-0.19 (0.39)	-0.02 (0.92)	0.01 (0.97)	-0.03 (0.87)	-0.04 (0.85)	0.02 (0.92)	0.02 (0.89)
Constant	-65.96** (1.19)	-117.58*** (0.01)	110.08 (0.20)	4.74 (0.97)	38.56 (0.79)	-125.90 (0.39)	-143.8 (0.34)	-97.36 (0.53)	-93.65 (0.55)	-150.2 (0.36)	-165.8 (0.29)
Observations	81	81	43	43	24	24	24	24	24	24	24
Adjusted R ²	0.76	0.75	0.81	0.76	0.80	0.66	0.65	0.66	0.67	0.63	0.63

Notes: ***, ** and * denote significance at the 1%, 5%, and 10% levels, respectively; p-values are in parentheses.

Description: Replication of Grohmann et al.'s OLS regressions with the proportion of the population that used a debit card in the previous year as the outcome variable. Column labels indicate which financial literacy indicator was used as the main independent variable and, when needed, sample size.

Interpretation: The coefficient of financial literacy remains significant when alternative metrics are used. However, for overlapping samples, the magnitude of the coefficient decreases drops substantially, and, in parallel, in columns (6)-(11) also the significance.

Table 10. Grohmann et al. – Overview of results, OLS.

Sample Outcome variable	S&P-50	S&P-26	OECD/INFE	Big Three	Difference (in %)
Account ownership	0.57***		0.32**	0.41***_0.51***	–44 –35, –19
Debit card ownership	0.87***	0.63***	0.61**	0.23-0.37**	–30 –75, –59
Saved on account	0.72***	0.91***	0.22*	0.54***_0.68***	–69 –45, –31
Used debit card	1.17***	0.98***	0.68**	0.42-0.56*	–42 –66, –54
		1.23***			

Note. *p < 0.1, **p < 0.05, ***p < 0.01.

Description: Summarises the results of our replication of Grohmann et al.'s OLS regressions presented in Tables 6–9. The entries in columns two to four are the coefficients of the Financial literacy variable in the corresponding regressions (see first column). The labels of columns two to four indicate which financial literacy metric was used as the main independent variable, and, when needed, sample size. The entries in the final column are the percentage differences between the S&P results and the OECD/INFE or Big Three results.

Interpretation: The main observation is that even though the coefficient of financial literacy rarely becomes insignificant when using the alternative metrics, the magnitude of the coefficient invariably drops substantially – irrespective of the form of financial inclusion.

This obviously raises the question of where these discrepancies come from, and whether it can be maintained that national culture is an antecedent of financial literacy. Part of the explanation may lie in the fact that De Beckker et al. have individual-level observations, whereas A&VH and the present paper use aggregate data. Moreover, De Beckker et al. do not use the OECD/INFE data *as is*. Rather, they compute the financial literacy score of an individual as a weighted sum of the correct answers (with factor loading weights derived from a principal component analysis). With 12 countries, De Beckker et al. also have substantially fewer countries (and the present paper has demonstrated that the size and composition of the sample can matter). Another difference is that, in their baseline models, De Beckker et al. have the PISA math score as a country-level control variable, rather than GDP per capita or any of the other variables used by A&VH and the present paper. When they do include GDP per capita, in a robustness check, the significance of individualism disappears. The effect of uncertainty avoidance is robust, but is mostly significant only at the 10 per cent level, even in the baseline models.

Clearly, the precise impact of culture on financial literacy needs further research, but, all in all, even the present paper – and especially the results for power distance – indicates that deeply rooted cultural differences may help explain differences in financial literacy. This indicates that a cross-country study such as Nicolini et al. (2013) might benefit from including aspects of national culture into their regressions, rather than straightforward country dummies.

To turn to the Grohmann et al. article, our findings clearly do not bode well for, in particular, studies that are (very) similar in nature, such as Mahmood-ur-Rahman (2022) and Lo Prete (2022).²² Chances are that, in these papers too, the use of an alternative metric would affect the findings.

Interestingly, Grohmann et al. themselves compare the impact of financial literacy with that of another factor, namely financial infrastructure. Specifically, they measure financial depth through the ratio of private credit to GDP. For debit card ownership, they find that ‘comparatively, the effect associated with financial literacy is relatively high’ (Grohmann et al., 2018, p. 89). However, results such as these also change when we use alternative financial literacy metrics. Still regarding debit card ownership, Table 7 shows that not only does the coefficient on financial literacy decrease, but, at the same time, that on Private credit to GDP *increases* – at least when using the OECD/INFE indicator.

Grohmann et al. also explicitly analyse whether literacy and infrastructure act as substitutes or complements by including an interaction term in their regressions. They find, for example, that ‘the average marginal effect of financial literacy on the proportion of the population that has a bank account is higher for countries that have lower private credit to GDP ratios’ (o.c., p. 90). However, in our regressions, the interaction term proved mostly insignificant (see Tables A11–A14 in the Appendix). This casts doubts on Grohmann et al.’s policy suggestions, such as the following: ‘at early stages of financial development literacy may be seen to some extent as alternative to increasing financial depth (representing infrastructure); at later stages of financial development, however, financial literacy seems to be a necessary ingredient in order to make full use of available infrastructure’ (o.c., p. 90). In addition, even more worrisome, when we replicate Grohmann et al.’s IV regressions, we find no significant results anymore; see Tables A15–A18.

Overall, in line with Gignac and Ooi (2022) and other critical voices mentioned in Section 3, our paper sends a strong signal that the literature would benefit from looking carefully into the reliability of simple financial literacy metrics. It would also be judicious to revisit key papers – and, for future studies, to use more than one metric.

The signal is loudest for cross-country studies, as this is the (only) type of studies that we have examined – for reasons mentioned at the start of Section 5. However, chances are that the different financial literacy metrics yield not only diverging country-level scores, but also dissimilar individual scores. A first indication in this direction comes from the experiment conducted by Ahunov and Van Hove,²³ who measure the financial literacy of their respondents using both the S&P and Big Three tests. Ahunov and Van Hove find that as many as 82 per cent are considered literate by the S&P test, compared to a mere 55 per cent by the Big Three. Hence, single-country studies too might yield different conclusions when using a different financial literacy metric.

Fortunately, whereas cross-country studies typically rely on one of the simple/simplified metrics examined in the present study, single-country studies do this less often – because there is less need to, and because there is room for country-specific questions.²⁴ Still, there are quite a few single-country papers that do use one of the simple tests. The studies that participated in the FLat World project are a case in point; see Lusardi (2019, p. 3, Table 2) for an overview. Bucher-Koenen and Ziegelmeier (2014), for Germany, also use the Big Three *as is*.

In addition, there are studies – including in top journals – which use an indicator that expands upon, or is inspired by, the extant tests. Anderson and Robinson (2022), for example, take the Big Five as their starting point, but replace the fourth question, on mortgages, with a question on long-term savings ‘because residential mortgages operate differently in Sweden’ (o.c., p. 25). They leave the other questions unchanged – and, as mentioned in Section 2, the first three questions of the Big Five are identical to the Big Three. van Rooij et al. (2011) measure both basic and advanced financial literacy. Their metric for the former, which consists of five questions, shares two questions with the Big Three. Lamla and Vinogradov (2019), for their part, use a set of seven questions, four of which are copied from the OECD/INFE toolkit.

6.2. Where might the differences come from?

The second point of discussion was: where might the differences between the financial literacy metrics come from? Given that we have taken care to use overlapping samples, it is clear that the differences in results between the S&P, Big Three, and OECD/INFE regressions must be due to differences in the way financial literacy is estimated. To be clear, our replication efforts do not allow us to determine which measure is ‘best’, and we cannot say anything about the validity of this or that measure. Our main finding is the surprising lack of robustness in the conclusions of the replicated papers.

At first sight, a possible explanation might lie in the different ‘thresholds’ of the financial literacy metrics; that is, the minimum number of questions that an individual needs to answer correctly to be classified as financially literate.²⁵ However, upon closer scrutiny, there is no one-to-one correspondence between the required ‘scale saturation’ of the indicators and their estimates. If we focus on the 19 countries for which we have estimates for all three metrics, an interesting observation is that, with almost no exceptions, the Allianz, Aegon and FLat World estimates are lower than the S&P estimates (see Table A2). In turn, the S&P estimates are, in most cases (14 out of the 19, to be precise), lower than the OECD/INFE scores. This can also be observed in Figure A1.

This would seem to be in line with the respective thresholds. *Ceteris paribus*, the higher the threshold, the lower the probability that a person is classified as literate. The thresholds are: all three questions in the Big Three approach, three out of four topics for the S&P measure, and five out of seven questions for the OECD/INFE metric. At face value, the required scale saturation is thus 100, 75, and 71 per cent. However, both the S&P and the OECD/INFE measure have additional stipulations. If these are taken into account, the correct numbers are 100 per cent, 60-80 per cent,²⁶ and 71-86 per cent.²⁷ In other words, the thresholds do not explain everything. And, in any case, one should not forget the ‘*ceteris paribus*’ condition; the differences in estimates could also be due to differences in the nature and number of questions in the surveys.

Building on this, since the different metrics purport to discriminate between financially literate and illiterate individuals, one would assume that the chosen threshold accounts for the nature and difficulty of the questions. This would indeed seem to be the case to some extent. Regarding the S&P measure, Klapper et al. (2015, p. 7) state the following: ‘A person is defined as financially literate when he or she correctly answers at least three out of the four financial concepts [...]. We chose this definition because the concepts are basic, and this is what would correspond to a passing grade’. Also concerning the S&P measure, Klapper and Lusardi (2020, p. 592) explain: ‘Because interest compounding is such a hard concept, [...] respondents need to answer only one out of two questions correctly to get a score of one’.

Nevertheless, future research might want to examine whether the difficulty level of the questions was assessed correctly, and whether differences in the content areas that are covered might not play a role; see Table 1 in Ouachani et al. (2021, p. 271). As mentioned in Section 2, the OECD/INFE metric has an item on the relationship between risk and return that has no equivalent in the other two metrics. One of the referees also noted that our findings underscore the need for cross-cultural validation to ensure consistent interpretation across different populations. As Ouachani et al. (2021, p. 267) put it, financial literacy is not a ‘concept that can be evaluated by the same questions in all countries’; see also below.

Finally, the question can also be raised whether the literature should not move away from a dichotomous view of financial literacy and make more use of ‘raw scores’; that is, the number of correct answers (either absolute or, when using multiple metrics, as a percentage of the total number of questions).

7. Conclusion

On the level of the individual articles that we replicate, our conclusions are as follows. Regarding the A&VH article, for many dimensions of national culture, the results change (almost) completely when the S&P measure is replaced with the Big Three or the OECD/INFE metric. The Grohmann et al. paper would, at first sight, seem to hold its ground slightly better, in that in OLS regressions, the coefficient of financial literacy only rarely becomes insignificant when using the alternative metrics. However, crucially, the magnitude of the coefficient invariably drops substantially. In the IV regressions, even the significance disappears.

Overall, our replications show that Grohmann et al. (2018, p. 86) were correct when they pondered that ‘this [S&P] measure is imperfect ... Ideally, one would like to know more about people’s financial literacy, including questions which fit to the institutional circumstances in each country which is impossible in a worldwide survey. Thus, there will be quite some error in measuring the degree of financial literacy’.

And then our efforts do not even begin to address the criticism of, amongst others, Warmath and Zimmerman (2019) and Ouachani et al. (2021). These authors argue that the prevalent conceptualisation and operationalisation of financial literacy is myopic, equating financial literacy with financial knowledge, whereas it also involves self-efficacy and skills. As Warmath and Zimmerman (2019, p. 1605) put it pithily, ‘financial literacy involves more than being able to pass an economics or finance quiz’. The present paper shows that, to use a pun, these simple quizzes should definitely be quizzed further. Alternative scales, such as those of Folke et al. (2021) and Ranyard et al. (2020), are thus most welcome.²⁸

Notes

1. For reviews, see Fernandes et al. (2014), Hastings et al. (2013), Lusardi and Mitchell (2014), Stolper and Walter (2017), and Goyal and Kumar (2021).
2. Global Financial Literacy Excellence Center (GFLEC), “The Big Three and Big Five”, at url: <https://gflec.org/education/questions-that-indicate-financial-literacy/> (last accessed on 6.11.2024).
3. A salient illustration is a recent article by Vaahtoniemi et al. (2023) on Finland. The authors state that they “apply the ‘Big Three’ methodology developed by Lusardi and Mitchell” (o.c., p. 368). They also use this label throughout their article; see, for example, the title of their Table 1 (o.c., p. 372). However, in practice, while their question on inflation is effectively a variant of the corresponding question in the Big Three, the other two – on compound interest and risk diversification – come straight from the OECD/INFE toolkit (o.c., p. 371). Vaahtoniemi et al. do this “to follow the OECD ... survey as closely as possible” (ibid.). They also compare

their 'Big Three' results (that is, based on 3 questions) with the 2018 OECD/INFE results (7 questions) for Finland, and conclude that "the results w[ould] place Finland in the middle category among OECD countries" (o.c., p. 374).

4. Ranyard et al. (2020, p. 19) make the same point about the Big Five: "there is relatively little known about how well they perform as accurate assessments of the financial literacy construct".
5. Data are available upon request.
6. Note that this approach differs from the Allianz (2017) report. Allianz makes a distinction between "basic financial literacy" and "risk literacy", where the first relates only to the questions on compound interest and inflation. The third of the Big Three questions (on risk diversification) is part of risk literacy – together with other, new questions. For this paper, we have re-aggregated the survey answers so as to bring the Allianz results in line with common practice in the literature.
7. The minimum per-country sample size is 1,000 (OECD, 2017, p. 14).
8. Note that the OECD (2017, p. 17) considers the answer to the compound interest question correct only if the respondent also correctly answered the question on simple interest.
9. There are other international datasets. Section 2 of the [Appendix](#) explains why we do not use them.
10. In some of the FLat World surveys, the questions did have slightly different wording compared to the original Big Three.
11. This also explains why we do not use any of the results of the OECD data collection round of 2022/2023 (OECD, 2023).
12. Hofstede Insights, at url: <https://www.hofstede-insights.com/product/compare-countries/> (last accessed on 24.07.2024).
13. We refer to Table A1 in A&VH for definitions of these controls. Note that the data used by A&VH is cross-sectional in nature – as is ours – and therefore does not allow to make inferences about causality. However, A&VH (2020, p. 2263) build on the literature to argue that "culture is clearly more profound than financial literacy" and that it would be difficult to maintain that financial behaviour drives changes in cultural scores.
14. This said, for the other dimensions the results also differ depending on the financial literacy metric that is used – especially so for 'masculinity'. The results are available upon request.
15. The OECD/INFE data that we use were compiled from six different sources; see [Table A3](#).
16. As a rule, the survey with the highest number of observations is taken as the base category.
17. The WLS results are available upon request.
18. Note that the average level of power distance is lower in the S&P-26 sample and that the variation is higher.
19. Where the Big Three results are concerned, a technical point is that the results for the samples where the Aegon data are prioritised – rows (9) and (10) in [Table 5](#) – are the weakest. It is tempting to link this to the lower representativeness and online nature of the survey, as discussed in Section 3 of the [Appendix](#).
20. For example, the number of bank branches per 1,000 sq. km is now no longer significant in any of the regressions. In the other direction, the negative coefficient on the share of the adult population – which, as Grohmann et al. (2018, p. 90) point out, "seems difficult to interpret economically" – is now significant for three of the four outcome variables.
21. A minor qualification is in order: with OECD/INFE data we no longer find a significant positive (negative) impact of individualism (uncertainty avoidance) on financial literacy as A&VH (2020) do, but mostly insignificant results. However, overall, there is still a clear-cut difference, and for uncertainty avoidance there is no sign (pun intended) of a positive relationship in our [Table 5](#).
22. The first is, in fact, a simple extension of Grohmann et al.'s framework – with the same S&P data – to other forms of financial inclusion, such as the use of electronic payment instruments.
23. Ahunov, M., & Van Hove, L. (2024) Big Three illiterate, but Standard & Poor's literate? Experimental evidence on differences between financial literacy metrics. Mimeo.
24. Cross-country studies rely on a simple metric so as to have a set of questions that can be understood in all countries surveyed; cf. Lusardi and Mitchell (2023, p. 2) concerning the Big Three: "the list of questions had to be few in number, so as to secure widespread adoption (brevity)".
25. Note that there is quite some research, especially in a cross-country setting, that accepts these thresholds and thus does not work with raw scores. Besides A&VH (2020) and Grohmann et al. (2018), examples are Davoli and Rodríguez-Planas (2020, 2021), Klapper and Lusardi (2020), Meoli et al. (2022), Oh and Rosenkranz (2020), and Panos et al. (2020). To be fair, in robustness checks, Klapper and Lusardi (2020) do replicate their regressions with alternative definitions of being financially literate; e.g., knowing two out of four and all four concepts. This is not something we can do, as these data are not publicly available.
26. In the S&P approach, the compound interest topic consists of two questions, and a respondent is considered as having understood this concept as soon as they correctly answer one of the two (Klapper & Lusardi, 2020, p. 592). In other words, three out of five correct answers (60 per cent) can be enough to be classified as financially literate, but if a respondent answers the two interest questions correctly, they need another two correct answers, or four in total (80 per cent).
27. Here one has to take into account that the OECD considers the answer to the compound interest question correct only if the respondent also correctly answers the question on simple interest.

28. Interestingly, for their brief scale, Ranyard et al. replace two items of the Big Five but leave untouched the Big Three that are at the core of the Big Five. Conversely, of Folke et al.'s final ASSET items only one (understanding of inflation) overlaps with the S&P, even though all of the S&P items were included in the pilot version of the scale.

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CRedit authorship contribution statement

Leo Van Hove: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. Muzaffarjon Ahunov: Data curation, Visualization, Formal analysis, Conceptualization.

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Data availability statement

Data are available from the corresponding author upon request.

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