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ARE INTERNET AND EDUCATION ENOUGH FOR DIGITAL FINANCIAL INCLUSION? THE MODERATING ROLE OF INSTITUTIONAL QUALITY

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This paper explores why despite the recent proliferation of internet penetration, educational attainment, and digital-financial infrastructure, the extent of digital-cashless transactions is low. We examine if the presence of strong institutions, in the form of rule of law and low corruption, mitigate the concerns associated with cashless transactions. We conduct this study in the backdrop of the existing literature, which demonstrates that consumers avoid online financial services due to concerns about potential online scams or frauds. Based on the cross-section of 139 countries, spread over three years and employing panel data estimation models, probit models, and instrumental variable models, this study demonstrates that a country's institutional quality enhances the positive effect of internet penetration and educational attainment on cashless transactions. Our findings are robust to year and continent fixed effects and different indicators for digital financial inclusion and institutional quality.

Keywords: Digital Financial Inclusion; Internet Penetration; Educational Attainment; Rule of Law; Corruption.
JEL Classification: D73; O11; G21

1. INTRODUCTION

The merging of the digital and financial spheres, underpinned by information technology, has become an indispensable part of the modern financial system. In this context, "digital finance" refers to the provision of financial services by electronic means, such as those provided through internet by smartphones, computers, and cards connected to a safe online payment system. (Manyika et. al., 2016). Having an availability of these services and making use of them is broadly referred to as digital financial inclusion (CGAP, 2015).

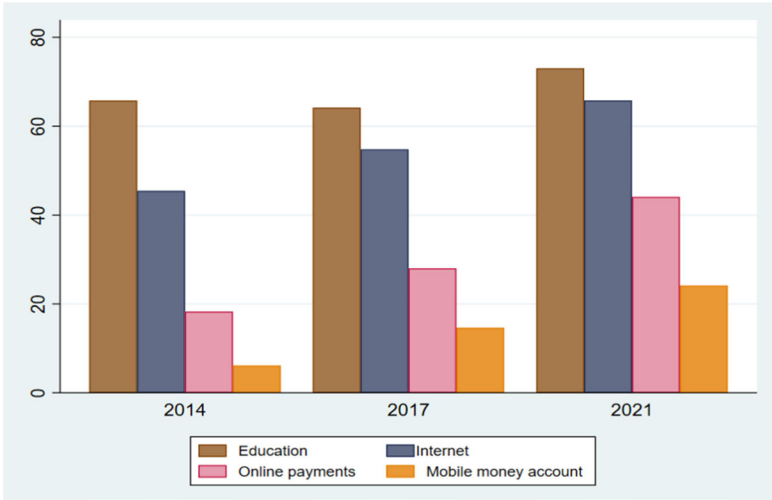
As of 2021, 4.2 billion individuals around the world had an access to a mobile internet connection, as reported by the GSMA (Global System for Mobile Communications Association), a worldwide mobile network operators' group. The GSMA also reports that mobile payments amount to $1 billion daily, facilitated by 276 systems in 90 countries. This allows people to access financial services without physically going to a bank branch in person, as they can do so through their mobile phones and other methods. Digital finance acts as a catalyst in improving the availability of services in banking that are reasonable, convenient, and secure for those living in poverty in developing countries (CGAP), promoting the growth of financial inclusion (World Bank, 2014) and enhancing banking performance (Scott et. al., 2017). It eases the burden of handling currency by eliminating the need to make a change or worry about cash-related frauds, eliminates the cost and inconvenience of visiting a bank or an ATM, and increases accountability and security by allowing for the tracking and recording of all financial transactions (Ligon et al., 2019). Digital financial inclusion also helps banks in reducing costs by maintaining fewer bank branches, facilitates improved efficiency by reducing customer crowds in the banks and by dropping manual paper works and documentations (IFC, 2017; Manyika et al., 2016), enhances the economic welfare of individuals and businesses (CGAP, 2015) and by decreasing the quantity of physical currency in circulation[1], helps in slashing high inflation rates (GPFI, 2016).

*Despite the documented benefits of making use of financial services through digital sphere, participation of people in using these services, worldwide, is nowhere near a desired level. A*ccording to the Global Findex database, as of 2021, around 56% adults in the world were away from making any use of digital financial services. What are the ways to enhance the usage of digital financial services? Literature suggests that increasing internet and mobile phone penetration (Lenka and Barik, 2018; Evans, O. 2018), encouraging crypto-currency, internet usage, and mobile subscriptions (Vincent and Evans, 2019), introducing mobile money (Jack and Suri, 2014), reducing risk and transaction expenses (Klapper et al., 2016) promote inclusion. From the policy standpoint, Rogoff (2014) suggests purging most paper money. Several countries tried to follow this[2] and yet the cash-to-GDP ratio and cash per capita either have remained

[1] Cash payments are now more expensive than their cashless alternatives (Schmiedel et al., 2012) and the social costs associated with cash payments can be as high as 3% of GDP, of which more than 1% could be saved by switching to more secure electronic payments (Humphrey et al., 2003).

[2] In 2017, the central authorities in Europe commenced a 'war on cash'. Countries like France, Greece, Italy, Portugal and Spain limits (caps) on the amount of transactions that could be made in cash (Things just got serious in Europe's war on cash, Wolf Street: the stories behind business, finance and money. https://wolfstreet.com/2017/01/28/europe-limits-on-cash-transactions-war-on-cash. Accessed on 16-02-2022. The central bank of South Korea in 2016 announced its intention to remove small change from circulation by 2020, saying that the first step towards a "cashless society" is to get rid of the metal. https://www.ft.com/content/bf5c929c-b78d-11e6-ba85-95d1533d9a62. Accessed on 16-02-2022. The

constant or has increased over the years[3] (Arango et al., 2018). Despite these attempts to move towards digital financial inclusion, global digital financial inclusion is yet to reach the desired mark. Figure 1 indicates that even when internet penetration and educational attainment are high, adoption of digital financial services is relatively low.



Note: Vertical axis shows percentage of population.

Figure 1. Digital Financial Inclusion in Comparison to Educational Attainment and Internet Penetration.

In this backdrop, the purpose of this research is to investigate whether this relationship between digital financial inclusion and education and internet access is impacted by institutional quality. We conjecture that institutional quality could play a pivotal role because the literature indicates that consumers who are literate, have internet connection, and can afford digital transactions, but still stay away from using online platforms for financial services, fear of frauds and being cheated, or worry about losing money (Shankar and Kumari, 2019; Talwar et al., 2020). These consumers fear that their online identity, personal and financial information might be stolen by cyber-criminals

Reserve Bank of India withdrew the highest-denomination banknotes from circulation in 2016. One of the stated objectives was to promote digital transactions. https://www.bbc.com/news/business-37906742. Accessed on 16-02-2022).

[3] The Cash-to-GDP ratio in India was already back to pre-demonetisation levels by May 2018. https://scroll.in/article/927474/why-indians-still-prefer-cash-despite-demonetisation-and-multiple-digital-payment-options. Accessed on 16-02-2022).

(McCole et al., 2010; Frasquet et al., 2015; Hille et al., 2015) and therefore, they prefer channels that keep their personal and financial information private while still allowing for easy transaction processing (Ahmad Al-Hawari, 2014; Jebarajakirthy et al., 2020). Urban et al. (1999) finds that customers do not use internet if they do not feel safe while disclosing personal information or making financial transactions without the proper authorization. Therefore, given the uncertain and complex nature of the use of electronic financial services, there are evidences to suggest that trust between transacting parties is fundamentally important in mitigating the effect of risk and uncertainty and in facilitating digital transactions (e.g. Grabner-Krauter and Kaluscha, 2003; Ha and Stoel, 2008; Xu, 2020). Given this literature, we hypothesize that the presence of strong institutions, in the form of rule of law and less corruption, are necessary facilitators for adoption of cashless transactions, besides the availability of internet services and education. The other reason why some consumers prefer cash transactions over electronic transactions is for tax evasion since they value anonymity and lack of transparency (Ligon et al., 2019). The presence of better quality institutions, by bringing these consumers into the fold of digital financial services, enhances digital financial adoption.

This paper contributes to two strands of literatures: determinants of digital financial inclusion and the role of institutional quality. Our baseline estimation methods include random effect, fixed effect, pooled OLS, and probit models. In addition to this, IV-2SLS technique addresses the endogeneity concerns and establishes a causal link between institutional quality and people's willingness to use digital financial services. Following the studies like Rodrik et al. (2004), distance from the equator serves as an instrumental variable for the institutional quality. Further, we explore trust as the possible channel through which the institutional quality impacts digital financial inclusion.

Our analysis provides compelling evidences in favour of better quality institutions and shows that the positive marginal effects of having an access to internet and having completed secondary school or above on the proportion of population that makes use of electronic financial services is higher for the countries that have better quality institutions. To establish this relationship, we use the indicators that represent an access to and use of digital financial services: used internet to access account, used internet to buy something online, used internet to pay bills, made or received digital payments, used a debit or credit card. We also conduct an individual-level analysis to supplement the cross-country analysis and find that the positive marginal effects of having an access to internet and having a higher education on the probability of making use of digital financial services is higher for people residing in the countries with higher standards of institutional quality. Overall, we conclude that better quality institutions reduce barriers associated with the online platforms where the digital financial services are used and therefore enhance digital financial inclusion. Further, these results are robust for various control variables and fixed effects, across different measures of digital financial inclusion, different types of institutions and alternative estimation methods.

From a policy perspective, the finding that institutions explain why despite

satisfactory supply of digital financial services and internet facilities, digital financial inclusion is low, suggests that a transition towards a cashless economy requires ensuring good quality institutions.

The remaining paper is laid out as follows: The empirical model is described in Section 2, the findings of the baseline model are discussed in Section 3, Section 4 discusses the direct role of institutional quality, Section 5 presents Robustness check: IV-2SLS regressions, Section 6 investigates the possible channel of transmission, and Section 6 concludes.

2. EMPIRICAL SPECIFICATION

This section describes the specifications of the models that allow us to analyse the responsiveness of digital financial inclusion to internet penetration and educational attainment, contingent upon the indicators of institutional quality. The functional form is represented by Equations 1 and 2 as follows:

$$DFI_{it} = \beta_0 + \beta_1 IP_{it} + \beta_2 IQ_{it} + \beta_3 (IP_{it} * IQ_{it}) + \beta_4 ED_{it} + X'_{it}\gamma + \varepsilon_{it}, \quad (1)$$

$$DFI_{it} = \beta_0 + \beta_1 ED_{it} + \beta_2 IQ_{it} + \beta_3 (ED_{it} * IQ_{it}) + \beta_4 IP_{it} + X'_{it}\gamma + \varepsilon_{it}. \quad (2)$$

DFI_{it} represents digital financial inclusion in country *i,* at time *t*. IP_{it} denotes internet penetration, IQ_{it} represents institutional quality, and ED_{it} is educational attainment. X'_{it} is a vector of control variables including education, log GDP per employed person, number of commercial banks, the private credit to GDP ratio, and bank z-score. ϵ_{it} is the error term.

The above two equations allow us to estimate the significance of high-quality institutions in the relationship between internet and education-digital financial inclusion nexus. The decisive variables in both the equations are the interaction terms: we expect $\widehat{\beta_3}$ to be positively significant, implying that better institutional quality and internet penetration or education are likely to complement each other in improving digital financial inclusion. However, $\widehat{\beta_3}$ per se is not very imperative for our analysis because it does not directly indicate the net partial impact of internet penetration or educational attainment on digital financial inclusion. Instead, what interests us more are the marginal effects of internet penetration $\left(\frac{\partial DFI_{it}}{\partial IP_{it}}\right)$ and educational attainment $\left(\frac{\partial DFI_{it}}{\partial ED_{it}}\right)$ on digital financial inclusion, contingent upon the quality of institutions, derived as: $\frac{\partial DFI_{it}}{\partial IP_{it}} = \widehat{\beta_1} + \widehat{\beta_3} IQ_{it}$ and $\frac{\partial DFI_{it}}{\partial ED_{it}} = \widehat{\beta_1} + \widehat{\beta_3}$, along with the corresponding standard error calculated based on Brambor et al. (2006):

$$\hat{\sigma}_{\frac{\partial DFI_{it}}{\partial IP_{it}}} = \sqrt{var(\widehat{\beta_1}) + IQ_{it}{}^2 * var(\widehat{\beta_3}) + 2 * IQ_{it} * cov(\widehat{\beta_1} . \widehat{\beta_3})}.$$

All the interacted variables – internet penetration, educational attainment, and the indicators of institutional quality are standardized for the ease of interpretation.

2.1. Data and Variables

There are three categories of variables used in this analysis: (i) institutional quality, (ii) digital financial inclusion (DFI), and (iii) control variables. Definitions and data sources of these variables are provided in Table 1.

Table 1. Definitions of the Variables and Their Data Sources

Variables	Definitions and their sources of data
Panel A: Dependent variables / DFI	
Used internet to buy something online	The share of people who made online purchase using a mobile device or the web in the last one year. The data is taken from Global Findex database, 2014, 2017 and 2021.
Used internet to pay bills	The fraction of respondents who made a bill payment using a mobile device or the Internet in the last one year. The data is taken from Global Findex database, 2014, 2017 and 2021.
Made or received digital payments	The share of adults who have made a financial transaction online in the past year, such as a bill payment or a purchase, using a debit or credit card, or sending or receiving a remittance, payment for agricultural products, government transfer, wage, or public sector pension payment. The data is taken from Global Findex database, 2014, 2017 and 2021.
Used internet to access account	The proportion of respondents who state that they have used a mobile device or the Internet in the last year to transfer or receive money from their bank account, make a payment, or buy anything. The data is taken from Global Findex database, 2021.
Used a debit or credit card	The proportion of respondents who say they have made a purchase with a debit or credit card in the last year. The data is taken from Global Findex database, 2014, 2017 and 2021.
Panel B: Main explanatory variables	
Internet penetration	The proportion of the population who utilised the internet within the last three months. Source: International Telecommunication Union.
Rule of law	The rule of law represents views on the extent to which people trust and follow the rules of the society, particularly the quality of contract enforcement, property rights, the police, and the courts. Rule of law also reflects an understanding of the probability of violence or crime. Since digital transactions are faceless, they requires more confidence to complete any contract between buyers and sellers. Better rule of law provides that confidence and, therefore, promotes virtual economic activities. Source: World Governance Indicators, 2014, 2017 and 2021.

Table 1. Definitions of the Variables and Their Data Sources (cont')

Variables	Definitions and their sources of data
Corruption	Petty and major kinds of corruption, as well as the "capture" of the state by elites and commercial interests, represent how much the population believes that public power is used for personal gain. Corruption promotes underground economic activity and therefore, we expect an inverse association between corruption and online transaction incidences. World Governance Indicators, 2014, 2017 and 2021.
Panel C: Control variables	
Education (sec. or above)	Percentage of people with at least a secondary education in a nation. The data is taken from Global Findex database, 2014, 2017 and 2021.
Log of GDP	Log of Gross Domestic Product per capita at 2017 purchasing power parity. The data is taken from World Development Indicators (World Bank), 2014, 2017 and 2021.
No. of CBs	The proportion of commercial bank branches per 100,000 adults in a nation. The data is taken from World Development Indicators (World Bank), 2014, 2017 and 2021.
Private credit to GDP ratio	Private credit as a percentage of GDP by deposit money banks and other financial institutions, intended to gauge financial strength. The data is taken from Global Financial Development (World Bank), 2014, 2017 and 2021.
Bank Z-score	A sign of the stability of the financial industry, the probability of a country's commercial banking system defaulting is captured by the Z-score of a bank. The Z-score compares the commercial banking system's buffer (capitalization and returns) with the volatility of those returns. The data is taken from World Development Indicators (World Bank), 2014, 2017 and 2021.
Distance from the equator	Latitude in degrees. A nation's absolute distance from the equator.

2.1.1. Institutional Quality

In this study, the concept of institutional quality serves as the main explanatory and moderating variable. Institutional quality of a country includes many different elements and therefore, for the purpose of consistency with other studies, we take the variables from the World Governance Indicators (WGI). WGI provides 6 indicators of institutional quality namely, voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, control of corruption. The variables capturing the various dimensions of economic institutions that are relevant for our study are: (i) rule of law, and (ii) corruption. Digital financial services rely heavily on legal and regulatory frameworks that govern financial transactions, customer data protection, and dispute resolution. Without a strong rule of law, digital financial service users may be hesitant to enter or expand into the market, which could limit the

usage of such services. Similarly, corruption also results in lax adherence to rules and regulations, and may increase the risk of frauds and misuse of digital financial services. This can erode trust in the system and discourage individuals and businesses from adopting digital financial services.

While the other four indicators of institutional quality namely, voice and accountability, political stability and absence of violence, government effectiveness, and regulatory quality, are important for good governance, they might not have a noticeable impact on the spread of online banking. This is because while citizen engagement in the policy-making process is important, it may not directly translate into increased access to digital financial services.

2.1.2. Digital Financial Inclusion (DFI)

Following (Xu, 2020), we try to analyse digital financial inclusion through the usage of online banking services. This study examines five indicators that can be used to assess the usage of online banking services: used internet to buy something online, used internet to pay bills, made or received digital payments, used internet to access an account, and used a debit or credit card. Table 1 provides the more details.

2.1.3. Control variables

First, we try to control general country characteristics including, education, internet penetration, and the size of an economy captured by the log of GDP per capita. For controlling financial characteristics of a country, we have (i) variable that assesses actual proximity to financial institutions (number of branches of commercial banks), (ii) a metric for a country's level of financial development or the depth of financial sector (Private credit to GDP ratio), and (iii) a variable for the stability of financial sector (Bank z-score). For specifics, refer to Table 1. We further try to account for potential heterogeneity between continents and years by including controls for continent and year fixed effects in addition to the above extensive set of controls.

2.2. Descriptive Statistics

The indicators of digital financial inclusion are available on the Global Findex database of the World Bank in three waves (2014, 2017, and 2021) for around 160 countries. Combining this data with institutional quality indicators, we end up having a maximum sample size of 246 observations varying across 139 countries. Table 2 provides the descriptive statistics.

The global average value of 0.258 for the proportion of population who used internet to buy something online shows that, worldwide, only 25.8 percent population make use of digital financial services. Globally, about 67 percent of population has secondary or greater level of education and 55 percent has access to internet and yet only 27 percent

use online option to pay their bills. There is a significant heterogeneity among the countries in their levels of making use of these online banking services. In 2021, the lowest adoption was in Afghanistan, where only 0.03% population used internet to buy something online. The highest was 86.61% in Norway. This difference is not only because of difference in internet penetration (which is 18.4% and 97%, respectively) and educational attainment (16.5% and 97%, respectively) but also as a result of a huge disparity in institutional quality. Taking rule of law as an example, on a scale of 1 to 11, Afghanistan has a rule of law score of 1.98, which is significantly lower than Norway's 10.75. There are similar differences for other measures of institutional quality.

Table 2. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Used internet to buy something online	262	0.258	0.248	0.000	0.866
Used internet to pay bills	262	0.271	0.250	0.001	0.885
Made or received digital payments	395	0.548	0.300	0.042	1.000
Used internet to access account	140	0.215	0.226	0.004	0.851
Used a debit or credit card	336	0.424	0.319	0.015	0.986
Rule of law	426	0.000	1.000	-2.290	2.106
Corruption	426	0.000	1.000	-2.374	1.755
Internet penetration	405	55.007	29.494	1.249	100.000
Education	393	67.425	24.289	4.630	99.351
Log of GDP	414	10.302	1.088	7.698	12.407
No. of CBs	386	16.814	14.357	0.410	79.549
Private credit to GDP ratio	399	64.473	80.713	1.393	972.205
Bank Z-score	415	14.807	9.252	1.374	57.161
Distance from the equator	402	0.316	0.191	0.011	0.711

3. MAIN RESULTS

This section presents the primary findings on how institutional quality affects digital financial inclusion both at macro and micro levels.

3.1. Institutional Quality as a Moderating Factor

This section tries to explore the moderating role of institutional quality on the internet penetration-digital financial inclusion nexus and educational attainment-digital financial inclusion nexus, using two indicators of institutional quality: rule of law and corruption. The purpose is to learn about the interactive impact of better quality institutions on the factors that aim to enhance digital finance usage.

3.1.1. Rule of Law as an Institutional Quality

Table 3 provides the results by estimating Equation (1), using rule of law as a measure of institutional quality.

Columns (1) to (9), show a significantly positive relationship between internet penetration, rule of law, and their interaction in one of the main indicators of digital financial inclusion- used internet to buy something online. Columns (1) to (3) show the results using random effect models. Repeating the same exercise using fixed effect models is done in Columns (4) through (6). Columns (7) to (9) present the pooled OLS estimations. Since it is expected that additional country-specific factors would also affect the digital financial inclusion, we adjust for these sets of variables in columns (3), (6), and (9) including continent and year fixed effects. Additionally, we find that a country's overall digital financial usage increases as its percentage of educated population increases. Overall, the findings demonstrate that rule of law consolidate the positive effect of internet penetration on the usage of digital financial services. Other indicators of online banking and the interaction between institutional quality and educational attainment are considered in Table 4A.

Columns (1) to (4) show that rule of law consolidates the positive impact of internet penetration on the other indicators of digital financial inclusion. Columns (5) to (9) show that rule of law consolidates the positive impact of educational attainment on the indicators of online banking. Since our main variable of interest are the interaction terms, we focus on Table 4B, which shows marginal effect of internet penetration and educational attainment on digital financial inclusion for varying degrees of rule of law.

In row 3 (Rule of law=mean) the coefficient in column 1 is 0.048, this indicates that keeping all other things equal and rule of law at an average, one percentage point increase in the percentage of population who have access to internet, increases the share of population using internet to buy something online by 4.87 percentage points. When rule of law advances to 1 standard deviation higher than average (row 4 where rule of law=1), a unit increase in internet penetration leads to an increase in the proportion of population that does online transactions by 12.5 percentage points. On the contrary, when rule of law decreases by 2 standard deviations below the mean (row 1 where rule of law=0), marginal effects of increase in internet penetration on the proportion of population that does online transactions becomes negative. Similar conclusions can be derived from Column (2). The magnitude of positive impact of increase in educational attainment on digital financial transactions is stronger for subsequent betterment in rule of law. Further, the visual representation of these results can be seen in Figure (2).

Table 3. Effect Of Rule of Law on Internet Penetration-Digital Financial Inclusion Nexus

VARIABLES	(1) RE	(2) RE	(3) RE	(4) FE	(5) FE	(6) FE	(7) OLS	(8) OLS	(9) OLS
Internet penetration	0.122***	0.160***	0.049**	0.220***	0.257***	0.134***	0.099***	0.144***	0.048**
	(0.013)	(0.012)	(0.024)	(0.026)	(0.029)	(0.035)	(0.012)	(0.011)	(0.022)
Rule of law	0.118***	0.058***	0.049***	0.055	0.042	0.055	0.140***	0.074***	0.049***
	(0.014)	(0.012)	(0.014)	(0.065)	(0.060)	(0.054)	(0.012)	(0.010)	(0.014)
Internet penetration* Rule of law		0.091***	0.076***		0.146***	0.112***		0.085***	0.073***
		(0.009)	(0.012)		(0.037)	(0.039)		(0.007)	(0.011)
Education (sec or greater)			0.002***			0.004***			0.001***
			(0.000)			(0.001)			(0.001)
Log of GDP			0.009			0.125			0.015
			(0.022)			(0.129)			(0.020)
No. of CBs			-0.001			-0.002			-0.001
			(0.001)			(0.002)			(0.001)
Private credit to GDP ratio			0.001*			0.002**			0.001**
			(0.000)			(0.001)			(0.000)
Bank Z-score			-0.001			0.003**			-0.001
			(0.001)			(0.002)			(0.001)
Year FE	No	No	Yes	No	No	No	No	No	Yes
Continent FE	No	No	Yes	No	No	No	No	No	Yes
Constant	0.232***	0.164***	-0.134	0.219***	0.112***	-1.514	0.237***	0.173***	-0.176
	(0.009)	(0.012)	(0.215)	(0.006)	(0.030)	(1.313)	(0.008)	(0.009)	(0.189)
Observations	246	246	209	246	246	209	246	246	209
R-squared	0.740	0.810	0.860	0.402	0.467	0.629	0.751	0.811	0.861
Number of countries	139	139	122	139	139	122			

Notes: 'used internet to buy something online' is the dependent variable in all the columns. Parentheses present the robust standard errors. ***, ** and * signify the level of significance at 1%, 5% and 10%, respectively

Table 4A. Effect of Rule of Law on Internet Penetration-Digital Financial Inclusion Nexus and Education-Digital Financial Inclusion Nexus

VARIABLES	(1) Used internet to pay bills	(2) Made or received digital payments	(3) Used internet to access account	(4) Used a debit or credit card	(5) Used internet to buy something online	(6) Used internet to pay bills	(7) Made or received digital payments	(8) Used internet to access account	(9) Used a debit or credit card
Internet penetration	0.069***	0.087***	0.035	0.046**	0.002**	0.002**	0.003***	0.000	0.001
	(0.020)	(0.026)	(0.035)	(0.020)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Rule of law	0.072***	0.107***	0.101***	0.079***	0.102***	0.104***	0.113***	0.134***	0.098***
	(0.017)	(0.019)	(0.017)	(0.021)	(0.013)	(0.017)	(0.018)	(0.017)	(0.025)
Internet penetration* Rule of law	0.082***	0.025**	0.088***	0.091***					
	(0.012)	(0.013)	(0.012)	(0.013)					
Education	0.003***	0.003***	0.002**	0.002***	0.066***	0.086***	0.079***	0.077***	0.062***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.013)	(0.016)	(0.015)	(0.023)	(0.018)
Education* Rule of law					0.062***	0.060***	0.013	0.068***	0.064***
					(0.010)	(0.010)	(0.010)	(0.010)	(0.020)
Log of GDP	-0.015	0.009	0.008	0.094***	-0.006	-0.022	0.010	-0.004	0.100***
	(0.020)	(0.022)	(0.019)	(0.027)	(0.022)	(0.021)	(0.022)	(0.022)	(0.027)
No. of CBs	-0.002**	0.001	-0.001	-0.000	-0.001	-0.002*	0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bank Z-score	-0.001	-0.002*	-0.002*	-0.001	-0.001	-0.002	-0.002*	-0.002**	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Continent FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.147	0.203	-0.029	-0.873***	0.110	0.343*	0.269	0.239	-0.800***
	(0.193)	(0.215)	(0.204)	(0.257)	(0.197)	(0.194)	(0.209)	(0.194)	(0.257)
Observations	219	342	122	296	219	219	342	122	296
Number of countries	124	131		117	124	124	131		117
R-squared	0.820	0.820	0.844	0.860	0.840	0.810	0.810	0.830	0.840

Notes: Parentheses present the robust standard errors. ***, ** and * signify the level of significance at 1%, 5% and 10%, respectively.

Table 4B. Average Marginal Effects of Internet Penetration and Education on Digital Financial Inclusion Across the Observed Range of Rule of Law

	(1)	(2)
	Marginal effects of internet penetration on used internet to pay bills	Marginal effects of education on used internet to pay bills
Rule of law= -2	-0.103***	-0.059***
	(0.026)	(0.018)
Rule of law= -1	-0.027	0.003
	(0.022)	(0.012)
Rule of law= Mean	0.049**	0.066***
	(0.024)	(0.013)
Rule of law=1	0.125***	0.128***
	(0.031)	(0.020)
Rule of law=2	0.200***	0.190***
	(0.041)	(0.029)
Rule of law=3	0.276***	0.252***
	(0.051)	(0.039)
Rule of law=4	0.352***	0.315***
	(0.062)	(0.049)
Observations	209	219

Notes: Parentheses present the standard errors. ***, ** and * signify the level of significance at 1%, 5% and 10%, respectively.

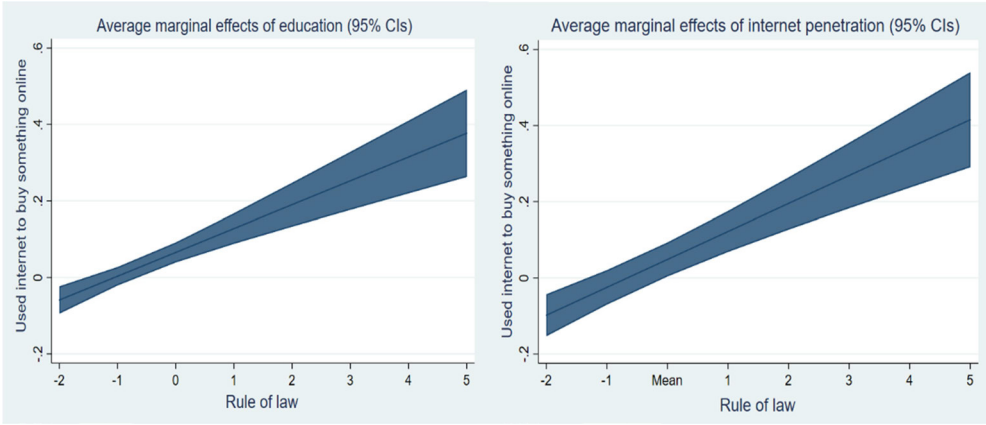


Figure 2. Marginal Effects of Internet Penetration and Education on Digital Financial Inclusion over the Range of Rule of Law

3.1.2. Corruption as an Institutional Quality

Table 5 provides the results by estimating Equation (1), utilizing the level of corruption as a measure of institutional quality.

Table 5. Effect of Corruption on Internet Penetration-Digital Financial Inclusion Nexus

VARIABLES	(1) RE	(2) RE	(3) RE	(4) FE	(5) FE	(6) FE	(7) OLS	(8) OLS	(9) OLS
Internet penetration	0.127***	0.168***	0.058**	0.221***	0.248***	0.087	0.108***	0.155***	0.058**
	(0.013)	(0.012)	(0.026)	(0.026)	(0.029)	(0.062)	(0.011)	(0.011)	(0.025)
Corruption	-0.115***	-0.045***	-0.036**	-0.053	-0.013	-0.003	-0.132***	-0.058***	-0.035**
	(0.013)	(0.012)	(0.016)	(0.047)	(0.041)	(0.047)	(0.011)	(0.011)	(0.016)
Internet penetration* Corruption		-0.084***	-0.062***		-0.090***	-0.060**		-0.078***	-0.062***
		(0.009)	(0.012)		(0.034)	(0.025)		(0.008)	(0.012)
Education (sec or greater)			0.002***			0.004***			0.001**
			(0.000)			(0.001)			(0.001)
Log of GDP			0.009			0.149			0.018
			(0.024)			(0.135)			(0.021)
No. of CBs			-0.001*			-0.002			-0.001
			(0.001)			(0.002)			(0.001)
Private credit to GDP ratio			0.001**			0.001			0.001***
			(0.000)			(0.001)			(0.000)
Bank Z-score			-0.001			0.003			-0.001
			(0.001)			(0.002)			(0.001)
Year FE	No	No	Yes	No	No	No	No	No	Yes
Continent FE	No	No	Yes	No	No	No	No	No	Yes
Constant	0.230***	0.169***	-0.118	0.219***	0.155***	-1.669	0.235***	0.177***	-0.182
	(0.009)	(0.012)	(0.227)	(0.005)	(0.026)	(1.391)	(0.008)	(0.010)	(0.201)
Observations	246	246	209	246	246	209	246	246	209
R-squared				0.404	0.437	0.620	0.756	0.799	0.851
Number of countries	139	139	122	139	139	122			

Notes: 'used internet to buy something online' is the dependent variable in all the columns. Parentheses present the robust standard errors. ***, ** and * signify the level of significance at 1%, 5% and 10%, respectively

Table 6A. Effect of Corruption on Internet Penetration-Digital Financial Inclusion Nexus and Education-Digital Financial Inclusion Nexus

VARIABLES	(1) Used internet to pay bills	(2) Made or received digital payments	(3) Used internet to access account	(4) Used a debit or credit card	(5) Used internet to buy something online	(6) Used internet to pay bills	(7) Made or received digital payments	(8) Used internet to access account	(9) Used a debit or credit card
Internet penetration	0.073***	0.098***	0.043	0.055**	0.040	0.052**	0.092***	0.010	0.037*
	(0.023)	(0.025)	(0.035)	(0.022)	(0.025)	(0.023)	(0.025)	(0.035)	(0.022)
Corruption	-0.050***	-0.088***	-0.074***	-0.079***	-0.064***	-0.084***	-0.093***	-0.106***	-0.100***
	(0.018)	(0.020)	(0.019)	(0.023)	(0.014)	(0.017)	(0.018)	(0.018)	(0.024)
Internet penetration* Corruption	-0.068***	-0.015	-0.080***	-0.069***					
	(0.012)	(0.013)	(0.012)	(0.013)					
Education	0.062***	0.068***	0.050**	0.050***	0.057***	0.076***	0.069***	0.078***	0.054***
	(0.014)	(0.015)	(0.019)	(0.016)	(0.013)	(0.016)	(0.015)	(0.022)	(0.017)
Education* Corruption					-0.049***	-0.046***	-0.004	-0.061***	-0.046**
					(0.009)	(0.010)	(0.010)	(0.010)	(0.019)
Log of GDP	-0.014	0.006	0.008	0.089***	0.003	-0.020	0.006	0.000	0.091***
	(0.021)	(0.022)	(0.021)	(0.027)	(0.025)	(0.023)	(0.022)	(0.024)	(0.028)
No. of CBs	-0.002*	0.001	-0.001	-0.000	-0.001*	-0.002*	0.001	-0.001	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Bank Z-score	0.000	0.000	0.000	-0.000	0.001**	0.000	0.000*	0.001	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Private credit to GDP ratio	-0.002	-0.002**	-0.002**	-0.001	-0.001	-0.002	-0.002**	-0.002*	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Continent FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.315	0.443*	0.098	-0.650**	0.077	0.400*	0.446*	0.200	-0.656**
	(0.211)	(0.226)	(0.224)	(0.271)	(0.243)	(0.225)	(0.228)	(0.249)	(0.280)
Observations	209	330	119	284	209	209	330	119	284
R-squared	0.815	0.815	0.837	0.840	0.840	0.800	0.800	0.823	0.830
Number of countries	122	129		115	122	122	129		115

Notes: Parentheses present the robust standard errors. ***, ** and * signify the level of significance at 1%, 5% and 10%, respectively.

Table 6B. Average Marginal Effects of Internet Penetration and Education on Digital Financial Inclusion Across the Observed Range of Corruption

	(1) Marginal effects of internet penetration on used internet to pay bills	(2) Marginal effects of education on used internet to pay bills
Corruption= -2	0.181***	0.155***
	(0.043)	(0.027)
Corruption = -1	0.120***	0.106***
	(0.034)	(0.019)
Corruption = 0	0.058**	0.057***
	(0.026)	(0.013)
Corruption =1	-0.004	0.009
	(0.023)	(0.013)
Corruption =2	-0.065**	-0.040**
	(0.027)	(0.018)
Corruption =3	-0.127***	-0.088***
	(0.034)	(0.026)
Corruption =4	-0.188***	-0.137***
	(0.044)	(0.034)
Observations	209	209

Notes: Parentheses present the standard errors. ***, ** and * signify the level of significance at 1%, 5% and 10%, respectively.

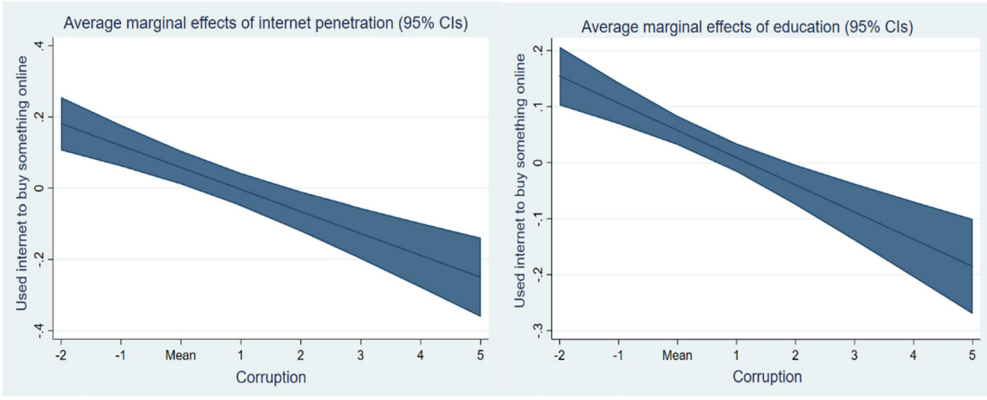


Figure 3. Marginal Effects of Internet Penetration and Education on Digital Financial Inclusion over the Range of Rule of Law

Table 7. Effect of Rule of Law and Corruption on Internet Penetration-Digital Financial Inclusion Nexus at an Individual

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Made bill payments online		Bought something online		Made bill payments online		Bought something online	
Internet penetration	0.470***	0.186***	0.548***	0.113***	0.496***	0.200***	0.594***	0.129***
	(0.009)	(0.018)	(0.009)	(0.019)	(0.008)	(0.018)	(0.008)	(0.019)
Rule of law	0.227***	0.079***	0.269***	0.053***				
	(0.010)	(0.014)	(0.011)	(0.015)				
Internet penetration*	0.220***	0.193***	0.220***	0.142***				
Rule of law	(0.006)	(0.008)	(0.007)	(0.010)				
Corruption					-0.209***	-0.048***	-0.232***	-0.010
					(0.010)	(0.012)	(0.011)	(0.014)
Internet penetration*					-0.198***	-0.173***	-0.190***	-0.131***
Corruption					(0.007)	(0.009)	(0.007)	(0.009)
Female	-0.066***	-0.084***	-0.027***	-0.055***	-0.069***	-0.086***	-0.030***	-0.056***
	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)	(0.010)	(0.010)
Age	-0.008***	-0.010***	-0.018***	-0.022***	-0.008***	-0.010***	-0.018***	-0.022***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education (sec. or	0.606***	0.550***	0.587***	0.602***	0.611***	0.553***	0.595***	0.606***
above)	(0.012)	(0.014)	(0.013)	(0.015)	(0.0119)	(0.014)	(0.013)	(0.015)
In the workforce	0.424***	0.430***	0.387***	0.375***	0.428***	0.428***	0.391***	0.373***
	(0.010)	(0.011)	(0.010)	(0.011)	(0.010)	(0.011)	(0.010)	(0.011)
Income quantile	0.326***	0.354***	0.361***	0.389***	0.326***	0.355***	0.359***	0.389***
	(0.009)	(0.009)	(0.009)	(0.010)	(0.008)	(0.010)	(0.009)	(0.010)
GDP p.c. (PPP)		0.294***		0.325***		0.287***		0.324***
		(0.013)		(0.014)		(0.013)		(0.014)
No. of CBs		-0.007***		-0.003***		-0.007***		-0.003***
		(0.000)		(0.000)		(0.000)		(0.000)
Private credit to		0.000		0.003***		0.000**		0.003***
GDP ratio		(0.000)		(0.000)		(0.000)		(0.000)
Bank Z-score		-0.006***		-0.005***		-0.006***		-0.005***
		(0.001)		(0.000)		(0.001)		(0.001)
Strength of legal		0.004**		0.005**		0.005***		0.006***
rights indicator		(0.002)		(0.002)		(0.002)		(0.002)
Regions FE	No	Yes	No	Yes	No	Yes	No	Yes
Constant	-1.755***	-4.310***	-1.464***	-4.365***	-1.747***	-4.247***	-1.464***	-4.376***
	(0.020)	(0.130)	(0.020)	(0.138)	(0.019)	(0.130)	(0.020)	(0.138)
Pseudo R-squared	0.300	0.330	0.330	0.360	0.300	0.330	0.330	0.360
Observations	150,647	126,636	150,647	126,636	150,647	126,636	150,647	126,636

Notes: Probit estimates. Parentheses present the robust standard errors. ***, ** and * signify the level of significance at 1%, 5% and 10%, respectively.

Columns (1) to (9) show that while internet penetration shows a positive and significant impact, the coefficient of the interaction terms are statistically significant and negative. This implies that the magnitude of positive impact of increase in internet connection on the proportion of population using digital financial transactions is lowered for subsequent rise in corruption (that is for worsening institutional quality). All the other measures of online banking lead to the same conclusions, presented in Table 6A.

Columns (1) to (4) show that corruption mitigates the positive impact of internet penetration on the other indicators of digital financial inclusion. Columns (5) to (9) show that corruption mitigates the positive impact of educational attainment on the indicators of digital financial inclusion. It is further observed in Table 6B that for the corruption level of 1 or more standard deviations higher than mean, even with the additional increase in internet penetration or educational attainment, digital financial inclusion will actually fall. Figure 3 shows the graphical representation.

The results obtained in this section conclude that if institutional quality of a country is of inferior quality, then despite increase in internet penetration and educational attainment, digital financial inclusion might not increase and might even fall.

3.2. Institutional Quality and Individual-Level Digital Financial Inclusion

This section looks into the moderating effect of institutional quality on internet penetration-digital financial inclusion nexus at micro level. The dependent variables include: whether an individual has made bill payments online using internet or not, and whether an individual has bought something online using internet or not. Table 7 shows the probit model estimates.

From columns (1) to (8), we observe that better rule of law and low corruption consolidate the positive effect of internet penetration on the probability of making digital transactions. Individuals living in better rule of law and less corrupt countries are more likely to prefer digital transactions. Furthermore, the results reveal that women and the elderly are less likely to engage in digital commerce. Also, the probability of doing digital transactions is more for those with a, those who are employed, and those in higher income quantiles. GDP per capita of a country, its financial development and its institutional quality have significantly positive effect on the probability of doing online transactions. Bank z-score and number of commercial banks are negatively related to the probability digital transactions.

4. THE DIRECT ROLE OF INSTITUTIONAL QUALITY

This section tries to explore the direct influence that the quality of institutions has in determining digital financial inclusion. Our data shows a strong correlation between the

prevalence of digital financial services and the strength of institutions, as evident in Figure 4.

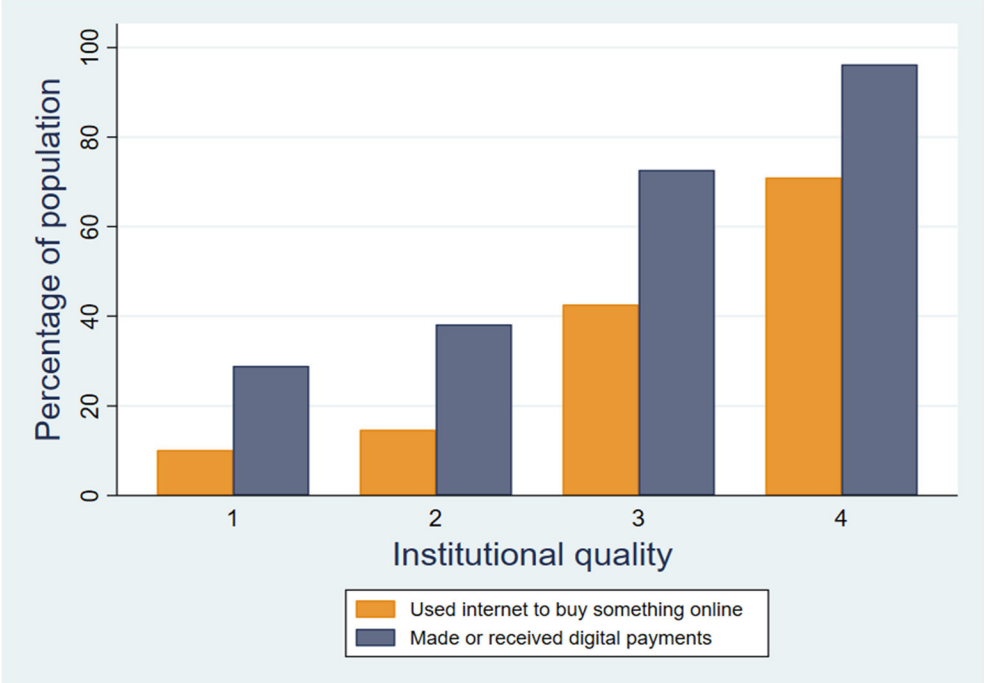


Figure 4. Positive Correlation Between Institutional Quality and Digital Financial Inclusion. Rule of Law Is Used as an Indicator of Institutional Quality.

We hypothesize that better institutions encourage the expansion of online banking and other forms of electronic financial services. Why do we expect that? There are evidences in the literature showing that good quality institutions contribute to wider access to and use of financial services in general (e.g. Orji et al., 2018; Nkoa and Song, 2020; Muriu, 2020). This is due to the fact that better quality institutions offer depositors with incentives to entrust their savings to financial institutions and also improve the readiness of banks to lend to borrowers who are both smaller and in more insecure financial positions (Djankov, 2008; Huang, 2010). Since increased consumer protection is especially important for widespread adoption of digital financial services, we expect that improved institutional quality will contribute to the broader acceptance of these services.

We begin by examining the effect of rule of law on the digital financial inclusion. Table 8 presents the results.

Table 8. Rule of Law and Digital Financial Inclusion- GLS Results

VARIABLES	(1) Used internet to buy something online	(2) Used internet to buy something online	(3) Used internet to buy something online	(4) Used internet to pay bills	(5) Made or received digital payments	(6) Used internet to access account	(7) Used a debit or credit card
Rule of law	0.201***	0.112***	0.085***	0.100***	0.069***	0.145***	0.104***
	(0.012)	(0.013)	(0.020)	(0.024)	(0.018)	(0.023)	(0.022)
Internet penetration		0.003***	0.003***	0.003***	0.006***	-0.000	0.002***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Education (sec or greater)		0.002***	0.002***	0.003***	0.003***	0.002**	0.002***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log of GDP			-0.047*	-0.066**	-0.032	0.004	0.075***
			(0.026)	(0.026)	(0.022)	(0.027)	(0.028)
No. of CBs			-0.003***	-0.003**	-0.000	-0.002	-0.002*
			(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Private credit to GDP ratio			0.001**	0.001	0.001*	0.001	0.000
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Bank Z-score			0.000	-0.001	-0.002	-0.002	-0.001
			(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Continent FE	No	No	Yes	Yes	Yes	Yes	Yes
Constant	0.251***	-0.068**	0.318	0.528**	0.393**	0.071	-0.736***
	(0.011)	(0.029)	(0.219)	(0.223)	(0.194)	(0.229)	(0.262)
Observations	262	245	209	209	330	119	284
Number of countries	142	138	122	122	129		115
R-squared	0.670	0.750	0.800	0.760	0.770	0.779	0.810

Notes: Parentheses present the robust standard errors. ***, ** and * signify the level of significance at 1%, 5% and 10%, respectively.

Table 9. Corruption and Digital Financial Inclusion- GLS Results

VARIABLES	(1) Used internet to buy something online	(2) Used internet to buy something online	(3) Used internet to buy something online	(4) Used internet to pay bills	(5) Made or received digital payments	(6) Used internet to access account	(7) Used a debit or credit card
Corruption	-0.197***	-0.111***	-0.082***	-0.100***	-0.079***	-0.133***	-0.120***
	(0.009)	(0.012)	(0.016)	(0.021)	(0.018)	(0.021)	(0.021)
Internet penetration		0.003***	0.003***	0.003***	0.006***	-0.000	0.003***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Education (sec or greater)		0.002***	0.002***	0.003***	0.003***	0.002**	0.002***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log of GDP			-0.049*	-0.069***	-0.038*	0.001	0.062**
			(0.026)	(0.025)	(0.022)	(0.028)	(0.029)
No. of CBs			-0.003**	-0.003**	-0.000	-0.002	-0.001
			(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Private credit to GDP ratio			0.001***	0.001	0.000	0.001*	0.000
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Bank Z-score			0.000	-0.001	-0.002	-0.002	-0.001
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Continent FE	No	No	Yes	Yes	Yes	Yes	Yes
Constant	0.251***	-0.077***	0.315	0.541**	0.444**	0.064	-0.593**
	(0.011)	(0.028)	(0.219)	(0.213)	(0.190)	(0.237)	(0.263)
Observations	262	245	209	209	330	119	284
Number of countries	142	138	122	122	129		115
R-squared	0.660	0.760	0.800	0.760	0.770	0.785	0.810

Notes: Parentheses present the robust standard errors. ***, ** and * signify the level of significance at 1%, 5% and 10%, respectively.

Columns (1) to (7), show a significantly positive relationship between rule of law and the indicators of digital financial inclusion. Column (1) shows the significantly positive relationship between rule of law and one of the main indicators of digital financial inclusion- using internet to buy something online. Column (2) adds two main determinants of digital financial inclusion, internet penetration and educational attainment. Column (3) shows the full model specification which includes potential confounders like country characteristics and continent fixed effects as controls in an effort to reduce the likelihood of omitted variable bias in the estimates of rule of law. In all the specifications, columns (1), (2), and (3), the core finding that rule of law is positively and significantly associated with the usage of digital financial services, remains unchanged. The coefficient of rule of law in column (3) is 0.085 implying that, an increase in rule of law by one standard deviation increases the proportion of population that does online purchase by 8.5 percent, keeping all other factors constant. Further, we find that internet penetration and educational attainment encourage digital financial usage. Columns (4) to (7) also show the significantly positive effect of rule of law on the other indicators of digital financial inclusion.

Table 9 repeats the estimations of Table 8 with corruption as an indicator of institutional quality.

Columns (1), (2) and (3) investigate the link between corruption and one of the main indicators of digital financial inclusion- using internet to buy something online; the coefficients of corruption are negative and statistically highly significant. The coefficient of -0.082 in column (3) shows that, ceteris paribus, with an increase in corruption by one standard deviation the proportion of population doing online payments decreases by 8.2 percent. Further, other indicators of digital financial inclusion, shown in columns (4) through (7), also show that higher levels of corruption reduces the usage of digital financial inclusion.

5. ROBUSTNESS CHECK: IV-2SLS REGRESSIONS

In this context, one of the most important questions to ask is whether or not the effect of institutional quality on digital financial inclusion is causal. To investigate this, we use an instrumental variables method.

5.1. Distance from the Equator as an Instrument for Institutional Quality

According to Hall and Jones (1999), a country's distance from the equator (or latitude) can be used as an instrument for the quality of its social infrastructure because latitude is correlated with “Western influence,” which is associated with good institutional quality. Many studies (e.g. Rodrik et al., 2004), use latitude as an instrument for the institutional quality.

Table 10. Effect of Rule of Law on Digital Financial Inclusion– IV-2SLS Results

VARIABLES	(1) First stage regression	(2) Second stage regressions	(3)	(4)	(5)	(6)
	Rule of law	Used internet to buy something online	Used internet to pay bills	Made or received digital payments	Used internet to access account	Used a debit or credit card
Distance from the equator	0.840***					
	(0.239)					
Rule of law		0.575***	0.730***	0.194**	0.633*	0.414***
		(0.209)	(0.262)	(0.088)	(0.380)	(0.096)
Internet penetration	0.000	0.000	-0.000	0.003***	-0.004	0.002*
	(0.003)	(0.002)	(0.003)	(0.001)	(0.004)	(0.001)
Education (sec or greater)	-0.002	0.003*	0.004**	0.003***	0.003	0.003***
	(0.003)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
Log of GDP	0.582***	-0.249**	-0.349**	-0.067	-0.214	-0.113*
	(0.079)	(0.122)	(0.153)	(0.044)	(0.155)	(0.064)
No. of CBs	-0.007***	0.002	0.002	0.002**	-0.001	0.003***
	(0.003)	(0.002)	(0.003)	(0.001)	(0.002)	(0.001)
Private credit to	0.007***	-0.002	-0.003*	0.000	-0.003	-0.001**
GDP ratio	(0.001)	(0.001)	(0.002)	(0.001)	(0.003)	(0.001)
Bank Z-score	-0.000	0.000	0.000	-0.003***	-0.000	-0.002*
	(0.004)	(0.002)	(0.003)	(0.001)	(0.003)	(0.001)
Constant	-6.445***	2.703**	3.772**	0.847*	2.693	1.262*
	(0.668)	(1.299)	(1.626)	(0.480)	(1.794)	(0.680)
Observations	277	204	204	322	115	277
R-squared		0.144	0.756	0.786	0.530	0.671
Cragg-Donald Wald F statistic	12.270					
Stock-Yogo F- statistics at 15%	8.960					

Notes: Parentheses present the standard errors. Distance from the equator acts as an instrument of rule of law. ***, ** and * signify the level of significance at 1%, 5% and 10%, respectively.

Table 11. Effect of Corruption on Digital Financial Inclusion – IV-2SLS Results

VARIABLES	(1) First stage regression	(2)	(3)	(4) Second stage regressions	(5)	(6)
	Corruption	Used internet to buy something online	Used internet to pay bills	Made or received digital payments	Used internet to access account	Used a debit or credit card
Distance from the equator	-0.915***					
	(0.265)					
Corruption		-0.420***	-0.533***	-0.168**	-0.458**	-0.380***
		(0.127)	(0.157)	(0.080)	(0.225)	(0.090)
Internet penetration	-0.001	0.001	0.000	0.003***	-0.003	0.001
	(0.003)	(0.002)	(0.002)	(0.001)	(0.003)	(0.001)
Education (sec or greater)	0.003	0.003***	0.005***	0.004***	0.004**	0.003***
	(0.003)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Log of GDP	-0.584***	-0.172**	-0.251**	-0.055	-0.172	-0.094
	(0.087)	(0.080)	(0.099)	(0.041)	(0.108)	(0.062)
No. of CBs	0.009***	0.002	0.002	0.002**	-0.000	0.003***
	(0.003)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)
Private credit to	-0.007***	-0.001	-0.002**	0.000	-0.001	-0.001**
GDP ratio	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Bank Z-score	0.002	0.001	0.001	-0.003***	-0.000	-0.002
	(0.004)	(0.002)	(0.002)	(0.001)	(0.003)	(0.001)
Constant	6.488***	1.782**	2.603***	0.695	2.043*	1.059
	(0.739)	(0.816)	(1.008)	(0.432)	(1.167)	(0.652)
Observations	277	204	204	322	115	277
R-squared		0.211	-0.178	0.768	-0.020	0.655
Cragg-Donald Wald F statistic	11.910					
Stock-Yogo F- statistics at 15%	8.960					

Notes: Parentheses present the standard errors. Distance from the equator acts as an instrument of rule of law. ***, ** and * signify the level of significance at 1%, 5% and 10%, respectively.

Table 12. Effect of Rule of Law and Corruption on Internet Penetration-Digital Financial Inclusion Nexus – IV-2SLS Results.

VARIABLES	(1) Used internet to buy st. online	(2) Used internet to pay bills	(3) Made or received digital payments	(4) Used internet to access account	(5) Used a debit or credit card	(6) Used internet to buy something online	(7) Used internet to pay bills	(8) Made or received digital payments	(9) Used internet to access account	(10) Used a debit or credit card
Internet penetration	0.126***	0.166***	0.060**	0.096**	0.051**	0.150***	0.196***	0.086***	0.134***	0.074***
	(0.041)	(0.054)	(0.025)	(0.049)	(0.024)	(0.043)	(0.053)	(0.028)	(0.050)	(0.026)
Rule of law	0.087*	0.135**	0.088***	-0.023	0.039					
	(0.052)	(0.069)	(0.026)	(0.051)	(0.033)					
Internet penetration*	0.243***	0.327***	0.081**	0.241***	0.167***					
Rule of law	(0.061)	(0.080)	(0.033)	(0.063)	(0.035)					
Corruption						0.104**	0.151**	-0.038	0.026	-0.012
						(0.051)	(0.064)	(0.028)	(0.044)	(0.032)
Internet penetration*						-0.212***	-0.283***	-0.089***	-0.206***	-0.145***
Corruption						(0.052)	(0.065)	(0.031)	(0.051)	(0.030)
Education (sec or	0.002**	0.003***	0.003***	0.002**	0.002**	0.001	0.002*	0.003***	0.001	0.002**
greater)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log of GDP	0.040	0.024	0.021	0.033	0.113***	0.040	0.021	0.032	0.016	0.118***
	(0.029)	(0.038)	(0.020)	(0.035)	(0.025)	(0.027)	(0.034)	(0.021)	(0.032)	(0.025)
No. of CBs	0.001	0.001	0.003***	0.000	0.002***	0.001	0.001	0.003***	0.001	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Private credit to	0.001	-0.000	0.000**	-0.000	-0.000	0.001**	0.000	0.001***	-0.000	0.000
GDP ratio	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Bank Z-score	-0.002	-0.003	-0.004***	-0.002*	-0.003***	-0.003**	-0.004**	-0.005***	-0.004**	-0.004***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Continent FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.510*	-0.379	0.014	-0.356	-1.053***	-0.417	-0.227	-0.085	-0.101	-1.088***
	(0.298)	(0.393)	(0.208)	(0.360)	(0.257)	(0.273)	(0.340)	(0.210)	(0.319)	(0.260)
Observations	204	204	322	115	277	204	204	322	115	277
R-squared	0.713	0.513	0.818	0.688	0.849	0.736	0.598	0.804	0.734	0.841
1st-stage regression F-test	15.050	15.050	37.040	11.760	48.480	19.960	19.960	45.690	14.950	76.020
F-test for weak instruments	8.960	8.960	8.960	8.960	8.960	8.960	8.960	8.960	8.960	8.960

Notes: Parentheses present the standard errors. Distance from the equator acts as an instrument for rule of law and corruption. ***, ** and * signify the level of significance at 1%, 5% and 10%, respectively.

Table 13. Indirect Effects of Rule of Law and Corruption on Digital Financial Inclusion Through Trust

VARIABLES	(1) Used internet to buy st online	(2) Used internet to pay bills	(3) Made or received digital payments	(4) Used internet to access account	(5) Used a debit or credit card	(6) Used internet to buy something online	(7) Used internet to pay bills	(8) Made or received digital payments	(9) Used internet to access account	(10) Used a debit or credit card
Trust	0.900***	0.819***	1.023***	0.852***	1.328***	0.988***	0.931***	1.138***	0.984***	1.463***
	(0.168)	(0.177)	(0.165)	(0.196)	(0.205)	(0.196)	(0.206)	(0.182)	(0.242)	(0.223)
Rule of law	-0.597***	-0.629***	-0.446***	-0.775***	-0.778***					
	(0.117)	(0.126)	(0.096)	(0.154)	(0.172)					
Trust*Rule of law	0.712***	0.772***	0.584***	0.948***	0.960***					
	(0.124)	(0.136)	(0.098)	(0.168)	(0.174)					
Corruption						0.701***	0.758***	0.503***	0.836***	0.734***
						(0.160)	(0.164)	(0.149)	(0.210)	(0.214)
Trust*Corruption						-0.801***	-0.884***	-0.603***	-0.982***	-0.890***
						(0.162)	(0.169)	(0.151)	(0.216)	(0.216)
Internet penetration	0.001*	0.001	0.001*	0.000	0.002*	0.001*	0.001*	0.002*	0.000	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Education (sec or greater)	0.001***	0.003***	0.003***	0.002***	0.003***	0.001**	0.002***	0.003***	0.002***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log of GDP	-0.008	-0.035*	-0.010	-0.016	0.033	0.001	-0.026	0.003	-0.006	0.033
	(0.020)	(0.021)	(0.018)	(0.023)	(0.024)	(0.020)	(0.021)	(0.019)	(0.026)	(0.025)
No. of CBs	-0.002**	-0.002**	0.002**	-0.002	0.001	-0.001*	-0.002**	0.002**	-0.002	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Private credit to GDP ratio	0.001**	0.000	0.000*	0.000	-0.000	0.001***	0.000	0.001***	0.001	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Bank Z-score	-0.001	-0.002	-0.004***	-0.002	-0.003**	-0.001	-0.002*	-0.004***	-0.002	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Continent FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.791***	-0.442*	-0.674***	-0.585**	-1.541***	-0.963***	-0.644**	-0.926***	-0.829***	-1.669***
	(0.209)	(0.226)	(0.221)	(0.255)	(0.257)	(0.244)	(0.248)	(0.233)	(0.315)	(0.279)
Observations	209	209	329	119	284	209	209	329	119	284
R-squared	0.865	0.820	0.850	0.836	0.877	0.863	0.821	0.837	0.831	0.871

Notes: The table reports a possible channel of transmission. Parentheses present the robust standard errors. ***, ** and * signify the level of significance at 1%, 5% and 10%, respectively.

Following these studies, we also use latitude as an instrumental variable for the institutional quality. Since we believe that a country's absolute latitude has little to no bearing on its level of digital financial inclusion, we think that distance from the equator is a fairly good instrument with which to conduct our study.

Table 10 shows the IV-2SLS regression results. The second stage results highlight the effect of rule of law on the usage of digital financial services. Column (1) presents the first stage regression results and shows the positive and highly significant effect of distance from the equator on the use of digital financial services. Cragg-Donald Wald F statistic is 12.27, greater than the cut-off of 10 which is typically used. Further, the value of Stock-Yogo F-statistics at 15% is 8.96. These tests, when taken together, give compelling evidence that distance from the equator as an instrument for rule of law is not a weak instrument and, consequently, can be accepted as a valid instrument. Since we only have one instrument, we are unable to conduct an overidentification test. Columns (2) to (6) present the second stage regressions results, we find that a significantly positive relationship between rule of law and the usage of digital financial services continue to exist and the magnitude gets even stronger. This points to the fact that the relationship is, in fact, causal.

Table 11 repeats the analysis of Table 10, with corruption an indicator of institutional quality. The overall results and interpretation remains the same.

Now, we move to identify our main finding, which is that better quality institutions have a positive moderating effect on internet penetration-digital financial inclusion nexus. We do this by treating distance from the equator as an instrumental variable for the quality of government institutions in an interaction model. Table 12 presents the second stage results from the IV-2SLS regressions. Columns (1) to (5) and (6) to (10), show that rule of law and corruption have a significantly positive and negative respectively, effects on internet penetration-digital financial inclusion nexus. This shows that the moderating impact of quality of government institutions on digital financial inclusion through internet penetration is causal.

5.2. Possible Channel of Transmission

Having documented the causal effect of better institutions on the usage of digital financial services, now we try to investigate the potential channel through which institutional quality might explain the digital financial inclusion. There are several studies in the extant literature arguing how better institutional quality improve the situation of trust among the individuals (e.g. Robbins, 2012). Based on the findings of this literature, we identify trust as a possible channel through which institutional quality can affect usage of digital financial services. According to these studies better institutional quality positively affects confidence among the individuals which increases their general level of trust. Further, the studies like Suh and Han (2003) demonstrate that trust is a key component in reducing the degrees of uncertainty that customers experience, and it plays an important role in determining whether or not customers will

participate in using digital financial services. Also Xu (2020) shows that trust improves financial inclusion (including digital financial inclusion). Putting these pieces together, we propose and test the hypothesis that better institutional quality positively affects trust through which it positively affects digital financial inclusion. Using interaction models, Table 13 provides the empirical results.

The significantly positive interaction terms in columns (1) to (5), validating our hypothesis that trust can be a possible channel through which rule of law leads to higher digital financial inclusion. Further, the marginal effects of rule of law on the digital financial inclusion is higher in those countries where the general level of trust on financial institutions is higher. Same conclusions can be drawn for corruption shown in columns (6) to (10). Thus higher trust consolidates

6. CONCLUSION

Transition to cashless societies is taking place all over the world in recent times. According to the Global Findex database, the percentage of global population making cashless transactions increased from 18% in 2014 to 44% in 2021. It is believed, based on the research that has been done, that internet penetration and educational attainment are two major factors that facilitate this transition towards adopting cashless transactions. Yet, as evident from the global data, despite reasonable availability of financial services in digital form, internet penetration and education, the usage of digital banking is still far from touching a desired mark. In this backdrop, this study adds another dimension in understating the limiting factors of digital financial inclusion. We conjecture that quality of institutions, especially in the form of rule of law and corruption, determines the extent to which the internet penetration channel and educational attainment channel work effectively towards attaining digital financial inclusion. This stems from the perception that cashless transactions are avoided either due to the fear of online frauds and lack of sufficient legal protection in such events, and/or due to unwillingness to adopt transaction transparency.

The findings of this study, at the macro-level, show that in the countries where rule of law and anti-corruption measures are stronger, the positive impacts of increase in internet penetration and educational attainment on adopting cashless transaction methods are stronger. Additionally, improvements in institutional quality increase the usage of digital financial services either directly or indirectly through generalized trust on financial institutions. The findings at an individual-level, on the other hand, show that the positive marginal effects of internet penetration and educational attainment on the probability of having exposure to and adopting online banking services is higher in countries with stronger institutional quality.

The main results come from applying fixed effect, random effect, pooled OLS, and probit models. To addresses the endogeneity concerns and establish a causal

interpretation of these results, standard IV-2SLS technique is used. From the policy standpoint, an environment of better rule of law and low corruption are imperative for internet penetration and educational attainment to have its desired impact on digital financial inclusion.

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