

THE IMPACT OF FINANCIAL LITERACY ON FINANCIAL INCLUSION - BEYOND STANDARD FINANCIAL INSTRUMENTS


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Abstract: *In this paper, we explore the relationship between financial literacy and a range of financial inclusion outcomes at the country level. Unlike Grohmann et al. (2018), who consider standard financial instruments as proxies for financial inclusion, we consider further instruments regarding digital payments. Using cross-sectional country-level data from the 2014/2015 Global Financial Literacy Survey alongside with other corresponding country-level economic and financial indicators as well as extensive regression analysis, we show that financial literacy is an important determinant of the use of digital payments as well as other standard financial instruments. The results of the quantile regression analysis further show that the effect of financial literacy is not uniform across the distribution of the financial inclusion instruments. Our results confirm the growing importance of financial literacy in the complex world of finance.*

Keywords: *financial inclusion, access to finance, digital finance, financial literacy, regression analysis, quantile regressions.*

JEL Classification: O1, G2, G53

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1 Introduction

Financial inclusion has gained recognition as a critical driver of economic growth and individual well-being, providing access to essential financial services such as savings, credit, and payment systems. However, access to and use of these services remain uneven, particularly in low-income regions and among marginalized groups. Financial literacy – understood as the ability to comprehend and apply financial concepts – has emerged as a key factor in closing this gap. Research indicates that individuals with higher financial literacy are better equipped to make informed decisions about saving, borrowing, and investing, which in turn fosters broader engagement with formal financial systems.

This study investigates the role of financial literacy as a driver of financial inclusion, examining whether higher financial literacy is associated with greater ownership and use of financial products, including digital payment tools. It also considers the importance of other relevant factors including education, demographic factors, such as the share of population in the productive age, as well as the relevance of banking infrastructure and macroeconomic conditions, including private debt levels and economic development status. While Grohmann et al. (2018) underscore the relationship between financial literacy and standard financial inclusion proxies, this paper builds on this by assessing its broader impact on financial inclusion, particularly through the adoption of digital payment methods, which have become an integral part of the modern financial landscape.

Furthermore, while Grohmann et al. (2018) analyse only the relationships through a simple linear regression analysis, we also explore the impact of financial literacy on financial inclusion at different parts of its distribution. We do this by using the unconditional quantile regression analysis developed by Firpo et al. (2009). Indeed, the results of this analysis show heterogeneous effects at different quantiles of the distribution of the outcome variables.

Although our results capture fairly strong associations between financial literacy and financial inclusion, the study acknowledges limitations such as potential endogeneity in the measurement of financial literacy and the lack of longitudinal data needed to establish causal relationships. Therefore, more data (such as the S&P Global Financial Literacy Survey) should be collected

to allow for more sophisticated analyses.

The remainder of the paper is structured as follows: Section 2 provides a comprehensive literature review, Section 3 introduces the data and methodology used, Section 4 reports the results and Section 5 concludes and discusses the policy implications.

2 Literature review and hypotheses development

Financial literacy refers to the ability to understand and apply financial concepts such as compound interest, inflation, and risk diversification, which has become increasingly important as financial systems have become more complex.⁴ Consumers today need strong financial skills to make informed decisions about saving, investing, and borrowing (Lusardi and Mitchell, 2011; Lusardi and Mitchell, 2014).

The benefits of higher financial literacy have been well-documented. For example, financial awareness supports retirement security (e.g. Lusardi and Mitchell, 2011; Cupak et al., 2019), improves comprehension of investment risks and returns (e.g. Van Rooij et al., 2011; Cupak et al., 2021), and contributes to wealth accumulation through effective planning and disciplined saving (e.g. Jappeli and Padula, 2011; Behrman et al., 2012; Lusardi et al., 2017).

Transitioning to financial inclusion, research explores it as a measure of access to financial services and outreach. For example, Beck et al. (2007) has developed a dataset assessing financial outreach, which includes physical access to banking and per capita deposit and credit usage. They conclude that factors determining financial access differ from those driving financial depth.

Supply-side barriers to financial inclusion – such as high transaction costs, uncertainty, asymmetric information, and lack of physical access – often hinder the effective use of financial services (e.g. Beck et al., 2008; Karlan and Morduch, 2010). These barriers may prevent banks from offering credit or savings accounts to clients. Addressing such obstacles, Klapper et al. (2016) highlight that promoting financial service access directly aids in reducing extreme poverty.

⁴ The state-of-the-art approach to measure financial literacy of consumers is via a set of questions in surveys, which Lusardi and Mitchell (2014) refer to as the “Big Three”.

Financial exclusion is particularly prevalent among marginalized groups. For instance, previous studies have shown that women, low-income individuals, and rural populations are more often financially excluded (see Allen et al., 2016; Ghosh and Vinod, 2017). Increasing access to bank accounts can elevate financial well-being by boosting account adoption, household savings (e.g. Brune et al., 2016), labour market participation, and income (e.g. Bruhn and Love, 2014), as well as by increasing spending in private and business contexts (e.g. Ashraf et al., 2010; Dupas and Robinson, 2013) and reducing rural poverty (e.g. Burgess and Pande, 2005). Access to savings accounts further motivates people to transition from informal savings methods, such as storing money at home or in non-financial assets (e.g. Demircuc-Kunt et al., 2017).

Although financial literacy is widely regarded as an individual wealth driver (see Behrman et al., 2012; Lusardi et al., 2017), its broader role in promoting financial inclusion has been increasingly recognized. For example, Grohmann et al. (2018) find that greater financial literacy correlates with increased financial inclusion at the country level, especially in emerging economies.

However, the impact of financial literacy on inclusion can be complex in emerging markets. For example, Cole et al. (2011) examine the low demand for formal financial services in Indonesia and India and find that while financial literacy has a positive impact on financial behaviour, education programs alone do not significantly increase account openings among the unbanked. However, when small financial incentives are introduced, account openings increase significantly, especially among those with initially low financial literacy. Importantly, those who opened accounts as a result of these incentives continued to use them two years later, suggesting that modest subsidies may be more effective than financial education alone in promoting inclusion in these regions.

In recent years, technological advances have further propelled financial inclusion, particularly in emerging and developing economies. Khera et al. (2022) introduce a Digital Financial Inclusion Index to measure digital financial access across 52 countries. Their findings show that digital financial services have notably advanced financial inclusion, especially in Africa and Asia. Yet, the impact varies significantly across regions, highlighting the need for policies to bridge the digital divide and sustain inclusive growth.

Given the previous theoretical and empirical literature on the positive relationship between financial literacy and participation in financial markets, we hypothesise that the effect of financial literacy on the use of digital financial instruments will be positive. Furthermore, as empirical research often shows (e.g. Cupak et al., 2022), we hypothesise that the effect will vary across different parts of the distribution of financial inclusion instruments.

3 Methodology and data

3.1 Methodology

In this paper, we aim to explain financial inclusion by a demand side, i.e. financial literacy, along with the supply of financial services. Grohmann et al. (2018) broadly define financial inclusion as “having a bank account”. We build upon their research and enhance financial inclusion by adding digital aspect (using a mobile phone or the internet to pay bills).

In the first step, we simply replicate the results of Grohmann et al. (2018) and estimate a baseline OLS regression to explain drivers of enhanced financial inclusion. This OLS regression takes the following form:

$$Y_i = \beta_0 + \beta_1 FL_i + \beta_2 X_i + \varepsilon_i \quad (1)$$

where Y_i represents a group of financial inclusion variables for the i -th country (see Appendix 1 for a detailed list of outcome variables) and FL_i is our main variable of interest (i.e. the level of financial literacy in a country i). X_i includes a list of institutional and country specific control variables including information about population structure as well as economic and financial country characteristics, and ε_i is the error term.

In the next step, we also analyse the results beyond the mean (which are given by the baseline OLS estimates) and estimate the effects of the main covariates of interest (X) at different quantiles (τ) of the outcome variable's (Y) distribution. We do this by estimating the unconditional quantile regressions (UQR) based on the concept of Recentered Influence Functions (RIF) suggested by Firpo et al. (2009).⁵ Once the RIF of a dependent variable is known, we can estimate

⁵ More details on the application of UQR are provided, for instance, in Cupak et al. (2022).

the UQR for the τ -th quantile using a simple OLS framework:

$$RIF(Y_i, Q_\tau(\cdot), F_Y) = \beta_0(\tau) + \beta_X(\tau)X_i + \varepsilon_i \quad (2)$$

Overall, our empirical strategy relies on the stepwise inclusion of covariates of interest to check the stability of the estimated regression coefficients. Furthermore, we use robust standard errors to account for a possible heteroskedasticity.

3.2 Data

Our study relies on cross-sectional data at the country level with the reference year 2014/2015. This part describes the particular datasets and details the construction of the main outcome and explanatory variables.

3.2.1 Outcome variables

We proxy financial inclusion (access to finance) similarly to Grohmann et al. (2018) by using data from the Global Findex database, a country-level panel including various countries from Europe, South and North America, Africa, Middle East and Asia launched in 2011, containing data on global access to financial services like payments, savings, and borrowing.⁶ Hence our dependent variables are defined as: bank account ownership, checking account ownership, debit card ownership, credit card ownership, savings at a formal financial institution, and borrowing at a formal financial institution. Importantly, we also consider more modern tools such as the usage of a mobile phone or the internet for payment and the usage of a credit card for payment. Further details on the construction of outcome variables are given in Appendix A.

3.2.2 Explanatory variables

There have been established several ways of measuring financial literacy. Unlike in the wide literature on measuring financial literacy (see Lusardi and Mitchell, 2011), we employ financial literacy score from the 2014/2015 The

⁶ More information about the data can be found here: <https://www.worldbank.org/en/publication/globalfindex>.

S&P Global Financial Literacy Survey⁷, which is a single cross-sectional dataset based on interviews with over 150,000 adults in more than 140 countries. The publicly available country-level data define financial literacy as the share of population who are able to answer at least 3 out of 4 questions on inflation, risk diversification, interest rate and interest compounding. Due to the availability of the data on financial literacy, we use the data from year 2014 in Findex and all subsequent data sources which are described in the following passage.

In addition to our main explanatory variable of interest, we use a range of control variables that might influence financial inclusion at the country level. Following Grohmann et al. (2018) we consider: population, secondary education, tertiary education, bank branches per 1000 km², bank branches per capita, household debt-to-GDP and dummy variable for high-income country. These variables have been collected from various sources including Global Findex database, IMF Global Debt database, as well as the World Bank and Barro and Lee education attainment dataset (see Appendix A for further details on explanatory variables).

4 Results

This section presents the main empirical results. First, we present the results of univariate analysis and simple correlations between the main variables of interest. The results of OLS and quantile regression analyses are also presented.

4.1 Descriptive results

We start our empirical analysis by summarising our variables of interest. Summary statistics of all variables entering our regressions are given in Table 1. Regarding the outcome variables, bank account ownership averages 55.18% but varies widely, ranging from 6.45% to 100%. Checking account ownership is lower, at 29.61%, with a similarly broad range up to 98.19%. Debit card ownership shows a mean of 39.84%, while credit card ownership is lower, averaging 18.01% – indicating varied levels of access to and reliance on these financial tools. Savings and borrowing have similar means (22.80% and

⁷ More information about the data can be found here: <https://gflec.org/initiatives/sp-global-finlit-survey/>.

23.21%) but show high variability, suggesting diverse financial behaviours. Internet payment usage is low, averaging 17.52%, and credit card use for payments is at 40.02%, showing uneven adoption of digital payment methods.

Table 1: Descriptive statistics

Variable	N	Mean	SD	Min	Max
Bank account ownership	141	55.18	30.72	6.45	100.00
Checking account ownership	133	29.61	31.62	0.00	98.19
Debit card ownership	141	39.84	30.88	0.49	98.63
Credit card ownership	141	18.01	20.06	0.00	77.07
Savings	141	22.80	18.89	0.86	78.41
Borrowing	141	23.21	18.24	0.60	78.92
Usage of internet for payment	141	17.52	21.87	0.00	78.98
Usage of credit card for payment	112	40.02	29.45	3.09	96.47
Financial literacy	142	36.67	13.78	13.00	71.00
Population	140	63.32	5.95	48.00	84.00
Secondary education	138	78.62	24.82	15.00	116.70
Tertiary education	131	19.50	14.13	0.23	59.85
Branch per km	131	25.33	68.14	0.05	605.08
Branch per capita	136	15.54	13.12	0.40	68.80
Private debt	111	84.47	80.12	3.64	381.99
High-income country (dummy)	142	0.30	0.46	0.00	1.00

Source: Authors' calculations based on data described in Appendix A.

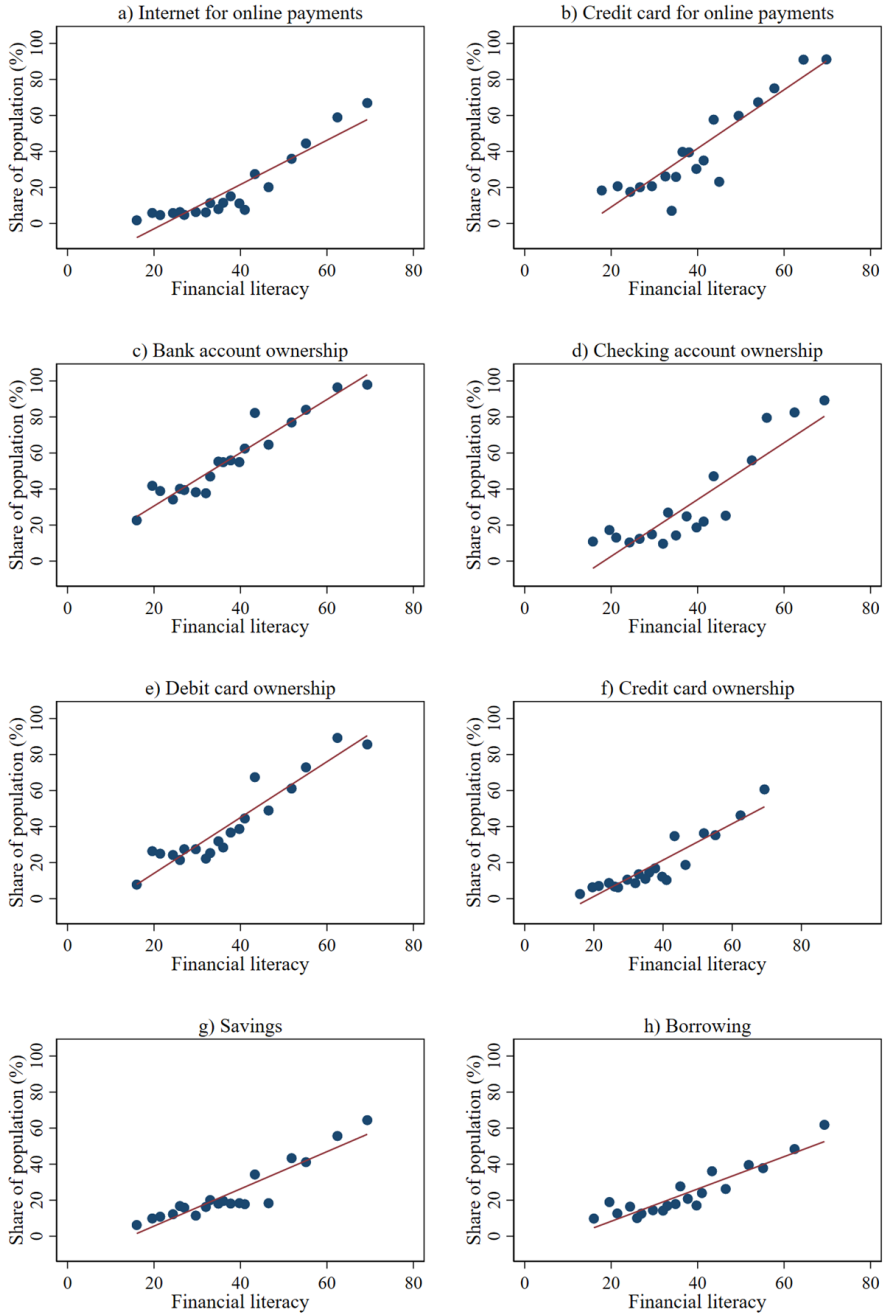
If it comes to explanatory variables, financial literacy averages at 36.67%, indicating that around 37% of people demonstrate sufficient financial knowledge. The population share aged 15-64 is more uniform, averaging 63.32%. Secondary education participation is high, with a mean of 78.62% but considerably spread, highlighting disparities in educational access. In contrast, tertiary education participation is quite low, with a mean of 19.50% and spread is even wider (e.g. only 0.23% of people in Malawi attained tertiary education, while in Canada the share is 59.85). Physical banking access also varies widely, with bank branches per kilometre averaging 25.33 and branch availability per capita at 15.54. Private debt ratio averages 84.47%, showing substantial disparities, and 30% of the sample consists of high-income countries, as indicated by the high-income country dummy with a mean of 0.30.

Building on these descriptive insights, visual analysis can further clarify relationships between the data of our interest. Figure 1 offers a complex glance at the baseline relationships between the level of financial literacy and the proportion of population being engaged in the particular financial instrument / payment.

In particular, panel (a) and panel (b) show the relationship between financial literacy and the usage of internet and credit card payments. In both cases, we see that higher financial literacy is associated with greater adoption of the internet and credit card for payments, suggesting that financially literate individuals may be more inclined to leverage digital tools for financial transactions. In panel (c) and panel (d), we observe a similar pattern in the relationship between financial literacy and ownership of bank and checking accounts. The scatter plots indicate that as financial literacy rises, the proportion of the population with access to these accounts also increases. This suggests that individuals with higher financial literacy are more likely to engage with traditional banking services, such as opening a bank or checking account.

Panels (e) and (f) further confirm those patterns, illustrating the positive association between financial literacy and ownership of both debit and credit cards. The data suggests that as financial literacy improves, so does the likelihood of individuals possessing these financial tools. Higher financial literacy may equip individuals with the knowledge to manage debit and credit cards responsibly, leading to greater adoption and usage. Finally, panel (g) and panel (h) show a positive relationship between financial literacy and both saving and borrowing at formal financial institutions. This suggests that individuals with higher financial literacy are more likely to save and borrow through formal financial channels, such as banks.

Figure 1: Correlations between financial literacy and the particular financial instrument holding



Source: own elaboration.

4.2 Regression results

While the associations shown in a graphical form were informative and clearly highlighted the importance of financial literacy for financial inclusion, the studied associations did not take into account the importance of the other relevant variables, which could possibly confound our results. Therefore, we now turn to a comprehensive regression analysis.

4.2.1 Baseline regression results

When it comes to more sophisticated financial instruments, Table 2 presents OLS regression results on internet and credit card payment usage across countries. Financial literacy is a strong positive predictor for both, with coefficients ranging from 1.033 to 0.628 for internet payments and 0.897 to 0.507 for credit card payments, all significant at the 1% level.

Regarding other explanatory variables: population in productive age and tertiary education do not have a persistent significant effect on both the use of internet and credit card for payment. Banking infrastructure shows different significant effects for the usage of credit card for payment. The number of branches per kilometre negatively affects (coefficient of -0.018 significant at the 5% level) the use of credit card for payment in specification (6). Conversely, the number of branches per capita shows a strong positive effect on the usage of credit card for payment in the same specification.

The high-income country dummy variable has a moderate effect on the use of credit card (coefficient of 6.425 significant at the 10% level) while being not significant for the use of internet for payment.

Table 2: OLS estimates of the determinants of internet and credit card usage for payment

	Internet for payment (1)	Internet for payment (2)	Internet for payment (3)	Credit card for payment (4)	Credit card for payment (5)	Credit card for payment (6)
Financial literacy	1.033*** (0.069)	0.930*** (0.089)	0.682*** (0.127)	0.897*** (0.087)	0.700*** (0.093)	0.507*** (0.124)
Population (15-65)		0.448* (0.266)	0.028 (0.266)		0.745*** (0.243)	0.293 (0.245)
Secondary education		0.055 (0.080)	0.061 (0.063)		0.089 (0.071)	0.065 (0.063)
Tertiary education		0.144 (0.118)	-0.019 (0.111)		0.259* (0.131)	0.156 (0.151)
Branch per km			-0.002 (0.010)			-0.018** (0.008)
Branch per capita			0.063 (0.102)			0.281*** (0.076)
Private debt			0.074** (0.030)			0.039 (0.027)
High-income country			6.518 (4.286)			6.425* (3.858)
Observations	141	129	100	141	129	100
R ²	0.571	0.641	0.785	0.462	0.662	0.781

Notes: Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: Authors' calculations based on data described in Appendix A.

The OLS regression results in Table 3 provide insights into the determinants of bank and checking account ownership. Financial literacy consistently shows a strong positive association with both types of account ownership across all specifications, significant at the 1% level. For bank account ownership, the coefficient of financial literacy ranges from 1.478 in the first specification to 0.774 in the third specification, indicating that higher financial literacy increases the likelihood of holding a bank account. For checking account ownership, the coefficient of financial literacy ranges from 1.576 in the fourth specification to 0.701 in the sixth specification.

Other covariates of interest, population in productive age (i.e. 15-65 years) also has a positive but moderate impact on bank account ownership, with a

significant coefficient of 1.301 in the second specification. However, its effect on checking account ownership is negative and statistically significant in the sixth specification, with a coefficient of -0.904. The results also indicate that tertiary education has a positive influence on both bank and checking account ownership, with a coefficient of 0.279 in specification (2) for bank account ownership and 0.687 in specification (5) for checking account ownership. In the final specifications (3 and 6), the coefficients for tertiary education become statistically insignificant for both types of account ownership.

The relationship between banking infrastructure variables, such as the number of branches per kilometre and the number of branches per capita, and account ownership is relatively weak. However, the number of branches per capita is identified as a significant determinant of bank account ownership in the third specification, with a coefficient of 0.316, significant at the 10% level. The effect of private debt on ownership of both accounts is relatively limited, with a statistically significant effect only observed at the 5% level in the third and sixth specifications, where the coefficients are 0.087 and 0.088, respectively.

Finally, the high-income country dummy shows a substantial positive effect on both bank and checking account ownership in the third and sixth specifications, with coefficients of 13.150 and 34.085, respectively. This finding reflects that high-income countries tend to have notably higher levels of account ownership.

Table 3: OLS estimates of the determinants of bank and checking account ownership

	Bank account ownership (1)	Bank account ownership (2)	Bank account ownership (3)	Checking account ownership (4)	Checking account ownership (5)	Checking account ownership (6)
Financial literacy	1.478*** (0.101)	1.155*** (0.139)	0.774*** (0.163)	1.576*** (0.129)	1.352*** (0.140)	0.701*** (0.159)
Population (15-65)		1.301*** (0.385)	0.564 (0.453)		0.203 (0.445)	-0.904** (0.394)
Secondary education		0.290** (0.117)	0.296*** (0.110)		-0.009 (0.135)	0.024 (0.101)
Tertiary education		0.279* (0.158)	-0.097 (0.174)		0.687*** (0.187)	0.100 (0.193)
Branch per km			0.000 (0.009)			-0.004 (0.015)
Branch per capita			0.316* (0.185)			0.012 (0.123)
Private debt			0.087** (0.038)			0.088** (0.036)
High-income country			13.150** (5.323)			34.085*** (7.834)
Observations	141	129	100	133	123	94
R ²	0.442	0.689	0.806	0.489	0.622	0.842

Notes: Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: Authors' calculations based on data described in Appendix A.

Regarding the next set of financial instruments, Table 4 shows results for debit and credit card ownership. Financial literacy is a consistently significant positive determinant, with coefficients from 1.549 to 0.450 across all specifications, indicating that higher literacy correlates with increased debit and credit card ownership.

Population in productive age positively impacts debit card ownership, with significant coefficients of 1.429 and 0.971 in specifications (2) and (3), while its effect on credit card ownership is weaker and significant only at 10% level with a coefficient of 0.502 in specification (5). Tertiary education significantly influences debit card ownership (0.378 in the second specification) but

is insignificant in specification (3). For credit cards, it is significant in the specification (4) but not thereafter.

Banking infrastructure variables show no significant effect on card ownership. Private debt significantly affects credit card ownership only in the sixth specification (0.056, 10% level), while remaining insignificant for debit cards. Private debt ratio is only significant in specification (6) having a positive coefficient of 0.056 at the 10% level. The high-income country dummy shows a strong positive effect on debit card ownership (20.123, 1% level) and a positive but weaker effect on credit card ownership (10.419, 5% level).

Table 4: OLS estimates of the determinants of debit and credit card ownership

	Debit card ownership (1)	Debit card ownership (2)	Debit card ownership (3)	Credit card ownership (4)	Credit card ownership (5)	Credit card ownership (6)
Financial literacy	1.549*** (0.123)	1.224*** (0.147)	0.758*** (0.205)	1.010*** (0.091)	0.784*** (0.099)	0.450*** (0.143)
Population (15-65)		1.429*** (0.374)	0.971** (0.449)		0.502* (0.288)	-0.106 (0.301)
Secondary education		0.185* (0.099)	0.130 (0.096)		0.063 (0.084)	0.063 (0.077)
Tertiary education		0.378** (0.149)	0.095 (0.147)		0.399*** (0.146)	0.270 (0.175)
Branch per km			-0.008 (0.012)			-0.008 (0.013)
Branch per capita			0.205 (0.150)			0.171 (0.173)
Private debt			0.078 (0.047)			0.056* (0.033)
High-income country			20.123*** (4.815)			10.419** (4.418)
Observations	141	129	100	141	129	100
R ²	0.481	0.707	0.839	0.484	0.650	0.789

Notes: Robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Source: Authors' calculations based on data described in Appendix A.

For our last set of investigated financial instruments, Table 5 presents the determinants of savings and borrowing. Financial literacy is a significant positive factor for both, with coefficients ranging from 1.229 to 0.566 for

savings and from 1.627 to 1.082 for borrowing, all significant at the 1% level, indicating that higher financial literacy correlates with increased likelihood of saving and borrowing.

Population positively do not have a significant effect on savings rate. In contrast, it does affect borrowing at a formal financial institution in specifications (5 and 6) with coefficients of 1.202 and 0.682, respectively. Tertiary education positively affects both savings (coefficients of 0.426 in the first and 0.163 in the second specifications) and borrowing (coefficients of 0.547 in the fifth and 0.171 in the sixth specifications).

Banking infrastructure has mixed effects: the number of branches per kilometre negatively impact savings in specification (6) with a coefficient of -0.042, while branches per capita positively influence borrowing in specification (6) with a coefficient of 0.211. Private debt significantly impacts savings in specification (3) with a coefficient of 0.080 but not borrowing. The high-income country dummy variable positively influences both savings (18.428) and borrowing (19.974), significant at the 1% level.

Table 5: OLS estimates of the determinants of savings and borrowing

	Savings (1)	Savings (2)	Savings (3)	Borrowing (4)	Borrowing (5)	Borrowing (6)
Financial literacy	1.229*** (0.093)	1.025*** (0.102)	0.566*** (0.119)	1.627*** (0.105)	1.442*** (0.121)	1.082*** (0.159)
Population (15-65)		0.356 (0.282)	-0.147 (0.213)		1.202*** (0.353)	0.682** (0.338)
Secondary education		0.035 (0.083)	0.051 (0.057)		0.004 (0.117)	0.012 (0.087)
Tertiary education		0.426*** (0.117)	0.163* (0.093)		0.547*** (0.132)	0.171* (0.103)
Branch per km			-0.042*** (0.011)			-0.010 (0.009)
Branch per capita			-0.003 (0.098)			0.211** (0.100)
Private debt			0.080*** (0.027)			0.050 (0.031)
High-income country			18.428*** (4.106)			19.974*** (4.734)
Observations	141	129	100	112	104	79
R ²	0.604	0.724	0.879	0.586	0.739	0.881

Notes: Robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Source: Authors' calculations based on data described in Appendix A.

The results presented in Tables 2-5 are consistent with those reported in previous literature. For example, Grohman et al. (2018) also report that an increase in financial literacy is associated with a greater propensity to own debit and credit cards, as well as bank accounts. Furthermore, the authors document that enhanced financial literacy is linked to a greater likelihood of individuals saving and borrowing from formal financial institutions. Additionally, our results indicate that an improvement in financial literacy is associated with a greater utilisation of digital financial services, which are a crucial driver of increased financial inclusion in developing countries, as proposed by Khera et al. (2022).

4.2.2 Quantile regressions

Following the estimation of the effects of financial literacy on financial

instruments using standard OLS, which provides an average effect across the entire sample, UQR are employed to gain a more nuanced understanding of these relationships across different levels of distribution in outcome variables. Figure 2 provides the results of UQR estimates across different proxies of financial inclusion considered previously.

Panel (a) exhibits that the effect of financial literacy on the use of internet for online payments gradually increases across quantiles, with a noticeable rise at higher quantiles (p70-p90). These findings indicate that the impact of financial literacy is particularly evident among individuals who are generally more inclined towards using the internet for online payments. Panel (b) demonstrates quite similar patterns to those of panel (a). Thus, the effect of financial literacy is relatively stable at lower quantiles but increases substantially at higher quantiles, especially beyond the median.

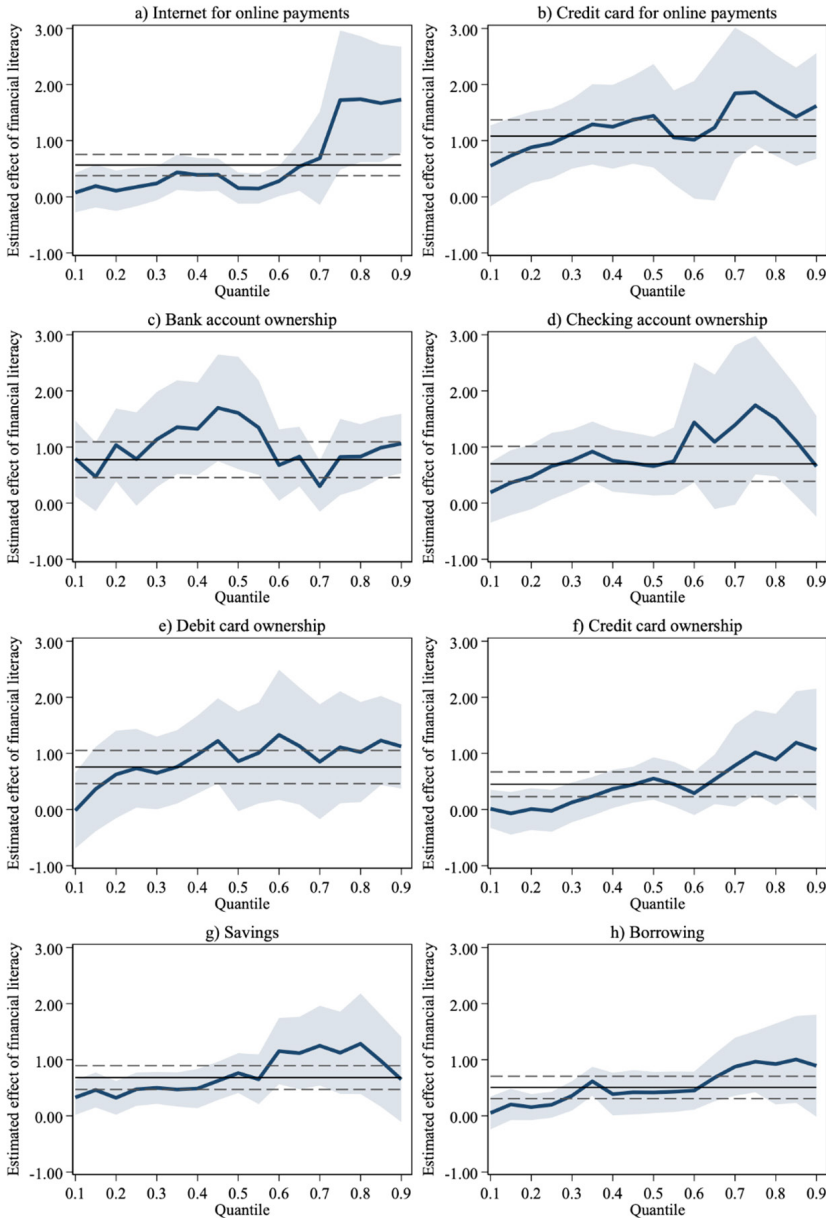
Panel (c) shows that financial literacy affects bank account ownership more at the lower quantiles (p10-p40) than at the higher quantiles. This indicates that financial literacy helps people who are less likely to have bank accounts, potentially reducing obstacles to financial inclusion. For people who are more likely to have bank accounts, the effect of financial literacy is less pronounced. Panel (d) shows a generally consistent effect as in panel (a) across the majority of quantiles, with slight fluctuations above the median.

In panel (e), the effect of financial literacy on debit card ownership is relatively constant across quantiles, with only minor variations. Similar to debit card ownership, financial literacy has a fairly stable effect on credit card ownership across quantiles (panel f). However, the effect appears slightly stronger at higher quantiles (p60-p90), indicating that financial literacy may play a more crucial role in promoting credit card ownership for individuals who are already more inclined to use financial services.

Panel (g) indicates that the influence of financial literacy on savings behaviour is moderate, with some increase in the middle quantiles and slight decrease in the top 2 quantiles. These results suggest that financial literacy has a slightly stronger effect for individuals with moderate levels of saving behaviour. Panel (h) suggests that financial literacy has a consistent impact on borrowing, with a slight increase at the median and at the upper end (p80-p90). This indicates that while financial literacy encourages borrowing, it is particularly influential for those who are already inclined to borrow.

Overall, the UQR results highlight that the impact of financial literacy varies across financial instruments and quantiles. For advanced tools like internet and credit card use for online payments, the effect strengthens at higher quantiles, suggesting that individuals with better financial outcomes derive greater benefits from the usage of digital tools (e.g. Prete, 2022). In contrast, for basic instruments such as bank and checking accounts, debit and credit cards, the effects are more consistent across quantiles, reflecting their widespread accessibility (see Allen et al, 2016). Savings and borrowing also show stronger effects at higher quantiles, indicating that financial literacy plays a greater role in complex financial behaviours as individuals' financial standing improves. This variation reflects the differing levels of complexity and necessity of financial instruments.

Figure 2: Unconditional quantile regression estimates of the effect of financial literacy on various financial instruments



Notes: The unconditional quantile regressions include the same explanatory variables as in specifications (3) and (6). The solid black lines with the dashed black lines show the estimated OLS effects and their confidence intervals, while the solid blue lines together with the light blue areas show the estimated UQR effects and their confidence intervals.

Source: Authors' calculations based on data described in Appendix A.

5 Conclusion

The main objective of this paper was to confirm the hypothesis that higher financial literacy is associated with better access to finance at the country level, and thus with better financial inclusion. Similar to Grohmann et al. (2018), we were able to confirm this pattern. In addition to standard measures of access to finance, we also included more modern instruments such as mobile and internet payments.

Our study underscores the essential role of financial literacy in advancing financial inclusion, as greater financial knowledge consistently aligns with higher ownership of financial products, such as bank accounts, debit and credit cards, and more frequent use of digital payment methods. This positive association is stable across models, reinforcing the idea that financial literacy broadens access to financial services. Higher education, particularly tertiary education, also enhances financial inclusion, mainly in the adoption of traditional and digital tools, indicating that advanced education equips individuals with skills critical to managing financial systems. While the effect of banking infrastructure is moderate, it remains significant for encouraging borrowing, especially in regions with restricted digital access. Demographic factors, such as the proportion of the population aged 15-64, also play a modest role in fostering financial inclusion, especially in payment tool ownership and in savings and borrowing behaviour. Additionally, a higher household debt-to-GDP ratio correlates with increased formal saving, potentially as a precautionary response in high-debt economies. High-income status is strongly linked to greater financial inclusion, highlighting economic advantages that facilitate broader access to financial services.

Furthermore, the quantile regression results (unlike the simple OLS) highlight that the impact of financial literacy varies across the distribution of financial instruments. We argue that this variation could reflect the differing levels of complexity and necessity of financial instruments.

While our results are informative, they should be treated with caution as these findings illustrate only conditional correlations, rather than causal relationships. Financial literacy is often viewed as endogenous due to potential measurement error, which can complicate a straightforward causal interpretation. To estimate the effect of financial literacy on financial inclusion more accurately,

using an instrumental variables approach would be beneficial. Additionally, to account for country-specific fixed effects, a consistent panel dataset would be ideal. Currently, the Global Financial Literacy Survey, conducted only in 2014, limits the ability to examine changes over time, highlighting the need for more frequent data collection to support longitudinal analysis.

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REFERENCES

- [1] Allen, F., Demirgüç-Kunt, A., Klapper, L., & Peria, M. S. M. (2016). The foundations of financial inclusion: Understanding ownership and use of formal accounts. *Journal of Financial Intermediation*, 27, 1–30. <https://doi.org/10.1016/j.jfi.2015.12.003>
- [2] Ashraf, N., Karlan, D., & Yin, W. (2010). Female empowerment: Impact of a commitment savings product in the Philippines. *World Development*, 38(3), 333–344. <https://doi.org/10.1016/j.worlddev.2009.05.010>
- [3] Beck, T., Demirgüç-Kunt, A., & Martínez Peria, M. S. (2008). Banking services for everyone? Barriers to bank access and use around the world. *The World Bank Economic Review*, 22(3), 397–430. <https://doi.org/10.1093/wber/lhn020>
- [4] Beck, T., Demirgüç-Kunt, A., & Peria, M. S. M. (2007). Reaching out: Access to and use of banking services across countries. *Journal of Financial Economics*, 85(1), 234–266. <https://doi.org/10.1016/j.jfineco.2006.07.002>
- [5] Behrman, J. R., Mitchell, O. S., Soo, C. K., & Bravo, D. (2012). How financial literacy affects household wealth accumulation. *American Economic Review*, 102(3), 300–304. <https://doi.org/10.1257/aer.102.3.300>
- [6] Bruhn, M., & Love, I. (2014). The real impact of improved access to finance: Evidence from Mexico. *The Journal of Finance*, 69(3), 1347–1376. <https://doi.org/10.1111/jofi.12091>
- [7] Brune, L., Giné, X., Goldberg, J., & Yang, D. (2016). Facilitating savings for agriculture: Field experimental evidence from Malawi. *Economic Development and Cultural Change*, 64(2), 187–220. <https://doi.org/10.1086/684014>
- [8] Burgess, R., & Pande, R. (2005). Do rural banks matter? Evidence from the Indian social banking experiment. *American Economic Review*, 95(3), 780–795. <https://doi.org/10.1257/0002828054201242>
- [9] Cupak, A., Fessler, P., & Schneebaum, A. (2021). Gender differences in risky asset behavior: The importance of self-confidence and financial literacy. *Finance Research Letters*, 42, 101880. <https://doi.org/10.1016/j.frl.2020.101880>
- [10] Cupak, A., Fessler, P., Hsu, J. W., & Paradowski, P. R. (2022). Investor confidence and high financial literacy jointly shape investments in risky assets. *Economic Modelling*, 116, 106033. <https://doi.org/10.1016/j.econmod.2022.106033>
- [11] Cupak, A., Kolev, G. I., & Brokešová, Z. (2019). Financial literacy and voluntary savings for retirement: Novel causal evidence. *The European Journal of Finance*, 25(16), 1606–1625. <https://doi.org/10.1080/1351847X.2019.1641123>
- [12] Demirgüç-Kunt, A., & Singer, D. (2017). Financial inclusion and inclusive growth: A review of recent empirical evidence. *World Bank Policy Research Working Paper (8040)*. Available at SSRN: <https://ssrn.com/abstract=2958542>

- [13] Dupas, P., & Robinson, J. (2013). Savings constraints and microenterprise development: Evidence from a field experiment in Kenya. *American Economic Journal: Applied Economics*, 5(1), 163–192. <https://doi.org/10.1257/app.5.1.163>
- [14] Ghosh, S., & Vinod, D. (2017). What constrains financial inclusion for women? Evidence from Indian micro data. *World Development*, 92, 60–81. <https://doi.org/10.1016/j.worlddev.2016.11.011>
- [15] Jappelli, T., & Padula, M. (2013). Investment in financial literacy and saving decisions. *Journal of Banking & Finance*, 37(8), 2779–2792. <https://doi.org/10.1016/j.jbankfin.2013.03.019>
- [16] Karlan, D., & Morduch, J. (2010). Access to finance. In *Handbook of Development Economics* (Vol. 5, pp. 4703–4784). Elsevier. <https://doi.org/10.1016/B978-0-444-52944-2.00009-4>
- [17] Khera, P., Ng, S., Ogawa, S., & Sahay, R. (2022). Measuring digital financial inclusion in emerging market and developing economies: A new index. *Asian Economic Policy Review*, 17(2), 213–230. <https://doi.org/10.1111/aepr.12377>
- [18] Klapper, L. F., Lusardi, A., & Panos, G. A. (2012). Financial literacy and the financial crisis (No. w17930). *National Bureau of Economic Research*. <https://doi.org/10.3386/w17930>
- [19] Klapper, L., El-Zoghbi, M., & Hess, J. (2016). Achieving the sustainable development goals: The role of financial inclusion. Retrieved from <http://www.ccgap.org>.
- [20] Lusardi, A., & Mitchell, O. S. (2011). Financial literacy around the world: An overview. *Journal of Pension Economics & Finance*, 10(4), 497–508. <https://doi.org/10.1017/S1474747211000448>
- [21] Lusardi, A., & Mitchell, O. S. (2014). The economic importance of financial literacy: Theory and evidence. *Journal of Economic Literature*, 52(1), 5–44. <https://doi.org/10.1257/jel.52.1.5>
- [22] Lusardi, A., Michaud, P.-C., & Mitchell, O. S. (2017). Optimal financial knowledge and wealth inequality. *Journal of Political Economy*, 125, 431–477. <https://doi.org/10.1086/690950>
- [23] Prete, A. L. (2022). Digital and financial literacy as determinants of digital payments and personal finance. *Economics Letters*, 213, 110378. <https://doi.org/10.1016/j.econlet.2022.110378>
- [24] Van Rooij, M., Lusardi, A., & Alessie, R. (2011). Financial literacy and stock market participation. *Journal of Financial Economics*, 101(2), 449–472. <https://doi.org/10.1016/j.jfineco.2011.03.006>

Appendix

Table A1: Description of variables used in empirical analysis

Variable	Description	Source
<i>Outcome variables</i>		
Bank account ownership	Proportion of the population that has a bank account	FINDEX database
Checking account ownership	Proportion of the population that has a checking account	FINDEX database
Debit card ownership	Proportion of the population that has a debit card	FINDEX database
Credit card ownership	Proportion of the population that has a credit card	FINDEX database
Saving	Share of people who saved any money at a formal financial institution	FINDEX database
Borrowing	Share of people who borrowed any money at a formal financial institution	FINDEX database
Usage of internet for payment	Proportion of people that used a mobile phone or the internet to pay bills	FINDEX database
Usage of credit card for payment	Share of people who used a credit card	FINDEX database
<i>Explanatory variables</i>		
Financial literacy	Share of adults that can answer at least three out of four questions correctly	S&P Financial Literacy Survey
Population	Share of population with age 15-64	FINDEX database
Secondary education	Proportion of people that have secondary education	FINDEX database
Tertiary education	Share of people who have tertiary education	FINDEX database, World Bank, Barro and Lee education attainment dataset
Branch per km	Bank branches per 1000 km ²	FINDEX database
Branch per capita	Bank branches per capita	FINDEX database
Private debt	Private debt, loans and debt securities as a percentage of GDP	IMF Global Debt database
High-income country	Dummy variable taking a value of 1 if a country's GDP is more than mean and 0 otherwise	FINDEX database

Note: All variables are collected with the reference year 2014.