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Does Financial Literacy Improve Financial Inclusion? Cross Country Evidence

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Does Financial Literacy Improve Financial Inclusion? Cross Country Evidence

Antonia Grohmann, Theres Klühs and Lukas Menkhoff

Abstract

We study the effect of financial literacy on financial inclusion at the cross country level. Inclusion is proxied by two measures of access to finance and two measures of use of financial services. We find that financial literacy is always strongly related to higher financial inclusion and that IV-regressions support a causal interpretation. We further study the heterogeneous effects of financial literacy across countries and show that the average marginal effect of financial literacy on financial inclusion tends to be largest in countries with lower income, a less developed financial sector, and fewer bank branches.

JEL-Classification: G21 (banks), O1 (economic development), E44 (financial markets and the macroeconomy)

Keywords: financial literacy, financial inclusion, financial institutions, financial development

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Does Financial Literacy Improve Financial Inclusion? Cross Country Evidence

1 Introduction

Financial inclusion, measured as access to financial services and use of financial services, is an important goal of economic and, in particular, financial development. It is hence of high interest for policy makers to learn about drivers of financial inclusion and how these can be influenced by national policies. Research at the country level so far documents the state of access to financial services (Beck et al., 2007) and shows that financial inclusion is related to country characteristics, such as low costs for financial accounts, physical proximity of financial institutions or a strong legal system (Allen et al., 2016).

Thus, country studies on financial inclusion so far focus on the supply side of financial markets. However, shouldn't financial development consider more than the various aspects of financial infrastructure? Which role does the demand side play? It seems plausible that functioning financial markets do not only need good infrastructure but also informed customers, i.e. customers with a higher degree of financial literacy. Informed customers make better financial decisions for themselves and their businesses, they support the effectiveness of the financial system by demanding more sophisticated financial services and they will demand financial inclusion.

Despite this almost natural line of argument, we provide the first empirical study at the country level examining the relation between financial literacy and financial inclusion. This has become possible due to a new dataset documenting the degree of financial literacy for 143 countries as described in Klapper et al. (2015). This novel data complements the World Bank's Findex data on the access to and use of financial services (Demirguc-Kunt and Klapper, 2013), and, of course, earlier data on financial and institutional country characteristics. These new data allow us to contribute to the literature on financial inclusion in three ways:

First, we find that higher financial literacy is related to better financial inclusion at the country level. We establish this relation for four measures of financial inclusion. These relations are quite robust and hold when controlling for various kinds of country characteristics, including standard variables of financial infrastructure which represent the supply-side of financial markets. While a few micro-based studies, such as Cole et al. (2011), Doi et al. (2014), and Jamison et al. (2014), hint at this desired role of financial literacy for

financial inclusion, these studies are typically quite specific in their design. Thus, the cross-country approach has a different external validity and can better capture potential general equilibrium effects of this relation. Moreover, a cross-country analysis can easily observe institutional variation and their interaction with financial literacy. Overall, the cross-country study provides new evidence complementing what we know from micro-studies.

Second, we provide evidence that financial literacy has a causal impact on financial inclusion. While a causal relationship running from financial literacy to financial inclusion seems natural, the available data is cross-sectional. It is possible that people that live in countries that have a more developed financial system learn more about finance through their greater use of financial services. At the same time, there might be unobserved factors that influence both, the level of financial literacy within that country and access to financial services. In order to tackle these problems we apply an instrumental variable approach allowing for causal inference.

We use the level of numeracy of primary school children as an instrument. This data has been made available by the EDSTAT initiative, which makes several cross country education studies comparable. As numeracy is a precondition for financial literacy, numeracy and financial literacy are highly correlated. Countries that have high numeracy rates in primary school are also likely to have higher financial literacy. It is unlikely that numeracy of primary school children has a direct effect on financial inclusion other than that through financial literacy.

Third, studying the heterogeneous effect of financial literacy across countries and institutional backgrounds, we find that the effect of financial literacy is larger in less economically and financially developed countries. Our analysis shows that financial literacy has a larger average marginal effect on *access* to financial services in countries with below average GDP per capita and below average financial depth. The average marginal effect of financial literacy on our measures of *use* of financial services, on the other hand, is higher at high levels of GDP per capital and financial depth.

The interlinkages between financial literacy and physical financial access are also interesting: the average marginal effect of financial literacy is constant for all levels of bank branch penetrations. This applies to financial inclusion as well as to use of financial services.

We further test whether high levels of financial literacy are more important for some parts of the population than others. We run the original regressions again, but using the financial literacy level of the lowest 40% and highest 60% in separate regressions. We also run all regressions using financial literacy of men and women. Interestingly, there is no

significant difference between the effects for richer versus poorer parts of the populations. There is only a small difference in the effect of women's and men's financial literacy that is significant at 10% for two of our outcome variables only.

Literature. Our research is related to three strands of literature, i.e. on (i) financial inclusion at the country level, (ii) financial inclusion in micro studies and (iii) financial literacy. (i) Recent studies measure and explain financial access as a measure of outreach and inclusion. Beck et al. (2007) present a dataset designed to measure financial outreach by looking at both elements of physical access to banking infrastructure and deposit and credit use per capita. They show that these measures of financial access are not determined by the same indicators as financial depth (see Levine et al., 2000). Neither religion nor (French) legal origin (LaPorta et al., 1998) are significantly correlated with these variables.

When researching the barriers to financial inclusion, a number of supply side factors have been studied. Factors such as high transaction costs, uncertainty, asymmetric information or a lack of physical access are often discussed as hindering efficient use of financial services (Aghion and Morduch, 2005, Karlan and Murdoch, 2009). Hence these are supply-side reasons why formal banks and other financial institutions may not give credit or offer a savings account to clients.

(ii) The findings from cross-country studies are largely supported by a number of micro-studies that assess the causes of financial inclusion by looking at the individual or household level via surveys or by running a randomized control trial. In a combined approach, Allen et al. (2016) show that women, the poor and those living in rural areas tend to be financially excluded. Further, a growing body of evidence suggests that providing access to bank accounts increases take-up rates of these accounts, household savings, labor market activity and income (e.g. Burgess and Pande, 2005; Ashraf et al., 2010; Dupas and Robinson, 2013; Bruhn and Love, 2014). While also Cole et al. (2011) find that subsidized bank accounts have a positive effect on bank account take up, even very short financial literacy trainings can have a (smaller) desired effect, in particular for poor households.

A few studies question strong results. Prina (2015) finds that providing zero cost bank accounts and prevalence of local banks increase take up of these bank accounts, but the author finds no effect on asset accumulation. Dupas et al. (2016) present evidence from Chile, Malawi, and Uganda to show that providing only basic bank accounts does not result in significantly higher savings or other downstream outcomes.

(iii) Studies on financial literacy typically examine the relationship between financial literacy and good financial decision making, based on household surveys during which

respondents' financial literacy is tested using a number of multiple choice questions. Essentially, these studies show that participants with high financial literacy make better financial decisions, such as improving retirement savings (Lusardi and Mitchell, 2008, Skimmyhorn, 2016), stock holding (van Rooij et al., 2011), wealth (van Rooij et al., 2012), micro-entrepreneurs' financial practices (Drexler et al., 2014), investment decisions (Guiso and Viviano, 2015), and proper debt taking (Lusardi and Tufano, 2015).

Desired effects, of course, also include financial inclusion. For example, Jamison et al. (2014) report positive effects of financial education on savings accumulation. The advantage of these micro-based studies is their clear identification, ensuring that indeed an increase in financial literacy improves financial behavior (e.g., Fernandes et al., 2014; Kaiser and Menkhoff, 2016).

The only study we are aware of, which analyzed "economic literacy" in a cross-country setting is Jappelli (2010). While he shows several interesting relations, he does not study financial inclusion. Thus, summarizing the state of the literature, we add to it by looking at financial literacy and financial inclusion on a cross country basis.

Our study proceeds with five sections: Section 2 describes the empirical approach and data, Section 3 provides main results and extended results are shown in Section 4. Robustness checks are documented in Section 5 and conclusions in Section 6.

2 Empirical approach and data

This section provides information about the foundations of our empirical study. Section 2.1 introduces the methods used, Section 2.2 documents the data and their definitions and Section 2.3 gives descriptive statistics.

2.1 Method

This research aims to explain financial inclusion by a demand side variable, i.e. financial literacy, together with the supply of financial services. The most prominent measure of financial inclusion that is studied in the literature (as LHS-variable) is "having a bank account". Among the RHS variables, the demand for financial services is the degree of financial literacy, while supply of financial services is measured by variables such as the size of the financial sector, strength of legal rights or branches per square km. These supply-side variables have been previously analyzed in the literature on financial inclusion (Allen et al, 2016).

We start our analysis with a simple OLS regression (with robust standard errors) in order to ease interpretation. We also use fractional response regressions and show the results in the robustness section. This simple OLS regression takes the following form:

$$Y = \beta_1 FL + \beta_2 X + u$$

Our main variable of interest is FL, the level of financial literacy in a country. X is a matrix of country and institutional specific control variables, details of which are discussed in the data section below.

The regression above may suffer from endogeneity problems, which would lead to biased regression results. It is possible that the availability and use of financial services in a country provides training for the general population in financial affairs which may improve financial literacy. At the same time, unobserved variable bias may lead to biased results that falsely indicate a positive relationship between the level of financial literacy in the population and the level of financial inclusion. In order to test whether the relationship between financial literacy and financial inclusion is causal we employ an instrumental variables approach. To do this, we need an instrument that is highly correlated with financial literacy, but at the same time has no direct effect on the outcome variable.

We here use the quality of mathematics education in primary school as instrumental variable. This is measured by the EDSTAT data (see Angrist et al., 2013, for details of data generation). This dataset makes educational achievement test scores comparable for a larger number of countries. Studies that are designed to test international achievements such as the PISA or the TIMSS survey, usually do not include many developing countries. Fortunately, Angrist et al. (2013) also include countries that are only part of regional educational comparisons survey such as the LLECE, which covers countries in Latin America. Similarly, the SACMEQ only covers countries in Africa. The authors anchor these international and regional surveys to the US in order to make them comparable.

There is, however, still the problem in this data that numeracy scores in primary school are not available for all countries. In this case we impute numeracy scores in primary school using numeracy scores in secondary school. If this information was also not available, we record the data point as missing. Hence our sample size, covering 93 countries, is smaller for the instrumental variable regression than for the OLS regression.

In this paper we specifically look at numerical achievement of primary school children, as the kind of numerical skills that provide the foundations of good financial literacy are quite basic and are learned early on. It is highly likely that if the population of a country has good foundations of numeracy that it will also have higher levels of financial literacy.

It is, however, very unlikely that the numeracy skills of primary school children will have a direct effect on financial inclusion that does not work through financial literacy. Children in primary school are not yet legally allowed to make financial decisions and indeed the indicators that we use in our regression measure financial inclusion by only looking at the population above the age of 15. Microeconomic studies on financial literacy have shown that financial literacy is a very specific type of skill that is not synonymous with general education. We, therefore, argue that basic numeracy has an effect on financial literacy that improves financial literacy directly and so influences financial inclusion. It has a different effect on financial inclusion than general education.

Indeed, good numeracy (Sekita, 2011) and education dedicated to economics (van Rooij et al., 2012) have been used in microdata studies on financial literacy to instrument for financial literacy. In comparison to these studies which use microdata, looking at the population in general, rather than at the mathematical ability of the same individual, makes it even more likely that the exclusion restriction is satisfied.

2.2 Data

The data needed for our research result from the above sketched approach and contain six groups of variables: (i) financial literacy, financial inclusion measured as (ii) access to finance and (iii) use of financial services, and three groups of country control variables, i.e. (iv) general country characteristics, (v) financial infrastructure of a country and (vi) institutional country characteristics.

Financial literacy. The variable “financial literacy” is made up by four survey items. These survey items are collected by Gallup, together with the World Bank, and the Global Financial Literacy Center in a representative survey of more than 1,000 adults per country in 143 countries of the world in 2014. The items ask one question on three subjects and two questions on one subject, i.e. risk diversification, inflation, interest rate and interest compounding. The financial literacy score which is used here is a dummy variable, giving a “1” if questions on at least three out of four financial literacy concepts are correctly answered by a person. The score per country is the proportion of 1,000 people asked that could answer questions on three out of four concepts correctly.

These, and small variations, of these questions have been commonly used in the literature to measure financial literacy. They have been used in a large number of microeconomic studies in a large number of countries, previously to having been used by Gallup (Lusardi and Mitchell, 2014, Xu and Zia, 2012).

Access to finance. We measure financial inclusion by studying four different outcome variables. First, we look at the proportion of the population that has a simple bank account at a formal financial institution, including mobile money accounts. Having a bank account is the basis for a large number of financial transactions. Having a bank account makes holding and handling money easier and safer. This is a simple measure of access to financial services and has been used in a large number of studies (e.g., Karlan and Murdoch, 2009, Brune et al., 2016). It measures the most basic form of financial inclusion. In addition, we consider one more measure of access to financial inclusion: that is the proportion of adults in a country that has a debit card. Having a debit card is a more sophisticated form of financial inclusion than simply having a bank account. At the same time, having a debit card is clearly beneficial to those that hold it. It is both a more convenient and safer form of payment than cash. We expect these two measures of financial inclusion to be positively affected by financial literacy, as a good level of financial knowledge is needed to obtain sophisticated financial decisions.

Use of financial services. Furthermore, we also look at two variables that are designed to measure use of financial services rather than just simple access to financial services. The first variable is the proportion of respondents that use a bank account to save. Saving at a formal institution is beneficial for bank customers for safety. It can also play an important role in impulse control, as money is not being stored in an available form. Higher use of bank account, for example, has been shown to lower corruption in a country (Altunbas and Thornton, 2012). Lastly, we also study the use of debit cards, as the benefits from debit cards can only really be reaped if they are used. Our fourth outcome variable is therefore, the proportion of the population that used a debit card during the last year.

General country characteristics. To get a meaningful result about the relationship between financial literacy and financial inclusion, we control for a set of variables that have been shown to be related to financial literacy in a large number of micro studies (Lusardi and Mitchell, 2014). Summary statistics, as well as variable descriptions are shown in [Table A1](#) in the Appendix. These can be grouped into three: country compositional characteristics that include the log of GDP per capita to control for income levels and the proportion of the population that is between 15 and 64 and so working age. We use a measure of educational attainment in the country in the form of the proportion of people that have completed secondary or tertiary education.

Financial infrastructure. The next group of variables are financial characteristics of a country, here we control for variables that measure the depth and breadth of the financial system. We include private credit to GDP ratio as a measure of financial depth and so

financial sector development. Further, we control for a variable that measures physical access to financial services: bank branch penetration per 1000 km².

Institutional characteristics. In explaining financial inclusion further we follow Allen et al. (2016) and use two variables that can be considered to measure country institutional characteristics that are robustly significant in their study. These are the strength of legal rights index, which measures the legal protection of borrowers and lenders in the country. We also include the ease of doing business index. This variable controls for how easy it is for a firm to operate in a country. In robustness checks, we also control for further variables which have been suggested in the literature. Correlations between the control variables are given in [Table A2](#). All the data used in this study take the 2014 values.

2.3 Descriptive statistics

The descriptive statistics about the main explanatory variable, i.e. “financial literacy”, is provided in Panel A of Table 1. The variable is measured as a score over four items. The average score of the world is an unweighted average across all countries, which is 36.6. That means less than 37% of the survey participants provided three or four correct answers on four items capturing the dimensions of financial literacy. We also include an average that has been weighted by the population and that is even lower: 32% are considered financially literate.

<Table 1 about here>

However, there is enormous heterogeneity. The score per country varies between 13% and 71%. Of course, there are some patterns in this data to be expected from the literature (Lusardi and Mitchell, 2014). The score of financial literacy is higher in richer countries as can be seen from the World Bank classification of countries according to income groups. This applies to each of the questions (Figure 1). It is noticeable, that the average score is almost the same for lower middle and upper middle income countries on two of the questions. People in low income countries do better than middle income countries in a few cases. Only the high income countries have a significantly higher average score for all questions. Moreover, income is related to financial literacy within countries. The richer 60% of adults have an 8 percentage points higher degree of financial literacy than the poorest 40% on average, which means their degree of financial literacy is 25% higher than that of the poorer population. Finally, the degree of financial literacy of men is 6.5% percentage points higher than that of women on average.

<Figure 1 about here>

Regarding the indicators which measure financial access, Panel B of Table 1 provides descriptive statistics. In our sample, 54.5% of all adults being captured by the survey have a simple bank account. This is slightly higher when looking at the average weighted by population size. Here 58.6% of the population has a bank account. The variation across countries is even larger than for financial literacy, as it ranges from 2% to 100%, indicating that the broad population – in the extreme country cases – does either have hardly any account access or basically everyone has an account. As a second indicator for financial access we choose a more advanced product, i.e. owning a “debit card”. This applies to 39.5% (or 37.8% weighted by population) of the world population, with a range from 0% to 99%.

In addition to having specific financial products, such as an account, the literature also measures the use of these specific financial products. Our first indicator here is “saved at a financial institution last year” which applies to 22.6% of the covered population and 25.33% when weighted. Finally, the last indicator is “debit card used in the last year” which 28.4% of respondents that hold a debit card agree to.

Overall, we see that just over half of the world population has access to a formal financial account and even fewer hold a more sophisticated debit card. The numbers of people that actively use a financial product is even lower.

3 Baseline results

For the baseline results we add financial literacy as an explanatory variable to a set of other potential (rather supply-side) determinants explaining financial inclusion. Results are presented according to the main measures of financial inclusion, i.e. access to formal financial services (Section 3.1) and the use of this access (Section 3.2).

3.1 Access to financial services

We start our analysis by examining the most basic measure of financial inclusion – the proportion of the population that has a bank account. This is a standard measure for access to financial services. To explain account penetration, we control for the three sets of variables described above: country composition characteristics, financial and institutional characteristics. Finally, we include financial literacy as defined above. In addition to simple account ownership, we also look at the proportion of the population that has a debit card. This takes our analysis one step further, by not simply looking at the “banked” population, but also at use of more sophisticated financial services.

Results on the relationship between country financial literacy levels and our two measures of financial inclusion are shown in Table 2. The OLS regression between financial literacy and the proportion of the population that has a formal account is provided in column (1) of Table 2. The regression shows a positive and significant relationship between financial literacy and the proportion of the population that has a bank account. Alongside financial literacy log GDP per capita and private credit to GDP have a positive and significant effect on bank account ownership, showing that there is a significant positive relationship between financial depth and financial inclusion.

<Table 2 about here>

As discussed above, it is likely that the OLS regression suffers from reverse causality or endogeneity issues caused by unobserved variable bias. Hence, we repeat this using an IV-regression with the quality of numeracy education in primary school as an instrument. Column (2) shows that the positive and significant relationship between the level of financial literacy and the proportion that has access to a bank remains and even gets larger when we re-estimate the regression in column (1). First stage regression results are shown in [Table A3](#) in the Appendix. F-statistics for weak instruments of 9.67 show that the instrument is valid.

In columns (3) and (4) we run the same regressions, but this time explaining the proportion of the population that has a debit card as the outcome variable. We find the same pattern. There is a large and significant effect of financial literacy on the proportion of the population that has a debit card. This effect again gets larger when we use the IV approach instead of a simple OLS regression. Financial depth is now the only other significant variable in the regression.

These results provide clear evidence that the demand side, in the form of financial literacy, also plays a large role when it comes to understanding access to finance. The IV-results show that the observed effect is not due to reverse causality, nor is it caused by unobserved variable bias.

3.2 Use of financial services

In this section we will go one step further and not just study the effect of financial literacy on having a certain financial product, but analyze the effect of financial literacy on using that product. We here consider two different types of use of financial products. First, we study the proportion of the general population that has saved at a formal financial institution. Lastly, we study the proportions of a population that have used their debit card during the last year. Results are shown in Table 3.

<Table 3 about here>

Columns (1) and (2) study the link between the proportion of the population that is financially literate and the proportion that has saved in a formal financial institution. Column (1) shows that in countries where more people are financially literate, more people saved at a formal financial institution. Again the coefficient on financial literacy becomes considerably larger if we use the instrumental variable regression with the quality of math education in primary school as an instrument for financial literacy. This regression also shows that financial depth measured as the ratio of private credit to GDP as well as log GDP per capita are positively correlated with the proportion that has saved at a formal financial institution.

Lastly, we study the relationship between the financial literacy level and debit card use in the last year. As before, there is a significant effect of financial literacy and the proportion of the population that deposited money during the last year. It is interesting that the effect of financial literacy on debit card use within the last year is larger than on savings. This may suggest that financial literacy is even more important when it comes to improving use of more sophisticated financial products. The effect of financial literacy is again confirmed in the IV regression. Other than in the previous regressions, financial depth has no significant relationship with debit card use during the last year. This indicates that financial depth as a supply side factor may be less important in explaining use of debit cards than demand side factors.

Overall, the regressions above confirm, on a country level, findings based on microdata that show that people with higher financial literacy have better access to financial services (Cole et al., 2011; Doi et al., 2014; Drexler et al., 2014; Jamison et al., 2014). The difference here is that we are able to control for a number of institutional variables, which is typically impossible in a study based on microeconomic data. The question that leads on from here is: what is the role of different institutional and financial backgrounds? Is an improvement in financial literacy by the general population more effective in some institutional settings than in others?

4 Results on interaction between financial literacy and country institutions

In order to address the role of institutions for the impact of financial literacy on financial inclusion in more detail we proceed in three steps. We analyze the interaction of financial literacy and different levels of GDP per capita (Section 4.1). We relate financial literacy and financial sector development (Section 4.2). Lastly, we study how financial literacy interacts with different population groups (Section 4.3).

4.1 Financial literacy and different GDP levels

It is likely that financial literacy works differently in countries with different levels of GDP per capita. We expect that the relationship between financial literacy and access to financial services will be stronger for lower income countries. There are several reasons that make us form this hypothesis. First, on an individual level as well as in our descriptive statistics we can see that high income is correlated with high financial literacy. There may hence be less variation in financial literacy. Kaiser and Menkhoff (2016), indeed, also find that financial literacy trainings are less effective when baseline levels of financial literacy are high. At the same time, as we are here looking at simple financial services, access and use of financial services is already fairly high in higher income countries, there is therefore less “room for improvement”. For these reasons we expect the marginal effect of financial literacy to be higher in low GDP per capita countries.

In order to test if a larger proportion of the population being financially literate has heterogeneous effects depending on the income level of the population, we introduce an interaction term between financial literacy and GDP per capita in the regressions described above. Table 4 shows results of OLS regressions that include the interaction term. The outcome variables are the same as above. Columns (1) and (2) show results for access to finance, whereas columns (3) to (4) show the results for use of financial services. The dependent variables in the table were centered and hence the interaction term shows the effect of an increase in financial literacy at the mean GDP per capita. To increase clarity and give the effect of a change in financial literacy at all levels of GDP per capita we include figures that show the average marginal effect of financial literacy at each level of GDP. These can be seen in Figure 3 – there is one picture for each outcome variable.

<Table 4 about here>

<Figure 3 about here>

Table 4 and Figure 3 demonstrate that increasing the level of financial literacy in the population would have the strongest effect on account ownership in countries that have lower levels of GDP per capita, as hypothesized above. Increasing financial literacy would have the largest marginal effect on account ownership at levels of GDP per capita below the mean. The interaction term between financial literacy and log GDP per capita is negative but not significant, indicating that the effect of financial literacy on debit card ownership is similar at different levels of GDP.

Interestingly, the interaction between financial literacy and our measures of use of financial services is positive rather than negative, as Table 4 shows. Further, Figure 3 clearly shows that the average marginal effect of financial literacy is higher at higher levels of GDP. This pattern can also be seen when looking at the proportion that has used a debit card during the last year.

In this section we learn that increasing the level of financial literacy in the population has heterogeneous effects for countries with different levels of GDP per capita. Interestingly, the effect of increasing financial literacy on access to finance would have the largest effect in countries with low levels of GDP per capita. The effect of increased financial literacy on use of financial services, however, is larger at higher levels of GDP per capita.

4.2 Financial literacy and different financial institutions

We here study the institutional conditions under which an increase in financial literacy would lead to an increase in access and use of financial services. We start this analysis by looking at the interaction between financial depth as measured by the ratio of private credit to GDP. As above we include an interaction term between financial literacy and private credit to GDP into the regression (Table 5) and also show the average marginal effect graphically in Figure 4.

<Table 5 about here>

<Figure 4 about here>

The results show 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. These results do not show a significant difference in the marginal effect of financial literacy on the proportion of the population that has a debit card. As in Section 4.1 the interactions between financial literacy and private credit to GDP ratio are positive for both our measures of financial service use. The average marginal effect of financial literacy on savings at a formal financial institution is higher in countries that have higher private capital to GDP ratios. These results show that increasing financial literacy in a population would increase account ownership, and the effect is largest in countries with low levels of financial depth. On the other hand, the average marginal effects of increasing financial literacy on the use of financial services in the form of savings at a formal financial institutions and use of debit cards are highest in countries that have high levels of financial depth.

In a next step we look at the interaction between financial literacy and physical access to financial services. We do this by introducing an interaction term between financial literacy

and bank branch penetration into our regressions. The results are shown in Table 6. Graphical presentations of the average marginal effects of financial literacy at different levels of bank branch are shown in Figure 5.

<Table 6 about here>

<Figure 5 about here>

The patterns that we see in these regressions are different from the patterns that we find above. The interaction term between financial literacy and bank branch penetration is negative for bank account ownership and having used a debit card, and positive for owning a debit card and having saved at a formal financial institution. The coefficients on the interaction terms, however, are not significant. This shows that the average marginal effect of financial literacy is constant for all levels of bank branch penetration.

4.3 Financial literacy and different groups of people

In the last part of our analysis we test whether the link between financial literacy and financial inclusion is stronger for certain groups of the population than for other population groups. To do this we use data that show the proportion of the poorest 40% and richest 60% of the country that can answer questions on three out of four financial literacy concepts correctly. As the outcome variable we use respective measures of financial inclusion, i.e. also of the poorest 40% and richest 60% of the population. We rerun the regressions above, but this time broken down by within country income groups. Results are presented in Table 7. They show that the coefficient on the level of financial literacy of the richest 60% is larger than the coefficient on the level of financial literacy of the poorest 40% of the population. This cautiously indicates that the link between financial literacy and financial inclusion is tentatively stronger for the richer part of the population. However, when we test the difference between the coefficients, there is no significant difference between the two regression coefficients.

<Table 7 about here>

We perform the same exercise for the proportion of men and women who are financially literate and for the proportion of men and women who own and use different financial products. Results are shown in Table 8. Here we can see that the coefficient of the proportion of women who are financially literate is consistently and considerably larger than the coefficient on the proportion of men who are financially literate. However, difference in coefficients between men and women is only significant for owning a debit card and for saving at a formal financial institution, and only significant at a 10% level.

<Table 8 about here>

5 Robustness

We here test whether (i) looking at the effect of financial literacy on inclusion with respect to borrowing, (ii) adding political risk, ATM penetration and cost of bank account as further control variables, (iii) using disaggregated financial literacy items as variables of interest, (iv) applying fractional response regressions, (iv) modifying the definition of income, or (v) performing placebo IV first stage regressions, change the main result.

Financial literacy and borrowing. In this study we deliberately focus on the relationship of financial literacy and financial inclusion on the asset side of the balance sheet. As it is harder to determine the desired level of financial inclusion on the borrowing side, we do not study this form of inclusion in the main text (Schicks, 2014). However, we look at the relationship between inclusion w.r.t to borrowing and financial literacy here, by running our regressions with the proportion of the population that borrowed from a formal financial institution, the proportion that borrowed from an informal financial institution and the proportion that has used a credit card with in the last year. Results for OLS and IV regressions are presented in [Table A4](#). The results confirm the link between financial literacy and financial inclusion, also on the borrowing side: There is no significant relationship between financial literacy and borrowing at a formal financial institution. There is however a negative and significant relationship between financial literacy and the proportion that borrowed from an informal financial institution, indicating that there is a link between financial literacy and financial inclusion on the borrowing side. Lastly, the link between financial literacy and the proportion that used a credit card in the last year is positive and significant. All the OLS results are confirmed by the IV regressions.

Considering other control variables. Although, we already control for a number of variables in our main regression, we here expand the number of control variables and see if our results still hold. The results of the exercise are shown in [Table A5](#) for account ownership as the outcome variable. First, we introduce a political risk index into the regressions. This considerably reduces the sample size. The relationship between financial literacy and account ownership remains significant. Next, we introduce ATMs per km², as an additional measure of physical access to finance into the regressions; again the coefficient on the relationship between financial literacy and account ownership remains positive and significant.

Fees levied on holding and using financial products constitute barriers to accessing finance. In fact, data from the Micro Findex data base (World Bank) show that 29% of

respondents without a bank account state the high costs hindering them to acquire one. Thus, we consider the annual cost of checking accounts as additional control variable in our OLS regressions. As we did not get access to more recent World Bank data, as a second-best approach we use data presented in Beck et al. (2008) that are available for 68 countries and were collected in 2004. In order to enlarge the sample size, we impute the cost data for 43 other countries by estimating the annual fees of a checking account with the following explanatory variables: the share of population above 15 years and financial institutional variables such as private credit to GDP, bank return on assets, and bank return on equity.

Using this information as proxy for the cost of financial services and products, we re-run the OLS regressions. The results are shown in Table A5 column (4). Notably, there is no great difference in the point estimate or significance level of financial literacy compared to the regressions run without the cost data.

Column (5) shows results from regressions only with countries for which the original bank account cost data by Beck et al. (2008) are available. The sample size shrinks in these estimations and so the significant effect of financial literacy on the financial access variables is reduced to the 10% level. It is worth noting that fees paid for the checking account do not have a significant effect on financial inclusion in either specification. Further, running the regressions without the cost variable but with the decreased sample size still yields non-significant effects of financial literacy. Hence, we conclude that the missing effects of financial literacy are due to the specific small sample and are not related to the inclusion of a bank account cost covariate. We here only show the results for the regressions explaining account ownership, we did perform this exercise with all outcome variables and found similar results. Financial literacy remains significant, also when controlling for additional variables.

These checks make us confident to say that the cost of financial products should not be neglected in such estimations, however, financial literacy, nevertheless, remains to have a distinct effect on financial inclusion (detailed results upon request).

Disaggregating financial literacy. As already mentioned, the variable of interest, financial literacy, depicts the share of a country's population that is able to answer 3 out of 4 financial literacy topics correctly. Disaggregating this measure and inserting the actual shares of correctly answered risk diversification, inflation, interest and interest compounding questions as explanatory variables, and running the OLS regression lets us disentangle which field of knowledge is most important in supporting financial access and financial use. At the same time, these measures set a lower standard of financial literacy, than the rather harsh cut off of being able to answer questions on four out of five concepts. Considering that

multicollinearity could endanger the results, we calculated the variance inflation factor for each of the explanatory variables and find that it never exceeds 10. Based on this rule of thumb, we rule out multicollinearity in our case.

We find that there is no clear pattern about knowledge on a single financial literacy concept affecting financial access or use more than others. Rather, knowledge about interest rates influences the share of people that have an account or a debit card positively whereas knowledge on inflation or interest compounding does not change the share of people with financial access. The financial use variables are also affected differently by the disaggregated financial literacy measures: Knowledge on interest compounding has a highly significant effect on saving at a formal financial institution which hints to the conclusion that more sophisticated financial products may require more sophisticated financial knowledge. On the contrary, using a debit card is affected significantly and positively by financial literacy on risk. Regression results are available upon request.

Fractional response regressions. All our dependent variables reflect proportions of aggregated binary outcome questions. Papke and Wooldridge (1996) propose functional forms for regressions with such fractional variables that take into account their specific discrete characteristics. Thus, in order to check for the validity of the OLS results, we run probit regressions considering the fractional response nature of the data. [Table A6](#) presents the marginal effects regarding the financial access and use variables and shows that they are similar in magnitude to the OLS results discussed earlier. Countries with a higher level of financial literacy have higher access to and higher use of financial products. Furthermore, higher financial depth affects access to accounts, owning a debit card and saving at formal financial institutions positively and significantly.

Applying different income definitions. In our standard regression specification, we use log GDP per capita in PPP constant 2011 international US-dollars as the measure of income. As expected, repeating this exercise with other income definitions such as GNI per capita (as it is used by the World Bank for the derivations of its country classifications) does not change the results significantly. Rather, the size of the effect of financial literacy on the respective access and use measures is higher in the OLS regressions.

Placebo IV regressions. It could be argued that numeracy levels of primary school children are not a suitable instrument for financial literacy. The exclusion restriction could potentially be violated. One could imagine that certain types of government, for example, are particularly interested in reducing poverty and so increase education and financial inclusion at the same time. If this were the case, it should also be possible to use other measures of

educational quality, such as performance on literacy, as an instrument for financial literacy. The first stage regression is shown in [Table A7](#), whereas the second stage regression is shown in [Table A8](#). We can see from the first stage regression that literacy levels do not work as an instrument for financial literacy, as the F-statistics for weak instrument test is only 0.77 and hence is too small. When looking at the second stage we can see that financial literacy no longer explains financial inclusion when instrumented with literacy levels in primary school. Hence we show that numeracy, but not performance on general literacy, works as an instrument for financial literacy.

6 Conclusion

There is a considerable literature showing that good financial literacy leads to good financial decision making. To the best of our knowledge this is the first study that examines the link between good financial literacy and financial inclusion at the country level. This comes with the advantage that contrary to individual level studies we can control for a large number of country factors, institutional factors, and financial characteristics of a country such as financial depth, and physical access to branches. Further, we are able to study the heterogeneous effects of financial literacy in relation to country characteristics. Knowing how financial literacy interacts with other country specific variables is crucial for policy makers that are hoping to increase financial inclusion.

We start our analysis by looking at the relationship between the proportions of people in a country that can be considered financially literate and four measures of financial inclusion. We study two measures of access to finance, i.e. having a bank account and having a debit card and two measures of use of financial services, i.e. savings at formal financial institutions and having used a debit card within the last year. We find a positive and significant relationship between financial literacy and all our measures of financial inclusion. However, these regressions are potentially plagued by endogeneity bias. We tackle this by using the quality of numeracy education in primary school as an instrument for financial literacy. In these regressions the relationship between financial literacy and all measures of financial inclusion remains significant and the coefficients become even larger. This is commonly found in the literature that looks at the link between financial literacy and financial behavior (Lusardi and Mitchell, 2014).

We dive deeper into the subject by examining the effects of financial literacy for heterogenous country and institutional backgrounds. We test whether financial literacy has a different effect, depending on country income and institutional financial characteristics.

Lastly, we check whether the level of financial literacy has different effects for different population groups.

We find that the average marginal effect of financial literacy on financial inclusion shows considerable heterogeneity. Generally speaking we find that the effect of financial literacy on access to finance is larger in countries whose level of GDP per capita is below the mean and whose level of financial depth, measured by private credit to GDP, is below the mean. Interestingly, the average marginal effect of financial literacy, however, on the use of financial services is larger at higher levels of GDP and financial depth. When looking at the interaction between financial literacy and physical access, measured by bank branch penetration to financial services, we can see that the average marginal effect of financial literacy is constant and does not change with physical access to financial services.

To sum up, financial literacy explains both access and use of financial literacy, also at the country level. If one was to improve the level of financial literacy in a population, the effect on financial access would be strongest in economically and financially less developed countries. The effect on use, however, would be larger in economically more developed countries and countries with a deeper financial system.

If one would want to study the interaction between financial literacy and institutional country characteristics further, this could be done with a large scale financial literacy intervention across a number of countries. This, however, would come at considerable financial costs.

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Table 1
Panel A: Financial literacy summary statistics

	Weighted mean	Weighted s.d	Mean	Sd	min	max
Financial literacy	32.00	11.45	36.61	13.79	13	71
Financial literacy, poorest 40%	27.00	10.51	31.72	13.15	7	67
Financial literacy, richest 60%	35.40	12.36	39.96	14.66	14	76
Financial literacy, men	35.06	12.07	39.86	14.39	15	77
Financial literacy, women	29.00	11.36	33.54	13.61	8	70
Risk diversification	34.90	16.80	41.64	16.13	11	78
Inflation	49.95	10.71	52.46	12.59	17	78
Interest	48.10	8.46	49.74	11.77	16	79
Interest compounding	45.18	8.26	46.38	11.88	22	74
Observations	143					

Notes: Financial literacy is the proportion of the adult population that can answer at least three out of four questions correctly, Financial literacy, bottom 40% and 60% report the same for the bottom 40% and top 60% of the income distribution. Financial literacy of men and women is the proportion of men and women in a country that can answer at least 3 out 4 questions correctly. Risk diversification, inflation, interest and interest compounding depict the proportion of the population that answered each respective question correctly. Weighted means were weighted by the population.

Panel B: Access and use of financial services summary statistics

	Weighted mean	Weighted sd	mean	sd	min	max
Account at a formal financial institution	58.63	25.74	54.53	30.78	2	100
Owens debit card	37.82	24.96	39.45	30.86	0	99
Saved at a financial institution last year	25.33	17.17	22.59	18.86	1	78
Debit card used in the past year	22.03	22.28	28.36	28.78	0	96
Observations	143					

Notes: Account at formal financial institution denotes the proportion of the population that has an account at a formal financial institution, including mobile money accounts; debit card is the proportion of the population that has a debit card; Saved at a formal financial institution is the proportion of the population that saved at a formal financial institution in the past 12 months; debit card used is the proportion that used a debit card during the last year. Weighted means were weighted by the population.

Table 2: Financial literacy and access to finance - OLS and IV results

	(1) Account ownership OLS	(2) Account ownership IV	(3) Has debit card OLS	(4) Has debit card IV
Financial literacy	0.511*** (0.140)	1.885*** (0.688)	0.518*** (0.154)	1.636*** (0.522)
Ln GDP per capita	13.223*** (2.798)	2.686 (8.298)	13.943*** (2.550)	6.230 (5.903)
Population share between 15 and 64	-0.239 (0.342)	1.063 (0.926)	-0.482 (0.305)	0.621 (0.719)
Secondary education	0.018 (0.106)	-0.089 (0.179)	0.028 (0.102)	-0.011 (0.171)
Tertiary education	-0.151 (0.137)	-0.364* (0.188)	0.031 (0.150)	-0.233 (0.185)
Private credit to GDP	0.130*** (0.031)	0.119** (0.049)	0.093** (0.044)	0.076* (0.044)
Branches per 1000 km2	0.058*** (0.017)	0.064 (0.061)	0.034** (0.017)	0.030 (0.057)
Strength of legal rights	0.309 (0.542)	-1.078 (1.028)	-0.002 (0.509)	-1.162 (0.818)
Ease of doing business index	-0.102** (0.049)	-0.048 (0.096)	-0.105* (0.053)	-0.064 (0.089)
Constant	-71.886*** (25.653)	-96.144** (42.738)	-77.526*** (24.802)	-107.907*** (39.002)
R2	0.80	0.64	0.82	0.70
Observations	119	93	119	93

Notes: The table reports OLS regression results in columns (1) and (3) and IV regression results in in columns (2) and (4) with robust standard errors in brackets. The instrument is the math skills of primary school children. The outcome variable is the proportion of people over the age of 15 that have a bank account, a credit account or a mobile money account. Has debit card is the proportion of the population that owns a debit card. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. P-value of exogeneity test shows a p-value for Chi² test to test that the potentially endogenous variable can be treated as exogenous.

Table 3: Financial literacy and use of financial services - OLS and IV results

	(1) Save at formal financial institutions OLS	(2) Save at formal financial institution IV	(3) Used debit card within the last year OLS	(4) Used debit card within last year b/se
Financial literacy	0.529*** (0.086)	1.117*** (0.410)	0.687*** (0.155)	1.630*** (0.505)
Ln GDP per capita	6.238*** (1.518)	1.388 (4.773)	12.207*** (2.391)	5.520 (5.096)
Population share between 15 and 64	-0.616*** (0.217)	-0.114 (0.601)	-0.719** (0.301)	0.326 (0.739)
Secondary education	-0.053 (0.068)	-0.042 (0.127)	-0.031 (0.094)	-0.019 (0.151)
Tertiary education	0.026 (0.107)	-0.059 (0.147)	0.241* (0.142)	0.030 (0.182)
Private credit to GDP	0.114** (0.045)	0.101** (0.041)	0.046 (0.041)	0.030 (0.042)
Branches per 100 km ²	0.033* (0.018)	0.075* (0.040)	0.029 (0.018)	0.016 (0.058)
Strength of legal rights index	0.146 (0.410)	-0.486 (0.735)	0.332 (0.498)	-0.611 (0.799)
Ease of doing business index	-0.030 (0.040)	-0.011 (0.059)	-0.074 (0.059)	-0.038 (0.091)
Constant	-18.961 (19.067)	-25.666 (27.199)	-65.957** (29.774)	-99.822** (43.958)
R ²	0.74	0.68	0.78	0.70
Observations	119	93	119	93

Notes: The table reports OLS regression results in columns (1) and (3). IV regression results are shown in regression (2) and (4). Robust standard errors are shown in brackets. The outcome variables are the proportion of people that saved at a formal financial institution, the proportion that deposited money in the last year, and the proportion of people that used their debit card during the last year. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. P-value of exogeneity test shows a p-value for Chi² test to test that the potentially endogenous variable can be treated as exogenous.

Table 4: Financial literacy, GDP, and their interaction

	(1)	(2)	(3)	(5)
	Has account at formal fin. institution	Owns debit card	Saved at formal fin. institution	Debit card used in the past year
Financial literacy	0.520*** (0.165)	0.428** (0.171)	0.449*** (0.084)	0.546*** (0.161)
Log GDP per capita (PPP)	0.684*** (0.165)	0.777*** (0.178)	0.190* (0.100)	0.634*** (0.169)
Interaction fin. lit. and log GDP p.c.	-0.015** (0.006)	-0.003 (0.007)	0.019*** (0.005)	0.013* (0.006)
Population share between 15-64	0.010 (0.357)	-0.134 (0.277)	-0.251 (0.209)	-0.281 (0.292)
Secondary education	0.145 (0.107)	0.170* (0.097)	0.031 (0.072)	0.107 (0.083)
Tertiary education	-0.189 (0.144)	-0.134 (0.181)	-0.106 (0.110)	0.014 (0.169)
Private credit to GDP	0.149*** (0.032)	0.100** (0.042)	0.107*** (0.038)	0.042 (0.037)
Bank branches per 1000 km ²	0.057*** (0.018)	0.029 (0.023)	0.030** (0.013)	0.023 (0.025)
Strength of legal rights index	0.003 (0.546)	-0.368 (0.480)	-0.283 (0.380)	-0.129 (0.421)
Ease of doing business index	-0.158*** (0.050)	-0.168*** (0.051)	-0.066* (0.035)	-0.135** (0.054)
Constant	55.114** (24.191)	51.277** (20.057)	35.807** (15.263)	47.168** (23.407)
R-squared	0.790	0.815	0.773	0.799
Observations	119	119	119	119

Notes: The table shows the effect of financial literacy, GDP per capita and their interaction on different measures of financial inclusion, including access to and use of financial services. Robust standard errors in parentheses. All dependent variables were centered at their mean. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 5: Financial literacy, financial depth and their interaction

	(1)	(2)	(3)	(5)
	Has account at formal fin. institution	Owns debit card	Saved at formal fin. institution	Debit card used in the past year
Financial literacy	0.550*** (0.143)	0.497*** (0.157)	0.492*** (0.079)	0.628*** (0.152)
Private credit to GDP	0.146*** (0.033)	0.085** (0.042)	0.098** (0.042)	0.022 (0.036)
Interaction fin. lit. and private credit to GDP	-0.004** (0.002)	0.002 (0.002)	0.004** (0.002)	0.006*** (0.002)
Log GDP per capita (PPP)	13.846*** (2.781)	13.610*** (2.599)	5.643*** (1.472)	11.259*** (2.333)
Population share between 15-64	-0.414 (0.360)	-0.388 (0.336)	-0.448** (0.214)	-0.451 (0.339)
Secondary education	0.026 (0.103)	0.024 (0.104)	-0.061 (0.068)	-0.042 (0.093)
Tertiary education	-0.101 (0.132)	0.004 (0.162)	-0.021 (0.114)	0.166 (0.153)
Bank branches per 1000 km ²	0.055*** (0.017)	0.036** (0.016)	0.036* (0.019)	0.034** (0.017)
Strength of legal rights index	0.473 (0.561)	-0.090 (0.525)	-0.011 (0.397)	0.082 (0.471)
Ease of doing business index	-0.093* (0.051)	-0.110** (0.053)	-0.039 (0.037)	-0.089 (0.056)
Constant	-42.061 (26.212)	-55.322** (24.754)	3.247 (17.150)	-43.977 (28.815)
R-squared	0.809	0.817	0.750	0.793
Observations	119	119	119	119

Notes: The table shows the effect of financial literacy, private credit to GDP and their interaction on different measures of financial inclusion, including access to and use of financial services. Robust standard errors in parentheses. All dependent variables were centered at their mean. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 6: Financial literacy, bank branch penetration and their interaction

	(1) Has account at formal fin. institution	(2) Owns debit card	(3) Saved at formal fin. institution	(5) Debit card used in the past year
Financial literacy	0.506*** (0.141)	0.518*** (0.157)	0.534*** (0.086)	0.686*** (0.158)
Bank branches per 1000 km ²	0.079** (0.033)	0.033 (0.029)	0.011 (0.027)	0.033 (0.034)
Interaction fin. lit. and bank branches per 1000 km ²	-0.003 (0.003)	0.000 (0.004)	0.003 (0.003)	-0.000 (0.005)
Log GDP per capita (PPP)	13.392*** (2.834)	13.936*** (2.570)	6.061*** (1.479)	12.236*** (2.428)
Population share between 15-64	-0.274 (0.342)	-0.480 (0.303)	-0.578** (0.222)	-0.725** (0.302)
Secondary education	0.017 (0.106)	0.028 (0.103)	-0.052 (0.067)	-0.031 (0.095)
Tertiary education	-0.129 (0.140)	0.030 (0.147)	0.004 (0.114)	0.245* (0.139)
Private credit to GDP	0.127*** (0.032)	0.094** (0.043)	0.117*** (0.044)	0.046 (0.041)
Strength of legal rights index	0.279 (0.548)	-0.000 (0.512)	0.177 (0.408)	0.327 (0.502)
Ease of doing business index	-0.098* (0.050)	-0.105* (0.053)	-0.034 (0.040)	-0.074 (0.058)
Constant	-51.204** (25.194)	-57.948** (25.265)	0.236 (18.639)	-40.174 (29.623)
R-squared	0.804	0.816	0.739	0.779
Observations	119	119	119	119

Notes: The table shows the effect of financial literacy, bank branch penetration and their interaction on different measures of financial inclusion, including access to and use of financial services. Robust standard errors in parentheses. All dependent variables were centered at their mean. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 7: Financial literacy and financial inclusion for income groups

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Has bank account	Has bank account	Owens debit card	Owens debit card	Saved at a formal fin. institution	Saved at a formal fin. institution	Debit card used in the past year	Debit card used in the past year
	Bottom 40%	Top 60%	Bottom 40%	Top 60%	Bottom 40%	Top 60%	Bottom 40%	Top 60%
FL bottom 40%	0.426*** (0.148)		0.500*** (0.139)		0.360** (0.145)		0.649*** (0.136)	
FL top 60%		0.530*** (0.134)		0.508*** (0.129)		0.442*** (0.145)		0.689*** (0.136)
Log GDP p.c. (PPP)	14.073*** (2.965)	12.864*** (2.670)	13.587*** (2.784)	14.340*** (2.581)	2.203 (2.917)	3.291 (2.894)	10.725*** (2.732)	13.360*** (2.709)
Population share between 15-64	-0.537 (0.347)	-0.066 (0.316)	-0.760** (0.326)	-0.314 (0.306)	-0.849** (0.342)	-0.769** (0.343)	-0.885*** (0.320)	-0.628* (0.321)
Secondary education	0.019 (0.117)	0.018 (0.103)	0.036 (0.110)	0.024 (0.100)	0.002 (0.116)	-0.045 (0.112)	0.005 (0.108)	-0.053 (0.105)
Tertiary education	-0.035 (0.164)	-0.223 (0.143)	0.161 (0.154)	-0.055 (0.139)	0.156 (0.162)	-0.005 (0.155)	0.359** (0.151)	0.165 (0.146)
Private credit to GDP	0.158*** (0.043)	0.111*** (0.038)	0.096** (0.040)	0.091** (0.037)	0.127*** (0.042)	0.108** (0.041)	0.046 (0.040)	0.046 (0.039)
Bank branches per 1000 km ²	0.059* (0.033)	0.058** (0.029)	0.030 (0.031)	0.037 (0.028)	0.014 (0.032)	0.025 (0.031)	0.018 (0.030)	0.037 (0.029)
Strength of legal rights index	0.247 (0.605)	0.375 (0.534)	-0.035 (0.568)	0.038 (0.516)	0.737 (0.596)	0.643 (0.578)	0.394 (0.558)	0.298 (0.542)
Ease of doing business index	-0.137** (0.057)	-0.079 (0.051)	-0.122** (0.054)	-0.094* (0.049)	0.033 (0.056)	0.033 (0.055)	-0.081 (0.053)	-0.071 (0.052)
Constant	-63.114** (31.726)	-77.057*** (28.073)	-61.545** (29.782)	-87.831*** (27.147)	49.882 (31.207)	47.887 (30.428)	-46.158 (29.226)	-78.765*** (28.488)
Test 40% = top 60% (p-values)		0.3085		0.9258		0.3871		0.6039
R ²	0.789	0.797	0.782	0.821	0.312	0.352	0.734	0.793

Observations	119	119	119	119	119	119	119	119
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Notes: The table shows OLS results with standard errors in brackets. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 8 : Financial literacy and financial inclusion for women and men

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Has bank account	Has bank account	Owns debit card	Owns debit card	Saved at a formal fin. institution	Saved at a formal fin. institution	Debit card used in the past year	Debit card used in the past year
	Women	Men	Women	Men	Women	Men	Women	Men
FL - women	0.556*** (0.146)		0.578*** (0.138)		0.475*** (0.147)		0.685*** (0.140)	
FL - men		0.434*** (0.132)		0.417*** (0.126)		0.346** (0.143)		0.619*** (0.130)
Log GDP p.c. (PPP)	12.489*** (2.823)	14.200*** (2.708)	12.793*** (2.673)	15.482*** (2.592)	1.823 (2.843)	3.912 (2.934)	11.888*** (2.715)	13.049*** (2.675)
Population between 15-64	-0.325 (0.336)	-0.251 (0.316)	-0.614* (0.318)	-0.466 (0.302)	-0.791** (0.339)	-0.855** (0.342)	-0.871*** (0.323)	-0.698** (0.312)
Secondary education	0.062 (0.111)	-0.014 (0.105)	0.054 (0.105)	0.016 (0.101)	0.010 (0.112)	-0.056 (0.114)	-0.015 (0.107)	-0.033 (0.104)
Tertiary education	-0.151 (0.155)	-0.186 (0.147)	0.039 (0.146)	-0.018 (0.140)	0.068 (0.156)	0.033 (0.159)	0.272* (0.149)	0.183 (0.145)
Private credit to GDP	0.140*** (0.041)	0.126*** (0.039)	0.104*** (0.039)	0.089** (0.037)	0.125*** (0.041)	0.110*** (0.042)	0.059 (0.039)	0.040 (0.038)
Bank branches per 1000 km ²	0.063** (0.031)	0.057* (0.029)	0.034 (0.029)	0.038 (0.028)	0.017 (0.031)	0.025 (0.032)	0.030 (0.030)	0.032 (0.029)
Strength of legal rights index	0.381 (0.572)	0.292 (0.545)	0.137 (0.542)	-0.076 (0.521)	0.640 (0.576)	0.746 (0.590)	0.521 (0.550)	0.205 (0.538)
Ease of doing business index	-0.123** (0.055)	-0.088* (0.051)	-0.120** (0.052)	-0.095* (0.049)	0.034 (0.055)	0.029 (0.056)	-0.076 (0.053)	-0.081 (0.051)
Constant	-63.833** (30.229)	-74.712*** (28.461)	-62.945** (28.622)	-86.730*** (27.242)	52.539* (30.444)	47.549 (30.837)	-55.676* (29.070)	-70.451** (28.115)
Test women = men (p-values)	0.1916		0.0791*		0.0879*		0.3929	
R-squared	0.800	0.791	0.805	0.811	0.358	0.318	0.769	0.774
Observations	119	119	119	119	119	119	119	119

Notes: The table shows OLS results with standard errors in brackets. ***, ** and * denote significance at the 1%, 5%, and 10% levels, respectively.

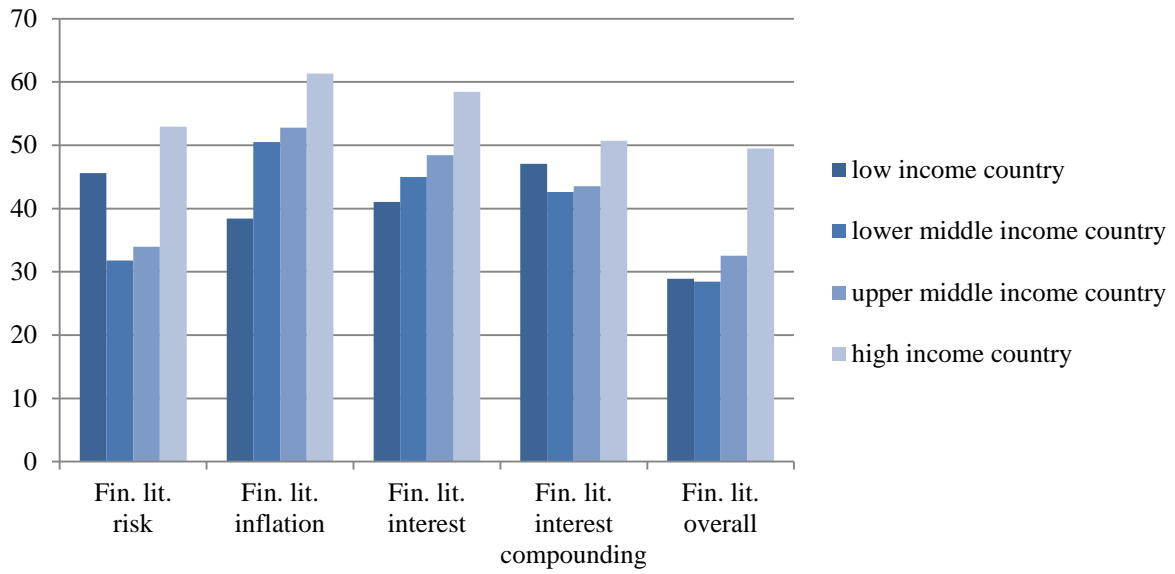


Figure 1: Financial Literacy concepts at income groupings

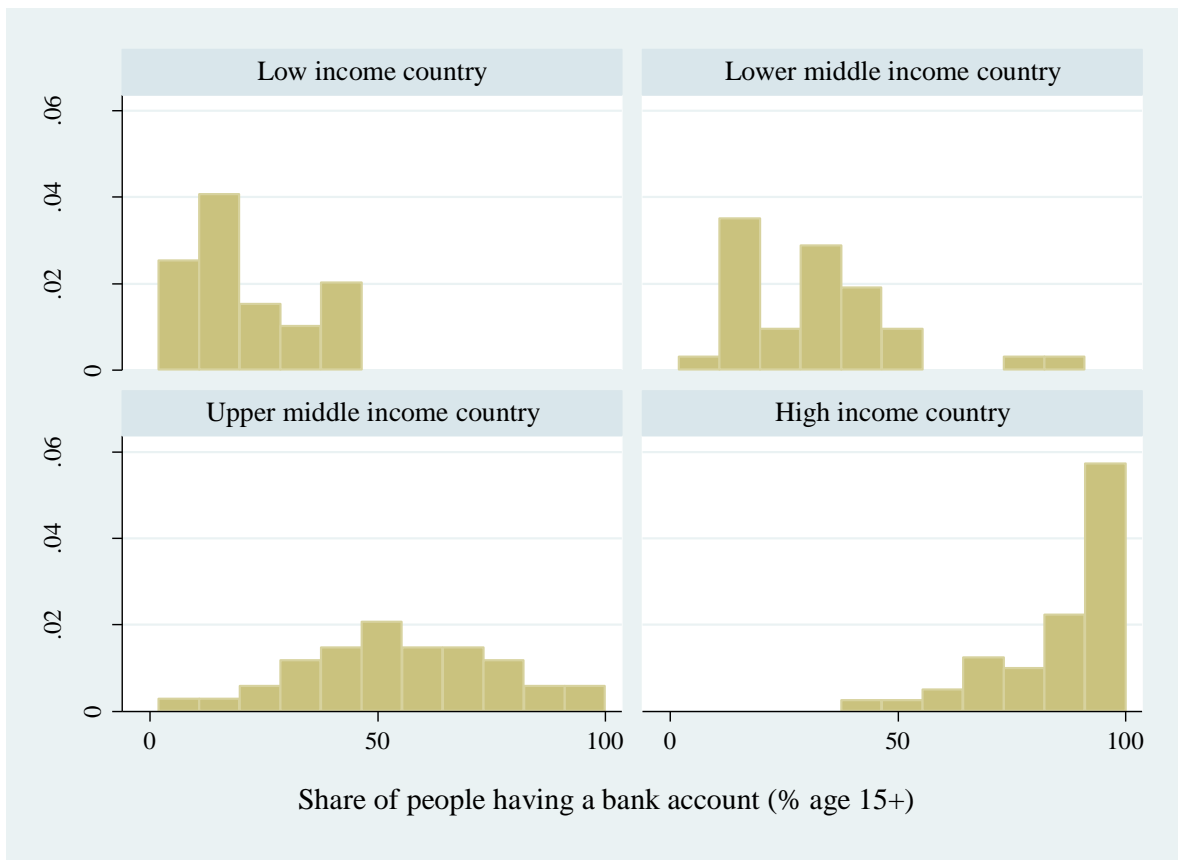


Figure 2: Having an account by World Bank income classification

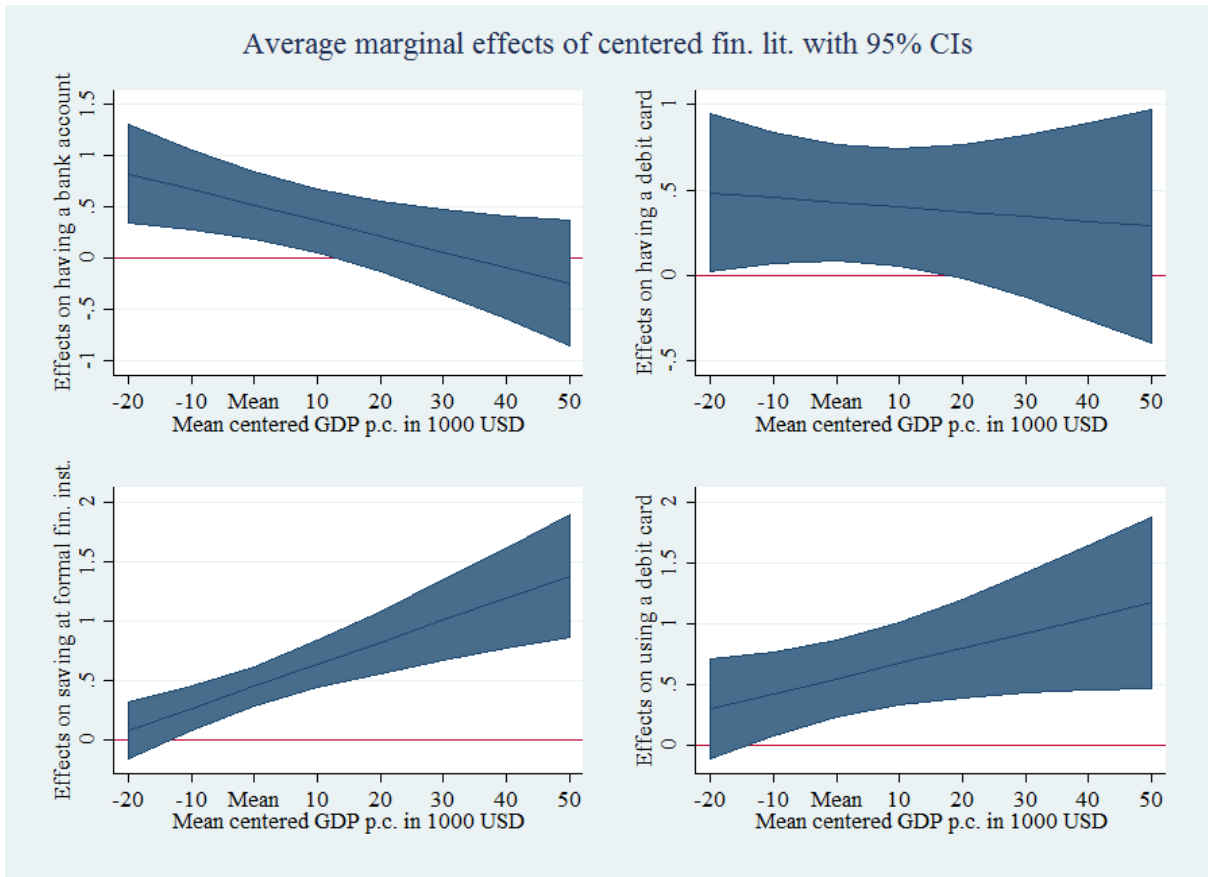


Figure 3
Average marginal effect of financial literacy on four measures of financial inclusion at different levels of GDP per capita

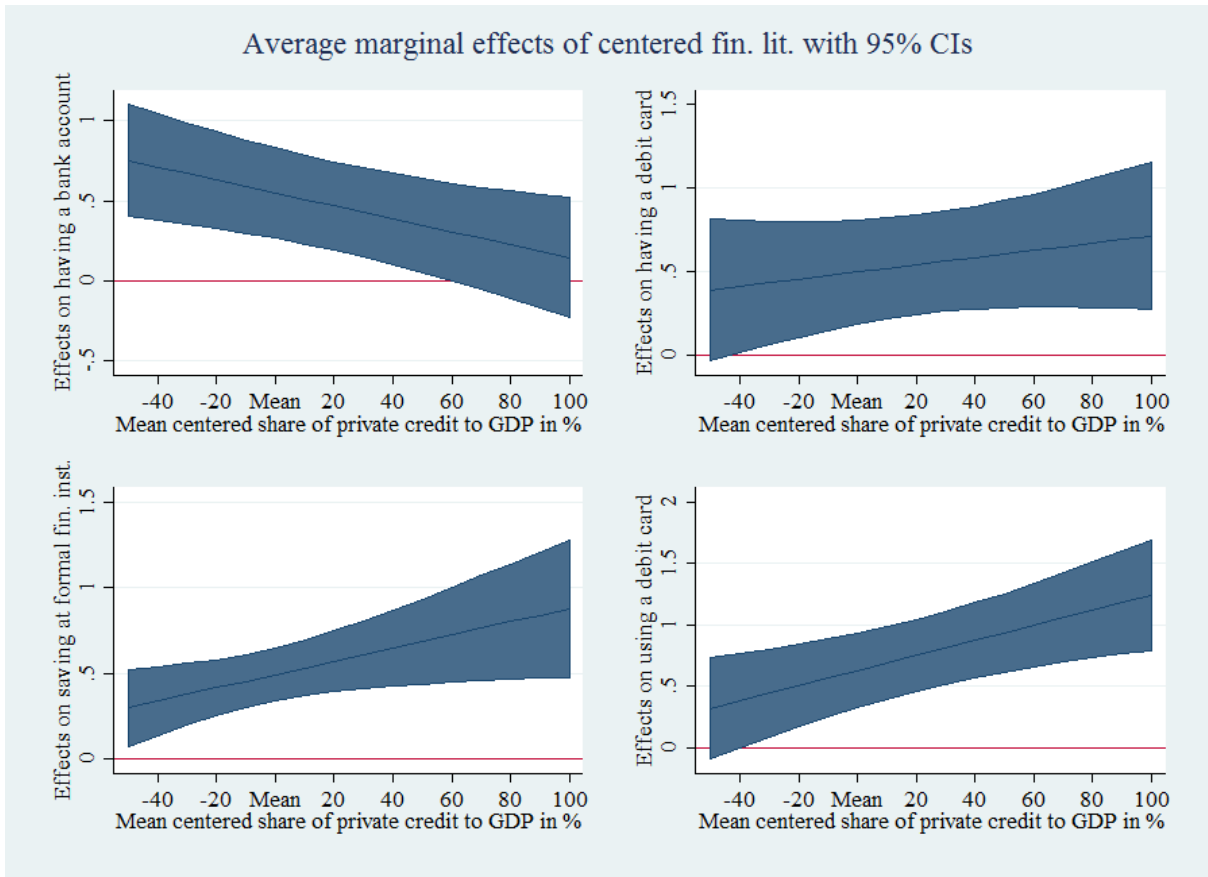


Figure 4
Average marginal effects of financial literacy on four measures of financial inclusion at different levels of private credit to GDP

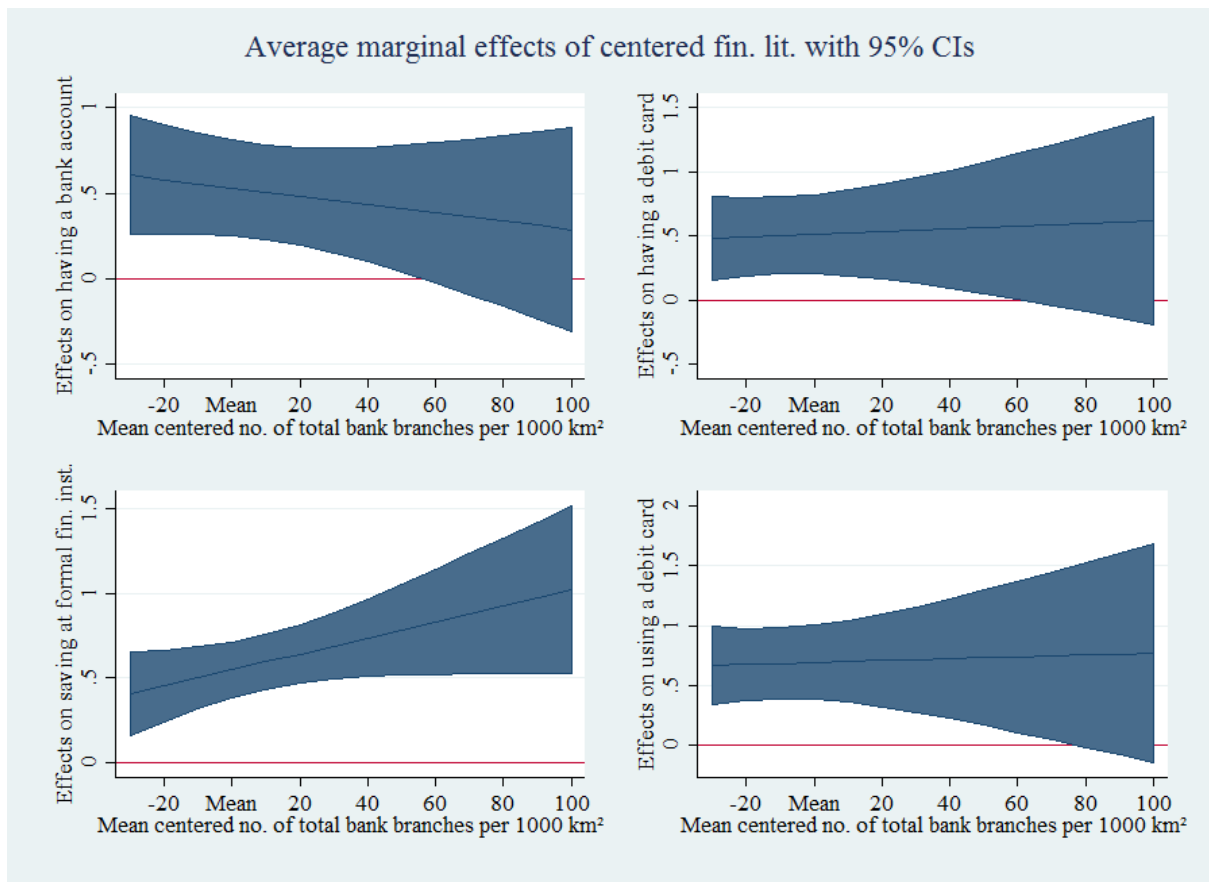


Figure 5
Average marginal effects of financial literacy at different levels of bank branches per 1000 km²

APPENDIX

Table A1: Control variables summary statistics and sources

	mean	sd	min	max	count	description	source
GDP per capita	18230.11	17862.26	711	91368	136	GDP per capita purchasing power parity, constant 2011 USD	World Bank, World Development Indicators 2014
Population ages 15-64	63.68	6.85	47	85	141	Proportion of the population that is between 15 and 64 year old	World Bank, World Development Indicators 2014
Secondary education	0.51	0.16	0	1	142	Proportion of population that has completed secondary school	World Bank, Global Findex 2014
Tertiary education	0.16	0.14	0	1	142	Proportion of population that has completed tertiary education	World Bank, Global Findex 2014
Private credit to GDP	60.50	48.06	4	260	126	Private credit by deposit money banks and other financial institutions to GDP, designed to measure financial depth	World Bank, Global Financial Development 2014
Strength of legal rights index	5.14	2.89	0	12	141	Strength of legal rights index measures the degree to which collateral and	World Bank, World Development

Ease of doing business index	85.39	55.41	1	187	140	bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. Ease of doing business ranks economies from 1 to 190, with first place being the best. A high ranking (a low numerical rank) means that the regulatory environment is conducive to business operation.	Indicators 2014 World Bank, World Development Indicators 2014
Political Risk Rating ICRG 2012	64.57	12.77	23	90	121	Measures the political stability of a country along 12 dimensions, e.g. corruption, government stability, and bureaucracy quality.	ICRG 2012
Branches of commercial banks per 1,000 km ²	37.55	137.83	0	1382	129	Number of branches per 1000 km ²	IMF, Financial Access Survey 2014
Automated Teller Machines (ATMs) per 1,000 km ²	89.91	362.60	0	3870	129	ATMs per 1000 km ²	IMF, Financial Access Survey 2014
Observations	143						

Table A2: Correlations between control variables

	GDP p.c. (PPP, 2011 int. USD)	Population share between 15-64	Secondary education	Tertiary education	Private credit to GDP	Strength of legal rights index	Ease of doing business index	Political risk index	Branches of com. banks per 1000 km ²	ATMs per 1000 km ²
GDP p.c.	1.0000									
Population share 15-64	0.5507 (0.0000)	1.0000								
Secondary education	0.3210 (-0.0001)	0.4267 (0.0000)	1.0000							
Tertiary education	0.7338 (0.0000)	0.5379 (0.0000)	0.2268 (-0.0066)	1.0000						
Private credit to GDP	0.6219 (0.0000)	0.4925 (0.0000)	0.2705 (-0.0017)	0.5090 (0.0000)	1.0000					
Strength of legal rights	0.0532 (-0.5339)	0.0178 (-0.8355)	0.0401 (-0.6383)	0.0888 (-0.2966)	0.1549 (-0.0751)	1.0000				
Ease of doing business index	-0.6672 (0.0000)	-0.6726 (0.0000)	-0.4594 (0.0000)	-0.6636 (0.0000)	-0.6511 (0.0000)	-0.3649 (0.0000)	1.0000			
Political risk index	0.7702 (0.0000)	0.5276 (0.0000)	0.3511 (-0.0001)	0.6247 (0.0000)	0.6259 (0.0000)	0.2992 (-0.0009)	-0.8330 (0.0000)	1.0000		
Branches per 1000 km ²	0.3512 (0.0000)	0.2219 (-0.0118)	0.1222 (-0.1695)	0.1307 (-0.1414)	0.4066 (0.0000)	0.0429 (-0.6293)	-0.2279 (-0.0094)	0.2223 (-0.0196)	1.0000	
ATMs per 1000 km ²	0.4086 (0.0000)	0.2046 (-0.0205)	0.0848 (-0.3411)	0.1646 (-0.0634)	0.2842 (-0.0014)	0.0527 (-0.5529)	-0.2463 (-0.0049)	0.2517 (-0.0080)	0.8499 (0.0000)	1.0000

Notes: p-values in parenthesis

Table A3: First stage regression for IV results

	Financial Literacy
Maths education in primary school	0.539 (0.173)
Ln GDP per capita	9.982 (1.801)
Population between ages 15 64	-1.248 (0.204)
Secondary education	-0.0136 (0.084)
Tertiary education	0.043 (0.101)
Private credit to GDP	-0.001 (0.028)
Bank branches per 100 km ²	-.025 (0.030)
Strength of legal rights index	0.796 (0.404)
Ease of doing business index	-0.006 (0.041)
Constant	0.530 (19.763)
Observation	93
F- test of first stage regression	15.24
F-test for weak instruments	9.67

Notes: This table reports the first stage regression of the IV regressions shown in this paper. The F-statistics reports the F-stat for the first stage regression. The F-test for weak instruments denotes passing the Stock-Yogo test at 15%.

Table A4: Financial literacy and Borrowing decisions-OLS and IV results

	(1)	(2)	(3)	(4)	(5)	(6)
	Borrowed from a financial institution OLS	Borrowed from a financial institution IV	Borrowed from an informal institution OLS	Borrowed from an informal institution IV	Credit card used in the past year OLS	Credit card used in the past year IV
Financial literacy	0.092 (0.064)	-0.085 (0.150)	-0.094** (0.045)	-0.597** (0.248)	0.264** (0.111)	0.856** (0.351)
Ln GDP per capita	0.360 (0.972)	1.872 (1.937)	0.650 (1.093)	5.654* (2.926)	7.655*** (1.688)	3.102 (4.214)
Population ages 15-64	0.179 (0.131)	-0.177 (0.248)	0.008 (0.100)	-0.666* (0.337)	-0.593*** (0.177)	0.056 (0.508)
Secondary education	0.032 (0.047)	0.069 (0.051)	-0.051 (0.044)	-0.023 (0.083)	-0.031 (0.056)	-0.023 (0.096)
Tertiary education	0.022 (0.050)	0.086 (0.063)	0.011 (0.038)	0.071 (0.069)	0.240** (0.100)	0.123 (0.149)
Private credit to GDP	0.003 (0.016)	-0.003 (0.018)	-0.007 (0.016)	-0.001 (0.026)	0.059* (0.032)	0.039 (0.036)
Bank branches Per 1000 km2	-0.009 (0.006)	-0.001 (0.021)	-0.011* (0.006)	-0.027 (0.021)	0.037* (0.019)	0.076 (0.052)
Strength of legal rights index	0.273 (0.270)	0.195 (0.295)	-0.047 (0.185)	0.301 (0.338)	0.405 (0.323)	-0.168 (0.610)
Ease of doing Business index	-0.039** (0.019)	-0.052** (0.024)	0.014 (0.017)	-0.011 (0.032)	-0.017 (0.033)	0.008 (0.046)
Constant	-5.791 (10.457)	8.101 (12.622)	3.033 (9.766)	15.769 (16.756)	-35.636* (18.617)	-53.646** (25.766)
R2	0.44	0.38	0.18	.	0.71	0.60
Observations	119	93	119	93	119	93

Notes: The table reports OLS regression in columns (1), (3) and (5), and IV regression results in columns (2), (4) and (6) results with robust standard errors in brackets. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Borrowed at formal financial institution is the proportion of people that currently borrow at a formal financial institution, borrowed at informal financial institution described those that borrowed from an informal financial institution, credit card used during the last year is the proportion of people that used their credit card during the last year.

Table A5: Financial literacy and account ownership-additional control variables

	(1)	(2)	(3)	(4)
	Account ownership OLS	Account ownership OLS	Account ownership OLS	Account ownership OLS
Financial literacy	0.580*** (0.174)	0.599*** (0.177)	0.537*** (0.188)	0.508* (0.254)
Ln GDP per capita	12.106*** (3.627)	12.409*** (3.679)	19.127*** (3.444)	19.828*** (4.189)
Population ages 15-64	-0.109 (0.380)	-0.091 (0.386)	-0.167 (0.431)	-0.693 (0.590)
Secondary education	0.004 (0.133)	0.006 (0.132)	-0.045 (0.152)	-0.053 (0.181)
Tertiary education	-0.142 (0.164)	-0.157 (0.166)	-0.244 (0.184)	-0.415 (0.302)
Private credit to GDP	0.122*** (0.032)	0.121*** (0.032)	0.111*** (0.031)	0.147** (0.057)
Bank branches km2	0.052*** (0.019)	0.025 (0.021)	0.023 (0.023)	0.027 (0.025)
Strength of legal rights index	0.320 (0.692)	0.530 (0.712)	0.682 (0.720)	0.867 (1.021)
Ease of doing business index	-0.070 (0.064)	-0.050 (0.068)	-0.024 (0.068)	0.023 (0.092)
Political risk	0.176 (0.283)	0.188 (0.282)	-0.001 (0.308)	0.069 (0.443)
ATM per km2		0.016*** (0.006)	0.018*** (0.007)	0.023*** (0.007)
Cost checking account (imputed)			0.957** (0.473)	
Cost checking account (original)				0.490 (1.576)
Constant	-84.884** (32.868)	-93.177*** (33.779)	-136.445*** (38.592)	-116.704** (55.511)
R2	0.79	0.79	0.78	0.77
Observations	103	101	88	57

Notes: The table reports OLS regression results with robust standard errors in brackets. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

* p<0.1, ** p<0.05, *** p<0.01

Table A6: Fractional response probit regressions - marginal effects

Dep. Var:	(1) Has account at formal fin. institution	(2) Owns debit card	(3) Saved at formal fin. institution	(4) Debit card used in the past year
Financial literacy	0.537*** (0.130)	0.379*** (0.138)	0.441*** (0.073)	0.418*** (0.120)
Log GDP p.c. (PPP)	0.124*** (0.023)	0.146*** (0.023)	0.068*** (0.017)	0.139*** (0.024)
Population between 15-64	-0.529* (0.290)	-0.307 (0.262)	-0.398** (0.202)	-0.340 (0.242)
Secondary education	0.032 (0.089)	0.076 (0.090)	-0.044 (0.073)	0.048 (0.085)
Tertiary education	-0.063 (0.125)	-0.055 (0.126)	-0.078 (0.096)	0.047 (0.110)
Private credit to GDP	0.165*** (0.035)	0.074** (0.037)	0.086*** (0.032)	0.021 (0.026)
Bank branches per 1000 km ²	0.001** (0.000)	0.000 (0.000)	0.000* (0.000)	0.000 (0.000)
Strength of legal rights index	0.005 (0.005)	0.001 (0.005)	0.001 (0.004)	0.002 (0.004)
Ease of doing business index	-0.001 (0.000)	-0.001* (0.000)	-0.000 (0.000)	-0.001 (0.001)
Observations	119	119	119	119

Notes: The table reports fractional probit regression results. Robust standard errors are shown in brackets. The outcome variables are the the proportion of people over the age of 15 that have a bank account or a credit account, proportion of people that saved at a formal financial institution, the proportion of people that deposited money in the last year, and the proportion of people that used their debit card during the last year. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table A7: First stage regression for IV results

	Financial Literacy
Literacy education in primary school	0.2042 0.232
Ln GDP per capita	10.453 (2.498)
Population between ages 15 64	-1.407 (0.249)
Secondary education	-0.016 (0.102)
Tertiary education	0.050 (0.113)
Private credit to GDP	-.006 (0.026)
Bank branches per 100 km2	-0.001 .003
Strength of legal rights index	0.791 (0.523)
Ease of doing business index	-0.036 (0.052)
Constant	22.074 24.93
Observation	77
F- test of first stage regression	9.78
F-test for weak instruments	0.77

Notes: This table reports the first stage regression of the IV regressions using literacy instead of numeracy as an instrument. The F-statistics reports the F-stat for the first stage regression. The F-test for weak instruments denotes not passing the Stock-Yogo test.

Table A8: Financial literacy and Financial inclusion: Using literacy as an instrument

	(1)	(2)	(3)	(4)
	Has account	Has debit card	Saved at formal financial institution	Debit card used in the past year
	IV	IV	IV	IV
Financial Literacy	1.188 (1.694)	1.344 (1.830)	0.518 (0.925)	1.907 (1.939)
Ln GDP per capita	6.975 (19.023)	6.595 (20.250)	7.465 (10.475)	0.396 (21.242)
Population ages 15-64	0.048 (2.466)	0.125 (2.583)	-1.024 (1.323)	0.669 (2.746)
Secondary education	-0.074 (0.167)	-0.026 (0.182)	0.011 (0.108)	-0.059 (0.190)
Tertiary education	-0.143 (0.205)	-0.145 (0.240)	0.144 (0.147)	0.062 (0.249)
Private credit to GDP	0.139*** (0.038)	0.095** (0.046)	0.101** (0.046)	0.052 (0.046)
Bank branches per 1000 km2	-0.003 (0.005)	-0.006 (0.005)	0.003 (0.005)	-0.005 (0.006)
Strength of legal rights index	-1.051 (1.528)	-1.059 (1.611)	-0.163 (0.968)	-0.828 (1.710)
Ease of doing business index	-0.131 (0.120)	-0.142 (0.125)	-0.042 (0.075)	-0.093 (0.137)
Constant	-44.600 (57.320)	-65.545 (57.664)	-6.455 (34.067)	-79.588 (65.509)
R2	0.78	0.76	0.76	0.68
Observations	77	77	77	77

Notes: The table reports IV regression results with robust standard errors in brackets. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. The imputed literacy rate in primary school is used as an instrument for financial literacy.