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Building financial resilience through financial and digital literacy in South Asia and Sub-Saharan Africa

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ADB Working Paper Series

BUILDING FINANCIAL RESILIENCE THROUGH FINANCIAL AND DIGITAL LITERACY IN SOUTH ASIA AND SUB-SAHARAN AFRICA

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Abstract

Globally, 1.7 billion adults still lack access to formal financial services, with a large percentage living in South Asia and Sub-Saharan Africa. Current financial inclusion strategies provide these vulnerable populations with access to a wide array of financial services that aim to build more inclusive and financially resilient societies. With the movement towards Fintech and over 67% of the world's population having a mobile phone, digital financial literacy is gaining momentum. Nevertheless, negligible research has measured its impacts on financial behavior. This study uses data from the InterMedia Financial Inclusion Insights surveys for seven South Asian and Sub-Saharan African countries to investigate the impact of multi-dimensional measures of financial and digital literacy on resilience-building financial behaviors, including saving, borrowing, and risk management. The findings consistently show that both financial and digital literacy are key factors to building inclusiveness and financial resilience. Heterogeneities are identified across regions, as well as for poor, rural, and female households. A robustness check is also included to address potential endogeneity. The results emphasize the need to redefine traditional financial literacy to include digital literacy, with important implications for countries considering both financial and digital literacy as a dual approach to improving households' long-run financial resilience.

Keywords: financial resilience, financial behaviors, financial literacy, digital literacy, South Asia, Sub-Saharan Africa

JEL Classification: D14, D31, D91, G21, G23, J11, O17, O53

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1. INTRODUCTION

Globally, financial inclusion has become a powerful framework for building financial resilience by reducing vulnerabilities and providing a buffer against adversities. In fact, most national financial inclusion strategies have expanded and now aim to enhance individuals' livelihoods and build more inclusive and financially resilient societies. According to the World Bank, about 1.7 billion adults still lack access to formal financial services (Demirgüç-Kunt et al. 2018). Most of these financially excluded individuals (representing over 75% of the adult population) live in the developing world, with a large percentage residing in South Asia and Sub-Saharan Africa. Policy makers and other stakeholders argue that more inclusive financial systems empower individuals – especially the most vulnerable – to save, borrow, develop assets, protect against risk, and consequently build resilience (Gash and Gray 2016). Those populations most vulnerable include the poor, those living in rural areas, and women (Lyons, Kass-Hanna, and Greenlee 2020). Thus, resilience building has rapidly become a global priority aimed at enhancing individuals' ability to cope with threats, whether environmental, social, or economic (Jones and Tanner 2017).

What does it mean to build financial resilience? According to Jacobsen, Marshak, and Griffith (2009, p. 3), “[f]inancial resilience and vulnerability are two sides of the same coin.” Building financial resilience starts by understanding the vulnerabilities that result from exposure to risk and lack of access to appropriate resources (Morrow 2008; Norris 2010; Moore et al. 2019; Salignac et al. 2019). Unexpected shocks (such as the illness or death of a family member, job loss, natural disaster, crop failure, or livestock loss) can leave households less equipped to overcome adversities. Ideally, households would use their savings, borrow money, or rely on insurance payouts or transfers from family and friends. However, low savings rates and imperfections in insurance and credit markets are major reasons why some segments struggle to establish a cushion against these types of risks. To this end, access to resources such as well-designed and affordable financial services is believed to provide the means to build resilience in the face of economic vulnerabilities. However, not all households enjoy the same access to financial services. Economically vulnerable populations face multiple barriers to financial inclusion and are most at risk, relying on coping mechanisms that often lead to long-lasting financial insecurities and adverse developmental outcomes (Gash and Gray 2016). These coping strategies frequently involve reductions in food consumption, the sale of assets, and the accumulation of unmanageable debt loads. Financial inclusion represents an important pathway for marginalized households to mitigate risks and increase their capacity to cope (Hussain et al. 2019).

A wide range of mechanisms are being employed to enhance the effectiveness of national financial inclusion strategies so as to promote financial resilience. Current strategies go beyond simply providing access to bank accounts, as they include fostering access to and usage of a comprehensive set of financial services (such as payment and money transfer services, loans, insurance, and investment products). Financial literacy is recognized as an essential instrument for cultivating the financial awareness, knowledge, skills, attitudes and behaviors necessary for individuals to effectively access and use these services. Consequently, almost all national strategies for financial inclusion include financial literacy as a key component (OECD/INFE 2015, 2019; Stolper and Walter 2017).

Digital financial services (DFS) have gained momentum globally and are now viewed as perhaps the most promising mechanism to enable financial access and foster universal financial inclusion (GPFI 2016, 2017; OECD/INFE 2018; Lyons, Kass-Hanna, and Greenlee 2020). With more than 67% of the global population having a mobile phone, many parts of the developing world have experienced rapid growth in DFS, most notably in South Asia and Sub-Saharan Africa due to the surge in mobile phone subscribers (Manyika et al. 2016; GSMA 2019a, 2019b). Countries in South Asia and Sub-Saharan Africa have made rapid progress in “leapfrogging” from traditional financial services (brick-and-mortar banks and automated teller machines, ATMs) to DFS (digital payment tools such as mobile money and digital wallets) (Alexander, Shi, and Solomon 2017; Demirgüç-Kunt et al. 2018; Lyons, Kass-Hanna, and Greenlee 2020). This “digital financial revolution” has allowed people around the world to use their mobile devices to access and conduct a wide range of DFS. The fact that large segments of the world’s unbanked population live in South Asia and Sub-Saharan Africa further increases the potential for DFS to increase financial inclusion rates.

Current and anticipated growth in DFS intensifies the need for more progressive financial literacy initiatives that can adapt to the rapidly changing digital economy (OECD 2017, 2018). There is a growing need to augment digital financial literacy, which is now regarded as a mediator of the relationship between financial literacy and financial inclusion, and is assumed to improve the effectiveness of both (G20 GPFI 2016, 2017; Morgan, Huang, and Trinh 2019; Lyons, Kass-Hanna, and Greenlee 2020).¹ For individuals to effectively participate in the digital economy, they need to have the knowledge and skills both to perform digital financial transactions and to operate digital devices such as mobile phones, smart phones, and tablets (Carlin, Olafsson, and Pagel 2019; Vogels and Anderson 2019).

To date, very little research has investigated the actual impacts of digital literacy on financial behavior, especially compared to and in conjunction with financial literacy. This study is among the first to rigorously measure the impact of multi-dimensional measures of both financial and digital literacy on households’ ability to build financial resilience. We use data from the InterMedia Financial Inclusion Insights (FII) surveys for seven South Asian and Sub-Saharan African countries (Bangladesh, India, and Pakistan in South Asia, and Kenya, Nigeria, Tanzania, and Uganda in Africa) to estimate the impacts of multiple resilience-building financial behaviors, including saving, borrowing, and risk management. Robustness checks are conducted for economically vulnerable populations to identify heterogeneities and inequality gaps. Two-stage models using instrumental variables are also included to check for endogeneity. The findings show that both financial and digital literacy are key factors in building inclusiveness and financial resilience. Although heterogeneities exist, the results tend to be consistent and significant across behaviors and marginalized groups. The findings emphasize the need to redefine traditional financial literacy to include digital literacy, with important implications for countries considering both financial and digital literacy as a dual approach to building households’ long-run financial security and resilience.

¹ In 2016, the G20 leaders endorsed the “G20 High-level Principles for Digital Financial Inclusion,” which provide a foundation for countries to develop action plans to leverage digital technologies to assist in achieving financial inclusion goals (G20 GPFI 2016, 2017; OECD 2018). The G20 Communiqué includes eight Principles, as well as suggested action steps that countries can take to implement each Principle (subject to country context). Principle 6, “Strengthen Digital and Financial Literacy and Awareness,” plays a key role in increasing global support for the expansion of current financial literacy initiatives to include digital literacy. Appendix A presents an overview of the current financial inclusion strategies, including the financial and digital literacy initiatives for each of the South Asian and Sub-Saharan African countries in our study.

The remainder of this paper is structured as follows. Section 2 reviews the relevant literature and highlights the contributions of our study. Section 3 describes the data and how key variables were constructed. Section 4 presents the methodology for investigating the linkages between financial and digital literacy, and financial inclusion and resilience. A descriptive analysis of the data is then presented in Section 5, followed by the regression results in Section 6. Finally, Section 7 summarizes the key findings and the implications for the global financial inclusion community.

2. LITERATURE REVIEW

2.1 Does Financial Inclusion Lead to Resilience?

The existing literature has identified four channels through which financial inclusion – via financial services solutions – can build resilience (CGAP 2019; Moore et al. 2019). First, individuals can utilize financial services to make productive investments in the face of risk. Individuals lacking access to financial tools such as savings accounts, loans, and insurance are only able to participate in low-risk, low-return activities with less potential to grow future income and wealth. Households that use savings or credit to make strategic investments in their business, farm, education and even health are able to make higher risk, higher return investments that reduce exposure to future shocks (Karlan et al. 2014; Cai et al. 2015; Cole, Giné, and Vickery 2017).

Second, investments in risk-mitigating activities can support resilience. Some researchers have argued that saving constitutes an informal insurance tool that shifts risk preferences and encourages more productive risk-mitigating investments (Carvalho, Prina, and Sydnor 2013; Dupas and Robinson 2013a). Households that use credit or savings to make investments in preventative health measures or risk-mitigating technologies for business or agricultural purposes are also able to reduce their exposure to shocks before they even occur (Brown, Zelenska, and Mobarak 2013; Brune et al. 2016; Jack et al. 2016; Hallegatte et al. 2017).

The third resilience strategy is to use financial services to facilitate preparedness for shocks. In addition to insurance, low-cost liquid savings accounts allow individuals to self-insure by building a savings cushion that can smooth consumption when a shock occurs (Dupas and Robinson 2013b; Prina 2015; Dupas, Keats, and Robinson 2017; El-Zoghbi et al. 2017; Kast and Pomeranz 2018).

Finally, financial services can be used to respond when an adverse event occurs. Vulnerable populations that have been financially excluded from key financial services are often forced to turn to suboptimal coping strategies, as mentioned earlier. DFS can significantly reduce transaction costs in terms of both time and money, as well as expand one's access to a larger social network, which can be relied upon for resources when a shock hits (Jack and Suri 2014; Lyons, Grable, and Zeng 2017). DFS can thus be particularly effective in helping to build resilience, especially in South Asia and Sub-Saharan Africa.

Therefore, the new narrative is that financial services such as savings, credit, insurance, and digital payments can increase resilience (CGAP 2019; Hussain et al. 2019). Nevertheless, more research is required to better understand the pathways by which financial inclusion affects resilience, as well as to identify the policy levers needed to overcome existing barriers to financial inclusion so that financial resilience can be achieved. This is particularly pertinent because demand for financial services remains low in developing countries and across marginalized populations due to barriers related to factors like infrastructure, transaction costs, liquidity constraints, social inequalities,

informational asymmetries, and behavioral biases (Lyons, Grable, and Zeng 2017). In this study, we concentrate on the extent to which financial and digital literacy can be leveraged as effective policy tools to foster resilience-building behaviors, the latter of which has rarely been investigated.

2.2 Financial Literacy and the Road to Financial Resilience

Research has found that financial literacy often leads to positive financial behaviors. However, these studies also have pointed to low levels of financial literacy around the world, as well as large heterogeneities across populations, especially vulnerable subgroups with low socioeconomic status (OECD/INFE 2015; Stolper and Walter 2017; De Beckker, De Witte, and Van Campenhout 2019). Most of these studies have used micro data collected from households in the United States or Europe to investigate savings, investment, and retirement planning behaviors (Van Rooij, Lusardi, and Alessie 2011; Jappelli and Padula 2013; Lusardi and Mitchell 2014; von Gaudecker 2015; Lusardi, Michaud, and Mitchell 2017; Stolper and Walter 2017) or borrowing behaviors (Disney and Gathergood 2013; Lusardi and Tufano 2015). One study used macro-level data to examine the heterogeneous effects of financial literacy on inclusion across countries (Grohmann, Klühs, and Menkhoff 2018). This study found that the effects of financial literacy tended to be largest for lower income countries with less developed financial sectors. Other research has pointed to a more dynamic relationship between financial literacy and behavior, suggesting that the experience gained from using financial services contributes to making a person more financially literate (Frijns, Gilbert, and Tourani-Rad 2014; Lyons, Grable, and Zeng 2017; Lyons and Kass-Hanna 2019).

Existing meta-analyses of the relationship between financial literacy and financial resilience have identified an overall positive relationship, but have raised additional questions regarding the strength and the determinants of the relationship. Fernandes, Lynch, and Netemeyer (2014) reviewed 201 prior studies, finding strong and positive associations between financial literacy and financial behaviors. Although the effects of the financial education interventions were often significant, they tended to be negligible in size. In another study, Kaiser and Menkhoff (2016) conducted a meta-analysis on 115 experimental research studies, several of which used randomized controlled trials to test the impacts of financial literacy training on financial behavior (e.g., Cole, Sampson, and Zia 2011; Bruhn, Ibarra, and McKenzie 2014; Jamison, Karlan, and Zinman 2014). Kaiser and Menkhoff's review also revealed that financial education is likely to have a positive impact on behavior, although the impacts were found to be highly heterogeneous across populations, behaviors, and geographic locations.

The empirical literature on financial literacy in Asia and Africa remains sparse. Most of what exists has focused on Asia and the impacts of financial literacy on the financial behaviors of Chinese households, especially in terms of portfolio choice and investment decisions (Chu et al. 2017) and formal and informal borrowing (Lyons, Grable, and Zeng 2017). Using the work of the OECD/INFE as a foundation, Morgan and Trinh (2019a) conducted a financial literacy survey in the low-income economy of the Lao People's Democratic Republic (Lao PDR). They found that financial literacy had a positive and significant effect on saving behavior and financial inclusion, even after applying corrections for the likely endogeneity of financial literacy. In addition, the OECD/INFE (2019) recently released a descriptive report highlighting financial literacy levels in 21 of the member economies of the Asia-Pacific Economic Cooperation (APEC). The report emphasized the need for further financial education approaches to DFS.

Nevertheless, additional research is still needed, as the major discrepancies in existing findings reflect a lack of consensus regarding how financial literacy should be defined and measured (Lyons, Grable, and Zeng 2017). At the core of all definitions, however, is the need for all individuals to possess the knowledge and skills to be able to apply one's knowledge to make well-informed financial decisions and develop sound financial practices. In order to measure financial literacy, researchers typically have taken a performance-based approach that uses multiple-choice or true/false questions to test an individual's knowledge of financial concepts and numeracy skills (Allgood and Walstad 2016; Stolper and Walter 2017). These traditional measurement tools have had the advantage of providing an objective evaluation of individuals' cognitive financial abilities. Despite becoming the international benchmark for assessing financial literacy, several shortcomings have also been identified related to possible inaccuracies and sensitivity to the questions' design and framing (Lusardi and Mitchell 2014; Lyons, Grable, and Zeng 2017). As an alternative approach, some researchers have used self-assessments of respondents' financial knowledge and skills. Subjective measures that provide information on how respondents perceive their financial knowledge and capability are not necessarily better than test-based measures, as they may be subject to overconfidence bias (Lusardi and Mitchell 2014). Regardless, both traditional and self-reported measures have been associated with positive financial behaviors. However, few studies have used them simultaneously. In response, we contribute to the literature on financial literacy and inclusion by using a two-part measure inspired by Allgood and Walstad (2016) to capture the combined effects of test-based and perceived financial literacy on financial behavior.

2.3 The Growing Need for Digital Literacy

The advent of DFS has called more attention to digital literacy. Yet, compared to financial literacy, the role of digital literacy has not been rigorously studied in detail, if at all. Those studies that do exist have focused on identifying the factors and heterogeneities linked to the adoption of DFS, especially financial literacy (Königsheim, Lukas, and Nöth 2017; Shen, Hu, and Hueng 2018; Morgan and Trinh 2019b) and risk preferences (Bauer and Hein 2006; Königsheim, Lukas, and Nöth 2017). Morgan and Trinh (2019b) examined the relationship between financial literacy and awareness and adoption of digital financial products via internet-based and mobile-based platforms for individuals living in the Lao PDR. Using a financial literacy index, they discovered that higher levels of financial literacy were positively associated with an individual's awareness of Fintech products, even when using instrumental variables to account for endogeneity. However, due to insufficient data, they were unable to find a significant relationship between financial literacy and usage of digital financial products. In addition, Königsheim, Lukas, and Nöth (2017) used survey data collected from customers of a German retail bank, finding that financial knowledge and risk tolerance were positively associated with demand for DFS. Interestingly, they also found that individuals preferring traditional banking services required greater compensation to switch to DFS compared to the compensation that was needed to encourage DFS customers to switch back to traditional banking services.

Shen, Hu, and Hueng (2018) used partial least squares to estimate a structural equation model (SEM) using a formative construct. They found that financial literacy and digital financial product usage had a positive relationship with financial inclusion. Moreover, digital financial product usage was found to be a direct mediator of the relationship between financial literacy and financial inclusion, and a partial (indirect) mediator of the relationship between internet usage and financial inclusion. The authors thus argued that financial literacy represents an effective means by which to promote the usage of DFS, manage related financial risks, and advance the goals of financial inclusion. Although this study was severely limited by a sample that only included 218 individuals from different areas of the People's Republic of China, the resulting evidence from this line of research supports the need for financial literacy to be expanded to include digital literacy.

Studies that specifically focus on digital literacy and financial behavior are virtually non-existent. However, a few have used survey data to examine the impacts of DFS (namely mobile money) on the livelihoods and welfare of households living in developing countries. Unsurprisingly, the focus has been on Sub-Saharan Africa, where mobile money has represented the key catalyst for financial inclusion. The general findings have showed that access to and usage of mobile money services lead to consumption smoothing, reductions in food insecurity, and poverty alleviation in the face of negative income shocks or natural disasters (Jack and Suri 2014; Blumenstock, Eagle, and Fafchamps 2016; Munyegera and Matsumoto 2016; Suri and Jack 2016; Riley 2018; Wieser et al. 2019; Lyons, Kass-Hanna, and Greenlee 2020). A few studies have examined the impacts of DFS on saving behavior, finding that mobile money significantly raises one's likelihood of saving, along with increasing transfers and reducing one's propensity to use informal savings channels (Demombynes and Thegeya 2012; Mbiti and Weil 2015; Ouma, Odongo, and Were 2017; Apiors and Suzuki 2018). Two exceptions have been studies by Grootenhuis (2019) and Wieser et al. (2019), which have suggested that mobile money has no effect on one's likelihood of saving or being in poverty. A limited number of studies have also analyzed the impacts of mobile money on formal and informal borrowing, finding similar positive impacts (Seng 2017; Bharadwaj, Jack, and Suri 2019).

2.4 Addressing the Critical Gaps

To our knowledge, this paper is the first to rigorously measure the impacts of digital literacy on resilience-building financial behaviors. First, we contribute to the existing literature by controlling for digital literacy – which is often overlooked in the literature – in comparison to and in conjunction with financial literacy. Second, most previous research has relied on data from convenience samples for country-specific cases. We use micro-level data from randomized samples for several countries in South Asia and Sub-Saharan Africa – two regions of the world that are particularly promising in terms of DFS – facilitating comparisons across countries at different levels of implementation of financial inclusion strategies and financial and digital literacy policies (See Appendix A). Third, we transcend the traditional focus on saving via banks to examine the drivers of multiple resilience-building financial behaviors (including saving, borrowing, risk management, and insurance) provided by formal and informal institutions. We also use the data to develop multi-dimensional indices for financial and digital literacy, as well as a composite index that includes multiple dimensions for both financial and digital literacy. Finally, we examine heterogeneities and possible gaps for the most vulnerable populations (the poor, those living in rural areas, and women), while also checking for potential endogeneity between financial and digital literacy and financial behavior.

3. DATA

The data for this study are taken from the fifth wave of the InterMedia Financial Inclusion Insights (FII) surveys, which were conducted in 2017 in three countries in South Asia (Bangladesh, India, and Pakistan) and four countries in Sub-Saharan Africa (Kenya, Nigeria, Tanzania, and Uganda). For these surveys, micro-level data were gathered from nationally representative samples of adults aged 15 or older living in each of the seven countries.² InterMedia's standardized survey methodologies and data collection processes allow for cross-country comparisons. For a complete overview of the data, see InterMedia (2017, 2018).³

The survey questionnaires were developed in consultation with the Financial Services for the Poor program at the Bill & Melinda Gates Foundation. The main goal of the FII surveys was to track the adoption and usage of traditional and digital financial services among various target populations in the developing world, but especially among the poor, rural, and unbanked (InterMedia 2017). Core survey topics include detailed information on: (1) ownership and usage of banks, non-bank financial institutions (NBFIs), and mobile financial services; (2) financial literacy; (3) digital capability; (4) financial behaviors; (5) subjective well-being; and (6) socio-demographics. The FII data enable us to adopt a robust and comprehensive approach to investigating the impacts of both financial and digital literacy on various measures of financial behavior in order to better assess individuals' potential for financial resilience.

The 2017 FII surveys present data from a large sample of 74,364 respondents. For our analysis, we have dropped the observations with missing information for key variables. Our final sample consists of 72,858 individuals, representative of a global population of about two billion adults across the selected South Asian and African countries.

3.1 Financial Behaviors for Building Resilience

Building financial resilience requires that individuals engage in financial behaviors and practices that lead to financial security, and ultimately, financial resilience (Hussain et al. 2019; Salignac et al. 2019). We define these critical financial behaviors using FII data on respondents' saving and borrowing decisions and risk management strategies related to insurance and preparation for emergencies. In terms of saving behavior, we focus on: (1) whether respondents are currently saving; and (2) whether they are saving using a bank (formal saving), or using a non-bank financial institution (NBFI) or a mobile money service provider (informal saving). Similarly, the variables related to borrowing focus on: (1) whether respondents currently have a loan; and (2) whether they currently have a loan with a bank (formal borrowing), or with an NBFI or a mobile money service provider (informal borrowing). In the developing world, considering both formal and informal saving and borrowing is important because informal markets and social networks continue to play a critical role in families' livelihoods and overall financial well-being, often more so than formal markets.

² To ensure national representativeness, sampling weights were constructed for each country. The weights were based on the probability of selection at each stage of sampling. They were then adjusted for non-response at the household and the household member levels, as well as urban-rural residence and gender. The weights were also normalized at the national level so that the weighted number of cases equaled the total sample size.

³ The data from the InterMedia Financial Inclusion Insights (FII) surveys are available at <http://finclusion.org/>.

With regard to risk management, we construct variables that capture whether respondents have two of the most common types of insurance: life and health insurance. Two additional indicators of risk account for respondents' risk preparedness in terms of their ability to come up with emergency funds. The first indicator identifies respondents who could "very likely" gather sufficient funds if they were to have an emergency and urgently needed to pay a sum equal to one year of their income. The second indicator identifies respondents who "somewhat" or "strongly" agree that they have access to an emergency fund large enough to cover unplanned expenses. See Appendix B for a description of these and all the variables included in our study.

3.2 Measuring Financial and Digital Literacy

The two main explanatory variables – financial and digital literacy – are measured using multi-dimensional indices. The financial literacy index incorporates objective and subjective dimensions. We sum up the number of correct answers to five knowledge-based questions related to key financial literacy concepts (interest rates, compound interest, inflation, and risk diversification). An additional measure of self-reported financial capability is included, which is equal to one if respondents report that they "somewhat" or "strongly" agree that they have the skills and knowledge to manage their finances well. Scores for the financial literacy index range from 0 to 6.

The digital literacy index is based on three dimensions: mobile technology access, mobile phone proficiency, and mobile money proficiency. The first dimension includes two items related to whether respondents own a mobile phone and/or a smart phone. The second dimension pertains to the number of the following tasks that respondents completed using a mobile phone in the past 90 days: (1) using a mobile phone to send or receive calls; (2) sending or receiving text messages; (3) sending or receiving photos; (4) browsing or using the internet; (5) downloading music, videos, or games; (6) conducting financial transactions; and (7) accessing social networking sites. Scores for mobile phone proficiency range from 0 to 7. The third measure concerns the number of actions respondents are able to perform without assistance from anyone when using mobile money.⁴ The actions performed include: (1) opening a mobile money menu; (2) finding particular menu options; (3) initiating a transaction; (4) completing a transaction; (5) correcting an error; and (6) reversing or cancelling a transaction. The scores for mobile money proficiency range from 0 to 6. The digital literacy index is constructed by summing the scores across all three dimensions, where total digital literacy scores can range from 0 to 15.

Factor analysis and Cronbach's alpha test are used to test the validity and the reliability of the indices. The factor loadings and other related test results can be found in Appendix C. In terms of financial literacy, the factor loadings using the principal component method from both varimax and promax rotations show that the six items measure one underlying latent concept, which we refer to as financial literacy. Cronbach's alpha test indicates that the index has a reasonable degree of reliability ($\alpha = 0.5366$). The factor loadings for digital literacy reveal that the three dimensions outlined above are likely measuring a single, underlying latent concept. The index is found to be highly reliable ($\alpha = 0.9005$). For the remainder of this paper, we refer to this concept as digital literacy.

⁴ Note that these tasks are conditional on respondents having ever used a mobile money service, but are not conditional on them having a registered mobile money account in their own name. Indeed, respondents could be using someone else's account, such as a spouse or other family member.

As a final check, a composite index is constructed that includes all of the items for both the financial and the digital literacy indices. Scores for the composite index range from 0 to 21. Testing reveals that the composite index is both valid and reliable. The factor loadings reflect four distinct dimensions: one for financial literacy plus the three dimensions for digital literacy ($\alpha = 0.8506$).

3.3 Other Control Variables

Other variables are included in this study to account for respondents' attitudes and perceptions about their financial security. "Security" can be considered both as a feeling and as a reality, where the difference can be explained as behavioral biases and the psychology of decision making (Schneier 2008). To account for the relationship between *feeling* financially secure and actually *being* financially secure, psychometric measures are constructed related to respondents' satisfaction with their current financial situation, as well as their level of confidence that their income will grow in the future and that their savings or assets will keep them financially secure in the future. A series of socio-demographic characteristics are also included to account for respondents' age, gender, education, marital status, employment status, sources of income, whether the household has experienced a serious negative shock such as the death or illness of a family member, and whether the household lives in a rural or an urban area.

4. METHODOLOGY

Probit models are estimated to empirically investigate the impacts of financial and digital literacy on each of the households' resilience-building financial behaviors. These behaviors are grouped into four categories: (1) saving behaviors (currently saving, formal saving, informal saving); (2) borrowing behaviors (currently borrowing, formal borrowing, informal borrowing); (3) insurance coverage (has life or health insurance, has life insurance, has health insurance); and (4) emergency fund preparedness (ability to come up with an emergency fund equal to one year of income, availability of an emergency fund for unplanned expenses). Empirically, the relationship for each behavior is assumed to be as follows:

$$FB_{ijk}^* = FinLit_{ijk}'\beta_1 + DigLit_{ijk}'\beta_2 + X_{ijk}'\beta_3 + \varepsilon_{1ij}, \quad (1)$$

where $FB_{ijk}=1$ iff $FB_{ijk}^* > 0$ and 0 otherwise $i=\{1, \dots, I\}$, $j=\{1, \dots, J\}$, and $k=\{1, \dots, K\}$.

In this equation, FB_{ijk}^* is the continuous, latent random variable that represents the actual dollar amount related to the k^{th} financial behavior for the i^{th} household in the j^{th} country. Within the data, FB_{ijk}^* is unobservable. The discrete dependent variable, FB_{ijk} , is observable and equal to one if the i^{th} respondent in the j^{th} country is currently engaging in that particular financial behavior, and zero otherwise. The error terms, ε_{ij} , are assumed to be distributed standard normally with mean zero and variance equal to one.

The factors that determine FB_{ijk}^* , and thus FB_{ijk} , are represented by $FinLit_{ijk}$ and $DigLit_{ijk}$, the multi-dimensional indices for financial and digital literacy described in the data section. The vector, X_{ijk} , is comprised of the psychometric controls related to respondents' perceptions and beliefs about their financial situation. Also included are the socio-demographic characteristics of the respondent as listed in the data section. Country fixed effects are also included.

To test whether our results are robust to heterogeneity, we re-estimate the probit models for those populations likely to be the most economically vulnerable and least likely to be able to build resilience, namely poor, rural, and female respondents. The models include the same control variables for each financial behavior as defined in Equation (1), but are estimated separately for the three key population groups in order to make comparisons between: (1) the poor (below \$2.50/day) versus the non-poor (above \$2.50/day); (2) rural versus urban households; and (3) women versus men.

We also conduct a robustness check for potential endogeneity between financial and digital literacy and the various financial behaviors. As presented, our models suggest that the direction of the relationship is from literacy to behavior change. However, as individuals engage in specific financial practices, they are also likely to increase their overall financial and digital competencies via a “learning by doing” process (Frijns, Gilbert, and Tourani-Rad 2014; Lyons and Kass-Hanna 2019). Thus, there is the potential for reverse causality and/or the existence of factors that affect financial and digital literacy along with financial behaviors.

To test for potential endogeneity, we use a two-stage least squares (2SLS) approach to estimate a series of linear probability models with an instrumental variable (IV LPM). Numeracy is used as one of the instruments and is defined as the respondent’s ability to correctly answer mathematical problems that test basic skills in addition and division (see Appendix B). Language comprehension is used as a second instrument and is explained in terms of the respondent’s general ability to read and understand information presented to them during the interview. Previous research has argued that numeracy and language skills have a direct impact on respondents’ financial and digital competencies, while only indirectly influencing their financial decisions via their impact on financial and digital literacy (e.g., Grohmann, Klühs, and Menkhoff 2018; Morgan and Trinh 2019a). The IVs are included in the first-stage regressions, where the linear probability method is used to obtain predicted values for financial and digital literacy. The predicted values are substituted into the financial behavior equations, and the linear probability method is again used to obtain the second-stage estimates.

For simplicity, we focus on three behaviors: (1) currently saving; (2) currently borrowing; and (3) has life or health insurance. For ease in estimation, we also use the composite index for financial and digital literacy, which combines the six financial literacy items with the 15 digital literacy items into one index so that we can use a single instrumental variable. Otherwise, we would need to devise separate instruments for both financial and digital literacy that do not influence each other and do not directly affect the financial behaviors. We now present the descriptive analysis, followed by the empirical results.

5. DESCRIPTIVE STATISTICS

5.1 Country-Level Comparisons

Table 1 presents a macro-level overview of access to and usage of financial and digital services for the seven South Asian and Sub-Saharan African countries.⁵ In terms of demand for financial services, general account ownership rates range from as low as 21.3% for Pakistan to as high as 81.6% for Kenya. However, for South Asia, rates of

⁵ Data for Table 1 were gathered from multiple sources including the World Bank’s Global Findex Database and World Development Indicators, the International Monetary Fund (IMF) Financial Access Survey, the S&P Global Financial Literacy Survey, the United Nations Human Development Reports, the International Telecommunication Union, the Heritage Foundation, and the Sustainable Development Goals (SDG) Index & Dashboard Report. See Appendix D for a complete list.

formal account ownership tend to be higher than rates of mobile account ownership, whereas the reverse is generally true for Sub-Saharan Africa. These findings are perhaps unsurprising because financial inclusion strategies in South Asia have focused more on increasing rates of bank account ownership rather than access to digital finance services. In fact, the aim of India's national financial inclusion program, Pradhan Mantri Jan Dhan Yojana (PMJDY), which was launched in 2014, has been to provide every household in the country with at least one basic banking account.⁶ The greatest growth in DFS has occurred in Sub-Saharan Africa due to the rapid adoption of mobile money brought about by relaxed regulations that have granted mobile network operators (MNOs) permission to hold mobile money and banking licenses.⁷ For further discussion, see Lyons, Kass-Hanna, and Greenlee (2020).

Table 1: Macro-Level Characteristics for South Asian and Sub-Saharan African Countries

Variables	South Asia		
	Bangladesh	India	Pakistan
<i>Demand for financial services</i>			
Account (% age 15+)	50.0	79.9	21.3
Financial institution account (% age 15+)	41.0	79.8	18.0
Mobile money account (% age 15+)	21.2	2.0	6.9
Made or received digital payments (% age 15+)	34.1	28.7	17.7
Used mobile phone or the internet to access an account (%)	22.4	5.3	7.6
Saved any money in the past year (% age 15+)	27.5	33.6	35.1
Saved at a financial institution in the past year (% age 15+)	9.9	19.6	6.1
Borrowed any money in the past year (% age 15+)	36.8	42.4	37.4
Borrowed from a financial institution in the past year (% age 15+)	9.1	6.6	2.3
Coming up with emergency funds: possible (% age 15+) ^a	64.1	45.3	47.4
<i>Supply of financial access</i>			
Commercial bank branches per 100,000 adults	8.6	14.7	10.6
Commercial bank branches per 1,000km ²	77.7	47.9	17.7
ATMs per 100,000 adults	8.1	22.1	10.4
ATMs per 1,000km ²	73.2	71.8	17.4
<i>Digital access</i>			
Mobile phone subscriptions (per 100 people)	83.4	85.2	70.6
Internet users (% of population)	18.2	29.5	15.5
Fixed broadband subscriptions (per 100 people)	4.4	1.3	0.9
<i>Financial capability</i>			
Adults who are financially literate (%)	19.0	24.0	26.0
<i>Economic and demographic indicators</i>			
Population (millions)	164.7	1,339.2	197.0
GDP per capita, PPP (current international \$)	3,868.8	7,059.3	5,527.4
GDP per capita growth (%)	6.2	5.5	3.7
Unemployment rate (% of population)	4.4	3.5	4.0
Youth unemployment rate (% population)	11.4	10.5	7.7
<i>Economic access</i>			
Economic freedom	55.0	52.6	52.8
Sustainable Development Goals (SDG) Index	59.3	59.1	54.9

continued on next page

⁶ For details about Pradhan Mantri Jan-Dhan Yojana (PMJDY), visit <https://www.pmjdy.gov.in/about>. The initiative is led by the Government of India's Ministry of Finance.

⁷ In fact, Kenya has led African countries in digital finance for more than a decade with its mobile money service M-Pesa. The exception is Nigeria, which did not permit MNOs to hold mobile money and banking licenses until summer 2019, when MTN Nigeria, the country's largest MNO, was granted a "super agent" license to set up an agent network to provide mobile money services. MTN officially launched mobile money (MoMo) operations in Nigeria at the end of August 2019.

Table 1 *continued*

Variables	Sub-Saharan Africa			
	Kenya	Nigeria	Tanzania	Uganda
<i>Demand for financial services</i>				
Account (% age 15+)	81.6	40.0	46.8	59.2
Financial institution account (% age 15+)	55.7	39.4	21.0	32.8
Mobile money account (% age 15+)	72.9	5.6	38.5	50.6
Made or received digital payments (% age 15+)	79.0	29.7	43.0	54.7
Used mobile phone or the internet to access an account (%)	71.8	7.7	36.5	47.2
Saved any money in the past year (% age 15+)	70.3	62.0	48.4	68.6
Saved at a financial institution in the past year (% age 15+)	26.8	20.6	6.1	12.7
Borrowed any money in the past year (% age 15+)	64.4	39.6	41.2	66.1
Borrowed from a financial institution in the past year (% age 15+)	16.8	4.0	5.3	13.7
Coming up with emergency funds: possible (% age 15+) ^a	51.1	44.9	38.6	43.0
<i>Supply of financial access</i>				
Commercial bank branches per 100,000 adults	5.3	4.4	2.5a	2.6
Commercial bank branches per 1,000km ²	2.7	5.2	0.8a	2.9
ATMs per 100,000 adults	9.5	16.3	6.0a	4.1
ATMs per 1,000km ²	5.0	19.2	2.0a	4.5
<i>Digital access</i>				
Mobile phone subscriptions (per 100 people)	80.4	83.0	72.1	55.0
Internet users (% of population)	26.0	25.7	13.0	21.9
Fixed broadband subscriptions (per 100 people)	0.6	0.0	3.2	0.3
<i>Financial capability</i>				
Adults who are financially literate (%)	38.0	26.0	40.0	34.0
<i>Economic and demographic indicators</i>				
Population (millions)	49.7	190.9	57.3	42.9
GDP per capita, PPP (current international \$)	3,285.4	5,874.7	2,945.9	1,864.2
GDP per capita growth (%)	2.3	-1.8	3.9	0.5
Unemployment rate (% of population)	11.5	7.0	2.2	2.1
Youth unemployment rate (% population)	26.2	13.4	3.9	2.9
<i>Economic access</i>				
Economic freedom	53.5	57.1	58.6	60.9
Sustainable Development Goals (SDG) Index	56.8	47.5	55.1	54.9

Note: Data were taken from multiple sources including the World Bank's Global Findex Database and World Development Indicators, the IMF Financial Access Survey, the S&P Global Financial Literacy Survey, the United Nations Human Development Reports, the International Telecommunication Union, the Heritage Foundation, and the SDG Index & Dashboard Report. See Appendix D for a complete list.

^a The reported time frame for the financial security indicators is "in the past 12 months," except for "Coming up with emergency funds: possible (% age 15+)," which is the percentage of respondents who reported that in case of an emergency, it is possible for them to come up with 1/20 of gross national income (GNI) per capita in the local currency within the next month.

These global trends are reflected in Table 1. India reports the highest percentage of adults with an account at a financial institution (79.8%), but also the lowest percentage of adults with a mobile money account (2.0%). By contrast, Pakistan has the lowest percentage of account owners (18.0%), and an even lower percentage of mobile money account owners (6.9%). As expected, Kenya leads in terms of mobile money account ownership (72.9%), digital payment adoption (79.0%), and digital account access (71.8%), followed by Uganda and Tanzania.

With regard to financial behavior, formal savings rates vary widely across countries, from 6.1% for Pakistan and Tanzania to 26.8% for Kenya. Similar trends are observed for borrowing, with Pakistan, Nigeria, and Tanzania reporting the lowest rates of formal borrowing, and Kenya reporting the highest. In terms of ability to respond to shocks, more than half of the respondents are able to come up with emergency funds

in Bangladesh (64.1%) and Kenya (51.1%), while this share is less than 40.0% in Tanzania.

With respect to the supply of financial services, the South Asian countries have greater bank branch and ATM penetration compared to the African countries, especially in terms of geographical distribution. On the digital side, most of the countries have high levels of mobile phone subscriptions, this figure being more than 70 per 100 persons in all but Uganda, which only has 55 subscriptions per 100 persons. Internet usage remains low overall, with large cross-country variation. In India, nearly 30.0% of the population uses the internet compared to only 13.0% in Tanzania. There is also wide variation in financial literacy. In Tanzania, 40.0% of adults are financially literate, whereas the financial literacy rate is only 19.0% in Bangladesh.

The other macroeconomic indicators highlight disparities across the countries in terms of factors such as unemployment (highest rates for Kenya, lowest for Uganda) and economic freedom (ranging from 52.6 for India to 60.9 for Uganda).⁸ All sampled countries have SDG Index scores below 60, indicating that large gaps remain in achieving the SDGs. Overall, the macro overview presented in Table 1 provides important context for interpreting the relationship between financial and digital literacy, as well as the financial behaviors needed to build financial resilience at the micro level.

5.2 Descriptive Profile of the Sample

Table 2 presents a descriptive overview of the respondents from the seven countries sampled, including their financial behaviors, financial and digital literacy, psychometrics, and socioeconomic demographics. In terms of saving, the percentage of respondents who are currently saving is 39.3%, with South Asian respondents being only slightly more likely to save on average than those living in Sub-Saharan Africa (39.8% and 37.1%, respectively). Across individual countries there are stark differences, with saving rates ranging from below 7.0% in Pakistan to more than 60.0% in Kenya.⁹ Furthermore, South Asian respondents are more likely to be saving formally (with a bank), whereas African respondents are more likely to be saving informally (with an NBFi or a mobile money service provider). Borrowing differs across countries, although to a lesser extent than saving: for the overall sample, 10.2% of respondents are currently borrowing (9.8% for South Asia; 11.9% for Sub-Saharan Africa). Those living in Asia are about as likely to borrow formally as informally (4.9% compared to 5.9%), while those living in Africa are more likely to borrow informally than formally (9.0% compared to 4.2%). Kenya has the highest percentage of borrowers (18.2%), while Pakistan has the lowest (1.9%). With regard to risk management, having insurance is not a common financial practice, especially in the African countries. On average, only 12.4% have some type of life or health insurance (13.9% in South Asia; 6.5% in Sub-Saharan Africa). In

⁸ Economic freedom was measured using the annual Index of Economic Freedom created by The Heritage Foundation and *The Wall Street Journal*. It is based on 10 aspects of economic freedom each graded on a scale of 0 to 100, including trade freedom, business freedom, investment freedom, and property rights. Based on an average score, graded countries are classified as “free” (i.e., combined scores of 80 or higher); “mostly free” (70–79.9); “moderately free” (60–69.9); “mostly unfree” (50–59.9); or “repressed” (under 50).

⁹ The substantial differences between the respondent-level percentages presented in Table 2 and the macro-level percentages presented in Appendix A are due to differences in the survey questions that were used to construct the variables, as well as the time frames associated with each of the survey questions. For example, the 2017 Global Findex reports the percentage of those “having saved in the past 12 months.” The 2017 FII surveys report current savings by asking respondents, “Do you save with any of the following (bank, non-bank financial institution (NBFi), or mobile money service provider)?” Thus, the figures reported in Tables 1 and 2 are not directly comparable.

South Asia, respondents tend to be about as likely to have life insurance (8.7%) as health insurance (7.2%), whereas in Africa, respondents are more likely to have health insurance (5.8%) than life insurance (1.4%). This is likely due to regional differences in the functionality and accessibility of insurance products within these countries.¹⁰ When it comes to emergency funds, more respondents report having an emergency fund that is large enough to cover unplanned expenses (27.2% overall; 29.9% for Asia; 16.1% for Africa). Fewer respondents report being able to come up with emergency funds that cover one year of income (10.5% overall; 9.8% for Asia; 13.4% for Africa). Interestingly, these numbers suggest that social networks may be stronger in the Sub-Saharan African countries. Nigeria has the highest share of adults able to gather sufficient funds (16.8%). Despite having the lowest saving and borrowing rates, Pakistan has the highest percentage of those reporting having an emergency fund that is large enough to cover unplanned expenses (32.7%).

Table 2: Descriptive Profile of Respondents Living in South Asian and Sub-Saharan African Countries

Variables	All N=72,858	South Asia n=58,509	Bangladesh n=5,959	India n=46,577	Pakistan n=5,973
<i>Resilience-building financial behaviors</i>					
Saving behaviors					
Currently saving	39.3	39.8	20.3	46.6	6.7
Formal saving	30.1	32.7	9.3	39.3	4.5
Informal saving	16.1	13.9	12.8	15.5	2.8
Not currently saving	60.7	60.2	79.7	53.4	93.3
Borrowing behaviors ^a					
Currently borrowing	10.2	9.8	15.3	10.1	1.9
Formal borrowing	4.7	4.9	4.9	5.5	0.2
Informal borrowing	6.5	5.9	12.0	5.6	1.8
Not currently borrowing	89.8	90.2	84.7	89.9	98.1
Risk management behaviors					
Life or health insurance	12.4	13.9	5.3	16.4	2.5
Life insurance	7.3	8.7	5.0	10.0	2.3
Health insurance	6.9	7.2	0.4	8.9	0.7
No life or health insurance	87.6	86.1	94.7	83.6	97.5
Ability to come up with emergency fund ^b	10.5	9.8	11.0	9.1	14.3
Availability of emergency fund	27.2	29.9	20.6	30.7	32.7
<i>Financial and digital literacy</i>					
Composite index for financial and digital literacy	5.60	4.94	7.14	4.63	5.20
Financial literacy index (#)	2.26	2.10	2.84	1.98	2.24
Interest rates	37.3	36.8	44.0	36.2	34.8
Compound interest 1	40.2	37.6	60.6	34.3	40.3
Compound interest 2	36.4	33.7	49.9	31.7	33.3
Inflation	40.9	41.7	57.2	38.4	52.5
Risk diversification	29.6	22.5	33.5	20.5	27.2
Financial capability	41.7	37.2	39.2	37.0	36.2

¹⁰ Interestingly, Tanzania has the lowest adoption rate for life insurance (0.4%) and the highest adoption rate for health insurance (13.5%). Tanzania's life insurance market has been slow to embrace digital change, whereas its health insurance market has been an emerging leader in the developing world when it comes to digitalization. Specifically, Tanzania has made major efforts to provide health insurance to low-income populations via their mobile phones. Jamii Africa, a microinsurance health startup in Tanzania, built and launched a mobile phone platform in 2015 that was able to offer an affordable health insurance product that families could pay for using their mobile phones for as little as \$1 per month. In early 2017, Jamii was successfully launched in several regions in Tanzania. See GSMA (2019c) for more details.

*continued on next page***Table 2** *continued*

Variables	All N=72,858	South Asia n=58,509	Bangladesh n=5,959	India n=46,577	Pakistan n=5,973
Digital literacy index (#)	3.34	2.85	4.29	2.65	2.96
Owns mobile phone	63.3	61.2	67.0	60.5	60.2
Owns smart phone	15.6	15.4	20.0	14.6	16.6
Mobile phone proficiency score (#)	1.97	1.81	2.01	1.78	1.82
Sends or receives calls	80.1	78.6	82.3	78.2	77.8
Sends or receives text messages	38.3	31.8	38.8	28.5	50.7
Sends or receives photos	15.1	15.2	17.6	15.6	9.8
Browses or uses the internet	18.0	16.9	19.0	17.0	14.5
Downloads music, videos, or games	15.5	15.4	14.9	16.0	11.8
Makes financial transactions	13.0	7.5	11.4	7.5	3.3
Uses social networking sites	16.7	15.6	17.0	15.6	14.4
Mobile money proficiency score (#)	0.58	0.27	1.41	0.12	0.37
Opens a mobile money menu	10.1	4.5	24.5	1.7	6.4
Finds particular menu options	10.2	4.7	24.6	1.9	6.6
Initiates transaction	10.0	4.7	24.3	2.0	6.5
Completes transaction	10.1	4.8	24.4	2.1	6.1
Corrects an error	9.0	4.3	21.7	1.9	6.0
Reverses or cancels a transaction	8.7	4.4	21.7	2.0	5.2
<i>Psychometrics</i>					
Financial satisfaction	64.0	69.0	66.0	69.7	66.1
Confident income will grow	47.6	44.2	37.0	45.3	43.3
Confident of financial security	29.9	30.7	20.5	33.2	21.4
<i>Demographics</i>					
Poor (below \$2.50/day)	60.1	61.3	75.1	60.8	51.8
Rural	68.7	68.8	73.7	68.6	64.9
Female	48.6	48.1	49.1	48.0	48.2
Age 15–24	25.2	23.4	30.7	21.0	34.1
Age 25–34	25.7	25.4	25.8	25.5	24.1
Age 35–44	19.8	20.6	19.1	21.3	16.3
Age 45–54	14.0	14.6	12.3	14.7	16.2
Age 55 and over	15.4	16.1	12.2	17.5	9.3
Educ: No formal education	35.5	36.8	33.5	36.9	39.4
Educ: Primary	30.0	27.5	40.3	25.9	27.3
Educ: Secondary	27.5	28.2	20.4	29.7	24.5
Educ: Higher	7.0	7.5	5.8	7.5	8.8
Numeracy	81.6	82.7	94.0	80.5	88.5
Language comprehension	56.8	57.8	52.7	59.1	52.5
Married	68.8	73.1	75.4	73.3	69.2
Household head	38.6	37.9	35.4	39.4	28.4
Working	54.4	51.4	39.5	53.7	45.4
Employed full-time	18.4	20.5	8.8	22.7	14.5
Employed part-time	6.3	6.6	1.6	7.5	4.4
Working occasionally/seasonally	16.9	15.9	13.6	17.1	8.7
Self-employed	12.8	8.5	15.6	6.4	17.8
Not working	45.6	48.6	60.5	46.3	54.6
Income source: Employment	15.5	16.2	3.9	17.4	18.5
Income source: Business	18.8	13.0	8.5	12.5	21.1
Income source: Farm	33.8	30.6	25.4	32.9	18.3
Income source: Government	8.9	9.7	4.6	11.0	4.7
Income source: Family	28.8	24.4	26.0	19.8	59.1
Illness of family member	32.9	26.3	49.6	23.0	29.5
Death of a family member	6.3	4.0	2.6	3.6	8.5

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Table 2 continued

Variables	Africa n=14,349	Kenya n=3,081	Nigeria n=5,300	Tanzania n=2,995	Uganda n=2,973
<i>Resilience-building financial behaviors</i>					
Saving behaviors					
Currently saving	37.1	61.9	30.5	28.2	31.7
Formal saving	19.4	23.8	29.6	7.8	8.7
Informal saving	25.1	57.3	3.4	25.5	29.2
Not currently saving	62.9	38.1	69.5	71.8	68.3
Borrowing behaviors ^a					
Currently borrowing	11.9	18.2	7.6	9.1	15.6
Formal borrowing	4.2	5.3	5.0	2.5	3.5
Informal borrowing	9.0	15.8	3.5	7.3	13.2
Not currently borrowing	88.1	81.8	92.4	90.9	84.4
Risk management behaviors					
Life or health insurance	6.5	9.1	3.6	13.7	1.6
Life insurance	1.4	2.2	1.9	0.4	0.6
Health insurance	5.8	8.2	2.6	13.5	1.4
No life or health insurance	93.5	90.9	96.4	86.3	98.4
Ability to come up with emergency fund ^b	13.4	12.1	16.8	9.4	12.7
Availability of emergency fund	16.1	18.4	18.0	11.6	15.1
<i>Financial and digital literacy</i>					
Composite index for financial and digital literacy	8.29	12.23	6.26	8.54	7.49
Financial literacy index (#)	2.93	3.21	2.67	3.06	2.98
Interest rates	39.1	46.8	31.9	37.1	45.8
Compound interest 1	50.7	52.6	47.0	56.5	49.4
Compound interest 2	47.2	60.1	33.4	56.8	48.5
Inflation	37.3	42.3	41.8	28.5	33.0
Risk diversification	58.8	58.0	50.5	69.5	63.4
Financial capability	60.3	61.4	62.6	57.5	58.2
Digital literacy index (#)	5.35	9.01	3.59	5.48	4.51
Owns mobile phone	72.3	79.2	83.0	64.2	54.7
Owns smart phone	16.7	29.0	16.9	11.9	8.6
Mobile phone proficiency score (#)	2.62	3.60	2.45	2.55	1.96
Sends or receives calls	86.6	91.9	92.3	80.7	77.1
Sends or receives text messages	65.0	80.5	68.4	64.2	43.7
Sends or receives photos	14.9	22.0	16.3	13.4	6.6
Browses or uses the internet	22.3	34.8	23.7	17.3	11.9
Downloads music, videos, or games	16.1	25.9	14.3	16.0	9.1
Makes financial transactions	35.8	71.6	9.8	44.3	35.7
Uses social networking sites	21.1	33.4	20.6	18.6	11.8
Mobile money proficiency score (#)	1.84	4.33	0.14	2.18	1.92
Opens a mobile money menu	33.1	76.4	1.9	39.4	36.7
Finds particular menu options	32.7	76.7	2.6	38.1	34.7
Initiates transaction	31.9	75.0	2.2	37.6	33.3
Completes transaction	32.0	75.3	2.4	37.6	33.4
Corrects an error	28.0	67.3	2.4	32.9	27.0
Reverses or cancels a transaction	26.5	62.4	2.1	31.9	26.5
<i>Psychometrics</i>					
Financial satisfaction	43.5	41.0	57.9	34.1	30.5
Confident income will grow	61.2	64.0	75.7	44.9	49.1
Confident of financial security	26.4	28.4	28.0	28.0	20.2

*continued on next page***Table 2** *continued*

Variables	Africa n=14,349	Kenya n=3,081	Nigeria n=5,300	Tanzania n=2,995	Uganda n=2,973
<i>Demographics</i>					
Poor (below \$2.50/day)	54.9	28.6	56.4	77.2	57.0
Rural	68.6	63.6	70.1	66.5	73.4
Female	50.4	51.0	48.1	52.4	51.6
Age 15–24	32.7	35.7	31.1	33.7	31.3
Age 25–34	27.0	26.1	30.0	25.2	24.7
Age 35–44	16.6	15.9	16.8	17.4	16.4
Age 45–54	11.3	9.3	11.6	11.3	12.9
Age 55 and over	12.3	12.9	10.5	12.4	14.7
Educ: No formal education	30.2	24.4	24.1	21.2	56.0
Educ: Primary	40.4	38.4	31.2	64.8	34.1
Educ: Secondary	24.4	29.9	37.6	12.7	7.3
Educ: Higher	5.0	7.3	7.1	1.3	2.6
Numeracy	77.2	85.8	93.7	69.8	46.7
Language comprehension	52.9	61.6	42.5	81.8	32.9
Married	51.4	47.2	57.3	48.8	48.0
Household head	41.7	50.2	31.5	48.6	43.7
Working	66.5	59.4	65.7	70.2	71.5
Employed full-time	9.9	12.3	13.2	5.4	6.2
Employed part-time	5.1	5.5	6.1	5.6	2.8
Working occasionally/seasonally	20.9	16.7	12.4	21.7	39.4
Self-employed	30.5	24.8	34.0	37.5	23.1
Not working	33.5	40.6	34.3	29.8	28.5
Income source: Employment	12.7	19.9	11.0	11.8	8.8
Income source: Business	42.5	44.7	52.4	42.0	23.4
Income source: Farm	46.8	46.9	45.8	38.1	57.1
Income source: Government	5.6	7.1	7.1	3.8	3.3
Income source: Family	46.8	51.8	50.3	34.6	47.8
Illness of family member	59.7	48.3	61.2	52.5	76.3
Death of a family member	15.9	9.4	23.6	11.6	13.3

Note: All summary statistics have been weighted using the base sampling and post-stratification weights for each country provided in the 2017 Financial Inclusion Insights Survey (Wave 5).

^a Summary statistics for borrowing behaviors are based on a reduced sample size due to missing values (n=68,286).

^b Summary statistics for “Ability to come up with emergency fund” are based on a reduced sample size due to missing values (n=69,872).

We also find considerable variation across the countries in terms of financial and digital literacy. With respect to the composite index that includes all 21 items, we note that the average score for all respondents is only 5.60, with South Asia reporting a considerably lower score than Sub-Saharan Africa (4.94 compared to 8.29). A closer look at the two sub-indices reveals that this divide is largely driven by disparities in digital literacy levels, which is unsurprising given the rapid growth in mobile money services in Africa. In terms of financial literacy, low and uneven levels are observed across the countries. As Table 2 shows, the financial literacy score – covering the six indicators of financial knowledge and capability – is only 2.26 on average for all the countries, 2.10 for Asia, and 2.93 for Africa. India has the lowest level of financial literacy (1.98), while Kenya has the highest (3.21). The average score for the digital literacy index – which includes 15 indicators across three dimensions – is 3.34 overall (compared to 2.85 for Asia, and 5.35 for Africa).

Kenya stands out with a score of 9.01, followed by Tanzania at 5.48, while scores below 5.0 are reported for the other countries.

With respect to psychometrics, those living in South Asia are more satisfied with their financial situation, with percentages exceeding 65.0%. These percentages fall to 57.9% in Nigeria, 41.0% in Kenya, and less than 35.0% in Tanzania and Uganda. In terms of financial confidence, 75.7% of respondents living in Nigeria are confident that their income will grow in the future, compared to only 37.0% in Bangladesh, the lowest figure. Less variation is observed for the shares of respondents who report having savings or assets that will keep them financially secure in the future, with percentages ranging from 20.2% for Uganda to 33.2% for India.

The poor, rural, and female households are three groups that have traditionally been excluded from mainstream financial markets and that are likely to face the greatest challenges in establishing financial security and building resilience. In general, 60.1% of respondents are living in poverty (below \$2.50 per day), 68.7% are living in rural areas, and 48.6% are women. Higher shares of vulnerable populations tend to be living in Bangladesh, India, and Tanzania compared to the other countries. The other demographics reveal that 50.9% of respondents are between the ages of 15 and 34, 35.5% have less than a primary education, and 68.8% are married. In terms of employment, 24.7% are working full-time or part-time, 12.8% are self-employed, and 45.6% are not working at all. The most common sources of income are from farm-related activities (33.8%) and from family or friends (28.8%). Those living in Uganda and Nigeria are the most likely to have experienced a negative shock related to the illness or death of a family member.

5.3 The Relationship between Financial Behaviors and Financial and Digital Literacy

Table 3 focuses on the relationship between financial behaviors and financial and digital literacy. In terms of saving and borrowing, it shows that financial and digital literacy levels are higher for savers than for non-savers. Specifically, the composite index for financial and digital literacy is 6.68 for savers, but only 4.90 for non-savers. Most of this gap is again due to differences in digital literacy, but this time related to mobile phone ownership and usage. Interestingly, financial and digital literacy levels are higher for those saving informally via NBFIs or mobile money service providers rather than formally via traditional banks.¹¹ The composite index score is 7.97 for informal savers, falling to 6.37 for formal savers. Similar trends and scores are also observed for borrowing. Those currently borrowing have higher levels of financial and digital literacy, with informal borrowers reporting higher scores than formal borrowers.

In terms of risk management, those who have either life or health insurance are more financially and digitally literate than those with no insurance, presenting composite scores of 7.04 and 5.39, respectively. Interestingly, these scores are higher for respondents who report having life insurance relative to health insurance. Respondents who currently have access to an emergency fund to cover unplanned expenses or who could come up with an emergency fund if needed also report higher levels of financial and digital literacy.

¹¹ Nevertheless, this result might owe to the fact that formal and informal saving are not mutually exclusive, such that those who are saving informally may also be more likely to be saving formally. Similar findings are observed for formal and informal borrowing, which are also not mutually exclusive.

Overall, among the sampled countries, the descriptive statistics show considerable disparities in financial behavior, as well as financial and digital literacy levels. Even so, the evidence also suggests that financial and digital literacy are likely to lead to better financial practices that are more likely to build financial resilience in the long run. While previous research has focused on financial literacy, digital literacy also appears to be an important factor, perhaps even more so than financial literacy. The next step is to determine if these descriptive findings are supported by the regression results when all other factors are held constant.

Table 3: Relationships for Financial and Digital Literacy According to Key Financial Behaviors

<i>Saving and Borrowing Behaviors</i>		Saving			
Variables		Currently Saving		Formal Saving (n=22,074)	Informal Saving (n=11,763)
		Yes (n=28,781)	No (n=44,077)		
Composite index for financial and digital literacy		6.68	4.90	6.37	7.97
Financial literacy index (#)		2.45	2.13	2.41	2.65
Interest rates		41.8	34.4	42.2	43.2
Compound interest 1		42.0	39.0	40.7	45.9
Compound interest 2		39.0	34.7	37.9	41.1
Inflation		43.6	39.1	44.7	42.4
Risk diversification		30.9	28.8	28.4	37.9
Financial capability		48.2	37.5	47.0	54.3
Digital literacy index (#)		4.23	2.76	3.96	5.32
Owns mobile phone		72.6	57.3	73.8	73.8
Owns smart phone		21.1	12.1	22.9	22.8
Mobile phone proficiency score (#)		2.42	1.67	2.43	2.67
Mobile money proficiency score (#)		0.87	0.40	0.57	1.69
		Borrowing ^a			
Variables		Currently Borrowing		Formal Borrowing (n=3,095)	Informal Borrowing (n=4,473)
		Yes (n=6,893)	No (n=61,393)		
Composite index for financial and digital literacy		6.93	5.59	7.11	7.31
Financial literacy index (#)		2.60	2.32	2.61	2.64
Interest rates		43.6	38.3	44.2	43.4
Compound interest 1		46.1	41.0	45.6	47.2
Compound interest 2		43.3	37.4	43.0	44.2
Inflation		43.6	42.3	49.6	41.4
Risk diversification		35.6	30.2	32.6	38.4
Financial capability		47.4	42.4	46.3	49.6
Digital literacy index (#)		4.34	3.28	4.49	4.66
Owns mobile phone		72.9	62.7	76.0	72.5
Owns smart phone		18.5	15.3	22.9	18.7
Mobile phone proficiency score (#)		2.31	1.96	2.50	2.39
Mobile money proficiency score (#)		1.11	0.54	1.01	1.36

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Table 3 *continued*

Variables	Insurance Coverage			
	Has Life or Health Insurance		Life Insurance	Health Insurance
	Yes (n=8,959)	No (n=63,899)	Yes (n=5,237)	Yes (n=4,993)
Risk Management Behaviors				
Composite index for financial and digital literacy	7.04	5.39	7.55	6.92
Financial literacy index (#)	2.60	2.21	2.73	2.49
Interest rates	46.7	35.9	50.3	43.7
Compound interest 1	46.3	39.3	49.8	43.9
Compound interest 2	43.7	35.3	46.3	42.6
Inflation	43.5	40.5	47.3	38.5
Risk diversification	28.3	29.8	26.2	29.4
Financial capability	51.8	40.3	53.1	51.2
Digital literacy index (#)	4.44	3.18	4.82	4.43
Owns mobile phone	76.4	61.5	83.9	71.5
Owns smart phone	28.8	13.8	34.7	27.8
Mobile phone proficiency score (#)	2.67	1.87	2.98	2.58
Mobile money proficiency score (#)	0.72	0.56	0.66	0.86
Risk Management Behaviors				
Variables	Emergency Fund			
	Ability to Come up with Emergency Fund ^b		Availability of Emergency Fund	
	Yes (n=7,280)	No (n=62,592)	Yes (n=19,930)	No (n=52,928)
Composite index for financial and digital literacy	7.00	5.54	6.33	5.33
Financial literacy index (#)	2.81	2.25	2.61	2.13
Interest rates	42.6	37.6	40.8	36.0
Compound interest 1	49.6	40.0	42.7	39.2
Compound interest 2	45.6	36.2	40.1	35.0
Inflation	42.3	41.8	44.0	39.7
Risk diversification	36.8	29.5	29.7	29.6
Financial capability	64.2	40.0	63.5	33.6
Digital literacy index (#)	4.19	3.29	3.72	3.20
Owns mobile phone	74.8	62.5	70.8	60.5
Owns smart phone	22.3	15.0	20.6	13.8
Mobile phone proficiency score (#)	2.36	1.95	2.24	1.87
Mobile money proficiency score (#)	0.86	0.57	0.57	0.59

Note: All summary statistics have been weighted using the base sampling and post-stratification weights for each country provided in the 2017 Financial Inclusion Insights Survey.

^a Recall that the summary statistics for borrowing behaviors are based on a reduced sample size due to missing values (n=68,286).

^b Recall that the summary statistics for "Ability to come up with emergency fund" are based on a reduced sample size due to missing values (n=69,872).

6. RESULTS

6.1 Impacts of Financial and Digital Literacy on Resilience-Building Financial Behaviors

The probit results for the saving and borrowing behaviors are presented in Table 4A. The marginal effects for both the financial and the digital literacy indices are positive and significant. Specifically, a one-unit increase in the financial and digital literacy indices increases the likelihood of currently saving by 2.33 and 3.26 percentage points, respectively. In addition, the likelihood of saving with a bank increases by 2.07 and 2.35 percentage points, respectively. In terms of economic significance, the probability of formal saving increases by 6.9% (2.07/30.1%) for a one-unit increase in the financial literacy index, and by 7.8% (2.35/30.1%) for a digital literacy increment. Informal saving is also found to be sensitive to financial and digital literacy levels, but to a lesser extent. Similar trends are observed when it comes to the borrowing behaviors. Increases in financial and digital literacy levels are associated with increases in borrowing, both formally and informally. Note, however, that the increases are larger for borrowing than for saving. In addition, the marginal effects for digital literacy are larger than those for financial literacy for each of the behaviors.

Table 4A: Probit Results for the Impacts of Financial and Digital Literacy on Saving and Borrowing Behaviors

Variables	Saving Behaviors			Borrowing Behaviors		
	Currently Saving	Formal Saving	Informal Saving	Currently Borrowing	Formal Borrowing	Informal Borrowing
Financial literacy index (#)	0.0233*** (0.0015)	0.0207*** (0.0013)	0.0079*** (0.0009)	0.0053*** (0.0009)	0.0033*** (0.0006)	0.0031*** (0.0007)
Digital literacy index (#)	0.0326*** (0.0008)	0.0235*** (0.0007)	0.0161*** (0.0005)	0.0066*** (0.0004)	0.0035*** (0.0003)	0.0044*** (0.0003)
<i>Psychometrics</i>						
Financial satisfaction	-0.0209*** (0.0047)	0.0106** (0.0041)	-0.0431*** (0.0030)	-0.0113*** (0.0027)	0.0006 (0.0016)	-0.0122*** (0.0021)
Confident income will grow	0.0491*** (0.0046)	0.0283*** (0.0041)	0.0324*** (0.0030)	-0.0051* (0.0029)	-0.0055*** (0.0017)	-0.0000 (0.0022)
Confident of financial security	0.0350*** (0.0050)	0.0322*** (0.0044)	0.0131*** (0.0032)	-0.0010 (0.0029)	-0.0030* (0.0016)	0.0020 (0.0023)
<i>Demographics</i>						
Poor (below \$2.50/day)	-0.0171*** (0.0045)	-0.0104*** (0.0039)	-0.0231*** (0.0028)	0.0114*** (0.0026)	0.0073*** (0.0015)	0.0013 (0.0020)
Rural	-0.0064 (0.0049)	-0.0092** (0.0043)	-0.0046 (0.0031)	0.0086*** (0.0029)	0.0067*** (0.0017)	-0.0007 (0.0023)
Female	0.0362*** (0.0056)	0.0222*** (0.0050)	0.0256*** (0.0035)	0.0185*** (0.0037)	0.0035 (0.0023)	0.0198*** (0.0026)
Age 15–24	-0.1462*** (0.0083)	-0.1589*** (0.0075)	-0.0277*** (0.0055)	-0.0397*** (0.0051)	-0.0235*** (0.0032)	-0.0151*** (0.0038)
Age 25–34	-0.0397*** (0.0072)	-0.0623*** (0.0064)	0.0193*** (0.0046)	-0.0026 (0.0039)	-0.0122*** (0.0024)	0.0088*** (0.0030)
Age 35–44	-0.0109 (0.0071)	-0.0287*** (0.0063)	0.0166*** (0.0046)	0.0040 (0.0039)	-0.0049** (0.0022)	0.0084*** (0.0030)

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Table 4A *continued*

Variables	Saving Behaviors			Borrowing Behaviors		
	Currently Saving	Formal Saving	Informal Saving	Currently Borrowing	Formal Borrowing	Informal Borrowing
Age 45–54	–0.0091 (0.0077)	–0.0191*** (0.0068)	0.0142*** (0.0052)	0.0101** (0.0042)	0.0021 (0.0024)	0.0083** (0.0033)
Educ: Less than primary	–0.1076*** (0.0097)	–0.1480*** (0.0083)	0.0119* (0.0064)	0.0083 (0.0055)	–0.0107*** (0.0031)	0.0215*** (0.0042)
Educ: Primary	–0.0642*** (0.0093)	–0.1111*** (0.0080)	0.0236*** (0.0060)	0.0102** (0.0052)	–0.0066** (0.0029)	0.0181*** (0.0040)
Educ: Secondary	–0.0386*** (0.0090)	–0.0663*** (0.0076)	0.0154*** (0.0059)	0.0127** (0.0052)	–0.0018 (0.0028)	0.0146*** (0.0040)
Married	0.0329*** (0.0056)	0.0218*** (0.0050)	0.0112*** (0.0036)	0.0281*** (0.0033)	0.0136*** (0.0021)	0.0162*** (0.0025)
Household head	0.0211*** (0.0058)	0.0158*** (0.0052)	0.0176*** (0.0036)	0.0032 (0.0033)	0.0024 (0.0020)	0.0034 (0.0024)
Employed part-time	–0.0128 (0.0103)	–0.0200** (0.0088)	–0.0098 (0.0072)	0.0228*** (0.0065)	0.0216*** (0.0036)	–0.0177*** (0.0041)
Working occasionally/ seasonally	–0.0219*** (0.0075)	–0.0428*** (0.0066)	0.0285*** (0.0046)	0.0054 (0.0040)	0.0001 (0.0024)	0.0058* (0.0031)
Self-employed	0.0105 (0.0095)	–0.0127 (0.0084)	0.0295*** (0.0056)	–0.0050 (0.0051)	–0.0019 (0.0030)	–0.0003 (0.0038)
Not working	–0.0287*** (0.0068)	–0.0460*** (0.0059)	0.0239*** (0.0042)	–0.0305*** (0.0039)	–0.0151*** (0.0022)	–0.0160*** (0.0030)
Income source: Employment	0.0451*** (0.0061)	0.0409*** (0.0052)	0.0279*** (0.0040)	0.0083** (0.0033)	0.0026 (0.0019)	0.0123*** (0.0024)
Income source: Business	0.0513*** (0.0070)	0.0295*** (0.0062)	0.0323*** (0.0042)	0.0361*** (0.0041)	0.0142*** (0.0024)	0.0181*** (0.0031)
Income source: Farm	0.0435*** (0.0049)	0.0205*** (0.0044)	0.0317*** (0.0031)	0.0357*** (0.0029)	0.0175*** (0.0018)	0.0209*** (0.0022)
Income source: Government	0.0837*** (0.0077)	0.0652*** (0.0065)	0.0512*** (0.0047)	0.0343*** (0.0039)	0.0176*** (0.0022)	0.0265*** (0.0031)
Income source: Family	0.0615*** (0.0052)	0.0240*** (0.0047)	0.0473*** (0.0032)	0.0043 (0.0031)	0.0055*** (0.0019)	–0.0044* (0.0023)
Illness of family member	–0.0075 (0.0048)	–0.0219*** (0.0043)	0.0206*** (0.0032)	0.0219*** (0.0028)	0.0037** (0.0018)	0.0197*** (0.0020)
Death of a family member	–0.0248** (0.0117)	–0.0263** (0.0104)	0.0120* (0.0071)	0.0317*** (0.0063)	0.0202*** (0.0034)	0.0233*** (0.0046)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations (N)	72,858	72,858	72,858	68,286	68,286	68,286
R2	0.141	0.160	0.145	0.078	0.099	0.083

Note: All models have been weighted using the base sampling and post-stratification weights for each country provided in the 2017 Financial Inclusion Insights Survey. Marginal effects are reported for each model, and robust standard errors are presented in parentheses. Omitted categories include: Age: 55 and over; Educ: Higher; Employed full-time; Country: Tanzania.

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

In terms of the control variables, the psychometric factors tend to be more significant for saving than for borrowing. For example, financial satisfaction is found to be negatively associated with saving in general, but positively associated with formal saving and negatively associated with informal saving. Being confident in one's future income growth and financial security are positively associated with all of the saving behaviors. For the most vulnerable populations, respondents living in poverty (less than \$2.50 per day) are significantly less likely than those not living in poverty to be saving both formally and

informally, but are more likely to be borrowing. Compared to those living in urban areas, rural respondents are less likely to be formally saving, and more likely to be formally borrowing. Interestingly, women are more likely than men to be saving both formally and informally. The marginal effects are quite large, with women being 3.62 percentage points more likely to be saving in general. As for the other demographic controls, those who are younger, less educated, working seasonally, and experiencing negative shocks are significantly less likely to be saving and borrowing, especially from a bank. Instead, they appear to be relying more on informal borrowing.

Table 4B presents the probit results for the risk management behaviors related to life and health insurance and emergency preparedness. Similar to saving and borrowing, significant and positive associations are found for the financial and digital literacy indices and for all of the risk management behaviors. These findings highlight the critical role that financial and digital knowledge are likely to play in helping respondents to recognize the importance of adequately planning for the unexpected. However, unlike saving and borrowing, the marginal effects for financial literacy are larger than those for digital literacy. For instance, a one-unit increase in the financial and digital literacy indices increases the likelihood of having life or health insurance by 1.31 and 0.97 percentage points, respectively. In percentage terms, the likelihood of having life or health insurance increases by 10.6% (1.31/12.4%) for a one-unit increase in the financial literacy index, and by 7.8% (0.97/12.4%) for a similar improvement in digital literacy.

Table 4B: Probit Results for the Impacts of Financial and Digital Literacy on Risk Management Behaviors

Variables	Insurance Coverage			Emergency Fund	
	Has Life or Health Insurance	Life Insurance	Health Insurance	Ability to Come up with Emergency Fund	Availability of Emergency Fund
Financial literacy index (#)	0.0131*** (0.0008)	0.0072*** (0.0005)	0.0051*** (0.0006)	0.0079*** (0.0008)	0.0163*** (0.0013)
Digital literacy index (#)	0.0097*** (0.0004)	0.0059*** (0.0003)	0.0047*** (0.0003)	0.0021*** (0.0004)	0.0058*** (0.0007)
<i>Psychometrics</i>					
Financial satisfaction	−0.0019 (0.0026)	−0.0005 (0.0017)	−0.0027 (0.0018)	0.0276*** (0.0030)	0.0600*** (0.0042)
Confident income will grow	0.0132*** (0.0027)	0.0073*** (0.0018)	0.0059*** (0.0019)	0.0485*** (0.0028)	0.1711*** (0.0039)
Confident of financial security	0.0131*** (0.0026)	0.0142*** (0.0017)	−0.0006 (0.0017)	0.0690*** (0.0029)	0.2913*** (0.0043)
<i>Demographics</i>					
Poor (below \$2.50/day)	0.0103*** (0.0025)	0.0055*** (0.0017)	0.0020 (0.0017)	0.0062** (0.0028)	0.0104*** (0.0039)
Rural	−0.0076*** (0.0025)	−0.0073*** (0.0016)	−0.0032* (0.0017)	0.0076*** (0.0029)	−0.0171*** (0.0043)
Female	0.0097*** (0.0036)	0.0037 (0.0026)	0.0090*** (0.0025)	−0.0086** (0.0036)	0.0078 (0.0051)
Age 15–24	−0.0650*** (0.0050)	−0.0342*** (0.0033)	−0.0331*** (0.0034)	−0.0138*** (0.0052)	−0.0560*** (0.0073)
Age 25–34	−0.0255*** (0.0040)	−0.0085*** (0.0025)	−0.0175*** (0.0027)	−0.0071* (0.0042)	−0.0443*** (0.0062)

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Table 4B *continued*

Variables	Insurance Coverage			Emergency Fund	
	Has Life or Health Insurance	Life Insurance	Health Insurance	Ability to Come up with Emergency Fund	Availability of Emergency Fund
Age 35–44	–0.0051 (0.0038)	0.0062*** (0.0024)	–0.0112*** (0.0026)	–0.0022 (0.0043)	–0.0343*** (0.0063)
Age 45–54	0.0148*** (0.0040)	0.0141*** (0.0026)	0.0011 (0.0027)	0.0031 (0.0049)	–0.0152** (0.0068)
Educ: Less than primary	–0.0641*** (0.0046)	–0.0410*** (0.0029)	–0.0203*** (0.0031)	–0.0294*** (0.0052)	–0.0426*** (0.0082)
Educ: Primary	–0.0493*** (0.0046)	–0.0212*** (0.0027)	–0.0215*** (0.0032)	–0.0263*** (0.0048)	–0.0338*** (0.0080)
Educ: Secondary	–0.0204*** (0.0042)	–0.0024 (0.0024)	–0.0121*** (0.0029)	–0.0195*** (0.0045)	–0.0208*** (0.0074)
Married	0.0139*** (0.0032)	0.0089*** (0.0021)	0.0005 (0.0022)	0.0096*** (0.0034)	0.0215*** (0.0050)
Household head	–0.0019 (0.0032)	–0.0030 (0.0021)	–0.0004 (0.0022)	0.0200*** (0.0035)	–0.0061 (0.0052)
Employed part-time	0.0015 (0.0055)	–0.0043 (0.0031)	0.0087** (0.0038)	–0.0126** (0.0061)	0.0260*** (0.0093)
Working occasionally/ seasonally	–0.0122*** (0.0045)	–0.0171*** (0.0033)	0.0019 (0.0030)	–0.0107** (0.0042)	–0.0407*** (0.0066)
Self-employed	–0.0335*** (0.0053)	–0.0134*** (0.0034)	–0.0208*** (0.0039)	0.0064 (0.0054)	–0.0337*** (0.0086)
Not working	–0.0240*** (0.0044)	–0.0138*** (0.0031)	–0.0130*** (0.0031)	–0.0079* (0.0045)	–0.0330*** (0.0060)
Income source: Employment	0.0200*** (0.0033)	0.0099*** (0.0019)	0.0104*** (0.0023)	0.0063 (0.0038)	0.0284*** (0.0052)
Income source: Business	0.0216*** (0.0037)	0.0186*** (0.0022)	0.0011 (0.0026)	0.0070* (0.0042)	0.0452*** (0.0063)
Income source: Farm	0.0083*** (0.0028)	0.0108*** (0.0020)	–0.0027 (0.0019)	–0.0003 (0.0030)	0.0061 (0.0044)
Income source: Government	0.0466*** (0.0039)	0.0212*** (0.0025)	0.0248*** (0.0025)	–0.0075 (0.0047)	–0.0018 (0.0066)
Income source: Family	0.0014 (0.0031)	0.0012 (0.0021)	–0.0011 (0.0022)	–0.0040 (0.0034)	–0.0047 (0.0048)
Illness of family member	0.0005 (0.0029)	0.0025 (0.0019)	–0.0001 (0.0021)	–0.0024 (0.0030)	–0.0365*** (0.0043)
Death of a family member	0.0242*** (0.0068)	0.0039 (0.0047)	0.0148*** (0.0044)	0.0081 (0.0073)	0.0171* (0.0098)
Country dummies	Yes	Yes	Yes	Yes	Yes
Observations (N)	72,858	72,858	72,858	69,872	72,858
R2	0.127	0.169	0.101	0.085	0.217

Note: All models have been weighted using the base sampling and post-stratification weights for each country provided in the 2017 Financial Inclusion Insights Survey. Marginal effects are reported for each model, and robust standard errors are presented in parentheses. Omitted categories include: Age: 55 and over; Educ: Higher; Employed full-time; Country: Tanzania.

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

These findings suggest that, although financial and digital literacy are both likely to shape risk management practices, financial literacy may be more influential. By contrast, for saving and borrowing, digital literacy seems to matter more. With regard to vulnerable populations, the findings generally show that women and the poor are significantly more likely to have health or life insurance, while those living in rural areas are less likely. The poor are also more likely to have some type of emergency fund, while women are less likely. The results are mixed for rural respondents. Unsurprisingly, having experienced a negative shock related to the illness or death of a family member tends to increase one's likelihood of having insurance coverage, but it may make it more difficult to plan for an emergency. The findings for the psychometrics and the other socio-demographic characteristics are similar to those for saving and borrowing.

6.2 Impacts of Financial and Digital Literacy for South Asia and Sub-Saharan Africa

Table 5 compares the impacts of financial and digital literacy for South Asia and Sub-Saharan Africa. In both regions, higher levels of financial and digital literacy tend to increase the likelihood of resilience-building financial behaviors. Still, some interesting trends can be identified.

For South Asia, the results for both financial and digital literacy are positive and significant for all behaviors, with the marginal effects tending to be larger for financial literacy. However, for Sub-Saharan Africa, the results for digital literacy are positive and highly significant for all behaviors except risk management, whereas the findings for financial literacy are considerably weaker and vary across behaviors. In fact, the marginal effects are greater for digital literacy than for financial literacy. For saving and borrowing behaviors, especially informal saving and borrowing, the magnitudes of the marginal effects of digital literacy are considerably larger for Sub-Saharan African countries than for their South Asian counterparts. For instance, a one-unit increase in digital literacy increases the likelihood of currently saving by 2.32 percentage points for South Asia versus 5.22 percentage points for Sub-Saharan Africa. Moreover, the probability of informally saving increases by 0.91 percentage points for South Asia and 3.28 percentage points for Sub-Saharan Africa for a one-unit increase in digital literacy. In terms of economic significance, the likelihood of currently saving increases by 14.1% (5.22/37.1%), with informal saving increasing by 13.1% (3.28/25.1%) for Sub-Saharan Africa. This can be compared to 5.8% (2.32/39.8%) and 6.5% (0.91/13.9%), respectively, for South Asia. Overall, these findings show that digital literacy is a major driver of positive financial behavior and may matter even more than financial literacy, especially in Sub-Saharan Africa, which has seen a rapid expansion in DFS and mobile money services. The findings suggest the need for greater emphasis on digital literacy when designing financial literacy strategies and programs. Moreover, the results hint at the potential of digital literacy to surpass financial literacy by providing a more efficient and less costly tool to stimulate financial behaviors that build resilience, precisely in settings where DFS are developing.

Table 5: Impacts of Financial and Digital Literacy on Financial Behaviors in South Asia and Sub-Saharan Africa

	(1)	(2)	(3)
South Asia			
Saving Behaviors	Currently Saving	Formal Saving	Informal Saving
Financial literacy index (#)	0.0240***	0.0222***	0.0076***
Digital literacy index (#)	0.0232***	0.0217***	0.0091***
Borrowing Behaviors	Currently Borrowing	Formal Borrowing	Informal Borrowing
Financial literacy index (#)	0.0056***	0.0043***	0.0025***
Digital literacy index (#)	0.0052***	0.0035***	0.0032***
Insurance Behaviors	Life/Health Insurance	Life Insurance	Health Insurance
Financial literacy index (#)	0.0169***	0.0111***	0.0061***
Digital literacy index (#)	0.0121***	0.0080***	0.0053***
Ability to Come up With Emergency Fund			
Emergency Fund Behaviors		Availability of Emergency Fund	
Financial literacy index (#)	0.0087***	0.0185***	
Digital literacy index (#)	0.0027***	0.0075***	
	(4)	(5)	(6)
Sub-Saharan Africa			
Saving Behaviors	Currently Saving	Formal Saving	Informal Saving
Financial literacy index (#)	0.0133**	0.0072**	0.0053*
Digital literacy index (#)	0.0522***	0.0188***	0.0328***
Borrowing Behaviors	Currently Borrowing	Formal Borrowing	Informal Borrowing
Financial literacy index (#)	0.0031	−0.0014	0.0063***
Digital literacy index (#)	0.0083***	0.0029***	0.0058***
Insurance Behaviors	Life/Health Insurance	Life Insurance	Health Insurance
Financial literacy index (#)	−0.0019	−0.0010**	−0.0007
Digital literacy index (#)	0.0032***	0.0009***	0.0024***
Ability to Come up With Emergency Fund			
Emergency Fund Behaviors		Availability of Emergency Fund	
Financial literacy index (#)	0.0004	0.0075**	
Digital literacy index (#)	0.0006	0.0021*	

Note: Each cell presents the marginal effect for financial or digital literacy, generated by estimating separate probit regressions for each behavior, for each of the South Asian and Sub-Saharan African countries. Each regression includes the same set of control variables as in the models presented in Tables 4A and 4B. In total, 22 regressions were estimated. All models were weighted. Robust standard errors are presented in parentheses. Omitted categories include: Age: 55 and over; Educ: Higher; Employed full-time; Country: Tanzania.

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

6.3 Impacts of Financial and Digital Literacy for Vulnerable Populations

Table 6 takes a closer look at the impacts of financial and digital literacy on the financial behaviors of our three vulnerable populations (the poor, those living in rural areas, and women). In general, increases in financial and digital literacy are likely to lead to increases in almost all financial behaviors, regardless of whether the respondent is vulnerable or not. With this said, a few differences in the magnitudes of the effects are worth noting.

Table 6: Impacts of Financial and Digital Literacy on the Financial Behaviors of Vulnerable Populations

	(1)	(2)	(3)
	Poor: Below \$2.50/day		
Saving Behaviors	Currently Saving	Formal Saving	Informal Saving
Financial literacy index (#)	0.0178***	0.0149***	0.0069***
Digital literacy index (#)	0.0288***	0.0205***	0.0127***
Borrowing Behaviors	Currently Borrowing	Formal Borrowing	Informal Borrowing
Financial literacy index (#)	0.0051***	0.0039***	0.0026***
Digital literacy index (#)	0.0064***	0.0033***	0.0042***
Insurance Behaviors	Life/Health Insurance	Life Insurance	Health Insurance
Financial literacy index (#)	0.0105***	0.0034***	0.0059***
Digital literacy index (#)	0.0099***	0.0068***	0.0034***
Emergency Fund Behaviors	Ability to Come up with Emergency Fund	Availability of Emergency Fund	
Financial literacy index (#)	0.0075***	0.0133***	
Digital literacy index (#)	0.0013**	0.0051***	
	Rural Households		
Saving Behaviors	Currently Saving	Formal Saving	Informal Saving
Financial literacy index (#)	0.0243***	0.0207***	0.0092***
Digital literacy index (#)	0.0317***	0.0212***	0.0156***
Borrowing Behaviors	Currently Borrowing	Formal Borrowing	Informal Borrowing
Financial literacy index (#)	0.0081***	0.0049***	0.0049***
Digital literacy index (#)	0.0059***	0.0028***	0.0038***
Insurance Behaviors	Life/Health Insurance	Life Insurance	Health Insurance
Financial literacy index (#)	0.0137***	0.0057***	0.0069***
Digital literacy index (#)	0.0076***	0.0051***	0.0028***
Emergency Fund Behaviors	Ability to Come up with Emergency Fund	Availability of Emergency Fund	
Financial literacy index (#)	0.0096***	0.0160***	
Digital literacy index (#)	0.0025***	0.0049***	
	Female		
Saving Behaviors	Currently Saving	Formal Saving	Informal Saving
Financial literacy index (#)	0.0198***	0.0162***	0.0074***
Digital literacy index (#)	0.0356***	0.0252***	0.0164***
Borrowing Behaviors	Currently Borrowing	Formal Borrowing	Informal Borrowing
Financial literacy index (#)	0.0056***	0.0022***	0.0045***
Digital literacy index (#)	0.0069***	0.0032***	0.0049***
Insurance Behaviors	Life/Health Insurance	Life Insurance	Health Insurance
Financial literacy index (#)	0.0106***	0.0050***	0.0046***
Digital literacy index (#)	0.0080***	0.0046***	0.0041***
Emergency Fund Behaviors	Ability to Come up with Emergency Fund	Availability of Emergency Fund	
Financial literacy index (#)	0.0062***	0.0178***	
Digital literacy index (#)	0.0020***	0.0080***	

continued on next page

Table 6 *continued*

	(4)	(5)	(6)
Not Poor: Above \$2.50/day			
Saving Behaviors	Currently Saving	Formal Saving	Informal Saving
Financial literacy index (#)	0.0278***	0.0257***	0.0079***
Digital literacy index (#)	0.0341***	0.0248***	0.0196***
Borrowing Behaviors	Currently Borrowing	Formal Borrowing	Informal Borrowing
Financial literacy index (#)	0.0050***	0.0021***	0.0034***
Digital literacy index (#)	0.0062***	0.0030***	0.0045***
Insurance Behaviors	Life/Health Insurance	Life Insurance	Health Insurance
Financial literacy index (#)	0.0160***	0.0117***	0.0031***
Digital literacy index (#)	0.0084***	0.0037***	0.0057***
Emergency Fund Behaviors	Ability to Come up with Emergency Fund	Availability of Emergency Fund	
Financial literacy index (#)	0.0079***	0.0214***	
Digital literacy index (#)	0.0030***	0.0066***	
Urban Households			
Saving Behaviors	Currently Saving	Formal Saving	Informal Saving
Financial literacy index (#)	0.0198***	0.0191***	0.0034**
Digital literacy index (#)	0.0335***	0.0272***	0.0162***
Borrowing Behaviors	Currently Borrowing	Formal Borrowing	Informal Borrowing
Financial literacy index (#)	-0.0011	-0.0000	-0.0014
Digital literacy index (#)	0.0067***	0.0034***	0.0047***
Insurance Behaviors	Life/Health Insurance	Life Insurance	Health Insurance
Financial literacy index (#)	0.0112***	0.0105***	-0.0004
Digital literacy index (#)	0.0130***	0.0076***	0.0067***
Emergency Fund Behaviors	Ability to Come up with Emergency Fund	Availability of Emergency Fund	
Financial literacy index (#)	0.0036**	0.0171***	
Digital literacy index (#)	0.0018***	0.0071***	
Male			
Saving Behaviors	Currently Saving	Formal Saving	Informal Saving
Financial literacy index (#)	0.0276***	0.0253***	0.0088***
Digital literacy index (#)	0.0311***	0.0227***	0.0159***
Borrowing Behaviors	Currently Borrowing	Formal Borrowing	Informal Borrowing
Financial literacy index (#)	0.0049***	0.0044***	0.0017*
Digital literacy index (#)	0.0065***	0.0039***	0.0039***
Insurance Behaviors	Life/Health Insurance	Life Insurance	Health Insurance
Financial literacy index (#)	0.0156***	0.0094***	0.0056***
Digital literacy index (#)	0.0113***	0.0073***	0.0052***
Emergency Fund Behaviors	Ability to Come up with Emergency Fund	Availability of Emergency Fund	
Financial literacy index (#)	0.0097***	0.0155***	
Digital literacy index (#)	0.0021***	0.0045***	

Note: Each cell presents the marginal effect for financial or digital literacy, generated by estimating separate probit regressions for each behavior, and for each particular group. Each regression includes the same set of control variables as in the models presented in Tables 4A and 4B. In total, 66 regressions were estimated. All models were weighted. Omitted categories include: Age: 55 and over; Educ: Higher; Employed full-time; Country: Tanzania.

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

In comparing the poor and the non-poor, the marginal effects for the financial and digital literacy indices tend to be smaller for those living below the poverty line when it comes to savings. This is not surprising as poverty is still an important barrier to being able to save and accumulate wealth and build financial resilience, even with gains in

financial and digital literacy. The comparative effects for borrowing and risk management are, for the most part, quite similar.

For rural and urban respondents, the findings are more nuanced. The marginal effects of financial literacy on the saving behaviors tend to be higher for rural households. For instance, a one-unit increase in financial literacy leads to a 2.43 percentage points increase in the likelihood of saving for rural households, compared to a 1.98 percentage points increase for urban households. The marginal effects for digital literacy are conversely higher in urban areas for the saving behaviors. When it comes to borrowing, increases in financial literacy are more likely to lead to increases in both formal and informal borrowing for rural respondents, whereas the effect of financial literacy is largely insignificant for the borrowing behaviors of urban respondents. This may reflect recent policies in developing countries throughout South Asia and Sub-Saharan Africa specifically designed to increase financial literacy programs in rural areas, as well as to improve access to microfinance opportunities in both formal and informal lending markets. Increases in digital literacy lead to increases in borrowing for both rural and urban respondents. However, the increases are larger for urban respondents, perhaps because urban areas are more likely to have better access to the infrastructure required for Fintech and DFS to effectively operate. Furthermore, digital literacy is now a part of most financial inclusion agendas, and recent emphasis has been placed on the development and provision of digital lending services and payment platforms.

In terms of gender, the marginal effects are consistently positive and significant for all financial behaviors. Even so, there appears to be some heterogeneity between men and women with regard to the differential impacts of financial and digital literacy. For example, financial literacy tends to increase saving more for men than for women, while the effects of digital literacy appear to increase saving slightly more for women than for men. For borrowing, the impacts of financial and digital literacy are stronger for men when it comes to formal borrowing; however, the effects on informal borrowing are stronger for women. This likely reflects the gender gap in access to formal financial services, especially traditional bank loans. Even with gains in financial and digital literacy, women still face barriers to access when it comes to lending, and often need to rely on informal lenders such as NBFIs to meet their borrowing needs. In looking at the impacts on life and health insurance coverage, we find that the gender gap translates to smaller marginal effects for women in terms of financial and digital literacy. With regard to having an emergency fund to cover unplanned expenses, financial and digital literacy tend to lead to larger increases for women than for men.

6.4 Instrumental Variables Estimations

The estimates generated from the previous probit models allow us to discuss how financial and digital literacy are associated with financial behaviors that are key to building resilience. Within this framework, we assume that the direction of the relationship is most likely from knowledge to behavior, especially given that digital technologies and financial services are still fairly new throughout South Asia and Sub-Saharan Africa. However, this assumption may be flawed, as our models could be subject to endogeneity bias, as described in the methodology section.

In an attempt to account for this potential endogeneity, a series of two-stage linear probability models are estimated using an instrumental variable approach, where our composite index for financial and digital literacy is included as the main explanatory variable. Table 7 presents the results for the IV LPMs for three of our key financial behaviors: currently saving, currently borrowing, and having life or health

insurance.¹⁷¹² Columns 1–3 present the estimation results for the linear probability models (LPMs). These models are included as a baseline to be compared with the two-stage models. The findings show that increases in the composite index lead to significant and positive increases in all three financial behaviors, consistent with the probit findings in Tables 4A and 4B. Columns 4–6 present the estimates for the IV LPMs using numeracy as an instrument; columns 8–10 use language comprehension as the instrument. The first-stage estimates (presented in columns 7 and 11) show that both numeracy and language comprehension are significantly associated with higher levels of financial and digital literacy. The second-stage estimates after accounting for endogeneity find significant and positive effects for all three behaviors. These findings are consistent with the LPM results. However, the estimates using the IV LPMs are noticeably larger when numeracy is used as the instrument (see columns 4–6).¹³ For example, the LPM estimate for savings is 2.62, but for the IV LPM it is 11.02. Furthermore, the results when language comprehension is used as the instrument are similar to those generated by the LPMs without instrumentation (see columns 8–10).

Table 7: Robustness Check for Endogeneity: The IV LPM Estimations Related to the Composite Index for Financial and Digital Literacy

Variables	Linear Probability Model (LPM) Using a Composite Index for Financial and Digital Literacy		
	(1) Currently Saving	(2) Life or Health Insurance	(3) Currently Borrowing
Composite index for financial and digital literacy	0.0262*** (0.0006)	0.0123*** (0.0004)	0.0072*** (0.0004)
<i>Psychometrics</i>			
Financial satisfaction	−0.0182*** (0.0041)	−0.0009 (0.0027)	−0.0115*** (0.0029)
Confident income will grow	0.0395*** (0.0041)	0.0157*** (0.0029)	−0.0066** (0.0031)
Confident of financial security	0.0316*** (0.0045)	0.0196*** (0.0031)	−0.0019 (0.0032)
<i>Other control variables</i>			
Demographic controls	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes
<i>Instrumental variables</i>			
Numeracy	-.---- (-.----)	-.---- (-.----)	-.---- (-.----)
Language comprehension	-.---- (-.----)	-.---- (-.----)	-.---- (-.----)
Observations (N)	72,858	72,858	68,286
R2	0.1642	0.2016	0.1457
<i>Tests</i>			
Kleibergen-Paap rk LM statistic (p-value)			
Kleibergen-Paap rk Wald F statistic (10% maximal IV size)			

¹² The IV LPM results for the other financial behaviors are available upon request.

¹³ Other researchers such as Munyegera and Matsumoto (2016) have estimated similar models, with their IV coefficients also considerably larger than the OLS estimates. Munyegera and Matsumoto (2016) argue that the larger estimates may be due to the possibility that the dummy endogenous financial inclusion variables become less defined when using IV estimation, especially if there is considerable heterogeneity across respondents. Our regressions were weighted to remove at least some of the heterogeneity that could have been confounding the results.

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Table 7 continued

Variables	IV Linear Probability Model (IV LPM) Using Numeracy as an Instrument			
	(4)	(5)	(6)	(7)
	Currently Saving	Life or Health Insurance	Currently Borrowing	First Stage
Composite index for financial and digital literacy	0.1102*** (0.0060)	0.0492*** (0.0035)	0.0108** (0.0045)	-.---- (-.----)
<i>Psychometrics</i>				
Financial satisfaction	−0.0325*** (0.0048)	−0.0071** (0.0030)	−0.0122*** (0.0030)	0.1475*** (0.0273)
Confident income will grow	−0.0194*** (0.0063)	−0.0102*** (0.0040)	−0.0089** (0.0042)	0.6549*** (0.0285)
Confident of financial security	−0.0223*** (0.0065)	−0.0040 (0.0040)	−0.0041 (0.0042)	0.6319*** (0.0303)
<i>Other control variables</i>				
Demographic controls	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes
<i>Instrumental variables</i>				
Numeracy	-.---- (-.----)	-.---- (-.----)	-.---- (-.----)	0.9139*** (0.0328)
Language comprehension	-.---- (-.----)	-.---- (-.----)	-.---- (-.----)	-.---- (-.----)
Observations (N)	72,858	72,858	68,286	72,858
R2	0.323	0.098	0.144	0.809
<i>Tests</i>				
Kleibergen-Paap rk LM statistic	747.325	747.325	514.650	
(p-value)	(0.0000)	(0.0000)	(0.0000)	
Kleibergen-Paap rk Wald F statistic	775.066	775.066	527.497	
(10% maximal IV size)	16.38	16.38	16.38	
Variables	IV Linear Probability Model (IV LPM) Using Language Comprehension as an Instrument			
	(8)	(9)	(10)	(11)
	Currently Saving	Life or Health Insurance	Currently Borrowing	First Stage
Composite index for financial and digital literacy	0.0390*** (0.0048)	0.0138*** (0.0033)	0.0219*** (0.0034)	-.---- (-.----)
<i>Psychometrics</i>				
Financial satisfaction	−0.0204*** (0.0042)	−0.0011 (0.0027)	−0.0142*** (0.0030)	0.1055*** (0.0274)
Confident income will grow	0.0305*** (0.0054)	0.0146*** (0.0037)	−0.0160*** (0.0040)	0.6985*** (0.0284)
Confident of financial security	0.0234*** (0.0054)	0.0187*** (0.0038)	−0.0108*** (0.0039)	0.6024*** (0.0304)
<i>Other control variables</i>				
Demographic controls	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes

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Table 7 *continued*

Variables	IV Linear Probability Model (IV LPM) Using Language Comprehension as an Instrument			
	(8)	(9)	(10)	(11)
	Currently Saving	Life or Health Insurance	Currently Borrowing	First Stage
<i>Instrumental variables</i>				
Numeracy	-.---- (-.----)	-.---- (-.----)	-.---- (-.----)	-.---- (-.----)
Language comprehension	-.---- (-.----)	-.---- (-.----)	-.---- (-.----)	0.9435*** (0.0299)
Observations (N)	72,858	72,858	68,286	72,858
R2	0.488	0.201	0.125	0.810
<i>Tests</i>				
Kleibergen-Paap rk LM statistic	945.323	945.323	932.545	
(p-value)	(0.0000)	(0.0000)	(0.0000)	
Kleibergen-Paap rk Wald F statistic	994.444	994.444	984.844	
(10% maximal IV size)	16.38	16.38	16.38	

Note: Using a composite index for financial and digital literacy, each cell presents the marginal effect that was generated: (1) by estimating a separate LPM regression for each key behavior (columns 1, 2 and 3); (2) by estimating a separate IV LPM regression for each key behavior using numeracy as the instrumental variable in the first-stage regression (columns 4, 5, 6, and 7); and (3) by estimating a separate IV LPM regression for each key behavior using language comprehension as the instrumental variable (columns 8, 9, 10, and 11). Each regression includes the same set of control variables as in the models presented in Tables 4A and 4B. All models were weighted, and robust standard errors are presented in parentheses.

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

The instruments have been tested and the results are presented at the bottom of Table 7. Numeracy and language comprehension prove to be strong instruments, as indicated by the Kleibergen-Paap rk Wald F statistics, which are larger than the critical values at the 10% maximal IV size, ruling out the possibility of a weak instrument problem. The Kleibergen and Paap rk LM statistics verify that the models are not underidentified.

In sum, the results from the IV LPM regressions are consistent with the results from the probit and LPM models that do not account for potential endogeneity. Overall, digital and financial literacy are found to increase the likelihood of saving, borrowing, insurance coverage, and emergency preparedness, with effects being larger (particularly for the incidence of savings) when numeracy is used as the instrumental variable.

7. CONCLUSIONS

This study has used data from the 2017 Financial Inclusion Insights (FII) surveys to investigate the impacts of financial and digital literacy on resilience-building financial behaviors for seven developing economies in South Asia and Sub-Saharan Africa. In general, we have shown that both financial literacy and digital literacy are key factors to building inclusiveness and financial resilience. The results were consistent and significant across all the models. Marginal effects for digital literacy were larger than those for financial literacy in terms of saving and borrowing behaviors, suggesting that digital literacy is more influential for these behaviors. One possible explanation is that digital literacy stimulates the usage of online banking, mobile money, and other DFS that offer an efficient mechanism to foster saving and borrowing decisions. In terms of risk management behaviors, larger effects were observed for financial literacy, suggesting

that awareness and knowledge of financial concepts and risks play a key role in shaping decisions related to formal insurance and emergency preparedness. As a whole, these findings emphasize the critical role of digital literacy as a catalyst for improved financial behaviors, which is perhaps as important as that of financial literacy, if not even more so within a context of DFS. This stresses the need to redefine traditional financial literacy to include digital literacy. National financial inclusion strategies may prove more effective if goals were to be matched with financial literacy programs and targets that encompass digital literacy as a core component.

7.1 Discussion

Recall that previous research has mostly focused on examining the effects of financial literacy on financial inclusion. By contrast, few studies – if any – have explored the impacts of digital literacy on the usage of financial services, despite the rapid expansion of DFS. Our main contribution to the existing research has been to shed light on the importance of digital literacy as a critical pathway to resilience-building financial behaviors. Clearly, digital literacy is a fundamental requirement for the usage of DFS, such as online banking and mobile money. A person requires at least a basic level of knowledge about using a mobile phone and the internet to be able to operate DFS. Having an advanced level of digital literacy provides greater autonomy and confidence in using these services, and possibly leads to more frequent usage. However, increased usage of such services does not necessarily imply better financial decisions. Users can make the most of the accessibility of DFS when they use them not only for payments, but most importantly as efficient tools for saving, putting money aside for emergencies, borrowing, insuring against risk, and receiving transfers should a shock occur. From this perspective, it is important to understand the relationship between digital literacy and those financial behaviors that lead to financial security and resilience.

Does one's level of digital literacy affect the adoption of such behaviors? This is precisely the question that financial inclusion research has so far overlooked. Our study has laid a foundation for future research to pursue this new area of study. To this end, we constructed a multi-dimensional index for digital literacy that captured one's level of knowledge and capability related to mobile phones and mobile money. We analyzed its effects, along with those of financial literacy, which are examined alone in most studies. We identified significant and positive impacts of digital literacy on various resilience-building financial behaviors, even exceeding those of financial literacy. To better understand how financial literacy drives financial outcomes, we complemented the knowledge-based measure commonly used in the literature with a self-perception dimension to encompass the overall effects of objective and subjective financial literacy on financial behaviors.

Our analysis has also contributed to the literature by taking a comprehensive approach to evaluating resilience-building financial outcomes. Instead of focusing solely on saving via formal banking channels, as is commonly emphasized in the financial inclusion research, we considered a broad set of financial behaviors, including saving, borrowing, and risk management, provided by both formal and informal institutions. Moreover, the cross-country approach we adopted leads to meaningful implications as it provides important insights across countries that have different national policies of financial inclusion, financial literacy, and digital literacy, and that are also at different stages of their strategies' implementation. Specifically, our selected countries show different levels of the development of DFS. Digital finance and mobile technologies have

seen exponential growth in recent years, especially in Sub-Saharan Africa, while there has been slow expansion in South Asia.

Given that economically vulnerable populations are typically targeted by national financial inclusion and literacy strategies, it was essential that we also examined how financial and digital literacy affect their ability to engage in resilience-building financial behaviors. Our findings indicated that increases in financial literacy levels are likely to lead to increases in resilience-building behaviors for these at-risk groups. However, these effects tended to be smaller for the vulnerable groups relative to their less vulnerable counterparts, underscoring the persistence of other barriers. Poor households, for instance, appeared to be less sensitive to financial and digital literacy with respect to adopting positive financial behaviors, compared to the non-poor. In terms of locational vulnerabilities, financial literacy was found to matter more for saving and risk management decisions among rural households, while the effects of digital literacy were larger for those living in urban areas. This might be an indicator of the lack of infrastructure that still exists in many rural areas in developing countries, precluding the effective usage of DFS, and maintaining reliance on non-digital solutions. Furthermore, gender gaps were identified, especially for borrowing behaviors and insurance coverage.

Overall, the heterogeneity reflected in our findings reveals that, despite the importance of financial and digital literacy initiatives, such programs are not the only solution to drive behaviors that build financial resilience. Many existing barriers need to be simultaneously tackled through public policy and design. Possible measures include improving financial and technological infrastructure, promoting DFS, and addressing political, legal, and regulatory constraints that reduce economic and social inequalities (Lyons, Grable, and Zeng 2017; Lyons and Kass-Hanna 2019). Alongside such initiatives, financial and digital education programs, adapted to the needs of the most vulnerable populations, are required. Moving forward, there needs to be a more evidence-based assessment of the goals and outcomes of national financial and digital literacy strategies to ensure that they target at-risk populations in a meaningful and effective way. In particular, efforts should ensure that the shift to DFS does not widen gaps in access to and usage of financial services by vulnerable populations, as these groups' digital literacy rates tend to be lower. Topics ranging from the basic usage of mobile phones and the internet to the usage of mobile money and other DFS should be considered. Moreover, programs raising awareness of the importance of saving and insurance, as well as training in financial planning, debt management, and consumers' rights, should be given particular importance, as such knowledge empowers individuals and pushes them in the direction of adopting resilience-building financial behaviors.

7.2 Limitations

As we have seen in this study, many countries are taking steps to expand financial and digital inclusion. The ability of these policy tools to assist households in building resilience is hindered if individuals lack the knowledge and skills to use these services effectively. Financial and digital literacy are recommended as viable interventions. However, the ability of previous research to draw robust conclusions as to their effectiveness has been limited by a lack of data and methodological challenges. In our study, we have been able to run several robustness checks to address these concerns. Nevertheless, our results may be subject to some of the same limitations. First, we have already alluded to definitional issues related to what is meant by “resilience-building behaviors” and “financial and digital literacy.” In our analysis, we constructed multi-dimensional indices for financial and digital literacy, and tested them against

multiple behaviors. While our measures were limited by the data and may still be inadequate, our results were consistently robust across the measures.

Relatedly, there may be important “observables” linked to financial and digital literacy that are difficult to measure and that were not observable in the FII surveys. Our analysis was limited by the data that were observable. This may have subjected our regression analysis to omitted variable bias. Further, there are variations across countries in institutional, technological, political, social, and economic factors that we could not control for and that might also affect the uptake of certain resilience-building behaviors. Although we included country-fixed effects, this may not be enough. As an additional robustness check, we reran our analysis using clustered standard errors. The results were similar to those using robust standard errors, and are available upon request.

Finally, there are shifts over time that can affect financial and digital literacy, and that in turn influence resilience-building behaviors. For example, in recent years, technological innovations have resulted in cheaper, more capable smartphones that have likely affected risk and technology preferences. This time-variant household heterogeneity may be correlated with certain financial services, potentially creating selection and endogeneity issues. Similar to many other studies, we relied on cross-sectional data for our analysis. Ideally, we would have preferred to use panel data to account for these types of trends to better assess how individuals’ financial resilience changes before, during, and after a real shock occurs. However, longitudinal data that include both financial and digital literacy, as well as resilience-building behaviors, are rare. The FII survey data are among the best currently available.

Regardless of these limitations, our study is among the first to take such a comprehensive approach, and provides a useful starting point upon which other researchers can build. The findings have important implications for the fields of inclusive finance and financial literacy, and especially for countries considering financial and digital literacy as a dual approach to improving households’ financial resilience. As national financial inclusion strategies continue to move in the direction of Fintech and digital finance, researchers, educators, and other stakeholders will be challenged to rethink current definitions of financial literacy. Furthermore, as families continue to adopt digital devices to conduct basic and more sophisticated financial transactions, there will be a need to continually (re)define what it means to be “digitally financially literate.”

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APPENDIX A: FINANCIAL INCLUSION AND FINANCIAL AND DIGITAL LITERACY STRATEGIES: COUNTRY PROFILES

	Financial Inclusion Strategy	
	Sponsor(s) and Year	Objectives
Bangladesh	Joint initiative of Bangladesh Bank and the Ministry of Finance to develop a complete draft of NFIS-B. Final draft expected to be submitted for government approval in 2019.	<ol style="list-style-type: none"> 1. Regulated account for all adults by 2024. 2. Wide range of services for various groups. 3. Appropriately designed and priced financial services. 4. Adoption of technology by service providers. 5. Expansion of financial literacy and education. 6. Collection of quality financial inclusion data.
India	National Mission for Financial Inclusion named Pradhan Mantri Jan Dhan Yojana (PMJDY) launched in 2014 with the aim of opening at least one account for every household. National Strategy for Financial Inclusion 2019–24 under review by the Ministry of Finance.	<ol style="list-style-type: none"> 1. PMJDY Objectives: 2. Universal access to banking facilities. 3. Provision of a basic bank account with overdraft, and debit card to all households. 4. Encouragement of financial literacy. 5. Credit guarantee fund to mitigate risks. 6. Microinsurance for all account holders. 7. Unorganized sector pension schemes.
Pakistan	Five-year National Financial Inclusion Strategy (NFIS) launched in 2015 by the State Bank of Pakistan and the Ministry of Finance.	<ol style="list-style-type: none"> 1. Diversify basic payments, remittance and savings products through bank accounts and Digital Transactional Accounts (DTAs, such as branchless banking accounts). 2. Increase financing opportunities for urban and rural micro- and small and medium-sized enterprises (SMEs), and agricultural finance. 3. Increase penetration of insurance services. 4. Bring pensions to more workers. 5. Develop housing finance products. 6. Foster Islamic finance. 7. Ensure consumer protection, and increase financial awareness and literacy.
Kenya	No specific financial inclusion strategy or target. Financial services are briefly addressed in Kenya's Vision 2030, a macroeconomic development strategy.	
Nigeria	National Financial Inclusion Strategy (NFIS) launched in 2012 by the Central Bank of Nigeria.	<ol style="list-style-type: none"> 1. Ensure that a clear agenda is set to significantly increase both access to and usage of financial services by 2020. 2. Ensure that the concerns and inputs of all stakeholders are considered, and that roles and responsibilities are defined before regulations and policies are set for financial inclusion. 3. Outline the framework for increasing the formal usage of financial services to 70% by 2020 from the current level of 36% of the adult population.
Tanzania	National Financial Inclusion Framework 2014–2016 (NFIF1). NFIF2 2018–2022 builds on the previous.	<ol style="list-style-type: none"> 1. Enhance access channels, such as agent banking, mobile telephony financial services, etc. 2. Improve and develop ICT payment platforms. 3. Monitor and enhance usage of credit bureaus, proportionate Know Your Customer (KYC) requirements, and improved identification systems. 4. Consumer protection mechanisms and financial education strategy.
Uganda	National Financial Inclusion Strategy (NFIS) 2017–2022 driven by the Ministry of Finance, Planning and Economic Development (MoFPED) and the Bank of Uganda.	<ol style="list-style-type: none"> 1. Reduce financial exclusion and barriers to financial services. 2. Develop the credit infrastructure for growth. 3. Build out the digital infrastructure for efficiency. 4. Deepen and broaden formal savings, investment, and insurance usage. 5. Empower and protect individuals with enhanced financial capability.

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Appendix A *table continued*

Financial Literacy Strategy		
	Sponsor(s) and Year	Objectives
Bangladesh	No national policy addressing financial literacy.	
India	National Strategy for Financial Education (NSFE) implemented in 2013 by the National Centre for Financial Education (NCFE).	<ol style="list-style-type: none"> 1. Awareness about access to financial services, their availability and features. 2. Changing attitudes to translate knowledge into behavior. 3. Education for consumers' rights and responsibilities.
Pakistan	National Financial Literacy Program launched in 2012.	<ol style="list-style-type: none"> 1. Impart knowledge of banking/financial concepts and services. 5. Develop skills and attitudes: budgeting, saving, investing, debt management, financial negotiations, rights and obligations, Islamic banking. 3. Facilitate behavior change to improve financial outcomes. 4. Financial inclusiveness: Opening of DTAs and bank accounts for financial empowerment.
Kenya	No national policy addressing financial literacy specifically.	
Nigeria	National Financial Literacy Framework (FLF) developed in 2013 by the Consumer Protection Department of the CBN.	<ol style="list-style-type: none"> 1. Empower individuals to make better financial decisions. 2. Help to set realistic and achievable financial goals. 3. Increase awareness regarding personal financial planning and budgeting. 4. Help financially excluded individuals to understand and access financial products and services at affordable costs. 5. Help individuals and businesses to understand their rights and obligations of financial transactions. 6. Increase individuals' ability to generate and save income. 7. Create a platform for stakeholders' interaction in financial education. 8. Provide a platform for a multi-stakeholder approach to financial literacy and financial consumer protection.
Tanzania	National Financial Education Framework (N-FEF) 2016–2020.	<ol style="list-style-type: none"> 1. Educate stakeholders on the importance of financial education, and their roles. 2. Coordinate financial education initiatives, and encourage strategic partnerships. 3. Guide and support stakeholders in the implementation and measurement of initiatives. 4. Share lessons learned to ensure continuing improvement. 5. Set baseline criteria and measure progress over time at a national level.
Uganda	Financial Literacy Strategy (2013–2017) implemented since 2013 by the Bank of Uganda. Past financial literacy strategy reviewed to formulate a national financial literacy strategy for 2018–2023.	<ol style="list-style-type: none"> 1. Improve the ability of the population to manage their personal finances well. 2. Help to equip people to protect themselves against fraud. 3. Make cost-effective use of resources that can be used to strengthen financial literacy. 4. Promote increases in the number and quality of initiatives to strengthen financial literacy. 5. Facilitate effective coordination and knowledge sharing between organizations and individuals working to improve financial literacy.

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Appendix A *table continued*

	Digital literacy strategy	
	Sponsor(s) and year	Objectives
Bangladesh	Digital Bangladesh 2021 Vision launched in 2009 by the Government of Bangladesh, with no specific digital literacy strategy.	Digital Bangladesh agenda proposes to mainstream ICTs as a pro-poor tool to eradicate poverty, establish good governance, and ensure social equity through quality education, healthcare and law enforcement for all.
India	National Digital Literacy Mission (NDLM) Scheme initiated to empower at least one person per household with crucial digital literacy skills by 2020, as part of the Prime Minister's Vision of "Digital India" launched in 2015.	<ol style="list-style-type: none"> 1. Make citizens information and communications technology (ICT) literate so that they can operate a computer, digitally access devices (e.g., tablets), send and receive emails, search the internet for information, etc. 2. Train citizens to effectively access various e-governance services being offered by the government and other agencies.
Pakistan	No specific digital literacy initiative. ICT policy under National Education Policy 2017.	<ol style="list-style-type: none"> 1. Provide access to ICT in schools, and use it to strengthen quality of teaching and enhance student learning. 2. Develop complementary approaches to ICT in education, and improve capacity of education departments. 3. Integrate computer and other digital devices like smart phones for teaching and learning.
Kenya	Digital Literacy Programme (DLP) initiated by the Government of Kenya in 2013.	Improve learning and build 21st-century skills among primary school students through the use of digital technologies in education.
Nigeria	Digital Literacy Council established in 2017 to develop a National Digital Literacy Policy.	Policy not yet formulated.
Tanzania	National Skills Development Strategy (NSDP) implemented in 2016, with ICT as one of the focus sectors.	Not yet available.
Uganda	Digital Uganda Vision, a policy and strategy framework that aims to consolidate ICT-related initiatives and policies, and boost digital competencies.	Not yet available.

Note: Authors' collection based on multiple sources.

APPENDIX B: VARIABLE DEFINITIONS

Variable	Definition
<i>Resilience-building financial behaviors</i>	
<i>Saving behaviors</i>	
Currently saving	=1 if respondent reported currently saving using a bank, non-bank financial institution (NBFI), or mobile money service provider
Formal saving	=1 if respondent reported saving using a formal banking institution
Informal saving	=1 if respondent reported saving using a non-bank financial institution (NBFI) or mobile money service provider
Not currently saving	=1 if respondent reported that they were not currently saving
<i>Borrowing behaviors</i>	
Currently borrowing	=1 if respondent reported that they currently had a loan
Formal borrowing	=1 if respondent reported that they currently had a loan with a bank
Informal borrowing	=1 if respondent reported that they currently had a loan with a non-bank financial institution (NBFI) or mobile money service provider
Not currently borrowing	=1 if respondent reported that they did not currently have a loan
<i>Risk management behaviors</i>	
Life or health insurance	=1 if respondent reported having either life or health insurance
Life insurance	=1 if respondent reported having life insurance
Health insurance	=1 if respondent reported having health/medical insurance
No life or health insurance	=1 if respondent did not have life or health/medical insurance
Ability to come up with emergency fund	=1 if respondent reported that it is "very likely" that they could gather sufficient funds if they had an emergency and urgently needed to pay a sum equal to one year of their income
Availability of emergency fund	=1 if respondent "somewhat" or "strongly" agreed that they had an emergency fund that is large enough to cover unplanned expenses
<i>Financial and digital literacy</i>	
Composite index for financial and digital literacy	The composite index for financial and digital literacy was constructed by summing the scores across the financial and digital literacy indices. Score ranged from 0 to 21.
Financial literacy index	The financial literacy index was equal to the sum of the number of correct answers to a set of five questions assessing knowledge of interest rates (1 question), compound interest (2 questions), inflation (1 question), and risk diversification (1 question), plus an additional measure of self-reported financial capability. Scores ranged from 0 to 6.
Interest rates	Respondents were asked: "Suppose you need to borrow 100 [units of national currency]. Which is the lower amount to pay back: 105 [units] or 100 [units] plus 3%?" =1 if respondent selected "100 [units] plus 3%"
Compound interest 1	Respondents were asked: "Suppose you put money in the bank for two years and the bank agrees to add 15% per year to your account. Will the bank add more money to your account the 2 nd year than it did the 1 st year, or will it add the same amount of money both years?" =1 if respondent selected "More"
Compound interest 2	Respondents were asked: "Suppose you had 100 [units of national currency] in a savings account and the bank adds 10% per year to the account. How much money would you have in the account after five years if you did not remove any money from the account?" =1 if respondent selected "More than 150 [units]"
Inflation	Respondents were asked: "Suppose over the next 10 years the prices of the things you buy double. If your income also doubles, will you be able to buy less than you can buy today, the same as you can buy today, or more than you can buy today?" =1 if respondent selected "The same"
Risk diversification	Respondents were asked: "Is it safer to put your money into one business or investment, or to put your money into multiple businesses or investments?" =1 if respondent selected "Multiple businesses or investments"
Financial capability	=1 if respondent reported that they "somewhat" or "strongly" agreed that they had the skills and knowledge to manage their finances well.

continued on next page

Appendix B *table continued*

Variable	Definition
Digital literacy index	The digital literacy index was constructed by summing the scores across 3 dimensions or 15 indicators of digital capability: (1) mobile technology access (owns a mobile phone or a smart phone; (2) mobile phone proficiency (uses mobile phone to send or receive calls, sends or receives text messages, sends or receives photos, browses or uses the internet, downloads music, videos or games, makes financial transactions, or access social networking sites); (3) mobile money proficiency (opens a mobile money menu, finds particular menu options, initiates a transaction, completes a transaction, corrects an error, or reverses or cancels a transaction). Scores ranged from 0 to 15.
Owns mobile phone	=1 if respondent personally owned a mobile phone
Owns smart phone	=1 if respondent owned a smart phone
Mobile phone proficiency score	An index equal to the sum of tasks respondent undertook using a mobile phone in the past 90 days; scores ranged from 0 to 7.
Sends or receives calls	=1 if respondent used a mobile phone in the past 90 days to call or receive calls
Sends or receives text messages	=1 if respondent used a mobile phone in the past 90 days to send or receive text messages
Sends or receives photos	=1 if respondent used a mobile phone in the past 90 days to send or receive photo messages
Browses or uses the internet	=1 if respondent used a mobile phone in the past 90 days to browse or use the internet
Downloads music, videos, or games	=1 if respondent used a mobile phone in the past 90 days to download music, videos, or games
Makes financial transactions	=1 if respondent used a mobile phone in the past 90 days to make a financial transaction such as send/receive money, or make a payment or banking transaction
Uses social networking sites	=1 if respondent used a mobile phone in the past 90 days to use Facebook, WhatsApp, Twitter, Instagram or another social networking site
Mobile money proficiency score	An index equal to the sum of actions respondent reported being able to perform without assistance from anyone when using mobile money (conditional on having ever used a mobile money service, but not conditional on having a registered mobile money account)
Opens a mobile money menu	=1 if respondent reported finding it “very easy” or “easy” or “neither difficult, nor easy” for them to open a mobile money menu without assistance from anyone
Finds particular menu options	=1 if respondent reported finding it “very easy” or “easy” or “neither difficult, nor easy” for them to find a particular menu option without assistance from anyone
Initiates transaction	=1 if respondent reported finding it “very easy” or “easy” or “neither difficult, nor easy” for them to initiate a transaction without assistance from anyone
Completes transaction	=1 if respondent reported finding it “very easy” or “easy” or “neither difficult, nor easy” for them to complete a transaction without assistance from anyone
Corrects an error	=1 if respondent reported finding it “very easy” or “easy” or “neither difficult, nor easy” for them to correct an error in the amount or phone number for a transaction recipient without assistance from anyone
Reverses or cancels a transaction	=1 if respondent reported finding it “very easy” or “easy” or “neither difficult, nor easy” for them to reverse or cancel a transaction without assistance from anyone
<i>Psychometrics</i>	
Financial satisfaction	=1 if respondent reported being “very satisfied” with their financial situation
Confident income will grow	=1 if respondent “somewhat” or “strongly” agreed that they are confident that their income will grow in the future
Confident of financial security	=1 if respondent “somewhat” or “strongly” agreed that they had savings or assets that will keep them financially secure in the future
<i>Demographics</i>	
Age 15–24	=1 if respondent was less than 25 years of age
Age 25–34	=1 if respondent was between the ages of 25 and 34
Age 35–44	=1 if respondent was between the ages of 35 and 44
Age 45–54	=1 if respondent was between the ages of 45 and 54
Age 55 and over	=1 if respondent was aged 55 or older
Educ: Less than primary	=1 if respondent had no formal education or less than primary education

Educ: Primary	=1 if respondent had completed primary education to some secondary education
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*continued on next page***Appendix B table continued**

Variable	Definition
Educ: Secondary	=1 if respondent had completed secondary education to some tertiary education
Educ: Higher	=1 if respondent had completed some college/university or more
Female	=1 if respondent was female
Married	=1 if respondent was married
Household head	=1 if respondent was household head
Poor (below \$2.50/day)	=1 if household was below the poverty line of \$2.50 per day
Working	=1 if respondent was employed or self-employed
Employed full-time	=1 if respondent was working full-time for a regular salary
Employed part-time	=1 if respondent was working part-time for a regular salary
Working occasionally/seasonally	=1 if respondent was working occasionally with irregular pay or working seasonally
Self-employed	=1 if respondent was working for themselves
Not working	=1 if respondent was not working (looking for work, housewife, stay-at-home husband, full-time student, retired, ill, disabled, other)
Income source: Employment	=1 if household received money in the past 12 months from public or private sector employment
Income source: Business	=1 if household received money in the past 12 months from running their own business
Income source: Farm	=1 if household received money in the past 12 months from selling products of agriculture or rearing livestock
Income source: Government	=1 if household received money in the past 12 months from government payments, including pensions, student scholarships, government benefits, etc.
Income source: Family	=1 if household received money in the past 12 months from family/friends/spouse sent for regular support
Illness of family member	=1 if a family member had been ill in the past 12 months
Death of a family member	=1 if a family member had passed away in the past 12 months
Rural	=1 if respondent lived in rural area
South Asia	=1 if respondent lived in a South Asian country (Bangladesh, India, Pakistan)
Bangladesh	=1 if respondent lived in Bangladesh
India	=1 if respondent lived in India
Pakistan	=1 if respondent lived in Pakistan
Africa	=1 if respondent lived in an African country (Kenya, Nigeria, Tanzania, Uganda)
Kenya	=1 if respondent lived in Kenya
Nigeria	=1 if respondent lived in Nigeria
Tanzania	=1 if respondent lived in Tanzania
Uganda	=1 if respondent lived in Uganda
<i>Instrumental variables</i>	
Numeracy	= 1 if respondent answered both questions correctly testing addition and division skills Addition: Respondents were asked: "Imagine you have 2,000 [units of national currency]. Somebody gives you 200 [units]. How much total money will you have?" Answer is considered correct if respondent selected "2,200 [units]" Division: Respondents were asked: "Imagine you have 1,000 [units] and you have to divide it among five people. How much money will each person receive if you divide it equally?" Answer is considered correct if respondent selected "200 [units]"
Language comprehension	= 1 if respondent read and understood the informed consent form without any help from the interviewer or with a little help from the interviewer

Source: 2017 Financial Inclusion Insights Data (Wave 5) for India, Bangladesh, Kenya, Nigeria, Pakistan, Tanzania, and Uganda.

APPENDIX C: FACTOR LOADINGS FOR CONSTRUCTS FOR THE FINANCIAL AND DIGITAL LITERACY INDICES

Construct/Indicator	Financial Literacy Index		Digital Literacy Index		
	Factor Loadings ^a	Reliability ^b	Factor Loadings		
Financial literacy index	Factor 1	$\alpha = 0.5366$			
Interest rates	0.6644				
Compound interest 1	0.6854				
Compound interest 2	0.6953				
Inflation	0.3802				
Risk diversification	0.4933				
Financial capability	0.3160				
Digital literacy index			Factor 1	Factor 2	Factor 3
					$\alpha = 0.9005$
Owens mobile phone			0.4072	0.3095	0.7263
Owens smart phone			0.5615	0.5388	-0.1379
Sends or receives calls			0.3280	0.2609	0.7859
Sends or receives text messages			0.5970	0.3490	0.2844
Sends or receives photos			0.5349	0.5913	-0.1654
Browses or uses the internet			0.6506	0.6286	-0.2128
Downloads music, videos, or games			0.5984	0.6214	-0.2235
Makes financial transactions			0.6496	0.0523	-0.0691
Uses social networking sites			0.6945	0.6026	-0.2213
Opens a mobile money menu			0.8024	-0.4698	-0.0055
Finds particular menu options			0.8147	-0.4688	-0.0121
Initiates transaction			0.8250	-0.4709	-0.0166
Completes transaction			0.8300	-0.4658	-0.0190
Corrects an error			0.8039	-0.4533	-0.0272
Reverses or cancels a transaction			0.7968	-0.4380	-0.0351
Composite Financial and Digital Literacy Index					
Construct/Indicator	Factor Loadings				Reliability
	Factor 1	Factor 2	Factor 3	Factor 4	$\alpha = 0.8506$
Financial literacy index					
Interest rates	0.1713	0.0203	0.5956	0.2991	
Compound interest 1	0.1897	-0.0258	0.6237	0.2296	
Compound interest 2	0.2287	-0.0289	0.6016	0.2859	
Inflation	0.1009	0.0500	0.3620	0.1240	
Risk diversification	0.2491	-0.0815	0.3835	0.1324	
Financial capability	0.1898	-0.0190	0.2744	-0.1240	
Digital literacy index					
Owens mobile phone	0.4128	0.3102	0.2994	-0.6475	
Owens smart phone	0.5562	0.5426	-0.0848	0.1158	
Sends or receives calls	0.3345	0.2606	0.3256	-0.7006	
Sends or receives text messages	0.5999	0.3503	0.1195	-0.2469	
Sends or receives photos	0.5257	0.5956	-0.1352	0.1238	
Browses or uses the internet	0.6432	0.6328	-0.1344	0.1747	
Downloads music, videos, or games	0.5896	0.6257	-0.1495	0.1805	
Makes financial transactions	0.6905	0.0553	-0.1046	0.0306	
Uses social networking sites	0.6419	0.6069	-0.1433	0.1790	
Opens a mobile money menu	0.8028	-0.4650	-0.0577	-0.0075	
Finds particular menu options	0.8140	-0.4636	-0.0709	-0.0065	
Initiates transaction	0.8238	-0.4654	-0.0778	-0.0044	
Completes transaction	0.8285	-0.4602	-0.0824	-0.0048	
Corrects an error	0.8013	-0.4476	-0.0944	-0.0025	
Reverses or cancels a transaction	0.7941	-0.4321	-0.0973	0.0046	

^a The principal component factor method was used to generate the factor loadings. The complete results from the factor analysis are available upon request.

^b Cronbach's Alpha is the most common measure used to assess the scale reliability (or internal consistency) of a set of items, and how closely related the set of items are as a group.

APPENDIX D: COUNTRY-LEVEL INDICATORS AND DATA SOURCES

Country-level indicator	Source	Year
<i>Demand for financial services</i>		
Account (% age 15+)	World Bank – Global Financial Inclusion (Global Findex) Database	2017
Financial institution account (% age 15+)	World Bank – Global Financial Inclusion (Global Findex) Database	2017
Sent or received domestic remittances (% age 15+)	World Bank – Global Financial Inclusion (Global Findex) Database	2017
Sent or received domestic remittances: through a financial institution (% age 15+)	World Bank – Global Financial Inclusion (Global Findex) Database	2017
Made or received digital payments (% age 15+)	World Bank – Global Financial Inclusion (Global Findex) Database	2017
Saved any money (% age 15+)	World Bank – Global Financial Inclusion (Global Findex) Database	2017
Saved at a financial institution (% age 15+)	World Bank – Global Financial Inclusion (Global Findex) Database	2017
Borrowed any money (% age 15+)	World Bank – Global Financial Inclusion (Global Findex) Database	2017
Borrowed from a financial institution (% age 15+)	World Bank – Global Financial Inclusion (Global Findex) Database	2017
Coming up with emergency funds: possible (% age 15+)	World Bank – Global Financial Inclusion (Global Findex) Database	2017
<i>Supply of financial services</i>		
Commercial bank branches per 100,000 adults	IMF Financial Access Survey (FAS)	2017
Commercial bank branches per 1,000km ²	IMF Financial Access Survey (FAS)	2017
ATMs per 100,000 adults	IMF Financial Access Survey (FAS)	2017
ATMs per 1,000km ²	IMF Financial Access Survey (FAS)	2017
<i>Digital access</i>		
Mobile phone subscriptions (per 100 people)	United Nations Development Programme – Human Development Report (2018)	2016
Internet users (% of population)	United Nations Development Programme – Human Development Report (2018)	2016
Fixed broadband subscriptions (per 100 people)	International Telecommunication Union (ITU)	2017
<i>Financial capability</i>		
Adults who are financially literate (%)	S&P Global Financial Literacy Survey	2014
<i>Economic and demographic indicators</i>		
Population (millions)	World Bank DataBank – World Development Indicators (WDI)	2017
GDP per capita, PPP (current international \$)	World Bank DataBank – World Development Indicators (WDI)	2017
GDP per capita growth (%)	World Bank DataBank – World Development Indicators (WDI)	2017
Unemployment rate (% of population)	World Bank DataBank – World Development Indicators (WDI)	2017
Youth unemployment rate (% of population)	World Bank DataBank – World Development Indicators (WDI)	2017
<i>Economic access</i>		
Economic freedom	Heritage Foundation	2017
Sustainable Development Goals (SDG) Index	2018 SDG Index & Dashboard Report	2017

