

Financial literacy: different indicator, different insights?

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Abstract

This paper questions the reliability of the three most commonly used indicators of financial literacy for the purpose of cross-country analysis. We replicate two earlier studies – one on the antecedents of financial literacy and one on its consequences – and replace the Standard & Poor's indicator used in the original studies by, alternately, the Big Three and OECD/INFE metrics. Despite the similarities between the metrics, we find that several conclusions change depending on how financial literacy is measured. This is a strong signal that the literature would benefit from revisiting several key papers. – Words: 92

JEL codes: A12; G41; G53; Z10

Keywords: financial literacy, financial knowledge, Standard & Poor's, Big Three, OECD/INFE, national culture, financial inclusion, cross-country analysis

Conflict/Declaration of Interest Statement: The authors have no relevant financial or non-financial interests to disclose. The authors did not receive support from any organization for the submitted work.

Acknowledgements

We would specifically like to thank Antonia Grohmann for providing us with the data files used in Grohmann et al. (2018). We also thank Allianz, and in particular Lorenz Weimann, for allowing us to use the data described in Allianz (2017), and Petra Brandes, Michela Coppola, Andrea Hasler, and Annamaria Lusardi for helping us get hold of them. Thanks also go to Mike Mansfield of the Aegon Center for Longevity and Retirement and Marte Bryngård Gran of Intrum for the additional information on, respectively, the Aegon and Intrum surveys, as well as to Diana Mejía for help with the LAC estimates, and Kenneth De Becker for comments on an earlier version.

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1. Introduction

After the crisis of 2008, 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 the utmost importance that the empirical findings of 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. There are hardly any papers that verify whether using a different metric might not alter the conclusions. The present paper does just that: we replicate two previous studies and replace the financial literacy indicator by alternative metrics.

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).

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.

The reasons for selecting these two articles are as follows. First of all, the exercise which we had in mind cannot be done with studies that use individual-level data. Indeed, it is not feasible to ask the respondents of a given original study to, after the facts, take an alternative financial literacy test. In other words, we had no choice but 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.). A final feature that makes the two papers particularly suitable for our 'robustness tests' is that they have, at least where their topic is concerned, the biggest datasets in the literature – consisting of, respectively, 92 and 143 countries. This should, *ceteris paribus*, minimise the loss of observations when constructing overlapping samples, as we will do.

For their country-level measure of financial literacy (in fact: financial knowledge), both papers rely on the 2014 Standard & Poor's Global Financial Literacy Survey, hereafter S&P survey (Klapper et al. 2015). To have direct points of comparison, the present paper each time uses the same S&P survey but, in addition, exploits another four data sources. Three of these – the Allianz, Aegon, and FLat World surveys (which we will merge) – all employ the most heavily used metric, namely the so-called Big Three. 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 also employs these three concepts but has two questions on compound interest instead of one, and also

tests numeracy. A fifth dataset that we 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 reasons of comparability, we only use the (seven) questions on financial knowledge (OECD 2016, p. 20). Three of these – on compound interest, inflation, and risk diversification – are comparable (but not identical) to the Big Three.

Our analysis shows, first, that the cross-country correlations between the S&P, Big Three and OECD/INFE financial literacy estimates are far from perfect. 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 differ too. Given this, it is not so surprising that our regression analyses show that using a different indicator of financial literacy can indeed impact the results.

Where the A&VH article is concerned, our results for individualism and uncertainty avoidance are markedly different: with the S&P measure we find very significant results (as in A&VH), but with the Big Three and OECD/INFE measures they are mostly insignificant and at best weakly significant. For power distance, the picture is mixed: with the Big Three metric the results are largely similar to the original, but with the OECD/INFE data they disappear almost completely. At first sight, the Grohmann et al. paper would 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. But, importantly, the magnitude of the coefficient invariably drops substantially. In one particular case, 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. Unlike Grohman et al., we also find no significant evidence on the interaction

between financial literacy and financial development. Even more problematic, in Instrumental Variable regressions, which test whether the relationship between financial literacy and financial inclusion is causal, we find no statistically significant results anymore once we use the alternative literacy metrics.

Our paper makes two contributions. For one, two of the five data sources that we exploit – the Allianz and Aegon surveys – have never been used before in academic research, and the FLat World and OECD/INFE data have not yet been compiled in the way that we do. Second, and most importantly, ours is the first joint, large-scale test of the three financial literacy indicators that have become informal standards in the literature. Our finding that several conclusions change depending on how financial literacy is measured is a strong signal that the literature would benefit from looking carefully into the reliability and validity of these metrics, and that it would be judicious to revisit a number of key papers – especially in view of the policy importance of the issues involved.

The remainder of the present paper is organised as follows. Section 2 first discusses the prior literature that is of direct relevance. In Section 3 we introduce in detail all the datasets, Section 4 presents our regression results, and Section 5 concludes.

2. Prior literature

As mentioned in the Introduction, there are only a handful of papers that examine the reliability and validity of the commonly used S&P, Big Three, and OECD/INFE measures of financial literacy². This section first discusses the four papers that we are aware of. Afterwards, we turn to other literature that is relevant for our tests and discuss four recent papers that, just like the papers that we replicate, either examine the link between national culture and financial literacy or

² Ranyard et al. (2020, p. 19) make the same point about the so-called Big Five (see below): “there is relatively little known about how well they perform as accurate assessments of the financial literacy construct”.

analyse the impact of (a lack of) financial literacy – always in a cross-country setting. These papers will function as points of comparison in the discussion part of our paper.

2.1. Financial literacy metrics

A first evaluation of financial literacy metrics is by Nicolini and Haupt (2019), who report on five national surveys (in Germany, France, Italy, Sweden, and the UK). The surveys were conducted between 2014 and 2017, and all used the same questionnaire – with no less than 50 items on financial literacy. Interestingly, the list comprised 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 mortgages³. With these data, Nicolini and Haupt compare the explanatory power of different financial literacy measures – respondents’ overall score on 50, their score on the Big Five, etc. – in regressions for five different financial behaviours, such as planning for retirement and the use of payment cards. Nicolini and Haupt’s paper is thus of a similar inspiration as ours, but we use country-level data and examine other financial literacy metrics.

Nicolini and Haupt find that in their 120 regressions – four financial literacy measures x five financial behaviours x (five countries + a pooled sample) – financial literacy proved insignificant only 17 times. However, the coefficients of the (normalised) measures do vary substantially and, crucially, the Big Five outperforms the other measures only six times⁴ – and accounts for six of the 17 cases where financial literacy is insignificant. Nicolini and Haupt (2019, p. 10) conclude that “[i]f it is not a criticism to the well adopted measure, this result can be read as the need (in

³ 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 17.04.2023).

⁴ Nicolini and Haupt (2019, p. 12) do acknowledge that the reason behind the better performance of the other measures “could be the larger number of items used”. Concerning the 50-items index, they note that “[t]he fact that that measure includes all the items used to assess other measures (...) gives [it] an advantage in terms of amount of information used” (Nicolini and Haupt, 2019, p. 13).

some cases) not to limit the analysis of the significance of financial literacy in explaining one or more financial behaviors to the ‘big-5’”.

Turning to the first of three 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 out of the 30 countries that participated in the 2015 wave, confirms the applicability of the instrument for country-specific analysis (with the qualification that the test proved not sensitive enough to distinguish between high and low performers in all countries). However, de Clercq finds that the assumption that item difficulties are homogeneous across the various countries does not hold. She concludes that the OECD/INFE financial knowledge measure does not seem to qualify as an International Large-Scale Assessment. In other words, comparability across countries is not guaranteed and the “traditional league tables” (de Clercq 2019, p. 7) – of the sort that we will use – should be treated with caution.

Ooi (2020), for her part, re-examines the widely documented gender gap in financial literacy with survey data on 184,869 individuals from 39 countries and territories. Because the Item Response Theory method that Ooi uses “does not require the same set of questions to be asked across sample countries”, data are compiled from eight international surveys as well as national household surveys (Ooi 2020, p. 936). However, in 26 of the 39 countries the surveys made use of the OECD/INFE Toolkit. Hence, Ooi’s analysis is, in practice, mainly a test of this indicator. Ooi shows that when a conventional measurement approach is used, there is a gap in financial knowledge between males and females in 81 per cent of her sample. In contrast, when Item Response Theory is employed – which can account for guessing behaviour and differential item functioning – a gender gap exists in only 54 per cent of the sample. Ooi (2020, p. 931) concludes that “prior measurements may underestimate women’s financial knowledge”.

In the most recent paper of the three, Gignac and Ooi (2022) estimate 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 make use of the Big Three and the Big Five questions have internal consistency reliabilities between 0.30 and 0.47 and between 0.35 and 0.61, respectively – “values less than minimally acceptable for even exploratory research” (o.c., p. 938). In addition, 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 for early-stage research. By contrast, for all tests/samples with 11 or more items the reliability was greater than or equal to 0.70.

Gignac and Ooi (2022, 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”. Gignac and Ooi advise the use of tests with minimum 13-15 questions. They also argue that as low test-score reliability limits the magnitude of validity coefficients (such as beta-weights or correlations), many previous investigations showing financial literacy as a predictor of important outcome variables must have substantially underestimated its impact. Gignac and Ooi (2022, p. 950) underpin this for a number of single-country studies, as well as for a meta-analysis. 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 all four 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 the main purpose of which 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 questions.

Finally, Clark et al. (2021) examine older Americans’ financial fragility 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 which measure they use, Clark et al. find that being more financially literate lessens the probability of being financially fragile. For our purposes the most important observation is that the correlation between the number of correct answers to the Big Three questions and the other nine is (only) 0.6.

2.2. Other relevant literature

As announced, there are four recent articles that constitute interesting points of comparison for our efforts. Just like A&VH, the first two examine the effect of (certain of) Hofstede’s cultural dimensions on financial literacy in a cross-country setting. For one, Klapper and Lusardi (2020,

p. 602), in an article that also explores other issues, focus on ‘uncertainty avoidance’ (UA) and ‘long term orientation’ (LTO). In line with A&VH, but for a smaller sample (of 66 countries), they find that, after controlling for GDP per capita, UA shows a significant negative relation with the S&P index; LTO is not significant.

Second, there is De Beckker et al. (2020). Their set-up differs in two important respects from that of A&VH and Klapper and Lusardi: their financial literacy data originates not from the S&P but from the 2015 OECD/INFE survey and they have individual-level observations (for 12 countries). Interestingly, their results clash with those mentioned earlier: De Beckker et al. find that UA positively influences financial literacy, whereas A&VH and Klapper and Lusardi 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 find that the opposite is true. Although not part of the original inspiration for the present paper, these discrepancies in results – which we explore further below – obviously add to its relevance ⁵.

The two other papers that are worth mentioning here are related to the Grohmann et al. (2018) article. Mahmood-ur-Rahman (2022), in a simple extension of the framework of Grohmann et al. (and with the same S&P data), finds that financial literacy also positively affects other forms of financial inclusion, such as the use of electronic payment instruments and the use of mobile phones to pay bills or send remittances. Conversely, he finds no significant effect on the consumption of insurance products. Similarly, Lo Prete (2022), again with S&P data (but for

⁵ For completeness, let us also mention Davoli and Rodríguez-Planas (2020) – even though it is not (really) a cross-country study. Davoli and Rodríguez-Planas find that the financial literacy (as measured by the Big Three) of a representative sample of individuals who live in the US is positively associated with the financial literacy level (as measured by the S&P) in the country/region of ancestry the respondents identify with most. To explore which cultural factors drive this finding, Davoli and Rodríguez-Planas also run regressions where the S&P index is replaced by Hofstede cultural dimensions. For LTO, they find a significant positive effect. The coefficients of UA and indulgence are not significant.

only 25 countries), finds that, when considered separately, both digital and financial literacy are associated with higher use of digital payments. However, in regressions that control for both, only digital literacy is significant.

3. 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 obviously use the exact same method as in the original studies; see Section 4 for details. However, where the financial literacy indicator is concerned, we not only use S&P data as in A&VH and Grohmann et al. (in order to be able to work with overlapping samples), but we also exploit other datasets. In what follows, we first introduce the datasets in general terms and discuss their specifics (subsection 3.1). In subsection 3.2 we then explain how we have constructed our samples.

3.1. The datasets

Table 1 gives an overview of the five datasets that we use. A first remark is that three of these rely on Lusardi and Mitchell's Big Three questions to measure respondents' financial knowledge. The differences between the S&P measure used by A&VH and Grohmann et al. on the one hand and the Big Three on the other can be ascertained in the first two columns of Table A1 in the Appendix. Let us mention that in addition to compound interest, inflation, and risk diversification (the three concepts covered by the Big Three), the S&P survey also tests respondents' basic numeracy. There are also two questions on compound interest rather than one, and the wording of the overlapping questions differs.

<Table 1 about here>

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 the ‘Big Five’ developed by Lusardi and Mitchell; see above.

The fifth dataset that we will use is compiled from OECD publications (see below) and makes use of the seven financial knowledge questions in the OECD/INFE Toolkit (OECD 2016, p. 20). As can be seen in the third column of Table A1, there are items on risk diversification, inflation, and compound interest that are comparable or very comparable to both the Big Three and the S&P measure. 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.

Let us now discuss the specifics of our datasets – other than the S&P survey – one by one. Dataset #2 has been collected by financial services company Allianz (2017). In November 2016, Allianz surveyed a representative sample of 1,000 people in each of 10 western European countries. Column (6) of Table A2 reports the percentage of respondents that correctly answered all three of the Big Three questions ⁶.

⁶ Note that this approach differs from that of 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.

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 and Retirement 2018). Columns (3)-(5) of Table A2 again report the percentage of respondents that correctly answered all three questions. 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 have been 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 South East Europe (2020a), as well as in a third global wave involving 26 countries (OECD 2020b), many of which had already participated in one of the earlier waves. 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 (OECD 2016, p. 8) and as the proportion of adults who achieved a minimum target score of at least 5 out of 7

⁷ The minimum per-country sample size is 1,000 (OECD, 2017, p. 14). The OECD (2017, p. 14) also makes the following remark: “Whilst some countries have sampled young adults and the very elderly to inform their national initiatives, the international analyses presented here only take into account responses from people aged from 18 to 79 year olds”.

(OECD 2016, p. 26)⁸; see columns (9)-(10) in Table A2. For comparability with the two other 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. It is thus not just a matter of one measure consistently yielding higher estimates than the other; the relative positions of the countries differ too (see Tables A4 and A5). Our later finding that using a different indicator of financial literacy substantially impacts the results is thus not so surprising.

3.2. Construction of samples

Now that we have described all datasets⁹, 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 bigger samples. This is possible because the 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 we explain in Section 3 of the Appendix, after thorough analysis, we saw 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,

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.

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 variables; 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 in order to stay as close as possible to the dates when the S&P and FLat World surveys were administered. 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.)

Besides the above samples, we also created S&P sub-samples – 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). Luckily, all OECD/INFE countries also appear in the S&P dataset, so 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 the overlap between the OECD/INFE dataset and our Big Three samples is limited to 19 countries (when using the ‘5 out of 7’ measure). We judged this number to be too low to perform a reliable statistical analysis. We therefore do not make use of a OECD/INFE-19 subsample, and thus do not directly compare the OECD/INFE and Big Three financial literacy metrics. Descriptive statistics on all (sub)-samples are presented in Table 3.

<Tables 2 & 3 about here>

4. Methods and regression results

This section presents the results of our replication efforts, first for A&VH (section 4.1) and subsequently for Grohmann et al. (section 4.2). Each subsection starts with a brief summary of the approach used in the original study, along with further details when needed.

4.1. 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:

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

with subscript i referring to country i . The dependent variable is based on the S&P survey mentioned above, 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 taken from Hofstede¹¹. Because there are significant correlations between some of these cultural dimensions, in particular between power distance and individualism, 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 – and this is a difference with Klapper and Lusardi (2020) – in combination with one additional country-level factor that varies from one model to the next¹².

¹¹ Hofstede Insights, at url: <https://www.hofstede-insights.com/product/compare-countries/> (last accessed on 17.04.2023).

¹² 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.

We have estimated model (1) for all six of Hofstede’s cultural dimensions. However, we only report 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 ¹³.

All specifications are estimated using 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 have sourced the financial literacy estimates ¹⁴ 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) ¹⁵.

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 ¹⁶. 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.

<Tables 4 and 5 about here>

A first observation about the results in Table 5 derives from comparing the three S&P samples, in rows (1) to (3) – 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 less strong for the

¹³ 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.

¹⁴ The OECD/INFE data that we use were compiled from six different sources; see Table A3.

¹⁵ As a rule, the survey with the highest number of observations is taken as the base category.

¹⁶ The WLS results are available upon request.

S&P-26 and S&P-50 samples than for the S&P-92 sample¹⁷. For uncertainty avoidance there is no clear pattern (slightly stronger for S&P-26 than for S&P-92, but less strong for S&P-50). This indicates that the country composition of the sample can matter¹⁸.

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 with the lower representativeness and the online nature of the survey, as discussed in Section 3 of the Appendix. Table A8 shows that the AE+ samples correlate least well with the S&P-26 sample.

If we then focus on the comparison of A&VH's S&P results with those obtained with the alternative Big Three and OECD/INFE 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 (mostly at the 0.05 rather than at the 0.01 level) 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 actually 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 on the one hand and those for the OECD/INFE and Big Three measures on the other are stark. This is especially true for individualism: with the S&P data the results are very significant, but with the other two indicators

¹⁷ Note that the average level of power distance is lower in the S&P-26 sample and that the variation is higher.

¹⁸ A&VH (2020, p. 2275) themselves already indicated that “the sample can [...] make a difference”: their results for uncertainty avoidance are markedly better for a subsample consisting of solely OECD countries. This is in line with what we find here.

the vast majority of the results are insignificant. For uncertainty avoidance, the differences are somewhat less striking, but it is nevertheless 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.

As an aside, if one looks at the results in Table 5 from the prism of Gignac and Ooi's (2022) remarks about internal consistency reliability (see Section 2), it is somewhat surprising that the OECD/INFE metric (with 7 questions) mostly performs less well than the Big Three (which has only 3). Note that this remains the case when the two metrics are compared for an overlapping sample of 19 countries (results not reported).

4.2. 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 in the country who own a debit card. For usage, the two outcome variables are the proportion of respondents who save on a bank account and who 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 km.

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

$$Y = \beta_1 FL + \beta_2 X + u. \tag{2}$$

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)¹⁹. Because we 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. As can be seen, for the full models we have 122 countries rather than 119. Also, while the significance of most of the variables stays unchanged – in particular that of financial literacy – there are some differences. 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

¹⁹ For one, we noticed that Grohmann et al.’s spreadsheet contained a duplicate row for Cyprus. Conversely, Taiwan was missing, and Hong Kong and Singapore were excluded at the estimation stage. We removed the duplicate observations for Cyprus, and added observations for Taiwan, Hong Kong, and Singapore. As a result, our base regressions are for all 143 countries in the S&P survey, whereas Grohmann et al. start with 141 (including, as pointed out, one duplicate).

Second, Grohmann et al. base their secondary and tertiary education variables on microdata from the Global Findex database without using the sampling weights. As the Findex survey relies on stratified random sampling, the use of sampling weights is essential to obtain unbiased estimates. Also, for some reason, Grohmann et al.’s dataset did not include education variables for Iran. Finally, we noticed that the values for the Ease of doing business index used in the article were different from those in the Doing Business report for 2014. They also failed to match the rankings in either the 2013 or the 2015 report. We decided to use the numbers that we found for 2014.

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.

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, as explained above. For ease of interpretation, column (1) of each of the tables 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).

<Tables 6-9 about here>

As can be seen, the coefficient of financial literacy only rarely becomes insignificant when using the alternative metrics. But, 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.

<Table 10 about here>

Worryingly, when using the alternative financial literacy metrics, the coefficient drops with 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 in the past twelve months, 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. However, we discuss these in the next Section.

5. Discussion and conclusions

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 Global Financial Literacy Survey for their financial literacy variable, we exploit alternative datasets that rely on either the so-called Big Three questions developed by Lusardi and Mitchell or on the OECD/INFE Toolkit.

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. Where the A&VH article is concerned, for individualism and uncertainty avoidance the results are markedly different: with the S&P measure we find very significant results (as in the original article), but with either the Big Three²⁰ or the OECD/INFE measure the results are insignificant or only weakly significant. For power distance, the results depend on the metric: with Big Three data the results are largely similar to A&VH, but with the OECD/INFE data they fall apart almost completely. When replicating the Grohmann et al. paper, we find that the coefficient of financial literacy only rarely becomes insignificant. But, crucially, the magnitude of the coefficient invariably drops substantially when using the alternative metrics.

These findings raise (at least) two (related) points for discussion. First, what do the findings imply for the literatures on, respectively, the link between national culture and financial literacy, and the impact of financial literacy on financial inclusion – and, by extension, the broader

²⁰ This is true not only for the samples dominated by the non-academic Aegon and Allianz surveys but also for the samples where the FLat World data are prioritised.

literature on the antecedents and consequences of financial literacy? Second, where do the differences between the financial literacy metrics come from?

To start with the first angle, as mentioned in Section 2, the results of A&VH do not correspond with those of De Beckker et al. (2020). This is also true for the results obtained in the present paper, even when we use OECD/INFE data as De Beckker et al. do ²¹. This obviously raises the question where these discrepancies come from and whether it still can be maintained that national culture is an antecedent of financial literacy. Part of the explanation for the discrepancies 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 as a country-level control variable the PISA²² math score, 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 only significant 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

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 PISA (Programme for International Student Assessment) is an international study by the OECD that measures 15-year-olds' performance on mathematics, science, and reading.

rooted cultural differences can help explain differences in financial literacy. This implies that a cross-country study such as Nicolini et al. (2013) – who, incidentally, also merge existing data on financial literacy, for four countries, into a bigger, international dataset – would benefit from explicitly 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 the articles by Mahmood-ur-Rahman (2022) and Lo Prete (2022) mentioned in Section 2.2. Chances are that, in these papers too, the use of an alternative metric would affect the conclusions concerning the impact of financial literacy, both in absolute and, in the Lo Prete article, in relative terms – that is, compared to digital literacy. Interestingly, Grohmann et al. also compare the impact of financial literacy with that of another factor, namely the financial infrastructure. Concretely, they measure financial depth by 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 using alternative financial literacy metrics. Where specifically debit card ownership is concerned, Table 7 shows that not only does the coefficient on financial literacy drop, at the same time the coefficient 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 to be 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, our paper sends a strong signal that the literature would benefit from looking carefully into the reliability and validity of the short financial literacy measurement tools that have almost become informal standards, and that it would be judicious to revisit a number of key papers. This signal is loudest for cross-country studies, as this is the (only) type of studies that we have examined – for reasons exposed in the Introduction. 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 Hove²³, who measure the financial literacy of their respondents by means of 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 fall apart when replacing the financial literacy metric.

Luckily, whereas cross-country studies typically rely on one of the simple/simplified metrics examined in the present paper (so as to have a set of questions that can be understood in all

²³ Ahunov M, Van Hove L (2023) Big Three illiterate, but Standard & Poor’s literate? Experimental evidence on differences between financial literacy metrics. Mimeo.

countries surveyed²⁴), single-country studies do this less often – because there is less need to and because there is room for country-specific questions. 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 (finance) journals – which use a financial literacy 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 unchanged the other questions – and, as mentioned, 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.

The second point of discussion was: where do the differences between the financial literacy metrics come from? Indeed, 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. At first sight, one could argue that the differences in results are hardly surprising, given that we do not work with ‘raw’ average scores per country but rather with the percentages of the population classified as financially

²⁴ It is no coincidence that the title of the OECD/INFE (2011) publication reads “Measuring financial literacy: questionnaire and guidance notes *for conducting an internationally comparable survey* of financial literacy” (our emphasis).

literate²⁵. Since the different approaches use different thresholds – i.e., the minimum number of questions that an individual needs to answer correctly for him/her to be considered financially literate – surely it is only normal that the associations with financial literacy are different?

However, on closer scrutiny, there is no one-to-one correspondence between the required ‘scale saturation’ of the different indicators and their estimates. If we focus on the sample of 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 seen in Figure A1.

At first sight, this would seem to be fully in line with the respective thresholds. Obviously, *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, 3 out of 4 topics for the S&P measure, and 5 out of 7 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, in fact, 100 per cent, 60-80 per cent²⁶, and 71-86 per cent²⁷. In other words, the thresholds do not

²⁵ The purpose of our paper is to scrutinise existing empirical evidence on financial literacy, and there *is* quite some research, especially in a cross-country setting, that uses population percentages rather than 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. (2021), 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 and 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).

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.

To build on this, given that the different metrics do purport to be able to discriminate between financially literate and illiterate individuals, one would assume that the threshold that was picked takes into account the nature and difficulty of the questions. This would indeed to some extent seem to be the case. Concerning 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 choose 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 levels of the question were correctly assessed.

Overall, our replication shows that Grohmann et al. (2018, p. 86) were correct when they mused 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 which makes it harder to assess the exact impact of financial literacy on financial inclusion”.

And then our efforts do not even start to take into account Warmath and Zimmerman’s (2019) criticism that the prevalent conceptualisation and operationalisation of financial literacy is

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.

myopic, in that it equates financial literacy with financial knowledge, whereas the former 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 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.

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Tables

Table 1. Datasets

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

	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	FLat World Project	Big Three	15	Lusardi (2019)
#5	Survey of Adult Financial Literacy Competencies	OECD/INFE	50	See Table A3

Table 2. Overlapping samples

Description: Lists the S&P sub-samples 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.

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.

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

Description: Presents country-level descriptive statistics for the three financial literacy metrics that we use. 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: Shows that 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.

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

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

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, and 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.

	(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

Beta coefficients are standardised; p-values in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

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

Metric Sample	Observations	Power distance (-)				Individualism (+)				Uncertainty avoidance (-)			
		(1)				(2)				(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 (2020), Table 5. n.s. = statistically insignificant, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

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

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: Coefficient of financial literacy remains significant when using the alternative metrics. However, for overlapping samples, the magnitude of the coefficient drops substantially.

	(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	0.51*** (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 (0.21)	13.08 (0.16)	12.73 (0.21)	12.62 (0.21)	13.81 (0.16)	13.64 (0.14)
Population share 15-64	-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.

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

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: Coefficient of financial literacy remains significant when using the alternative metrics. However, for overlapping samples, the magnitude of the coefficient drops substantially, and, in parallel, in several cases also the significance.

	(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 15-64	-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 1000 sq. 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.

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

Description: Replication of Grohmann et al.’s OLS regressions with the proportion of the population that saved at a formal financial institution in the last 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: Coefficient of financial literacy remains significant when using the alternative metrics. However, for overlapping samples, the magnitude of the coefficient drops substantially, and, in parallel, in one case also the significance.

	(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 15-64	-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 1000 sq. 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.

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

Description: Replication of Grohmann et al.’s OLS regressions with the proportion of the population that used a debit card in the last 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: Coefficient of financial literacy remains significant when using the alternative metrics. However, for overlapping samples, the magnitude of the coefficient drops substantially, and, in parallel, in columns (6)-(11) also the significance.

	(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 1000 sq. 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** (0.03)	-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	119	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.

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

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. Entries in the final column are 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 only rarely becomes insignificant when using the alternative metrics, the magnitude of the coefficient invariably drops substantially – irrespective of the form of financial inclusion.

Sample	S&P-50	S&P-26	OECD/INFE	Big Three	Difference (in %)
Outcome variable					
Account ownership	0.57***		0.32**		-44
		0.63***		0.41*** -0.51***	-35, -19
Debit card ownership	0.87***		0.61**		-30
		0.91***		0.23-0.37**	-75, -59
Saved on account	0.72***		0.22*		-69
		0.98***		0.54*** -0.68***	-45, -31
Used debit card	1.17***		0.68**		-42
		1.23***		0.42-0.56*	-66, -54

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix to “Financial literacy: different indicator, different insights?”

1. Introduction

This is an appendix to “Financial literacy: different indicator, different insights?” by Anonymous.

Section 2 first provides more details as to the three financial literacy measures that are used in the five datasets that we exploit. We also point out the existence of two other international datasets and explain why we do not use these. Section 3 then reports which samples we have constructed based on the datasets listed in Table A2 in Section 2. In Section 4, we compare the samples used in our regressions. Finally, Section 5 presents our replication (and correction) of Grohmann et al.’s original results.

2. The three financial literacy measures

Table A1 lists and compares the questions used in the S&P, Big Three and OECD/INFE surveys, so as to highlight the similarities and differences. Table A2 provides an overview of the available scores for the three metrics, for 62 countries in total (i.e., all countries that appear at least twice in our datasets), Table A3 lists the sources of the OECD/INFE data in columns (9) and (10) of Table A2, and Tables A4-A5 compare the country rankings across the S&P, OECD/INFE and FLat World datasets.

Table A1. Measuring financial literacy: S&P vs. Big Three vs. OECD/INFE

Description: Compares the questions used in the S&P, Big Three and OECD/INFE surveys, which consist, respectively, of five, three, and seven questions.

Interpretation: All three surveys have items on risk diversification, inflation, and compound interest (albeit phrased differently). Both the S&P and OECD/INFE survey also test respondents' basic numeracy and have a second interest-related question. In addition, the OECD/INFE Toolkit has a second item on inflation, as well as one on the relationship between risk and return.

S&P	Big Three	OECD/INFE
<i>How many can answer 3 out of these 4 topics correctly?</i>	<i>How many can answer all 3 questions correctly?</i>	<i>Number of correct answers out of 7</i> Words or phrases in <> can be edited to fit the national context. Italics = alternative wording available to simplify the language where necessary.
RISK DIVERSIFICATION		
Suppose you have some money. Is it safer to put your money into one business or investment, or to put your money into multiple businesses or investments? [one business or investment; multiple businesses or investments ; don't know; refused to answer]	Please tell me whether this statement is true or false. "Buying a single company's stock usually provides a safer return than a stock mutual fund." [true; false ; do not know; refuse to answer]	Is the following statement true or false? It is usually possible to reduce the risk of investing in the stock market by buying a wide range of stocks and shares or <i>It is less likely that you will lose all of your money if you save it in more than one place.</i> [true ; false; do not know; refuse to answer]
INFLATION		
Suppose over the next 10 years the prices of the things you buy double. If your income also doubles, will you be able to buy less than you can buy today, the same as you can buy today, or more than you can buy today? [less; the same ; more; don't know; refused to answer]	Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account? [more than today; exactly the same; less than today ; do not know; refuse to answer]	Imagine that five <brothers> are given a gift of <\$>1,000 and have to share the money equally. The <brothers> have to wait for one year to get their share of the <\$>1,000 and inflation stays at <x>%. In one year's time, will they be able to buy [Multiple choice; correct response depends on inflation used] Is the following statement true or false? High inflation means that the cost of living is increasing rapidly. [true ; false; do not know; refuse to answer]

Table A1. Measuring financial literacy: S&P vs. the Big Three vs. OECD/INFE (*ctnd*)

S&P	Big Three	OECD/INFE
NUMERACY (INTEREST)		
Suppose you need to borrow 100 US dollars. Which is the lower amount to pay back: 105 US dollars or 100 US dollars plus three percent? [105 US dollars; 100 US dollars plus three percent ; don't know; refused to answer]		Suppose you put \$100 into a <no fee, tax free> savings account with a guaranteed interest rate of 2% per year. You don't make any further payments into this account and you don't withdraw any money. How much would be in the account at the end of the first year, once the interest payment is made? [Open response; correct response: \$102]
INTEREST		
		You lend \$25 to a friend one evening and he gives you \$25 back the next day. How much interest has he paid on this loan? [Open response; correct response: 'none'/0]
COMPOUND INTEREST		
Suppose you put money in the bank for two years and the bank agrees to add 15 percent per year to your account. Will the bank add more money to your account the second year than it did the first year, or will it add the same amount of money both years? [more ; the same; don't know; refused to answer]		
Suppose you had 100 US dollars in a savings account and the bank adds 10 percent per year to the account. How much money would you have in the account after five years if you did not remove any money from the account? [more than 150 dollars ; exactly 150 dollars; less than 150 dollars; don't know; refused to answer]	Suppose you had \$100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow? [more than \$102 ; exactly \$102; less than \$102; do not know; refuse to answer]	(continuation of numeracy (interest question) ... and how much would be in the account at the end of five years [add if necessary: remembering there are no fees or tax deductions]? Would it be ... [Multiple choice; correct response: more than \$110 , but only taken into account if simple interest question is correct]

Table A1. Measuring financial literacy: S&P vs. the Big Three vs. OECD/INFE (*ctnd*)

S&P	Big Three	OECD/INFE
RISK AND RETURN		An investment with a high return is likely to be high risk or <i>If someone offers you the chance to make a lot of money it is likely that there is also a chance that you will lose a lot of money.</i> [true ; false; do not know; refuse to answer]
Source: Klapper et al. (2015, p. 6)	Source: Lusardi (2019, p. 2, Table 1)	Source: OECD (2016, p. 20, Table 1)

Note: The answer options are in the brackets, with the correct answer in bold. Questions are not placed under headings in OECD (2016); headings have been added.

Table A2. Overview of financial literacy estimates, % of population (except †)

Description: Provides an overview of the available scores for the three metrics, for all countries that appear at least twice in our datasets (i.e., for which there is a point of comparison).

Interpretation: Country scores can differ substantially. Salient cases are Romania, Chile, and Russia.

Country	S&P survey 2014	Aegon Retirement Readiness survey			Allianz	FLat World Project *		OECD/INFE **	
		2020	2019	2018	2016	Estimate	Year	Average score †	% that scored 5 out of 7 or more
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1 Albania	14							4.2	43
2 Argentina	28							4.1	38
3 Armenia	18							3.6	27
4 Australia	64	33	27	28		42.7	2012		
5 Austria	53				47.1			4.9	66
6 Azerbaijan	36							3.2	23
7 Belarus	38							3.8	38
8 Belgium	55				29.3			4.9	60
9 Bolivia	24							4.8	
10 Brazil	35	29	25	30				4.3	48
11 Bulgaria	35							4.1	47.5
12 Cambodia	18							3.52	17
13 Canada	68	32	39	37		42.5	2012	4.9	61
14 Chile	41					7.7	2009	5.1	
15 China	28	20	37	29				4.7	61
16 Colombia	32							5.1	
17 Croatia	44							4.3	46
18 Czech Republic	58							4.4	52
19 Estonia	54							5.3	73
20 Finland	63					35.6	2014	5.2	70
21 France	52	32	36	33	28.3	30.9	2011	4.9	59
22 Georgia	30							4.6	55
23 Germany	66	41	42	45	45.9	53.2	2009	4.8	59
24 Hong Kong	43							5.8	84
25 Hungary	54	26	24	25				4.7	60

Table A2. Overview of financial literacy estimates, % of population (except †) (ctnd)

Country	S&P survey 2014	Aegon Retirement Readiness survey			Allianz	FLat World Project *		OECD/INFE **	
		2020	2019	2018	2016	Estimate	Year	Average score †	% that scored 5 out of 7 or more
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
26 India	24	23	23	33				3.7	32
27 Indonesia	32							3.9	50
28 Italy	37				24.9	24.9	2007	3.5	32
29 Japan	43	31	31	29		27	2010	3.4	
30 Jordan	24							4.3	47
31 Kazakhstan	40							4.1	41
32 Korea	33							5.4	77
33 Kyrgyz Republic	19							2.6	17
34 Latvia	48							5.1	68
35 Lithuania	39							4.7	60
36 Malaysia	36							3.6	33
37 Malta	44							2.2	
38 Mexico	32							4.1	39
39 Moldova	27							4	43.6
40 Montenegro	48							4.1	45.9
41 Netherlands	66	29	27	24	33	44.8	2010	4.9	64
42 New Zealand	61					24	2009	5	63
43 North Macedonia	21							3.9	42.3
44 Norway	71							5.2	70
45 Paraguay								3.3	
46 Peru	28							4.6	
47 Poland	42	27	27	25				4.4	55
48 Portugal	26				28.4			4.8	60
49 Romania	22					3.8	2011	3.5	30.8
50 Russia	38					3.7	2009	4.1	45
51 Saudi Arabia	31							3.9	51
51 Slovenia	44							4.8	61
53 South Africa	42							3.7	31

Table A2. Overview of financial literacy estimates, % of population (except †) (*ctnd*)

Country	S&P survey 2014	Aegon Retirement Readiness survey			Allianz	FLat World Project *		OECD/INFE **	
		2020	2019	2018	2016	Estimate	Year	Average score †	% that scored 5 out of 7 or more
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
54 Spain	49	32	33	32	30.9				
55 Sweden	71					21.4	2010		
56 Switzerland	57				39.9	50.1	2011		
57 Tajikistan	17							2.6	10
58 Thailand	27							3.9	41
59 Turkey	24	15	14	17				4.6	58
60 United Kingdom	67	24	25	28	24.5			4.2	47
61 United States	57	30	27	31		30.2	2009		
62 Vietnam	24							3.96	36

Notes: * Taken from Lusardi (2019). Hizgilov and Silber (2020, p. 807), in a recent study, measure financial literacy in Israel “on the basis of the ideas suggested by Lusardi and Mitchell”. However, we did not add this estimate to the FLat World dataset because, on closer scrutiny, two of Hizgilov and Silber’s three questions diverge substantially from the original Big Three; ** See Table A3 for sources. Estimates for the British Virgin Islands are not reported in the table given its special status and the lack of macroeconomic data.

Table A3. Sources for OECD/INFE dataset

Description: Lists the sources used to construct our OECD/INFE dataset.

Interpretation: As explained in Section 3.1 of the main text, the OECD reports present financial literacy estimates in two ways: as a per-country average score on 7 and/or as the proportion of adults who achieved a score of at least 5 out of 7. The second – respectively, third – column of the table mention the number of countries for which such estimates are available. Country names can be found in the final column, where italics indicate that only the average score (which we do not use) is available. The 50 countries in the third column appear in our S&P-50 overlapping sample; see Table 2 in the main text.

Data source	# countries		Countries
	Average score	Min 5 out of 7	
OECD (2016)	29	29	Albania; Austria; Belarus; Belgium; Brazil; Canada; Croatia; Czech Republic; Estonia; Finland; France; Georgia; Hong Kong SAR, China; Hungary; Jordan; Korea, Rep.; Latvia; Lithuania; Malaysia; Netherlands; New Zealand; Norway; Poland; Portugal; Russian Federation; South Africa; Thailand; Turkey; United Kingdom
OECD (2017)	9	8	Argentina; China; Germany; India; Indonesia; Italy; <i>Japan</i> ; Mexico; Saudi Arabia
OECD (2018)	5	5	Armenia; Azerbaijan; Kazakhstan; Kyrgyz Republic; Tajikistan
OECD (2020b)	7	6	Bulgaria; <i>Malta</i> ; Moldova; Montenegro; North Macedonia; Romania; Slovenia
Mejía (2019)	5	0	<i>Bolivia; Chile; Colombia; Paraguay; Peru</i>
Morgan and Trinh (2019)	2	2	Cambodia; Vietnam
Total	57	50	

Notes: Karakurum-Ozdemir et al. (2019) present estimates for Colombia, Lebanon, Mexico, Turkey and Uruguay that are based on the Financial Capability Survey of the World Bank. However, while of a similar inspiration as the OECD/INFE, the survey has only five instead of seven questions, and only four correspond. The estimates were therefore not used.

Table A4. Comparison of S&P and OECD/INFE rankings

Description: Compares the rankings of countries according to, respectively, the S&P and OECD/INFE financial literacy tests. Countries are ranked from highest to lowest S&P score. To facilitate the comparison, green indicates high literacy and red indicates low literacy. The underlying numbers relate to the % of the population that are deemed literate by the respective test. Numbers relate to the year 2014 for S&P and, depending on the country, to 2015 to 2019 for OECD/INFE; see Table A3 for details.

Interpretation: Rankings can differ dramatically. Salient examples are the UK (#1 in the S&P ranking, but only #27 in the OECD/INFE ranking) and, in the other direction, South Korea (#30 in the S&P ranking and #2 in the OECD/INFE ranking).

Country	S&P	OECD/INFE, Min 5 out of 7
Norway	1	4
Canada	2	10
United Kingdom	3	27
Netherlands	4	8
Germany	5	17
Finland	6	4
New Zealand	7	9
Czech Republic	8	22
Belgium	9	13
Estonia	10	3
Hungary	11	13
Austria	12	7
France	13	17
Latvia	14	6
Montenegro	15	30
Croatia	16	29
Slovenia	17	10
Hong Kong SAR, China	18	1
Poland	19	20
South Africa	20	44
Kazakhstan	21	35
Lithuania	22	13
Russian Federation	23	31
Belarus	24	38
Italy	25	42
Azerbaijan	26	47
Malaysia	27	41
Bulgaria	28	26
Brazil	29	25
Korea, Rep.	30	2
Indonesia	31	24
Mexico	32	37
Saudi Arabia	33	23
Georgia	34	20
China	35	10

Note: Countries are ranked from highest to lowest financial literacy

Table A4. Comparison of S&P and OECD/INFE rankings (*ctnd*)

Country	S&P	OECD/INFE, Min 5 out of 7
Argentina	36	38
Thailand	37	35
Moldova	38	32
Portugal	39	13
Vietnam	40	40
Turkey	41	19
India	42	42
Jordan	43	27
Romania	44	45
Macedonia, FYR	45	34
Kyrgyz Republic	46	48
Cambodia	47	48
Armenia	48	46
Tajikistan	49	50
Albania	50	33

Note: Countries are ranked from highest to lowest financial literacy

Table A5. Comparison of S&P and FLat World Project rankings

Description: Compares the rankings of countries according to, respectively, the S&P and the Big Three financial literacy tests conducted in the framework of the FLat World Project. Countries are ranked from highest to lowest S&P score. To facilitate the comparison, green indicates high literacy and red indicates low literacy. The underlying numbers relate to the % of the population that are deemed literate by the respective test. Numbers relate to the year 2014 for S&P and, depending on the country, to 2009 to 2014 for the FLat World Project; see Lusardi (2019) for details.

Interpretation: Rankings can differ dramatically. Sweden is a prime example: #1 in the S&P ranking, but only #12 out of 15 in the FLat World ranking.

Country	S&P	FLat World Project
Sweden	1	12
Canada	2	5
Netherlands	3	3
Germany	4	1
Australia	5	4
Finland	6	6
New Zealand	7	11
United States	8	8
Switzerland	9	2
France	10	7
Japan	11	9
Chile	12	13
Russian Federation	13	15
Italy	14	10
Romania	15	14

Note: Countries are ranked from highest to lowest financial literacy

As mentioned in footnote 10 in the main text, there are other international financial literacy datasets besides the five that we exploit. However, we decided against using these – for the reasons explained next.

To start with the oldest of the two, Agarwalla et al. (2015) and Rodrigues et al. (2019), among others, refer to the Visa Financial Literacy Barometer (Visa 2012), which has observations for 28 countries. We do not use these data because the Visa Barometer measures financial behaviour rather than knowledge and, more importantly, because there would seem to be issues of internal validity. For example, one of the five questions relies on respondents' impression of the financial

literacy of their fellow citizens: “To what extent would you say that teenagers and young adults in (Country) understand money management basics and are adequately prepared to manage their own money?” (Visa 2012, p. 5).

Another international dataset is collected by credit management company Intrum. In the 2019 version of its European Consumer Payment Report, Intrum introduced a Financial Wellbeing Barometer. Data is collected through an on-line survey among a minimum of 1,000 consumers in each of 24 European countries. The target group of the survey consists of persons “of 18 years and over who were mainly or partly responsible for their personal or household financial administration” (Intrum 2019, p. 19). Per-country quota are set on gender, age, and region.

The Barometer consists of 11 indicators, grouped into four pillars, one of which is financial literacy. The per-country financial literacy scores (Intrum 2019, p. 10) are calculated as the unweighted average of 0-10 scores on two indicators. The first is a question where respondents have to match basic financial terms to their correct definitions (Intrum 2019, p. 19). The terms tested are: budget, credit score, annual percentage rate (APR), variable interest rate, and inflation. The second question is very comparable to the compound interest item of the Big Three (and the S&P and OECD/INFE surveys, for that matter; see Table A1): “If you had €200 in a savings account earning 2% interest a year, how much would you have in the account after five years (assuming you didn’t pay any new money into the account or make any withdrawals)? [more than €208; exactly €208; less than €208; don’t know]” (Intrum 2019, p. 20) ¹.

¹ Just like the \$102 in the original Big Three questions (see main text), €208 would not seem the most appropriate benchmark. As the OECD (2016, p. 21, footnote 8) points out, if one considers a five-year period, the multiple-choice options should be “centred on the value of five times the simple interest”.

We decided not to use the Intrum financial literacy scores because of the limited number of items and because of the different nature of the first question (where respondents had to match financial terms and definitions). A comparison of the results for 2019 and 2020 (Intrum 2020, p. 14) also shows that the results are highly volatile. Estonia and Latvia, for example, jump from places 22 and 21 (out of 24) to places 3 and 4, respectively.

3. Construction of samples

As explained in Section 3.2 of the main text, we do not use the Aegon, Allianz and FLat World datasets – which all use the Big Three measurement approach – separately, but rather merge them into bigger samples. However, differences in the levels of the financial literacy estimates between the datasets triggered a concern about potential differences in reliability, which would dictate a pecking order when merging. We have therefore tried to gauge the quality of the surveys.

At (roughly) 1,000 the per-country sample size is comparable between the Allianz and Aegon surveys, and both were conducted on-line. However, whereas the Allianz samples “are representative of the population of each country with respect to age, sex and geography” (Allianz 2017, p. 6), the Aegon reports provide no details other than that 14,400 workers and 1,600 retired people were surveyed. Additional information provided to us by the Aegon Center for Longevity and Retirement reveals that age, gender and regional quota are effectively used². However, this does not do away with the fact that the target population of the Aegon survey consists of adults aged 18+ who are either employed or retired. Since students aged 18+ are not included, the Aegon samples would not seem nationally representative in terms of education.

² Source: private e-mail correspondence with Mike Mansfield, programme director for the Aegon Center for Longevity and Retirement, January 31, 2020.

The FLat World project, for its part, consists of separate surveys. As a result, sample sizes differ. However, with one exception – New Zealand – sample size always exceeds 1,000 (Lusardi 2019, p. 3). Importantly, whereas the Allianz and Aegon surveys were conducted on-line, 6 of the 15 FLat World surveys were conducted face-to-face, and only 3 on-line – with the remaining 6 evenly divided between telephone and mail-based. As Kalmi and Ruuskanen (2018, p. 338) point out, face-to-face interviews “are often regarded as the ‘gold standard’ in financial literacy studies (...). Internet- or mail-based surveys might provide the respondents with the opportunity to improve their knowledge, thereby overstating their true knowledge”.

Also, the correlation matrix in Table A6 shows that, of the three datasets under consideration, the FLat World estimates correlate best with the results of the S&P survey³, which, as is explained below, is methodologically stronger. However, one should not make too much of these correlations, as they are not measured for the same (number of) countries. They are thus affected not only by (the quality of) the measurement tool, but potentially also by the sample. All in all, we saw no strong reason to prefer any of the surveys upfront decided to give all possible combinations a try⁴.

³ Spearman rank correlations (not reported) confirmed this. In a rough test of criterion validity, we also computed the correlations between the different financial literacy estimates on the one hand and financial inclusion as measured by the Global Findex database on the other. With correlations of, respectively, 0.79*** and 0.74*** the FLat World and S&P surveys performed best. The correlation coefficients for the Allianz and 2018 Aegon surveys are on a distinctly lower level (0.61* and 0.47*).

⁴ There are, however, a number of individual financial literacy estimates that surprise. As can be seen by comparing columns (3), (4) and (5) of Table A2, for most countries the year-on-year differences between the Aegon estimates remain limited to 1-3 percentage points. But there are marked exceptions. The estimate for India, for example, drops from 33 to 23 percent between 2018 and 2019. But the most salient case is China: its financial literacy score first jumps from 29 to 37 percent, only to drop back to a mere 20 percent in 2020. One-year variations of this size would seem implausible. As for the FLat World project, the estimates for Romania, Chile and Russia are surprisingly low,

Table A6. Correlations between S&P, OECD/INFE, and Big Three datasets

Description: Correlation matrix. Number of observations varies, as the overlap between the datasets differs; see Table 2 in the main text.

Interpretation: Cross-country correlations are lower than one would expect for metrics that claim to measure the same phenomenon.

	S&P -143	OECD/INFE, Min 5 out of 7	Aegon 2020	Aegon 2019	Aegon 2018	Allianz 2016
S&P-143	1.00					
OECD/INFE, Min 5 out of 7	0.61***	1.00				
Aegon 2020	0.67***	0.22	1.00			
Aegon 2019	0.41	0.38	0.68***	1.00		
Aegon 2018	0.37	-0.09	0.75***	0.81***	1.00	
Allianz	0.34	0.58	0.91**	0.76	0.77	1.00
FLat World Project	0.73***	0.68**	0.64	0.40	0.45	0.95**

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Number of observations varies, as the overlap between datasets varies.

Table A7 illustrates that for the ‘AL+FW+AE’ sample, shown in column (4) we first took the maximum number of countries from the Allianz (AL) survey (10), subsequently added the remaining unique countries from the FLat World (FW) project (another 10), and only then added the non-overlapping 6 from the 2018 Aegon (AE) survey⁵. In other words, the names of the merged samples reflect the sequence in which we drew on the three surveys and all ‘Big Three samples’ consist of 26 observations.

To wrap up this section, let us explain why the S&P survey would appear to be methodologically stronger. The main reason is that while the per-country sample size is comparable to that of the

compared to not only the other countries but also to the S&P and OECD/INFE estimates – even after taking into account the differences in the year of estimation.

⁵ We have opted to use the 2018 Aegon estimates (rather than those for 2019 or 2020) in order to limit, as much as possible, the difference in timing with the S&P survey (which was conducted in 2014).

Allianz and Aegon surveys⁶, the S&P surveys were conducted not on-line, but by telephone or, “in economies where less than 80 percent of the population has access to a telephone or [where it] is the customary methodology”, face-to-face (Klapper et al. 2015, p. 5). Such face-to-face interviews were used in 7 of the 26 countries in the sample (8 if one includes China, where a combination of landline telephone and face-to-face was used). Note that five of these countries appear in the Aegon data, which, as mentioned, rely on on-line surveys⁷. Also, the target population of the S&P survey consists of the entire population aged 15 and above, excluding prisoners and soldiers. Data weighting is used to ensure nationally representative samples. Note that the poststratification weights include not only gender and age, but, “where reliable data are available”, also education or socioeconomic status (Klapper et al. 2015, p. 26). The latter is another difference with the Allianz and Aegon survey.

⁶ Cf. Klapper et al. (2015, p. 5): “More than 150,000 nationally representative and randomly selected adults in more than 140 economies were interviewed”, which gives an average of 1,071 respondents per country.

⁷ The other three countries are covered by the FLat World project, but the FLat World surveys for these countries were conducted face-to-face, as in the S&P survey.

Table A7. Example of construction of merged Big Three sample

Description: Column (4) shows that to construct the ‘AL+FW+AE’ sample, we first took the maximum number of countries from the Allianz (AL) survey (10), subsequently added the remaining unique countries from the FLat World (FW) project (another 10), and only then added the non-overlapping 6 from the Aegon (AE) survey.

Country	Aegon Retirement Readiness Survey	Allianz survey	FLat World project		AL+FW+AE sample	
	2018 (1)	2016 (2)	estimate	year	estimate	source
			(3)		(4)	
Austria		47.1			47.1	Allianz
Belgium		29.3			29.3	Allianz
France	33	28.3	30.9	2011	28.3	Allianz
Germany	45	45.9	53.2	2009	45.9	Allianz
Italy		24.9	24.9	2007	24.9	Allianz
Netherlands	24	33	44.8	2010	33	Allianz
Portugal		28.4			28.4	Allianz
Spain	32	30.9			30.9	Allianz
Switzerland		39.9	50.1	2011	39.9	Allianz
United Kingdom	28	24.5			24.5	Allianz
Australia	28		42.7	2012	42.7	FLat World
Canada	37		42.5	2012	42.5	FLat World
Chile			7.7	2009	7.7	FLat World
Finland			35.6	2014	35.6	FLat World
Japan	29		27	2011	27	FLat World
New Zealand			24	2009	24	FLat World
Romania			3.8	2011	3.8	FLat World
Russia			3.7	2009	3.7	FLat World
Sweden			21.4	2010	21.4	FLat World
United States	31		30.2	2009	30.2	FLat World
Brazil	30				25	Aegon
China	29				37	Aegon
Hungary	25				24	Aegon
India	323				23	Aegon
Poland	257				27	Aegon
Turkey	17				14	Aegon

4. A comparison of the samples

Figures A1 compares the samples that are eventually used in our regressions. The comparisons show that, overall, the Allianz, Aegon 2018 and FLat World estimates tend to be lower than the S&P estimates and that, in turn, the S&P estimates tend to be lower than the OECD/INFE scores. Table A8 shows how the samples correlate.

Figure A1. Box plots for S&P, OECD/INFE, and combined Big Three samples

Description: Box plots for selected datasets and sub-samples.

Interpretation: Overall, the Big Three country scores tend to be lower than the S&P estimates, which, in turn, tend to be lower than the OECD/INFE scores – with the exception of the S&P-26 sample, that is.

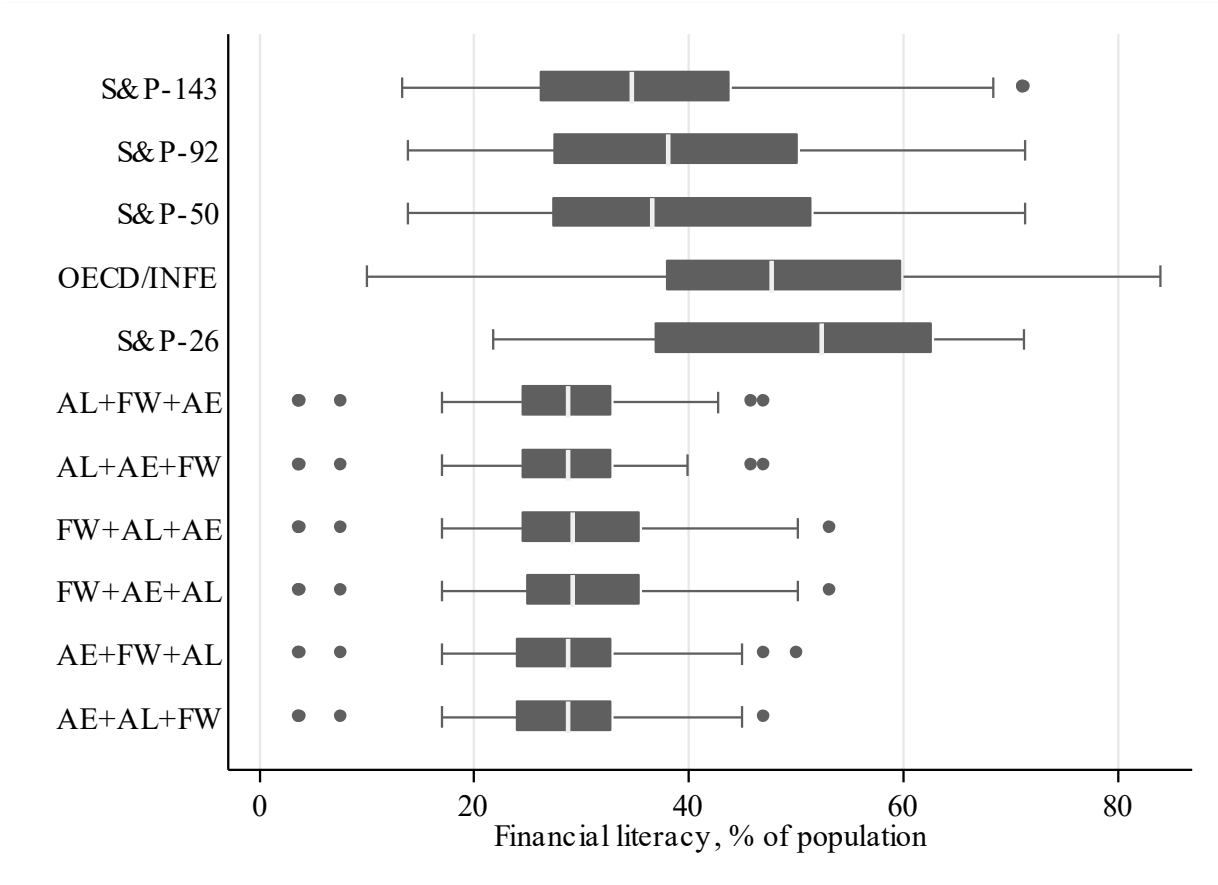


Table A8. Correlations between S&P, OECD/INFE, and combined Big Three samples

Description: Correlation matrix. Samples are listed according to sample size. Correlations for overlapping samples in bold.

Interpretation: As in Table A6 (which shows cross-country correlations for the datasets), the key correlations are lower than one would expect.

	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
S&P-143	1.00									
S&P-92	1.00	1.00								
S&P-50	1.00	1.00	1.00							
OECD/INFE, Min 5 out of 7	0.61***	0.51***	0.61***	1.00						
S&P-26	1.00	1.00	1.00	0.56**	1.00					
AL+FW+AE	0.49**	0.49**	0.52**	0.52**	0.49**	1.00				
AL+AE+FW	0.44**	0.44**	0.50**	0.52**	0.44**	0.96***	1.00			
FW+AL+AE	0.52***	0.52***	0.57**	0.52**	0.52***	0.97***	0.95***	1.00		
FW+AE+AL	0.53***	0.53***	0.59***	0.52**	0.53***	0.97***	0.95***	1.00***	1.00	
AE+FW+AL	0.41**	0.41**	0.47**	0.48**	0.41**	0.93***	0.97***	0.91***	0.91***	1.00
AE+AL+FW	0.42**	0.42**	0.47**	0.48**	0.42**	0.94***	0.98***	0.90***	0.91***	0.99***

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5. Grohmann et al.'s original results

As explained in Section 4.2 of the main text, we have spotted a number of mistakes in Grohmann et al.'s (2018) dataset. Tables A9 and A10 below present our re-estimation of Grohmann et al.'s Tables 2 and 3 with our corrected dataset.

Table A9. Grohmann et al. – Financial literacy and access to finance – OLS results

Description: Re-estimation of Grohmann et al.'s Table 2 with our corrected dataset, as explained in Section 4.2 of the main text. OLS regression results with robust standard errors in parentheses. Columns (1)-(3) show results with the proportion of the population that have a bank account as the outcome variable. Columns (4)-(6) show results with the proportion that have a debit card as the outcome variable.

Interpretation: The key independent variable is Financial literacy (S&P estimates).

	(1)	(2)	(3)	(4)	(5)	(6)
	Account ownership			Debit card ownership		
Financial literacy	1.46*** (0.10)	0.65*** (0.14)	0.47*** (0.12)	1.54*** (0.12)	0.63*** (0.14)	0.47*** (0.14)
Log GDP p.c. (PPP)		16.20*** (2.39)	12.92*** (2.73)		16.95*** (2.10)	14.25*** (2.52)
Population share 15-64		0.17 (0.37)	-0.32 (0.32)		-0.14 (0.33)	-0.59** (0.29)
Secondary education		0.01 (0.09)	0.09 (0.09)		0.01 (0.08)	0.06 (0.09)
Tertiary education		0.07 (0.12)	-0.06 (0.13)		0.23* (0.11)	0.07 (0.15)
Private credit to GDP			0.14*** (0.03)			0.10** (0.04)
Bank branches per 1000 sq. km			0.00 (0.01)			-0.00 (0.01)
Strength of legal rights index			0.16 (0.53)			-0.06 (0.50)
Ease of doing business			-0.10** (0.05)			-0.11** (0.05)
Constant	1.36 (4.30)	-132.07*** (13.94)	-66.49*** (24.46)	-16.95*** (4.52)	-136.65*** (11.94)	-73.01*** (24.61)
Observations	143	139	122	143	139	122
R^2	0.43	0.74	0.80	0.47	0.79	0.82

Note: ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table A10. Grohmann et al. – Financial literacy and use of financial services – OLS results

Description: Re-estimation of Grohmann et al.’s Table 3 with our corrected dataset, as explained in Section 4.2 of the main text. OLS regression results with robust standard errors in parentheses. Columns (1)-(3) show results with the proportion of the population that saved at a formal financial institution in the last year. Columns (4)-(6) show results with the proportion that have used their debit card within the last year.

Interpretation: The key independent variable is Financial literacy (S&P estimates).

	(1)	(2)	(3)	(4)	(5)	(6)
	Saved at formal fin. institution			Used debit card in the last year		
Financial literacy	1.03** (0.07)	0.63** (0.08)	0.51** (0.08)	1.54** (0.12)	0.78** (0.14)	0.66** (0.14)
Log GDP p.c. (PPP)		8.33** (1.49)	5.97** (1.51)		13.30** (1.98)	12.64** (2.41)
Population share 15-64		-0.43* (0.22)	-0.64** (0.20)		-0.40 (0.28)	-0.80** (0.28)
Secondary education		-0.10* (0.06)	-0.01 (0.06)		-0.03 (0.08)	-0.02 (0.09)
Tertiary education		0.13 (0.09)	0.08 (0.10)		0.38** (0.11)	0.26* (0.14)
Private credit to GDP			0.12** (0.05)			0.05 (0.04)
Bank branches per 1000 sq. km			0.00 (0.01)			0.00 (0.01)
Strength of legal rights index			0.06 (0.41)			0.30 (0.50)
Ease of doing business			-0.03 (0.04)			-0.08 (0.06)
Constant	-14.77*** (2.41)	-47.38*** (9.45)	-16.91 (18.42)	-28.09*** (4.26)	-103.04*** (10.82)	-63.51** (29.01)
Observations	143	139	122	143	139	122
R^2	0.53	0.69	0.74	0.55	0.78	0.78

Note: ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

6. Grohmann et al.'s further results

Tables A11 to A14 present our replication of Grohmann et al.'s regressions where they introduce an interaction term between financial literacy and financial infrastructure. Tables A15 to A18 do the same for their IV regressions.

Table A11. Grohmann et al. – Financial literacy, financial depth, their interaction, and account ownership

Description: Replication of Grohmann et al.’s OLS regression to estimate the effect of financial literacy, private credit to GDP, and their interaction on account ownership. Column labels indicate which financial literacy indicator was used as the main independent variable and, when needed, sample size. *p*-values are in parentheses. The interacted variables were centered at their means.

Interpretation: The key observation is that, unlike in Grohmann et al.’s (bigger) sample, the interaction term is insignificant in columns (3)-(5) and at best weakly significant in columns (6)-(11). Note also that, as in Table 6, the coefficient of Financial literacy drops substantially between columns (3) and (4), and between column (5) and columns (6)-(11); that is, when the S&P metric is replaced – in overlapping samples – by, respectively, OECD/INFE and Big Three measures.

	(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	0.54*** (0.00)	0.65*** (0.00)	0.60*** (0.00)	0.37** (0.03)	0.70*** (0.00)	0.61*** (0.00)	0.61*** (0.00)	0.57*** (0.00)	0.57*** (0.00)	0.61*** (0.00)	0.62*** (0.00)
Private credit to GDP	0.15*** (0.00)	0.12*** (0.01)	0.14*** (0.00)	0.17*** (0.00)	0.07 (0.17)	0.05 (0.24)	0.06 (0.19)	0.05 (0.26)	0.05 (0.27)	0.06 (0.20)	0.06 (0.19)
Financial literacy * Private credit to GDP	-0.00** (0.01)	-0.00* (0.06)	-0.00 (0.47)	-0.00 (0.29)	-0.00 (0.29)	-0.01 (0.26)	-0.01 (0.25)	-0.01* (0.07)	-0.01* (0.08)	-0.01** (0.04)	-0.01 (0.22)
Log GDP p.c. (PPP)	13.85*** (0.00)	11.36*** (0.01)	19.09*** (0.00)	23.49*** (0.00)	9.00 (0.27)	16.27 (0.10)	17.49* (0.07)	18.59* (0.05)	18.34* (0.06)	19.50** (0.03)	17.64* (0.06)
Population share 15-64	-0.41 (0.25)	-0.03 (0.94)	-0.57 (0.45)	-0.71 (0.33)	-0.58 (0.41)	-0.22 (0.76)	-0.19 (0.79)	-0.15 (0.84)	-0.16 (0.83)	-0.06 (0.93)	-0.13 (0.84)
Secondary education	0.03 (0.80)	0.07 (0.67)	-0.41** (0.02)	-0.20 (0.30)	-0.20 (0.32)	-0.14 (0.59)	-0.14 (0.58)	-0.16 (0.54)	-0.16 (0.55)	-0.16 (0.52)	-0.15 (0.56)
Tertiary education	-0.10 (0.45)	-0.13 (0.46)	-0.50** (0.03)	-0.40* (0.08)	-0.21* (0.08)	-0.05 (0.83)	-0.06 (0.80)	-0.09 (0.70)	-0.08 (0.71)	-0.09 (0.71)	-0.06 (0.80)
Strength of legal rights index	0.47 (0.40)	0.25 (0.76)	-0.13 (0.86)	0.98 (0.21)	-0.03 (0.97)	0.17 (0.84)	0.29 (0.69)	0.38 (0.63)	0.36 (0.64)	0.39 (0.60)	0.28 (0.70)
Ease of doing business	-0.09* (0.07)	-0.09 (0.20)	-0.22** (0.03)	-0.12 (0.27)	-0.09 (0.38)	-0.11 (0.31)	-0.09 (0.34)	-0.08 (0.44)	-0.08 (0.42)	-0.08 (0.40)	-0.10 (0.31)
Bank branches per 1000 sq. km	0.05*** (0.00)	0.05** (0.01)	0.10 (0.19)	0.14* (0.06)	0.08 (0.15)	0.04 (0.38)	0.05 (0.38)	0.05 (0.31)	0.05 (0.31)	0.06 (0.26)	0.05 (0.34)
Constant	-41.69 (0.11)	-39.70 (0.31)	-39.28 (0.56)	-99.04 (0.28)	47.64 (0.51)	-57.41 (0.61)	-73.15 (0.49)	-86.49 (0.43)	-83.13 (0.45)	-102.09 (0.31)	-78.07 (0.43)
Observations	119	81	43	43	24	24	24	24	24	24	24
R ²	0.79	0.74	0.83	0.82	0.81	0.81	0.81	0.81	0.81	0.82	0.81

Note: ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table A12. Grohmann et al. – Financial literacy, financial depth, their interaction, and debit card ownership

Description: Replication of Grohmann et al.’s OLS regression to estimate the effect of financial literacy, private credit to GDP, and their interaction on debit card ownership. Column labels indicate which financial literacy indicator was used as the main independent variable and, when needed, sample size. *p*-values are in parentheses. The interacted variables were centered at their means.

Interpretation: Unlike in Grohmann et al., the interaction term is only (somewhat) significant in columns (6)-(11). Note also that, as in Table 7, the coefficient of Financial literacy drops substantially between columns (3) and (4), and between column (5) and columns (6)-(11); that is, when the S&P metric is replaced – in overlapping samples – by, respectively, OECD/INFE and Big Three measures.

	(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	0.50*** (0.00)	0.57** (0.01)	0.83*** (0.00)	0.66*** (0.00)	0.95*** (0.00)	0.56*** (0.00)	0.55*** (0.01)	0.53*** (0.00)	0.54*** (0.00)	0.49*** (0.01)	0.52*** (0.01)
Private credit to GDP	0.09** (0.05)	0.11*** (0.01)	0.09 (0.19)	0.13* (0.06)	0.04 (0.49)	0.02 (0.82)	0.03 (0.72)	0.02 (0.81)	0.02 (0.83)	0.03 (0.65)	0.03 (0.70)
Financial literacy * Private credit to GDP	0.00 (0.31)	0.00 (0.91)	0.00 (0.42)	-0.00 (0.40)	-0.00 (0.60)	-0.01* (0.08)	-0.01* (0.08)	-0.01* (0.07)	-0.01* (0.08)	-0.01*** (0.01)	-0.01** (0.04)
Log GDP p.c. (PPP)	13.61*** (0.00)	14.24*** (0.00)	14.91*** (0.01)	19.51*** (0.00)	16.43 (0.29)	41.56** (0.01)	42.71** (0.02)	40.93** (0.02)	40.64** (0.02)	45.96** (0.01)	44.80** (0.01)
Population share 15-64	-0.39 (0.25)	-0.05 (0.90)	-0.97 (0.20)	-1.58* (0.06)	-1.71** (0.04)	-1.64* (0.10)	-1.62* (0.09)	-1.62* (0.10)	-1.63* (0.10)	-1.52 (0.10)	-1.57 (0.11)
Secondary education	0.02 (0.82)	0.14 (0.34)	-0.39* (0.09)	-0.02 (0.94)	-0.31 (0.17)	-0.26 (0.42)	-0.27 (0.43)	-0.27 (0.42)	-0.26 (0.42)	-0.30 (0.37)	-0.28 (0.42)
Tertiary education	0.00 (0.98)	-0.06 (0.77)	-0.48 (0.13)	-0.23 (0.37)	-0.41 (0.15)	-0.27 (0.46)	-0.30 (0.47)	-0.26 (0.47)	-0.26 (0.47)	-0.35 (0.40)	-0.34 (0.42)
Strength of legal rights index	-0.09 (0.86)	-0.19 (0.80)	-1.04 (0.35)	0.86 (0.43)	-0.53 (0.57)	0.75 (0.50)	0.76 (0.40)	0.71 (0.54)	0.70 (0.54)	0.93 (0.31)	0.92 (0.27)
Ease of doing business	-0.11** (0.04)	-0.08 (0.28)	-0.25* (0.06)	-0.08 (0.50)	-0.09 (0.61)	0.07 (0.67)	0.07 (0.61)	0.07 (0.69)	0.07 (0.70)	0.11 (0.45)	0.09 (0.50)
Bank branches per 1000 sq. km	0.04** (0.03)	0.02 (0.34)	0.07 (0.55)	0.10 (0.32)	0.04 (0.60)	-0.02 (0.84)	-0.00 (0.97)	-0.01 (0.88)	-0.01 (0.88)	0.01 (0.91)	0.01 (0.94)
Constant	-55.07** (0.03)	-86.31** (0.02)	20.65 (0.82)	-29.39 (0.77)	49.43 (0.71)	-230.27 (0.11)	-243.0* (0.09)	-224.9 (0.17)	-221.8 (0.18)	-283.3** (0.05)	-268.0* (0.05)
Observations	119	81	43	43	24	24	24	24	24	24	24
R ²	0.80	0.78	0.79	0.79	0.86	0.77	0.77	0.77	0.77	0.78	0.78

Note: ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table A13. Grohmann et al. – Financial literacy, financial depth, their interaction, and the proportion of population that saved at a formal financial institution

Description: Replication of Grohmann et al.’s OLS regression to estimate the effect of financial literacy, private credit to GDP, and their interaction on the proportion of the population that saved at a formal financial institution during the last year. Column labels indicate which financial literacy indicator was used as the main independent variable and, when needed, sample size. *p*-values are in parentheses. The interacted variables were centered at their means.

Interpretation: The interaction term is significant in column (3) – when we use, just like Grohmann et al., the S&P estimates for Financial literacy – but becomes mostly insignificant when using the alternative measures. Also, as in Table 8, the coefficient of Financial literacy drops substantially between columns (3) and (4), and between column (5) and columns (6)-(11).

	(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	0.50*** (0.00)	0.53*** (0.00)	0.62*** (0.00)	0.16 (0.22)	0.99*** (0.01)	0.80*** (0.00)	0.80*** (0.00)	0.76*** (0.00)	0.76*** (0.00)	0.79*** (0.00)	0.80*** (0.00)
Private credit to GDP	0.10** (0.02)	0.14*** (0.00)	0.24*** (0.00)	0.30*** (0.00)	0.17** (0.03)	0.13* (0.09)	0.14* (0.08)	0.13* (0.09)	0.13* (0.09)	0.14* (0.08)	0.14* (0.08)
Financial literacy * Private credit to GDP	0.00** (0.03)	0.00 (0.38)	0.01** (0.02)	0.00 (0.14)	-0.00 (0.91)	-0.01 (0.22)	-0.01 (0.22)	-0.01* (0.09)	-0.01* (0.09)	-0.01** (0.04)	-0.01 (0.17)
Log GDP p.c. (PPP)	5.64*** (0.00)	5.83* (0.05)	3.66 (0.23)	11.42** (0.01)	-5.89 (0.69)	13.23 (0.48)	12.79 (0.45)	14.53 (0.41)	14.27 (0.42)	16.11 (0.35)	14.27 (0.41)
Population share 15-64	-0.45** (0.04)	-0.44 (0.11)	0.42 (0.35)	-0.41 (0.55)	-1.09 (0.33)	-1.08 (0.43)	-1.11 (0.41)	-1.03 (0.46)	-1.04 (0.46)	-0.94 (0.49)	-1.02 (0.45)
Secondary education	-0.06 (0.38)	-0.09 (0.41)	-0.19 (0.30)	0.19 (0.37)	-0.26 (0.37)	-0.15 (0.69)	-0.14 (0.71)	-0.16 (0.67)	-0.16 (0.67)	-0.17 (0.64)	-0.15 (0.67)
Tertiary education	-0.02 (0.85)	-0.01 (0.94)	-0.19 (0.17)	0.08 (0.70)	-0.02 (0.91)	0.28 (0.37)	0.29 (0.38)	0.25 (0.41)	0.26 (0.40)	0.24 (0.46)	0.27 (0.42)
Strength of legal rights index	-0.01 (0.98)	0.52 (0.35)	-0.37 (0.70)	1.68 (0.17)	-0.07 (0.96)	1.13 (0.52)	1.15 (0.45)	1.28 (0.43)	1.27 (0.43)	1.30 (0.40)	1.21 (0.43)
Ease of doing business	-0.04 (0.29)	-0.02 (0.71)	-0.05 (0.54)	0.09 (0.49)	-0.15 (0.47)	-0.04 (0.92)	-0.03 (0.91)	-0.01 (0.97)	-0.02 (0.96)	-0.01 (0.98)	-0.03 (0.93)
Bank branches per 1000 sq. km	0.04* (0.06)	0.03 (0.10)	0.15** (0.02)	0.14 (0.10)	0.05 (0.51)	-0.03 (0.71)	-0.03 (0.71)	-0.02 (0.79)	-0.02 (0.79)	-0.02 (0.85)	-0.02 (0.78)
Constant	3.52 (0.84)	1.58 (0.95)	-25.76 (0.64)	-92.47 (0.33)	188.41 (0.21)	-29.70 (0.90)	-24.84 (0.90)	-46.82 (0.83)	-43.32 (0.84)	-69.20 (0.73)	-45.43 (0.82)
Observations	119	81	43	43	24	24	24	24	24	24	24
R ²	0.73	0.71	0.81	0.69	0.73	0.69	0.69	0.70	0.70	0.69	0.69

Note: ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table A14. Grohmann et al. – Financial literacy, financial depth, their interaction, and proportion of population that used a debit card during the last year

Description: Replication of Grohmann et al.’s OLS regression to estimate the effect of financial literacy, private credit to GDP, and their interaction on the proportion of the population that used a debit card during the last year. Column labels indicate which financial literacy indicator was used as the main independent variable and, when needed, sample size. *p*-values are in parentheses. The interacted variables were centered at their means.

Interpretation: The interaction term is weakly significant in column (3), but becomes insignificant in the smaller S&P-26 sample – in column (5) – as well as most of the times when we use the alternative indicators for Financial literacy – in columns (4) and (6)-(11). Also, as in Table 9, the coefficient of Financial literacy drops substantially between columns (3) and (4), and between column (5) and columns (6)-(11).

	(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	0.64*** (0.00)	0.68*** (0.00)	1.07*** (0.00)	0.64** (0.01)	1.18*** (0.00)	0.76*** (0.01)	0.76*** (0.01)	0.70** (0.02)	0.71** (0.02)	0.70** (0.02)	0.74*** (0.01)
Private credit to GDP	0.02 (0.51)	0.02 (0.73)	0.04 (0.58)	0.11 (0.18)	-0.03 (0.75)	-0.08 (0.53)	-0.07 (0.58)	-0.08 (0.55)	-0.08 (0.55)	-0.06 (0.62)	-0.07 (0.59)
Financial lit. * Priv credit to GDP	0.01*** (0.00)	0.00 (0.14)	0.01* (0.09)	0.00 (0.58)	0.00 (0.63)	-0.01 (0.11)	-0.02** (0.03)	-0.01 (0.22)	-0.01 (0.24)	-0.01** (0.03)	-0.02** (0.03)
Log GDP p.c. (PPP)	11.26*** (0.00)	12.43*** (0.00)	8.19* (0.08)	16.80** (0.01)	9.24 (0.56)	42.64*** (0.01)	46.54*** (0.01)	38.82** (0.02)	38.20** (0.02)	47.48*** (0.01)	49.38*** (0.01)
Population share 15-64	-0.45 (0.19)	-0.14 (0.75)	-1.69** (0.03)	-2.71*** (0.01)	-1.40 (0.29)	-1.87 (0.13)	-1.74 (0.17)	-2.03 (0.11)	-2.05 (0.10)	-1.73 (0.18)	-1.66 (0.20)
Secondary education	-0.04 (0.65)	0.05 (0.69)	-0.42* (0.10)	0.14 (0.59)	-0.36 (0.38)	-0.23 (0.67)	-0.25 (0.64)	-0.21 (0.70)	-0.20 (0.70)	-0.26 (0.62)	-0.26 (0.63)
Tertiary education	0.17 (0.28)	0.09 (0.61)	-0.34 (0.24)	0.03 (0.92)	-0.32 (0.19)	0.03 (0.92)	-0.04 (0.93)	0.07 (0.84)	0.08 (0.82)	-0.04 (0.91)	-0.09 (0.82)
Strength of legal rights index	0.08 (0.86)	-0.01 (0.98)	-1.23 (0.28)	1.64 (0.18)	-1.57 (0.24)	0.66 (0.68)	0.87 (0.51)	0.49 (0.76)	0.46 (0.77)	0.88 (0.51)	1.07 (0.40)
Ease of doing business	-0.09 (0.11)	-0.10 (0.25)	-0.30** (0.03)	-0.06 (0.64)	-0.24 (0.34)	0.04 (0.83)	0.07 (0.69)	0.02 (0.93)	0.01 (0.95)	0.09 (0.65)	0.10 (0.60)
Bank branches per 1000 sq. km	0.03** (0.04)	0.03 (0.15)	0.12 (0.34)	0.14 (0.22)	0.01 (0.96)	-0.12 (0.34)	-0.10 (0.45)	-0.13 (0.35)	-0.13 (0.34)	-0.09 (0.47)	-0.08 (0.51)
Constant	-43.80 (0.13)	-74.34* (0.07)	122.42 (0.20)	37.73 (0.75)	105.57 (0.51)	-239.02 (0.14)	-288.1* (0.08)	-190.07 (0.29)	-181.89 (0.31)	-298.4* (0.09)	-322.9* (0.07)
Observations	119	81	43	43	24	24	24	24	24	24	24
<i>R</i> ²	0.77	0.75	0.82	0.76	0.79	0.67	0.68	0.66	0.66	0.67	0.69

Note: ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table A15. Grohmann et al. – Financial literacy and account ownership – IV results

Description: Replication of Grohmann et al.’s IV regressions with the proportion of the population that have a bank account as the outcome variable. Numeracy in primary schools acts as the instrument. Column labels indicate which financial literacy indicator was used as the main independent variable and, when needed, sample size. *p*-values of robust standard errors are in parentheses.

Interpretation: Unlike in columns (1) and (2), Financial literacy is no longer significant for smaller samples and/or when using the alternative OECD/INFE and Big Three indicators.

	(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	1.88*** (0.01)	2.80*** (0.00)	0.74 (0.23)	0.96 (0.24)	2.31 (0.60)	555.03 (1.00)	6.81 (0.91)	95.43 (0.99)	52.89 (0.99)	-16.70 (0.97)	13.92 (0.96)
Log GDP p.c. (PPP)	2.69 (0.75)	-8.28 (0.47)	16.91* (0.10)	16.48 (0.14)	-54.66 (0.73)	-24002 (1.00)	-248.27 (0.92)	-5,064 (0.99)	-2,791.04 (0.99)	765.91 (0.97)	-502.18 (0.96)
Population share 15-64	1.06 (0.25)	2.31* (0.07)	-0.24 (0.75)	-0.41 (0.71)	1.02 (0.75)	-270.48 (1.00)	-3.65 (0.90)	-102.4 (0.99)	-58.46 (0.99)	8.76 (0.97)	-2.79 (0.95)
Secondary education	-0.09 (0.62)	-0.32 (0.23)	-0.44 (0.17)	0.06 (0.85)	0.04 (0.96)	261.42 (1.00)	2.82 (0.92)	49.70 (0.99)	26.52 (0.99)	-8.16 (0.97)	5.59 (0.96)
Tertiary education	-0.36* (0.06)	-0.71** (0.04)	-0.52** (0.03)	-0.28 (0.37)	-0.06 (0.94)	479.86 (1.00)	5.48 (0.92)	89.80 (0.99)	49.50 (0.99)	-15.59 (0.97)	11.31 (0.96)
Private credit to GDP	0.12** (0.02)	0.08 (0.36)	0.14** (0.01)	0.17** (0.05)	0.19 (0.52)	27.20 (1.00)	0.37 (0.90)	4.68 (0.99)	2.48 (0.99)	-0.57 (0.97)	0.69 (0.96)
Bank branches per 1000 sq. km	0.06 (0.30)	0.05 (0.63)	0.07 (0.31)	0.10 (0.35)	0.24 (0.55)	-14.05 (1.00)	-0.23 (0.93)	-2.81 (0.99)	-1.64 (0.99)	0.98 (0.97)	-0.51 (0.96)
Strength of legal rights index	-1.08 (0.30)	-2.76* (0.05)	-0.82 (0.56)	0.21 (0.80)	-3.31 (0.63)	-325.51 (1.00)	-1.03 (0.94)	-15.02 (0.99)	-8.19 (0.99)	8.24 (0.97)	-5.72 (0.96)
Ease of doing business	-0.05 (0.62)	-0.05 (0.75)	-0.27** (0.01)	-0.11 (0.51)	-0.39 (0.45)	-23.06 (1.00)	-0.18 (0.85)	-4.42 (0.99)	-2.65 (0.99)	0.79 (0.97)	-0.54 (0.95)
Constant	-96.14** (0.03)	-73.91 (0.33)	-68.17 (0.56)	-122.15 (0.27)	475.36 (0.70)	223431.9 (1.00)	2,385.59 (0.92)	51,115 (0.99)	28,404.7 (0.99)	-7,122.94 (0.97)	4,463.6 (0.96)
Observations	93	67	39	39	22	22	22	22	22	22	22
R ²	0.60	0.23	0.82	0.73	-0.37	.	.	.	.	.	.

Note: ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table A16. Grohmann et al. – Financial literacy and debit card ownership – IV results

Description: Replication of Grohmann et al.’s IV regressions with the proportion of the population that have a debit card as the outcome variable. Numeracy in primary schools acts as the instrument. Column labels indicate which financial literacy indicator was used as the main independent variable and, when needed, sample size. *p*-values of robust standard errors are in parentheses.

Interpretation: Same result as in Table A15: unlike in columns (1) and (2), Financial literacy is no longer significant for smaller samples and/or when using the alternative OECD/INFE and Big Three indicators.

	(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	1.64*** (0.00)	2.42*** (0.00)	0.85 (0.28)	1.09 (0.19)	0.52 (0.78)	125.01 (1.00)	1.53 (0.90)	21.49 (0.99)	11.91 (0.99)	-3.76 (0.97)	3.14 (0.96)
Log GDP p.c. (PPP)	6.23 (0.29)	0.40 (0.96)	15.06 (0.26)	14.57 (0.17)	22.17 (0.74)	-5,371 (1.00)	-21.44 (0.97)	-1,106 (0.99)	-594.15 (0.99)	206.98 (0.96)	-78.63 (0.97)
Population share 15-64	0.62 (0.39)	1.77 (0.11)	-1.28* (0.09)	-1.48 (0.20)	-2.49 (0.16)	-63.64 (1.00)	-3.55 (0.57)	-25.79 (0.99)	-15.89 (0.99)	-0.75 (0.99)	-3.35 (0.74)
Secondary education	-0.01 (0.95)	-0.14 (0.57)	-0.41 (0.32)	0.16 (0.64)	-0.30 (0.48)	58.57 (1.00)	0.33 (0.96)	10.89 (0.99)	5.67 (0.99)	-2.14 (0.96)	0.95 (0.97)
Tertiary education	-0.23 (0.21)	-0.58* (0.06)	-0.44 (0.17)	-0.16 (0.62)	-0.33 (0.38)	107.77 (1.00)	0.92 (0.93)	19.91 (0.99)	10.84 (0.99)	-3.83 (0.97)	2.23 (0.96)
Private credit to GDP	0.08* (0.09)	0.07 (0.36)	0.07 (0.40)	0.11 (0.23)	0.05 (0.76)	6.13 (1.00)	0.09 (0.89)	1.06 (0.99)	0.56 (0.99)	-0.13 (0.97)	0.16 (0.95)
Bank branches per 1000 sq. km	0.03 (0.60)	-0.01 (0.94)	0.05 (0.71)	0.08 (0.48)	0.02 (0.90)	-3.20 (1.00)	-0.09 (0.87)	-0.67 (0.99)	-0.40 (0.99)	0.19 (0.97)	-0.15 (0.95)
Strength of legal rights index	-1.16 (0.16)	-2.29** (0.03)	-1.05 (0.65)	0.13 (0.91)	0.17 (0.96)	-72.40 (1.00)	0.68 (0.82)	-2.47 (1.00)	-0.93 (1.00)	2.77 (0.95)	-0.38 (0.99)
Ease of doing business	-0.06 (0.47)	-0.01 (0.97)	-0.26 (0.12)	-0.08 (0.67)	0.02 (0.95)	-5.09 (1.00)	0.07 (0.76)	-0.89 (1.00)	-0.49 (0.99)	0.28 (0.96)	-0.02 (0.99)
Constant	-107.91*** (0.01)	-138.56** (0.01)	4.87 (0.97)	-56.91 (0.60)	4.22 (0.99)	50,221.00 (1.00)	434.46 (0.93)	11,409.99 (0.99)	6,294.79 (0.99)	-1,707.16 (0.97)	902.51 (0.96)
Observations	93	67	39	39	22	22	22	22	22	22	22
R ²	0.67	0.47	0.77	0.72	0.77	.	0.44	.	.	.	.

Note: ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table A17. Financial literacy and the proportion of population that saved at formal financial institution – IV results

Description: Replication of Grohmann et al.'s IV regressions with the proportion of the population that saved at a formal financial institution in the last year as the outcome variable. Numeracy in primary schools acts as the instrument. Column labels indicate which financial literacy indicator was used as the main independent variable and, when needed, sample size. *p*-values of robust standard errors are in parentheses.

Interpretation: With the exception of the S&P-26 sample, Financial literacy is significant when using S&P estimates, but insignificant using the alternative OECD/INFE and Big Three indicators.

	(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	1.12*** (0.01)	1.40** (0.01)	1.01** (0.03)	1.30 (0.15)	4.22 (0.48)	1,014.74 (1.00)	12.45 (0.92)	174.46 (0.99)	96.70 (0.99)	-30.53 (0.97)	25.46 (0.96)
Log GDP p.c. (PPP)	1.39 (0.77)	0.18 (0.98)	-2.36 (0.77)	-2.94 (0.81)	-123.6 (0.57)	-43906.7 (1.00)	-477.6 (0.92)	-9,282 (0.99)	-5,126.4 (0.99)	1,376.6 (0.97)	-942 (0.96)
Population share 15-64	-0.11 (0.85)	0.20 (0.80)	0.13 (0.82)	-0.11 (0.93)	1.55 (0.73)	-494.83 (1.00)	-6.99 (0.90)	-187. (0.99)	-107.19 (0.99)	15.70 (0.97)	-5.41 (0.95)
Secondary education	-0.04 (0.74)	-0.19 (0.28)	-0.20 (0.44)	0.48 (0.21)	0.37 (0.75)	478.23 (1.00)	5.46 (0.92)	91.15 (0.99)	48.77 (0.99)	-14.62 (0.97)	10.51 (0.96)
Tertiary education	-0.06 (0.69)	-0.26 (0.30)	-0.05 (0.79)	0.29 (0.45)	0.51 (0.69)	877.93 (1.00)	10.65 (0.92)	164.81 (0.99)	91.12 (0.99)	-27.88 (0.97)	21.30 (0.96)
Private credit to GDP	0.10** (0.01)	0.13*** (0.01)	0.22*** (0.00)	0.27*** (0.01)	0.41 (0.31)	49.80 (1.00)	0.75 (0.90)	8.63 (0.99)	4.59 (0.99)	-0.98 (0.97)	1.33 (0.95)
Bank branches per 1000 sq. km	0.07* (0.07)	0.07 (0.17)	0.09 (0.25)	0.13 (0.36)	0.31 (0.58)	-25.81 (1.00)	-0.55 (0.91)	-5.28 (0.99)	-3.13 (0.99)	1.65 (0.97)	-1.06 (0.96)
Strength of legal rights index	-0.49 (0.51)	-0.15 (0.85)	-0.93 (0.58)	0.46 (0.76)	-5.86 (0.55)	-594.92 (1.00)	-1.69 (0.95)	-27.27 (0.99)	-14.79 (0.99)	15.25 (0.97)	-10.27 (0.96)
Ease of doing business	-0.01 (0.85)	0.03 (0.72)	-0.08 (0.54)	0.14 (0.44)	-0.55 (0.44)	-42.00 (1.00)	-0.17 (0.93)	-7.92 (0.99)	-4.69 (0.99)	1.61 (0.97)	-0.83 (0.96)
Constant	-25.67 (0.35)	-38.90 (0.32)	5.80 (0.95)	-67.47 (0.65)	976.04 (0.57)	408598 (1.00)	4,468.43 (0.92)	93,559 (0.99)	52,038.1 (0.99)	-12915.6 (0.97)	8,267.6 (0.96)
Observations	93	67	39	39	22	22	22	22	22	22	22
R ²	0.64	0.58	0.74	0.25	.	.	.	.	.	.	.

Note: ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table A18. Financial literacy and proportion of population that used debit card in the last year – IV results

Description: Replication of Grohmann et al.'s IV regressions with the proportion of the population that used a debit card in the last year as the outcome variable. Numeracy in primary schools acts as the instrument. Column labels indicate which financial literacy indicator was used as the main independent variable and, when needed, sample size. *p*-values of robust standard errors are in parentheses.

Interpretation: Unlike in columns (1) and (2), financial literacy is no longer significant for smaller samples nor when using the Big Three indicator. It is significant at 10% when use the OECD/INFE metric.

	(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	1.63*** (0.00)	2.28*** (0.00)	1.40 (0.11)	1.81* (0.08)	-2.53 (0.65)	-608.53 (1.00)	-7.47 (0.92)	-104.62 (0.99)	-57.99 (0.99)	18.31 (0.97)	-15.27 (0.96)
Log GDP p.c. (PPP)	5.52 (0.28)	2.09 (0.79)	3.71 (0.79)	2.90 (0.82)	152.54 (0.47)	26,408.8 (1.00)	364.82 (0.91)	5,644.8 (0.99)	3,152.7 (0.99)	-747.12 (0.97)	643.19 (0.96)
Population share 15-64	0.33 (0.66)	1.37 (0.23)	-1.97** (0.01)	-2.30 (0.15)	-4.07 (0.48)	293.60 (1.00)	1.05 (0.98)	109.32 (0.99)	61.14 (0.99)	-12.56 (0.96)	0.10 (1.00)
Secondary education	-0.02 (0.90)	-0.12 (0.61)	-0.42 (0.32)	0.52 (0.23)	-1.00 (0.54)	-287.57 (1.00)	-4.05 (0.91)	-55.44 (0.99)	-30.03 (0.99)	7.99 (0.97)	-7.08 (0.96)
Tertiary education	0.03 (0.87)	-0.30 (0.32)	-0.23 (0.45)	0.23 (0.54)	-0.87 (0.55)	-527.04 (1.00)	-6.95 (0.92)	-99.39 (0.99)	-55.20 (0.99)	16.16 (0.97)	-13.33 (0.96)
Private credit to GDP	0.03 (0.47)	-0.00 (0.98)	0.01 (0.94)	0.07 (0.59)	-0.30 (0.54)	-29.92 (1.00)	-0.50 (0.90)	-5.22 (0.99)	-2.81 (0.99)	0.54 (0.97)	-0.85 (0.95)
Bank branches per 1000 sq. km	0.02 (0.78)	0.01 (0.92)	0.07 (0.62)	0.12 (0.45)	-0.34 (0.53)	15.33 (1.00)	0.18 (0.95)	3.02 (0.99)	1.73 (0.99)	-1.14 (0.96)	0.49 (0.97)
Strength of legal rights index	-0.61 (0.45)	-1.19 (0.24)	-1.83 (0.49)	0.10 (0.94)	4.73 (0.66)	357.98 (1.00)	2.23 (0.90)	17.57 (0.99)	10.08 (0.99)	-7.94 (0.97)	7.37 (0.96)
Ease of doing business	-0.04 (0.68)	-0.00 (0.98)	-0.35* (0.06)	-0.04 (0.86)	0.26 (0.73)	25.12 (1.00)	0.03 (0.98)	4.68 (0.99)	2.74 (0.99)	-1.03 (0.96)	0.43 (0.97)
Constant	-99.82** (0.03)	-144.5** (0.02)	136.49 (0.39)	34.60 (0.82)	-1,035 (0.50)	-2.45e+05 (1.00)	-3,129.3 (0.92)	-56556 (0.99)	-31656 (0.99)	7,295.67 (0.97)	-5,408 (0.96)
Observations	93	67	39	39	22	22	22	22	22	22	22
<i>R</i> ²	0.66	0.55	0.78	0.55

Note: ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

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