Leveraging Digital Services and Market Development for Financial Inclusion

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Bringing Rigour and Evidence to Economic Policy Making in Africa

Leveraging Digital Services and Market Development for Financial Inclusion

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Abstract

The paper examines the extent to which digital financial services – mobile money, online banking and agency banking – contribute to financial inclusion in Uganda. We identify the key enablers and inhibitors of access and usage of digital financial services. To achieve this, we adopt a mixed methods approach and use the recent 2019/20 Uganda National Household Survey (UNHS) data, the World Bank's Global Findex data for 2021, and insights from key informant interviews. We use an instrumental variable approach to control for endogeneity and run recursive probit models for the binary outcomes of usage of mobile money services, agency banking, and commercial banks. We also run models for access to commercial banks and usage of informal groups. The results re-affirm the gap between men and women in access to and usage of digital and formal financial services, although this gap has significantly reduced over time. We also find that informal financial groups are used more by women. Financial literacy proxied by an individual's ability to read and/or write is a significant enabler of digital financial services usage among both men and women. Conversely, saving money at home/secret place has a strong negative effect on the overall usage of digital financial services, but a strong positive effect on the usage of informal groups. The new financial inclusion strategy should provide incentives to the private sector to promote innovation and investment in a broad range of new, friendly, and affordable products to attract the excluded sections of the population. Importantly, cultural and community institutions provide better opportunity towards changing social norms that have for long disadvantaged women and kept them financially excluded.

Keywords: *Digital Financial Services; Market Development; Financial Inclusion; Gender*

JEL Codes: *G10, G19, G21, Z00*

"…The stark reality is that, most poor people in the world still lack access to sustainable financial services, whether it is savings, credit or insurance. The great challenge before us is to address the constraints that exclude people from full participation in the financial sector." Kofi Annan, former United Nations Secretary General, 2003[1].

1. Introduction

Financial inclusion, specifically access to affordable financial services, is very critical in reducing poverty, income inequality and accelerating economic growth (Pazarbasioglu, Mora, Uttamchandani et al., 2020; Fernandesa, Borges and Caiado, 2021). Access to and use of basic financial services facilitates savings that are much needed to mitigate shocks and promote asset development. Consequently, this increases resilience and improves people's welfare (Mullainathan and Shafir, 2009; Pazarbasioglu et al., 2020). Financial inclusion is partially facilitated by the degree of diffusion of digital financial services (fintech[2]) that a country has developed and harnessed. This is enabled by the creation of digital networks, associated Automated Teller Machines (ATMs), and mobile money and payments systems (Kanga et al., 2022). This implies that the higher the degree of fintech diffusion, the higher the likelihood of financial inclusion. Notably, there is a two-way relationship between financial development and growth. Therefore, policy instruments such as digital networking and infrastructure development are critical to leverage digital financial services for financial inclusion. This is premised on the fact that digital networks provide a technological platform to expand the reach of financial service providers (Batiz-Lazo, 2018).

Although fintech has great potential to support financial inclusion, in some instances it can be limited by the degree of financial market development in a country. In this context, financial market development is a multi-pronged approach to financial inclusion, which aims to build markets that include and serve the financially excluded, especially the poor consumers (El-Zoghbi, Mayada, Lauer, Kate, 2013). Financial market development starts by explaining why it does not work for the excluded in each market. It focuses on the enabling environment through the provision of advice and support to the financial inclusion ecosystem actors, such as policy makers and regulators, and the adoption and enforcement of financial consumer protection rules. This area is largely dominated by those who support the development of financial system infrastructure, such as the National Payment Systems and those who run platforms that enable financial inclusion. Furthermore, it includes individuals, organizations, regulators and policy makers engaged in developing financial capability training programmes and designing financial products and services that meet the

needs of the financially excluded from a significant portion of this ecosystem.

Uganda has undertaken major steps to ensure more financial inclusion. In 2015, the Financial Sector Deepening Uganda (FSDU) was formed to primarily address financial inclusion and inclusive financial market development. The FSDU works closely with financial market actors (policy makers, regulators and industry associations) to facilitate the development of a more competitive, robust and inclusive financial sector that meets the needs of everyone, especially the unserved and underserved. The FSDU interventions are geared towards creating an enabling policy and regulatory environment for the financial inclusion of unrepresented groups. Furthermore, the government has developed and implemented policies and strategies within the financial sector and the Bank of Uganda had also put in place a number of acts and regulations to achieve the same objective. Some of these interventions have improved Uganda's formal and informal financial inclusion landscape, albeit with some challenges.

For instance, Table 1 illustrates that 43% of Ugandan adults do not have access to formal and informal financial services (Uganda Bureau of Statistics, 2021; FSDU, 2022). The extent of exclusion varies by sex, region, income status and education level.

Table 1: The state of formal and informal financial inclusion in Uganda, 2022 (%)

	Overall financial inclusion (formal and informal)	Adults with access to a full-service formal financial account	Registered users of a full-service formal financial account	30-day active user of a registered full-service formal financial account	Advanced users of a registered a full-service formal financial account	Adults who are members ofinformal financial groups
Ugandan adults (age 16+)	57	48	47	30	28	18
Men	61	56	55	37	33	16
Women	53	42	40	24	23	21
Urban	68	65	63	46	45	14
Rural	52	42	40	24	21	20
16–30	44	39	38	23	22	11
31–59	72	61	60	40	36	27
60+	49	38	36	22	19	18
Less than primary or not stated	47	36	33	18	16	20
Completed primary/ some secondary	59	54	52	34	31	19
Completed secondary or above	80	78	77	59	55	16
Non-poor	61	54	52	35	32	19
Poor	35	23	22	10	8	14

Source: Table adapted from the Financial Sector Deepening Uganda Report (2022)

Notably, more women (21%) are members of informal financial groups compared to only 16% of men. More men (56%) have access to formal financial accounts than women (42%). A similar pattern is witnessed among urban and rural dwellers. More precisely, 20% of rural Ugandans are members of an informal financial group, but only 14% of urban people use informal groups. Women and rural Ugandans are proportionately more included in informal financial groups, whereas men and urban dwellers have more access to and usage of formal financial services.

The low level of formal financial inclusion in rural areas is partly explained by the high cost of providing financial services. Financial service providers, such as commercial banks, lack the incentives, information, and sometimes the ability to mitigate the risks of operating beyond urban markets or with low-income clientele (FinScope, 2018). Consequently, the bulk of rural and low-income Ugandans have remained financially excluded. Therefore, digital financial services such as mobile money are critical for bridging the financial access gap between the financially included and the excluded. Importantly, understanding and onboarding women, especially in rural areas, onto formal financial services is vital to closing these access gaps.

Although much has been achieved in Uganda due to past and current interventions, relatively little research has been done to establish the effect of digital financial services and financial market development on financial inclusion. Relatedly, the National Financial Inclusion Strategy (NFIS) 2017-2022, Uganda's holistic strategy for promoting financial inclusion, is yet to be revised upon its expiry. Therefore, this study aims to establish the factors that facilitate or inhibit access and usage of mobile money and agency banking services and formal banking and informal group services. The study's main objective is to establish the extent to which and how digital financial services contribute to financial inclusion in Uganda. In doing this, the role of financial market development is critical.

Specifically, the study seeks answers to the following questions: (i) Which digital financial products and services are most accessed and used by men and women? (ii) Are there significant differences in access and usage of formal and informal financial services among men and women? (iii) Are there significant differences in savings mechanisms used by men and women? and (iv) What factors facilitate or inhibit access and usage of mobile money, formal banking, agency banking and informal groups services? Overall, this study contributes to the recent literature that advances digital financial products and services in the changing world to bolster financial inclusion as a means to poverty reduction.

The rest of the paper proceeds as follows. Section 2 discusses the theoretical underpinnings and empirical literature while highlighting the respective methods used. Section 3 presents the data, theoretical framework and the estimation strategy. Section 4 presents the interpretation and discussion of the results. Section 5 concludes and highlights policy implications that emerge from the findings.

2. Theoretical underpinnings and empirical review

This section highlights the different arguments in the literature about financial inclusion. It delves into both the theoretical and empirical literature underpinnings of the study. A very important aspect of the section is the detailed definitions of digital financial services, financial inclusion, digital financial inclusion as key concepts of the study, collating the different understandings from various scholars.

Financial inclusion

Financial inclusion is the provision of and access to financial services to all members of the population, particularly the poor and other excluded groups (Ozili, 2018). It can be described as having access to and using a broad range of quality and affordable financial services, which helps ensure a person's financial security (Republic of Uganda 2017). Thus, it delivers banking services at an affordable cost to vast sections of the disadvantaged and low-income groups (Dev, 2006). Therefore, financial inclusion is the access to and use of formal financial services (Sahay et al., 2015).

The United Nations (2016) emphasizes the key elements of sustainability and the formal economy in the concept of financial inclusion. Similarly, Beck et al. (2007), Sarma and Pais (2010), Sarma (2008) and Bruhn and Love (2014) generally describe it as extension of formal financial services to the poor. According to Demirgüç-Kunt and Klapper (2012), it entails access to an account, favourable credit facilities, equity financing and financial packages, among others. Other elements embedded in the concept of inclusion include affordability, transparency and equity in the provision of financial services, with non-existence of both non-price and price barriers (Chakrabarty, 2006). Kofman and Payne (2021) and Beck and Torre (2006) suggest that the core indicators of financial inclusion are access, usage and quality of these services or financial products. However, the attributes of access and usage are well explained by Hamdan et al. (2021), who establish that possession of a mobile money account did not necessarily mean usage.

Theories of financial inclusion

Ozili (2021) compiles an extensive summary of financial inclusion theories, which this section draws on. The theories are broadly categorized into three financial inclusion theories, namely, beneficiaries, funding and delivery.

Financial inclusion beneficiary's theory

The financial inclusion beneficiary's theory explains the channels of dispensing financial services and is broken down into public good, dissatisfaction, vulnerable group and systems theories of financial inclusion. The ***public good theory of financial inclusion*** argues that provision of formal financial services should be treated as a public good, where formal financial services should be provided to everyone for the benefit of all, with unrestricted access to finance for everyone. The theory is limited by the likely burden on the public budget and the fact that some services are provided by the private sector for profit. The ***dissatisfaction theory of financial inclusion*** argues that financial inclusion programmes should target individuals who were previously in the formal financial sector but left because they were dissatisfied with the rules of engagement in the formal financial sector. Thus, it is easier to bring back this group of individuals into the formal financial sector through persuasion than to bring in those who have never been there.

The ***vulnerable group theory of financial inclusion*** argues that interventions on financial inclusion should target the vulnerable members of society who suffer the most from economic hardship and crises, such as poor people, young people, women, and elderly people. This theory implies that financial inclusion efforts should be targeted at vulnerable people in society. Finally, the ***systems theory*** posits that financial inclusion outcomes are achieved through existing sub-systems (such as the economic, social and financial systems). In this case, a significant change in a sub-system can significantly affect the expected financial inclusion outcome. For instance, imposing regulatory action on financial sector agents increases the chances of reconfiguring interests with the potential to affect the quality of service.

Theories of financial inclusion delivery

Theories of financial inclusion delivery are split between two poles: the government and the private sector, with others arguing that both are essential. Aggarwal and Klapper (2013), Staschen and Nelson (2013) and Chibba (2009) think that the government should take responsibility. However, Gabor and Brooks (2017) and Ozili (2018) argue that private corporations such as banks and financial technology businesses can deliver formal financial services to the people more efficiently. Arun and Kamath (2015) and Pearce (2011) argue for a position of both the public and private sectors being involved. According to Ozill (2021), these arguments and

counter-arguments led to the development of different perspectives/theories on financial inclusion delivery. Accordingly, there are the community echelon, public service, special agent, collaborative intervention and the financial literacy theories.

The ***community echelon theory of financial inclusion*** states that formal financial services should be delivered to the excluded population through their communal leaders. This is because community leaders are influential in their communities and can use their influence to encourage or persuade community members to join the formal financial sector. The ***public service theory of financial inclusion*** argues that financial inclusion is a public responsibility, which the government owes its citizens, and the citizens expect the government to deliver formal financial services to citizens. Therefore, under this theory, only the government is instrumental in achieving financial inclusion.

The ***special agent theory of financial inclusion*** argues for formal financial services to be delivered to the excluded population by special agents because the unbanked adults can be difficult to reach due to the nature of remote communities. For this reason, there is need to employ the services of specialized agents to deliver formal financial services to members of excluded communities. The theory espouses the agent-principal relationship where the principal is the national government, foreign government or foreign organization and the special agent is often a local bank, non-bank institutions or a special institution created for the sole purpose of achieving specific financial inclusion objectives. Financial institutions and technological companies can also play the role of special agent.

The ***collaborative intervention theory of financial inclusion*** argues that formal financial services should be delivered to the excluded population by collaborative intervention from multiple stakeholders. The theory suggests that joint effort from multiple stakeholders is needed to bring the excluded population into the formal financial sector. Finally, the ***financial literacy theory of financial inclusion*** states that financial literacy will increase people's willingness to join the formal financial sector. It argues that financial inclusion can be achieved through education, which increases the financial literacy of citizens. When people become financially literate, they will seek formal financial services wherever they can find the services.

Theories of financial inclusion funding

Funding of financial inclusion activities remains an important issue at the heart of the debate. Whereas some argue for public funding, such as Marshall (2004), others such as Mohiuddin (2015) think that the private sector should fund financial inclusion programmes. There is the last group that argues for joint engagement of both the public and private sectors (Dashi et al., 2013; Cobb et al., 2016) in funding financial inclusion. The theories regarding funding, according to Ozili (2021), include: private money, public money and intervention fund theories of financial inclusion.

The ***private money theory of financial inclusion*** states that financial inclusion programmes should be funded using private money (e.g., shareholders' equity capital) because private funders will: (i) require greater accountability from the users of their funds; (ii) ensure that private funds are utilized efficiently; and (iii) ensure that formal financial services are delivered to the excluded members of the population. On the other hand, ***the public money theory of financial inclusion*** argues for funding financial inclusion programmes using public money from government budgets. The ***intervention fund theory of financial inclusion*** argues that activities and programmes should be funded from special interventions by diverse funders rather than using taxpayers' money. It argues that many 'special funders' exist worldwide, such as philanthropists, non-governmental organizations and foreign governments. These special funders often support inclusive development finance programmes for the global population.

Empirical review

The empirical review of financial inclusion literature brings out key policy and academic messages. Whereas the policy literature stresses efforts to achieve financial inclusion, the academic literature is mainly concerned with the relationship between financial inclusion and poverty levels, income inequality, and the effect of financial inclusion on the economy (Sarma and Pais, 2011; Morgan and Pontines, 2014; Mehrotra and Yetman, 2015; Demirgüç-Kunt and Klapper, 2013a; Cull *et al*., 2013).

Beneficiaries of financial inclusion

Difference scholars posit different outcomes and benefits from financial inclusion. Whereas Bhandari (2018) argues that poor people are the ultimate beneficiaries of financial inclusion, Ghosh and Vinod (2017), Demirguc-Kunt et al. (2013b) and Swamy (2014) argue that women are the beneficiaries of financial inclusion outcomes. Zins and Weill (2016) established that women and young people were among the groups that are financially excluded in Africa in general. The last group argue that the entire economy and the financial system are beneficiaries of financial inclusion (Mehrotra and Yetman, 2015; Kim et al., 2018; Swamy, 2014: Ozili, 2018). This category argues that groups such as young people, elderly people, institutionalized people, people with disabilities, and individuals excluded from the financial sector are candidates for financial inclusion.

Manyika et al. (2016) find that women face various challenges in accessing financial services, evidenced by the estimate that they constitute 55% of the two billion in the world that lack a bank account. Furthermore, the authors find that the likelihood of females in emerging economies possessing an account is 20% less probable than males and 23% less likely to gain access to various products such as loans and mobile money. This gender gap is attributed to limited mobility whereby financial service

providers experience difficulty reaching women. Moreover, their frequency of travel to urban centres is insufficient for exposure to digital infrastructure and financial systems. In addition, women possess lower education, income and employment prospects, are hindered by cultural and social barriers, and have a narrow asset base. Therefore, they conclude that financial entities serve fewer women and have a shallow understanding of the exceptional obstacles they experience as prospective customers.

Kofman and Payne (2021) further argue that financial inclusion of women should transcend joining the formal economy but be more about their adaption of Digital Financial Services (DFS) to diminish the prevailing inequality. Furthermore, their entry into financial systems gives women dignity, i.e., control over their finances; reduces the burden of traveling to conduct transactions, hence freeing up their time; and the opportunity to expand their individual wealth. The authors highlight the factors that can increase financial inclusion for women: i) expanding females' education (including financial education) and employment prospects, which increases their income; ii) addressing legal and regulatory barriers to equal pay, inheritance and property rights, etc; iii) filling data gaps and studying the links between 'economic development and macroeconomic growth' and financial inclusion; and iv) a deeper understanding of behavioural factors such as trust in financial service providers; loyalty to informal financial services and 'social proof and approval' especially from fellow women, and attitudes towards money, savings and risks.

Enablers of and barriers to financial inclusion

The factors that influence financial inclusion have been identified in the literature. However, Ahmed et al. (2021) extensively analyzes the literature, and their work greatly contributes to this review. The authors established that at the global level, cross-country regressions suggest that growth in per capita income, low inflation, openness to trade and better institutional quality (such as the rule of law and absence of corruption) promote financial development (LaPorta et al., 1997; Chinn and Ito, 2006; Huang, 2010). There is consensus that financial inclusion in Sub-Saharan Africa is less than elsewhere (Demirg¨uc¸-Kunt and Klapper, 2012; Allen et al., 2014). Allen et al. (2012 and 2014) argue that population density is more closely linked to bank branch penetration in Africa than in other developing economies. Therefore, branch penetration in Africa remains low outside major cities, especially in low-income or sparsely populated areas (Beck and Cull, 2013).

On the supply side, Beck et al. (2007; 2008) explain that barriers such as minimum account balances, account fees, and documentation requirements are associated with lower levels of banking outreach worldwide. Barriers tend to be higher where there are restrictions on bank activities and entry, less disclosure and inadequate physical infrastructure and where banks are predominantly government-owned (Beck et al., 2008). Allen et al. (2016) report that on the demand side, richer, older, urban, educated, employed and married individuals are more likely to have a bank account and more likely to use it regularly. Although lack of money is itself a barrier,

other perceived barriers to access include the costs of opening and running an account, distance to a banking outlet, absence of documentation and lack of trust in banks. Although the identified factors are critical to financial exclusion, Ahmed et al. (2020) argue that this can be voluntary or involuntary. Voluntary exclusion occurs when individuals report that they do not need the financial system, while involuntary exclusion arises when households cannot use the financial system because of external barriers, such as cost or documentation (Beck et al., 2007; Allen et al. 2016). Soumar et al.'s (2016) study in Central and West Africa provides insights into the determinants of financial inclusion. Their findings corroborate with other findings where individual characteristics such as gender, education, age, income, residence area, employment status, marital status, household size and degree of trust in financial institutions play a significant role.

Kostov et al. (2015) conducts a logit estimation on cross-section household survey data in South Africa and establish that literacy and financial education help explain the take-up of informal finance but may not necessarily progress to use of formal finance. Relatedly, Nanziri (2015) used a pseudo-panel household in South Africa and established that low education and income levels explain low uptake of financial services. Akudugu (2013) conducted a study in Ghana and established that low income, lack of trust in banks and lack of documentation explain why individuals do not have bank accounts. Although documentation is critical, poorer households may be unable to obtain documentation that satisfies service providers and regulators (Hannig and Jansen, 2010). This implies that market development actions must target this nature of financial exclusion as concluded by Allen et al. (2016) to encourage households to engage with the financial system. The government should provide an enabling environment, such as lower-cost products, proximity of financial services and use of financial institutions for government payments to individuals to inculcate a banking habit.

Diffusion of fintech and financial inclusion

The degree of diffusion of fintech through the creation of digital networks, Automated Teller Machines (ATM), mobile money and payments systems has direct and indirect effects on financial inclusion (Kanga et al., 2022). The authors established that fintech diffusion has positive effects on financial inclusion and proposed that governments should look at a more comprehensive set of policy variables to increase the financial sector's performance. In addition, it was proposed that policy instruments such as standard setting (particularly in ICT, digital networks and security protocols that can enhance network externalities and interoperability) and infrastructure development are critical to leverage financial inclusion. This is because digital networks provide a technological platform to expand the reach of financial service providers, thus increasing financial inclusion (Batiz-Lazo, 2018). Such technologies in the financial services sector can potentially enhance financial inclusion. Even with this potential for transformation, more research has to be done to establish the impact of digital services and financial market development on financial inclusion in Uganda. This study seeks to contribute to this debate by identifying the circumstances where this is most effective.

The process of progressing from informality to formality in access to financial services is intricate and not linear. Although Arun and Kamath (2015) suggest that financial inclusion should involve a progression from informal to formal finance as consumer experience increases, it is observed that households hold on to their informal accounts as they progress, implying that informal and formal finance may be complements rather than substitutes. This is confirmed by Zins and Weill (2016), who find that the probability of an individual having a formal or informal savings account is determined by the same factors. This suggests that policies need to ensure that the provision of finance is balanced between formal and informal institutions.

Using the Autoregressive Distributed Lag (ARDL), Fernandes et al. (2021) estimated the contribution of Digital Financial Services (DFS) to financial inclusion, in Mozambique. They relied on two models. In the first model, independent variables included ordinary digital channels used for payments, for example the number of financial transactions conducted using direct debit, ATMs, electronic transfers of inter and intra-bank funds, domestic and cross-border remittances, and point-of-sales (POSs). Modern digital payment channels including e-money, mobile banking and Internet banking were used in the second model. This study found that besides traditional digital avenues such as direct debit and domestic remittances, and Internet banking transactions, the rest of the variables positively impacted financial inclusion. Therefore, this confirms that DFS are fundamental for financial inclusion, specifically increasing access and utilization of the insufficiently served populace.

Hamdan et al. (2021) hypothesized that mobile money is an essential tool in enhancing financial inclusion, particularly in emerging economies. The study sampled micro-entrepreneurs in rural Kabarole District, Uganda and data was collected from 108 trading centres from 5,478 small enterprises. This study found that mobile money significantly expanded financial inclusion. In Uganda, it was estimated that 40% of the active mobile money account holders did not bank 'formally' or 'semi-formally'. Additionally, out of the 86% of microentrepreneurs that held mobile money accounts, 49% frequently utilized it. The high fees charged to use mobile money services were cited as one of the main reasons for the low adoption. Secondly, the inadequate geographical spread of agents and the low-quality networks negatively impacted access. Regarding gender, as mentioned earlier, most active mobile money customers were young men, compared to women.

The missing link that this study seeks to provide is the role of digital financial services and the status of financial market development on financial inclusion. This suggests that strengthening regulations and laws to better protect financial services consumers, enlarging population access to education, and easing access to finance for vulnerable groups (women, youth, poor, etc) is critical. The government should promote the benefits of using formal financial services in the communities and affirmatively improve conditions for opening accounts by simplifying the documentation requirements and reducing the financial services fees.

3. Methodology

This section highlights the different methods and techniques adopted for this study to answer the research questions. A brief description of the data, the theoretical framework and the estimation strategy are also presented here. Noteworthy, the study uses a mixed methods approach, whereby qualitative techniques, specifically key informant interviews, are adopted to supplement the quantitative methods.

Data

The study uses data from the most recent Uganda National Household Survey (UNHS) of 2019/20, together with the latest World Bank's Global Findex Index data (2021). The Global Findex Data is mainly leveraged for descriptive analysis to understand trends of access and usage of digital financial services such as mobile money services and electronic payments (e-payments) among Ugandans aged 15 years and above. The data for 2014, 2017 and 2021 is also used to compare access to and usage of digital financial services in the pre-COVID-19 and COVID-19 periods. Conversely, the UNHS data presents the status of access and usage of formal and informal financial services by Ugandan adults aged 15 years and above, but it also entails detailed information on individuals' other demographic and socio-economic characteristics. Quantitative data is supplemented by qualitative insights from key informant interviews (Table 2).

Table 2: Summary of data used

Data	Details
Quantitative	
Uganda National Household Survey (UNHS)	Undertaken by the Uganda Bureau of Statistics from mid-2019 and to mid-2020 (in the pre-COVID-19 and COVID-19 periods)
Global Findex Data	Data collected by the World Bank in 2021
Qualitative	
Key Informant Interviews (KIIs)	6 KIIs were conducted in 2022 to triangulate the findings from the quantitative data. Key Informant Interviews were held with sector policy and regulators (Uganda Microfinance Regulatory Authority, NITA-U); financial institutions (Pride Microfinance Bank, Uganda Development Bank) and the civil society (Friends Consult, Financial Sector Deepening Uganda)

Theoretical framework

The study adopts a model of demand for digital financial services (DFS) as put forward by Bauer and Hein (2006) and later modified by Königsheim, Lukas and Nöth (2017). For this study, we assume that x represents a digital financial service (e.g., mobile money service) used by an individual. The individual exhibits the utility function $g(x)$ with respect to traditionally provided cash services to which they add digital financial services, and the DFS providers offer n different digital financial services. In contrast to traditional channels, the individual's utility derived from novel digital financial services is uncertain; that is, it can increase or decrease total utility with the marginal function $h(x)$.

Königsheim, Lukas and Nöth (2017) postulate that there are two sources of uncertainty associated with the use of digital financial services. First, an individual might not be sure regarding security issues related to the disclosure of sensitive data when choosing a digital financial service. Second, individuals might be uncertain about the capabilities and knowledge required to use a specific digital service. Therefore, individuals do not completely know the outcome of using a digital financial service. Further still, we assume that there are k uncertain outcomes to which each individual attributes a probability p_j. The outcome $j = 1$ is the ideal situation (where no sensitive data is lost, and individuals possess all capabilities required to use digital financial services).

Therefore, the total expected utility derived from a traditional financial service combined with digital financial services is:

$$U(x) = g(x) + \sum_{j=1}^{k} p_j \sum_{i=1}^{n} \delta_i \, h_{ij}(x) \tag{1}$$

Where δ_i represents a dummy variable for the i^{th} digital financial service. If m is the total cost of traditional and digital financial services, whereby $\phi(x)$ is the cost for the traditional financial service (such as costs involved in physical movements to complete cash transactions) and $\gamma(x)$ refers to the cost of digital financial services – inclusive of mental costs to develop the necessary skills and costs for technical equipment – m is then given by:

$$m = \phi(x) + \sum_{i=1}^{n} \delta_i \, \gamma_i(x) \tag{2}$$

Therefore, we maximize equation using the condition in , and when $\sum_{j=1}^{k} p_j$ =1, the equation is simplified to:

$$U(x) = g(x) + \sum_{i=1}^{n} \delta_i \, h_{i1}(x) + \pi \tag{3}$$

$$\pi = \left(\sum_{j=2}^{k} p_j \sum_{i=1}^{n} \delta_i h_{ij}(x) \right) - \left((1 - p_1) \sum_{i=1}^{n} \delta_i \, h_{i1}(x) \right) \tag{4}$$

From , π denotes the risk premium, which contains the marginal utility function of digital financial services $h(x)$, and the perceived probabilities, p_j. The very first term in parentheses refers to all outcomes except for the optimal outcome $j = 1$.

For an individual to consider using a digital financial service, he/she looks at π . In summary, risk tolerance and financial knowledge, among other factors, influence an individual's decision to choose a given digital financial service. Importantly, services that require advanced financial knowledge increase the costs (e.g., mental costs) of such digital financial services, thereby influencing $\gamma_i(x)$. Moreover, services that entail sensitive data and/or uncertainty about the skills required to use them impact the risk premium π . Therefore, an individual's cost function differs depending on the nature of the digital financial service, such that the more complex the respective service is, the lower the individual's knowledge and the higher the costs (Königsheim et al., 2017).

Since we cannot observe the utility, or the net benefit gained by a typical user of digital financial services, we let y_1 be the net benefit or utility derived from using a digital financial service and y_0 be the utility derived from not using the respective digital financial service, such that:

$$y_1 = \beta' X_1 + \varepsilon_1 \text{ and } y_0 = \gamma' X_0 + \varepsilon_0 \tag{5}$$

We assume that $(\varepsilon_1 - \varepsilon_0.) \sim f(0,1)$ where f is symmetric. The assumption of $Var(\varepsilon) = 1$ could be relaxed to $Var(\varepsilon) = \sigma^2$. Although we do not observe y_1 and y_0 , we do observe y (the action of using DFS) such that:

$$y = 1 \text{ if } y_1 > y_0 \text{ and } y = 0 \text{ if } y_1 \leq y_0 \tag{6}$$

More precisely, if the utility gained from using a digital financial service is greater than the utility gained from not using, that is, $y_1 > y_0$ then $y = 1$. Likewise, $y = 0$ if utility gained from using a digital financial service is less or equal to that gained from not using, that is $y_1 \leq y_0$.

We are interested in the probability of observing a Ugandan aged 15 years and above use digital financial services; i.e., we are interested in observing $y = 1$. Thus $P(y = 1) = F(\beta' X)$, because the expected value of y given X is just the probability, thus $E[y|X] = F(\beta' X)$ [3]. Unlike in linear models, the marginal effect of a change in X on is not simply β. Differentiating X by $E[y]$ by X;

$$\frac{\partial E[y]}{\partial X} = \frac{\partial F(\beta' X)}{\partial (\beta' X)} \frac{\partial (\beta' X)}{\partial X} = f(\beta' X)\beta \tag{7}$$

These marginal effects look different depending on the specification of the probability model, and the common specifications include the Linear probability model (LPM), Probit model, and Logit model (Wooldridge, 2016). From the outcome variable can be summarized as:

$$y = \begin{cases} 1 & if\ individual\ uses\ DFS \\ 0 & otherwise \end{cases} \tag{8}$$

Where $y = f(X =$ ability to read and/or write; location; phone type; income level; saving modality; other demographic and socio-economic factors. We proxy an individual's financial knowledge by their ability to read and/or write.

Estimation strategy

Using UNHS and Global Findex data, the study gathers information on individuals' access and usage of mobile money services, formal banking services, and informal financial services. In addition, the study uses information on the usage of emerging financial services such as agency banking.[4] To answer questions one, two and three, we use t-tests to compare access and usage of digital financial services, and other formal and informal financial services among men and women. We then compare the mean differences to ascertain whether there are indeed significant differences in access and use between men and women. For the subsequent research question, we follow a simple econometric model with an individual as the unit of analysis. The goal is to empirically identify the specific factors facilitating or inhibiting access and usage of digital, formal and informal financial services. The econometric model is specified as follows:

$$y_i = \alpha_0 + \beta_i' X + \theta_i' Z + \varepsilon_i \tag{9}$$

Where, y_i is: (i) mobile money services usage; (ii) banking agent usage; (iii) bank/MDI account access; (iv) bank/MDI account usage; and (v) informal group usage. y_i is a binary outcome which takes on a value of 1 if the individual i has access or uses either of the aforementioned services and 0 otherwise. Vector X represents

characteristics that capture the direct relationship/effect with y and these include: Internet use, saving money in a secret place, saving with a merry-go-round, belonging to a savings and credit cooperative organization (SACCO), micro finance institutions (MFIs) or credit institution, phone type and involvement in financial decision making in the household, whereas $\beta' = (\beta_0\ \beta_1 \dots \dots \beta_k)$ is a vector of respective parameters to be estimated. Vector Z represents demographic and socio-economic characteristics that may influence y either indirectly or directly and these include: individual ability to read and/or write, residence (i.e. rural or urban), household size, individual age in years, marital status, region of residence (i.e. central, eastern, northern or western), sex (female or male) income status (poor or non-poor), whereas $\theta' = (\theta_0\ \theta_1 \dots \dots \theta_k)$ is a vector of respective parameters to be estimated, α_0 is the constant term and ε_i is the error term that accounts for everything else that is not directly captured in the model.

Considering that the outcome variables are dichotomous, the logit or probit model would be appropriate on condition that the regressors are strictly exogenous. However, we cannot guarantee exogeneity of income since it is most likely correlated with other variables, including the error term. This creates the endogeneity problem, which eventually renders our estimates spurious. In addition, measurement errors in the regressors and simultaneity of the dependent variable and the regressor can also cause endogeneity (Angrist, 2001; Gujarati and Porter, 2009; Cameron and Trivedi, 2005; Green, 2012). Therefore, isolating income status variable out of vector *Z* leads to the modified model below:

$$y_i = \alpha_0 + \beta_i' X + \theta_i' Z + \psi\ Incomestatus_i + \varepsilon_i \tag{10}$$

To remedy the endogeneity problem, we run recursive probit models using the instrument variable (IV) approach in addition to baseline probit models for comparative purposes. We instrument the income status dummy (i.e., 0 = poor or 1= non-poor) with the dummy of each household member having two clothes (0 = No and 1 = Yes); i.e., $(\psi\ Incomestatus_i = \xi\ Twoclothes_i)$. The instrument is highly correlated with the income status of an individual or household, but not the error term. In addition, we expect individuals who use more mobile money services to be those with higher income levels. Contrariwise, they are expected to afford digital products and services. Noteworthy, the Linear Probability Model (LPM) cannot be applied because it is always heteroskedastic, and its simplistic assumption of linearity does not apply to a dichotomous outcome variable. The fact that the predicted probabilities can lie outside the [0 1] interval makes the LPM inappropriate (Gujarati and Porter, 2009; Cameron and Trivedi, 2005; Green, 2012; Jones, 2005; Wooldridge, 2016).

4. Results

Descriptive statistics are presented in Tables 3 and 4 and the subsequent regression results are based on a sample of individuals aged 15 years and above. Table 3 compares access to and usage of mobile phones and mobile money services, banks and Microfinance Deposit-taking Institutions (ts) (bank and/or MDI) services, Internet services, SACCOs, MFIs and informal groups among females and males. In addition, we compare other demographic and socio-economic factors for a holistic picture. Henceforth, we shall refer to females as women and males as men in our discussion.

From Table 3, we observe that more men own mobile phones and use mobile phone services more significantly than women, which is true irrespective of whether mobile money services are used for savings or wages. More precisely, 40.5% of men save using mobile money compared to 34.1% of women. This can be explained by the commensurate unequal levels of mobile phone ownership among men and women (i.e., 55.3% of men aged 15 years and above own a phone compared to only 38.1% of women). This trend is relatively similar even for access and usage of bank and/or MDI. For instance, the percentage of men who have ever used a bank is more than twice that of women. Further still, more men significantly use banking agents compared to women. Bank websites and mobile bank applications are the least used services in the category of bank or MDI services, even when more men proportionately use than women. This is partly explained by the low Internet access in Uganda, whereby 8.3% and 4.8% of men and women use the Internet, respectively. Moreover, bank websites and mobile bank applications are highly dependent on the availability of Internet services. Among those that use the Internet, more men proportionately use the Internet for academic work (22.4%), business (19.4%), online gaming (4.3%), betting (5.4%) compared to 16.8%, 10.4%, 0.8% and 0.3% for women, respectively. Conversely, more women use the Internet for online shopping (2.5%) and Internet-based work (42.5%) in relation to men at 37.6% and 2.2%, respectively. However, there is no significant difference between the proportion of men and women that use the Internet for social networking.

Results further indicate that 42.5% of women use an informal group compared to only 18.7% of men. This indicates variations in the usage of formal and informal financial services, whereby women often enroll into informal groups, whereas men dominate formal financial services such as commercial banks and MDIs. As we move towards relatively formal groups such as SACCOs and/or MFIs, men (3.8%) are proportionately more engaged than women (2.2%). Notably, men proportionately use money lenders more than women, which is consistent with literature that shows that women are relatively risk-averse compared to men. In addition, men are more literate than women, which may further explain why more men use formal products and services. In our sample, 79.8% of men can read and/or write compared to 65.3% of women.

KIIs with sector stakeholders confirm that women are indeed less banked or underserved by formal banks, possess fewer mobile phones and active mobile money accounts, and are disproportionally affected by the gender digital divide.

Table 3: Access and usage of digital and other services, disaggregated by gender, 2019/20

Variable	Male			Female			t-test (A – B)
	Mean (A)	SD	N	Mean (B)	SD	N	
Mobile phone access and mobile money services							
Mobile phone ownership	0.553	0.497	15824	0.381	0.486	18379	0.172***
Basic phone type	0.688	0.463	8660	0.701	0.458	6927	-0.013*
Feature phone type	0.192	0.394	8541	0.181	0.385	6813	0.011*
Smartphone type	0.133	0.340	8479	0.132	0.338	6747	0.001
Ever used mobile money	0.817	0.387	9507	0.734	0.442	8764	0.083***
Mobile money usage in 30 days	0.633	0.482	7627	0.591	0.492	6195	0.041***
Mobile money usage for savings	0.405	0.491	9506	0.341	0.474	8764	0.064***
Mobile money usage for wages	0.126	0.332	9506	0.077	0.266	8764	0.049***
Bank and/or MDI services							
Bank/MDI ever used	0.117	0.322	15822	0.054	0.225	18376	0.064***
Banking agent used	0.123	0.328	9506	0.071	0.257	8764	0.051***
Bank/MDI personal or joint account	0.813	0.390	1856	0.760	0.428	986	0.053***
Bank/MDI used for savings+	0.579	0.494	1856	0.559	0.497	986	0.019
Bank/MDI used for wages	0.421	0.494	1856	0.396	0.489	986	0.026
Bank website used	0.038	0.192	9506	0.020	0.141	8764	0.018***
Mobile bank app	0.033	0.177	9506	0.019	0.136	8764	0.014***
Internet services							
Internet use general	0.083	0.276	15252	0.048	0.214	18074	0.035***
Social network	0.862	0.346	1271	0.861	0.347	868	0.001
Academic work	0.224	0.417	1264	0.168	0.374	863	0.056***
Business	0.194	0.396	1268	0.104	0.305	866	0.090***
Internet-based work	0.376	0.484	1270	0.425	0.495	868	-0.049***
Health-related	0.096	0.295	1269	0.092	0.289	868	0.004
Online gaming	0.043	0.204	1267	0.008	0.089	868	0.035***
Betting	0.054	0.227	1268	0.003	0.059	866	0.051***
Online shopping	0.022	0.147	1267	0.025	0.157	866	-0.003

continued next page

Table 3 Continued

Variable	Male			Female			t-test (A – B)
	Mean (A)	SD	N	Mean (B)	SD	N	
SACCO, MFI and informal groups							
SACCO and/or MFI	0.038	0.190	15822	0.022	0.147	18376	0.016***
Informal group usage	0.187	0.390	15822	0.237	0.425	18376	-0.049***
Informal group membership	0.847	0.360	2965	0.872	0.335	4360	-0.024***
Informal group membership used	0.865	0.341	2512	0.872	0.334	3800	-0.006
Money lenders used	0.290	0.454	2965	0.246	0.431	4360	0.044***
Other Individual and Household Characteristics							
Can read and/or write	0.798	0.401	15757	0.653	0.476	18319	0.146***
Rural	0.749	0.433	17447	0.737	0.440	20305	0.012***
Urban	0.251	0.433	17447	0.263	0.440	20305	-0.012***
Household size	5.670	2.838	17350	5.587	2.765	20185	0.083***
Age	35.001	17.080	15867	35.265	17.350	18442	-0.264
Married monogamous/living together	0.491	0.500	15867	0.439	0.496	18441	0.052***
Married polygamous/living together	0.088	0.283	15867	0.094	0.291	18441	-0.006*
Divorced/ Separated	0.043	0.202	15867	0.094	0.292	18441	-0.052***
Widow/ Widower	0.014	0.120	15867	0.311	0.109	18441	-0.094***
Never married	0.364	0.481	15867	0.265	0.441	18441	0.099***

Source: Authors' computation using UNHS 2019/20 data

All these culminate into less access to digital financial services. Respondents assert that, by default, the rural population and specifically women are excluded or underserved due to challenges related to remoteness, cultural barriers, poor infrastructure, high poverty rates and low financial literacy, among others.

It is further stated that the gender-insensitive broad strategies fail to support inclusion, which further results into gender imbalances in financial access. Moreover, the monetary policy function of the Bank of Uganda is not gender centric. The private sector and commercial banks are primarily profit-driven, and largely focus on gender when there are financial opportunities. Some of the respondents viewed the recent push to disaggregate gender in financial inclusion and digital financial services as a relatively new but important agenda, as they agree that women are underserved. To this effect, some financial institutions (such as Pride Microfinance Limited) have created products that specifically target female customers. This product will be an unsecure loan requiring a guarantor and frequent visits from the local branch. In the initial stages, loans of UGX2.5 million will be made out to borrowers, subject to increase upon good repayment. Innovation in the digital financial services domain will thus ensure financial inclusion of the excluded.

Results presented in Table 4 show the different ways men and women save. Most men (54.2%) and women (53.5%) still save their money in secret places compared to

only 12.7% and 11.8% who save with commercial banks, respectively. Another form of saving is buying animals, which proportionately attracts more men than women. Others save with merry-go-rounds, Village Savings and Loan Associations (VSLAs), SACCOs, MDIs, MFIs, mobile money and buying other forms of assets. Noteworthy, more women (12.6%) do not save anything compared to 11.2% of men.

Table 4: Saving mechanisms used by men and women in Uganda, 2019/20

Variable	Male			Female			t-test (A – B)
	Mean (A)	SD	N	Mean (B)	SD	N	
Secret place	0.542	0.498	17,341	0.535	0.499	20,168	0.007
Commercial bank	0.127	0.333	17,294	0.118	0.323	20,120	0.009***
MDI	0.004	0.063	17,314	0.004	0.063	20,151	0.0001
SACCOs	0.054	0.226	17,309	0.051	0.219	20,142	0.003
MFI	0.003	0.056	17,299	0.004	0.061	20,137	-0.001
VSLA	0.325	0.468	17,341	0.329	0.469	20,167	-0.004
Merry-go-round	0.037	0.189	17,294	0.037	0.188	20,115	0.0004
Mobile money	0.128	0.334	17,312	0.121	0.326	20,146	0.007**
Buying animals	0.221	0.415	17,311	0.207	0.405	20,128	0.014***
Buying other assets	0.093	0.290	17,299	0.086	0.279	20,123	0.007**
Do not save	0.112	0.315	17,281	0.126	0.332	20,114	-0.015***

Source: Authors' computation using UNHS 2019/20 data

These findings are confirmed and supported by KII respondents. Largely, there was agreement that most Ugandans are averse to saving formally due to limited information, associated costs, limited proximity to banks, social structural barriers, and low financial literacy. Respondents stated that men and women who save in secret places do so because they do not trust the banks and/or digitalized system, where they contend that 'they cannot trust what they do not see.' This position amplifies the challenges associated with financial illiteracy. Further, VSLAs attract many women in the rural setting because they are low-income earners and their proximity affords them easy participation—financial inclusion, and community socialization.

Access and usage of digital financial services amidst the COVID-19 pandemic

Recent evidence shows that COVID-19 boosted the adoption of digital financial services, and about 40% of adults in developing economies, excluding China, made a digital merchant payment using a card, phone, or the Internet. Importantly, more than one-third of adults in developing economies who paid a utility bill directly from an account did so for the first time after the pandemic's start (Demirguc-Kunt, Klapper, Singer and Ansar, 2021).

Using the World Bank's Global Findex Data for 2021, we investigate access to mobile money and other digital services by visualizing their evolution among adult Ugandans aged 15 years and above. Figure 1 shows an increase in the percentage of mobile money accounts over time; i.e., from 35% in 2014 to 54% in 2021. Notably, women are increasingly becoming more financially included, and the gender gap has steadily narrowed through access to mobile money services. This re-affirms the importance of mobile money services in fostering financial inclusion for women. Precisely, in 2014, only 29% of women and 41% of men had a mobile money account, but this has since increased to 53% and 55%, respectively, in 2021 – the gap between men and women has reduced from 12% to 2% (Figure 2).

Figure 1: Percentage of Ugandans with mobile money accounts (% age 15+)

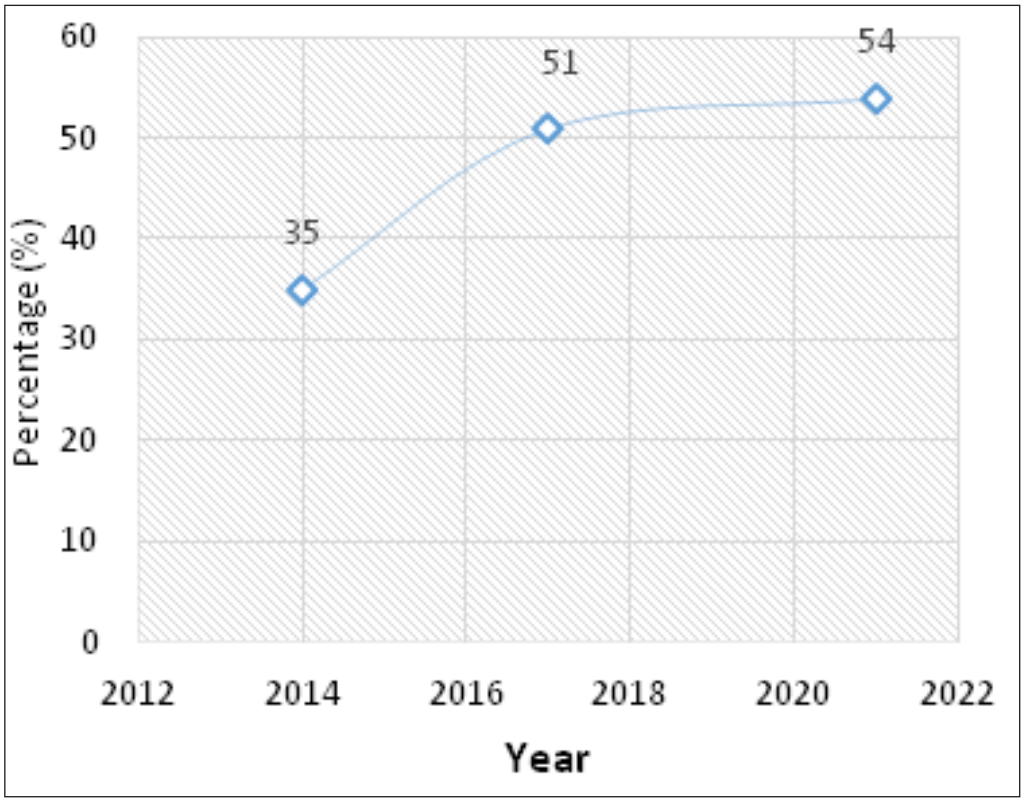
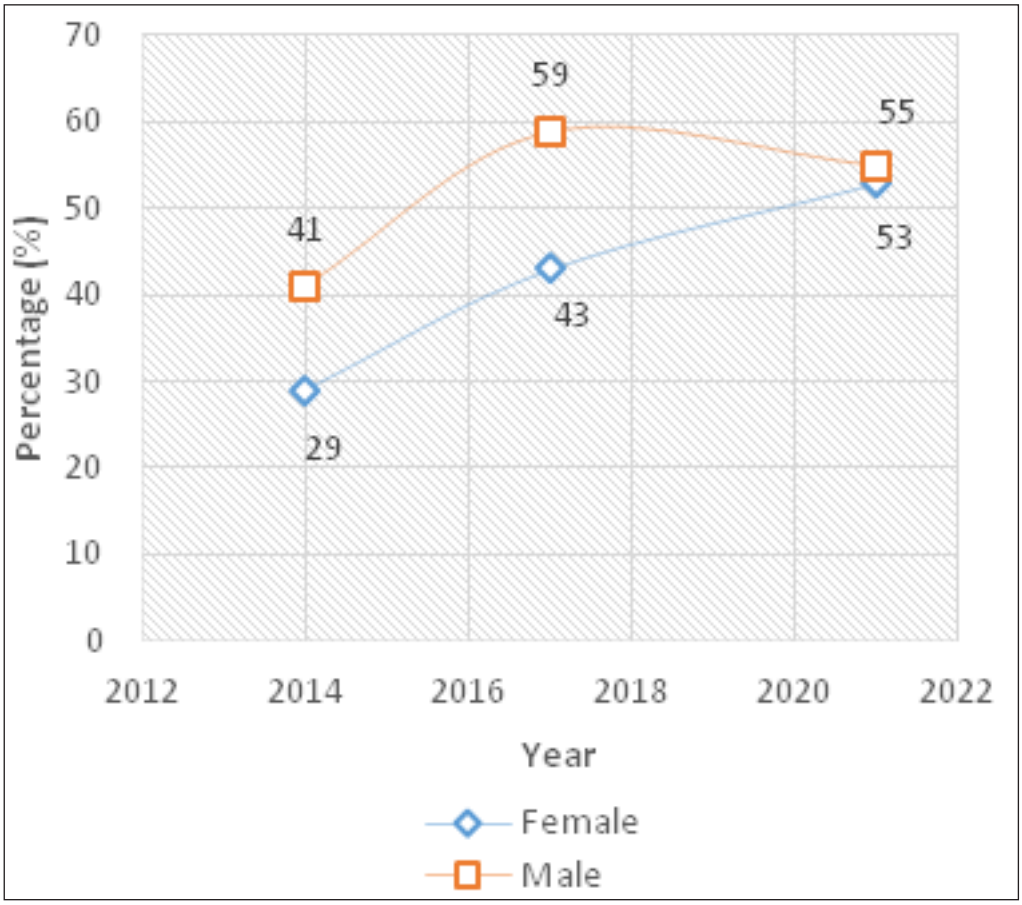


Figure 2: Female and male Ugandans with a mobile money account (% age 15+)



There is a significant rise in access to mobile money services by young people aged 15 to 24 years, which might be attributed to increased penetration of mobile phones among the youth. Only 27% of Ugandans aged 15 to 24 years had a mobile account in 2014, but this has increased to 52% in 2021 (Figure 3). In addition, mobile money services are mostly used by individuals who have at least attained secondary education. Before COVID-19 (in 2017), 62% of men made or received a digital payment compared to 48% of women. However, after the peak of the pandemic, the percentage of men increased by only 1% compared to an increase of 14% for women (Figure 5).

Figure 3: Percentage of mobile money accounts by age (% age 15+)

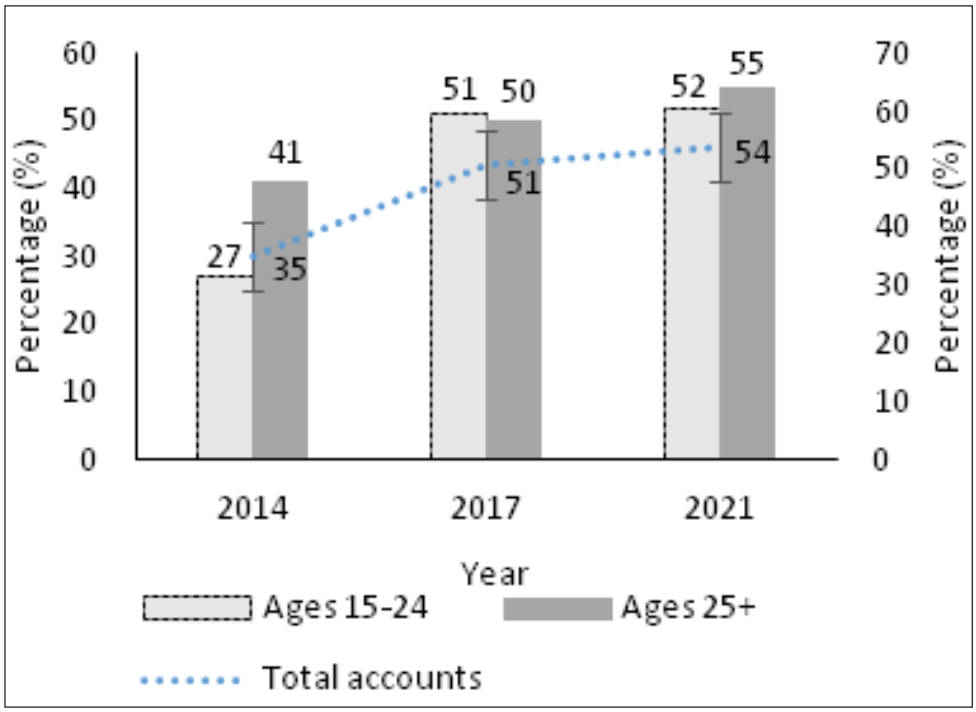


Figure 4: Percentage of mobile money accounts by education Level (% age 15+)

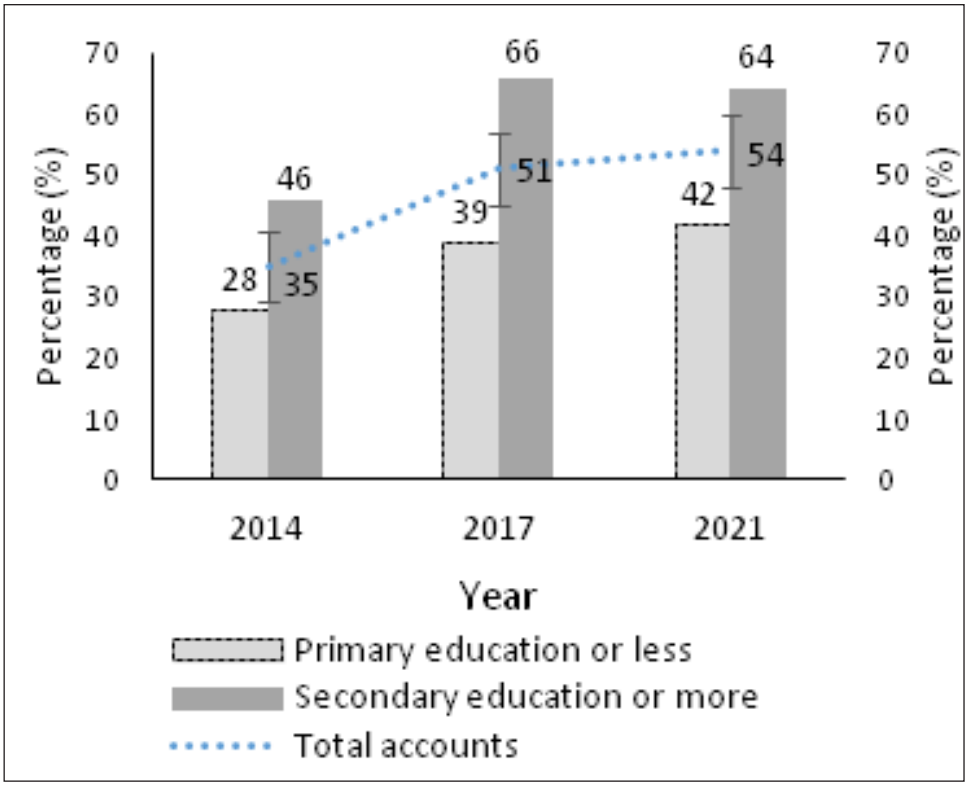


Figure 5: Made or received a digital payment (% age 15+)

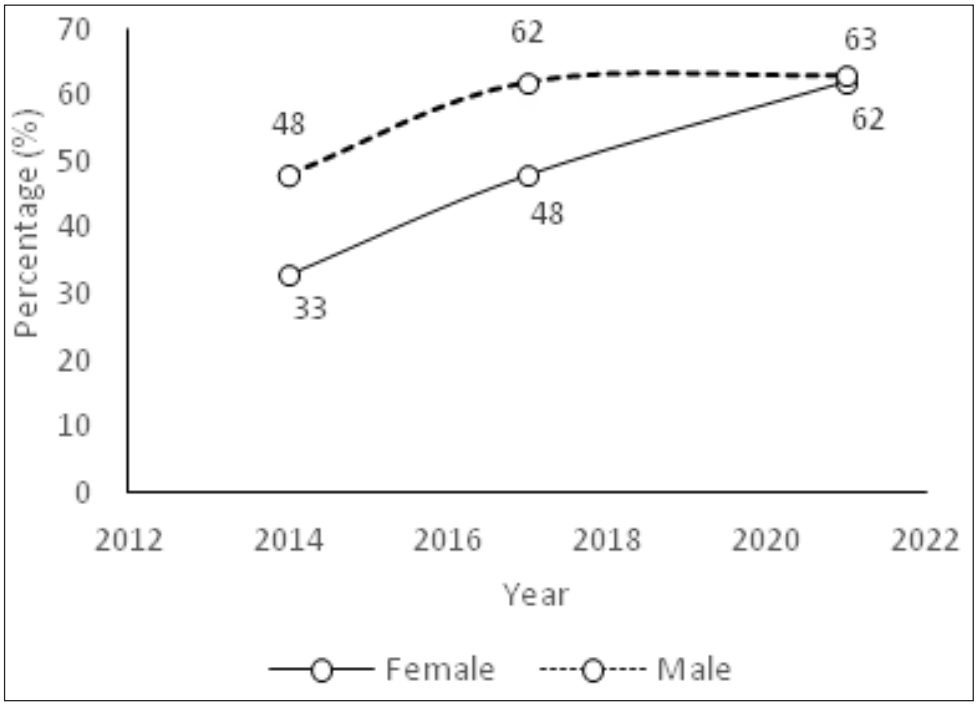


Figure 6: Used a mobile phone or the Internet to pay bills (% age 15+)

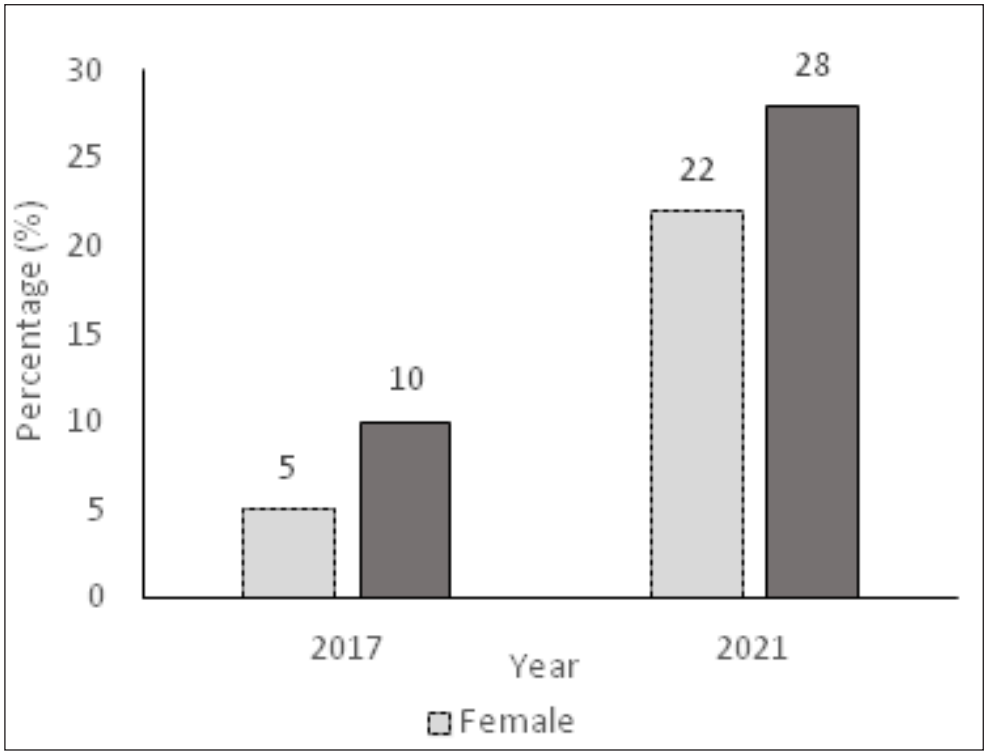
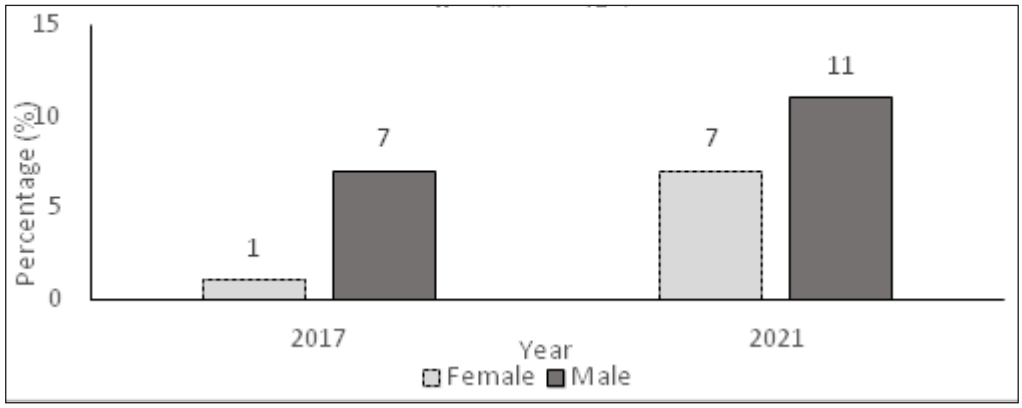


Figure 7: Used a mobile phone or the internet to buy something online (% age 15+)



Data source: World Bank's Global Findex Data for 2021

Furthermore, although the usage of mobile phones or e-commerce is still low among both men and women, the use of phones and the Internet to pay bills significantly increased in the wake of COVID-19. From Figure 6, only 5% of women used a mobile phone or the Internet to pay bills in 2017, but this increased to 22% in 2021. A relatively similar trend is witnessed for men. Overall, these developments highlight the role of COVID-19 in boosting the adoption of digital financial services,

hence underlining the significance of the same in fostering financial inclusion.

In Table 5, we report regression results from a probit model (baseline model) before accounting for endogeneity. We then report results from recursive biprobit models using the instrumental variable approach. Notably, results from the probit and biprobit models do not differ so much. Therefore, for this discussion, we shall only report results of the biprobit models. Firstly, results re-affirm that there is a strong and significant negative effect of saving money in a secret place with usage of digital financial services (e.g., mobile money services). Since we are reporting marginal effects, we concentrate much on the direction of the effect rather than the magnitude of the coefficient (dy/dx).

Table 5: Facilitators and inhibitors of digital financial services usage

Variables	Mobile money use (probit)	Mobile money use (rbiprobit)	Banking agent use (rbiprobit)
Internet use (Yes=1)	0.132***	0.106***	0.140***
	(0.0163)	(0.0129)	(0.0129)
Secret place (Yes=1)	-0.0756***	-0.0603***	-0.0168**
	(0.0210)	(0.0170)	(0.00703)
Merry-go-round save (Yes=1)	0.0113	0.00859	0.00927
	(0.0221)	(0.0177)	(0.0145)

continued next page

Table 5 Continued

Variables	Mobile money use (probit)	Mobile money use (rbiprobit)	Banking agent use (rbiprobit)
SACCO, MFI or credit institution (Yes=1)	0.0709***	0.0567***	0.0450***
	(0.0267)	(0.0215)	(0.0133)
Phone type (Ref=Basic phone)			
Feature phone type	-0.0251	-0.0202	-0.00690
	(0.0298)	(0.0239)	(0.00783)
Smartphone	0.0506**	0.0403**	0.0230**
	(0.0218)	(0.0175)	(0.00897)
Financial decision making (Ref=Not Involved)			
Involved	0.0166	0.0125	0.00311
	(0.0228)	(0.0181)	(0.0119)
Read and/or Write (Yes=1)	0.0878***	0.0699***	0.0664***
	(0.0187)	(0.0144)	(0.00784)
Rural (Ref)			
Urban	0.0769***	0.0616***	0.0538***
	(0.0136)	(0.0115)	(0.00770)
Household size	-0.0142***	-0.0113***	-0.00383**
	(0.00254)	(0.00211)	(0.00174)

Age (Ref=15-25 years)			
26 - 35 years	0.0816***	0.0650***	0.0423***
	(0.0178)	(0.0147)	(0.00662)
36 - 45 years	0.115***	0.0922***	0.101***
	(0.0179)	(0.0145)	(0.00927)
46 – 65 years	0.0937***	0.0748***	0.101***
	(0.0177)	(0.0146)	(0.00959)
> 65 years	0.0457	0.0356	0.109***
	(0.0281)	(0.0225)	(0.0193)
Marital status (Ref =Married monogamous)			
Married polygamous	0.0156	0.0124	-0.0164**
	(0.0194)	(0.0154)	(0.00669)
Divorced/ Separated	-0.0147	-0.0123	-0.0344***
	(0.0234)	(0.0185)	(0.00768)
Widow/ Widower	-0.00541	-0.00236	-0.0124
	(0.0274)	(0.0219)	(0.0131)
Never married	-0.0269	-0.0217	0.0114
	(0.0173)	(0.0137)	(0.0138)

continued next page

Table 5 Continued

Variables	Mobile money use (probit)	Mobile money use (rbiprobit)	Banking agent use (rbiprobit)
Region (Central=1)			
Eastern	0.0737**	0.0586**	0.0184**
	(0.0322)	(0.0254)	(0.00820)
Northern	0.0303	0.0244	0.0293***
	(0.0372)	(0.0296)	(0.00720)
Western	-0.0618	-0.0492	-0.0105
	(0.0405)	(0.0323)	(0.0131)
Female	-0.0340*	-0.0274*	-0.0302***
	(0.0195)	(0.0155)	(0.00624)
Log monthly HH food expenditure	0.0670***	0.0530***	0.0354***
	(0.0145)	(0.0119)	(0.00705)
COVID dummy	-0.0358***	-0.0288***	-0.0124**
	(0.0109)	(0.00867)	(0.00517)
Endog Var: Income status (Ref = Poor)			
Not Poor	0.113***		
	(0.0204)		

Exog Var: Each member owns at least two clothes (Yes=1)		0.0357*	0.00781
		(0.0191)	(0.0112)
Observations	12,649	12,646	15,018

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Note: Monthly household food expenditures in constant prices after adjusting for regional differences.

More precisely, for an individual saving money in a secret place, their probability of using mobile money and a banking agent reduces by 0.0603 and 0.0163 (Table 5), respectively, in relation to an individual who does not save their money in a secret place. Conversely, Internet access and usage exhibit a strong positive effect on the usage of digital financial services. For instance, using the Internet increases an individual's probability of using mobile money and a banking agent by 0.106 and 0.140, respectively. Possession of a smartphone and a higher income status also strongly and positively affects the usage of bank agents and mobile money services.

An individual who is capable of reading and/or writing increases their probability of using mobile money and a banking agent by 0.0699 and 0.0664, respectively, than one that cannot read and/or write. The results suggest that urban dwellers are more likely to use both mobile money and banking agents than their rural counterparts. This calls for further penetration of these services into rural areas. More precisely, residing in an urban area increases an individual's probability of using mobile money services and banking agents by 0.0616 and 0.0538 in relation to a rural dweller. Importantly, women are less likely to use both mobile and banking agents than their male counterparts.

In Table 6, the use of the Internet has a strong positive effect on both access and usage of banks and MDIs. However, saving money in a secret place reduces an individual's chances of using the bank by 0.071, but increases their chances of using an informal group by 0.0289. In the model for informal groups usage, we anticipate that saving with a merry-go-round (an informal group itself) might introduce multicollinearity, and so we run a separate model while excluding the merry-go-round variable. The results throughout all the regressors do not significantly change. Therefore, we decided to keep it in the model to mitigate any bias that often comes due to omitted variables beyond our control. Interestingly, we find that individuals owning smartphones are less likely to use informal groups and their probability of usage reduces by 0.08 in relation to individuals owning basic phones.

Findings from the key informant interviews indicate that financial exclusion issues are largely driven by social norms and not financial market dynamics. This position was based on the perspective that the banking sector cannot influence culture. Due to existing social cultural structures, women possess limited collateral, and some do not use formal financial institutions such as banks because men control their finances. Moreover, DFS may not solve the issue whereby some institutions only grant credit access upon a spouse's consent. Nevertheless, full implementation of DFS is still not achievable with the inadequate infrastructure, geographical network

limitation and lack of individual tools such as smart phones. Notably, financial inclusion targets the population that is at the base of the pyramid and has limited appreciation for technology and digital services. Furthermore, DFS do not work in isolation, therefore, first addressing the structural bottlenecks to cater for those who are costly and unprofitable to serve (low-income earner, youth, refugees and MSMEs) is very critical to ensuring financial inclusion. This will lay the grounds for financial inclusion targeting gender.

Table 6: Facilitators and inhibitors of access and usage of digital financial services

Variables	Bank/MDI account access (probit)	Bank/MDI account access (rbiprobit)	Bank/ MDI usage (rbiprobit)	Informal group usage (rbiprobit)
Internet use (Yes=1)	0.108***	0.102***	0.172***	0.0248
	(0.0299)	(0.0274)	(0.0342)	(0.0159)
Secret place (Yes=1)	-0.0269	-0.0255	-0.0710***	0.0289***
	(0.0229)	(0.0209)	(0.0236)	(0.00942)
Merry-go-round save (Yes=1)	-0.00591	-0.00567	0.0961**	-0.0250
	(0.0251)	(0.0236)	(0.0380)	(0.0193)
SACCO, MFI or credit institution (Yes=1)	-0.0304	-0.0282	0.0798***	-0.0580*
	(0.0312)	(0.0299)	(0.0301)	(0.0308)

continued next page

Table 6 Continued

Variables	Bank/MDI account access (probit)	Bank/MDI account access (rbiprobit)	Bank/ MDI usage (rbiprobit)	Informal group usage (rbiprobit)
Phone type (Ref=Basic phone)				
Feature phone type	-0.0169	-0.0152	-0.000721	0.00881
	(0.0207)	(0.0195)	(0.0369)	(0.0132)
Smartphone	0.00991	0.00984	0.0320	-0.0801**
	(0.0193)	(0.0184)	(0.0280)	(0.0325)
Financial decision making (Ref=Not Involved)				
Involved	0.00266	0.00347	0.0925	-0.0322
	(0.0482)	(0.0450)	(0.0700)	(0.0240)
Read and/or Write (Yes=1)	0.0518	0.0468	0.170***	0.000781
	(0.0873)	(0.0787)	(0.0555)	(0.0130)
Rural (Ref)				
Urban	0.0187	0.0178	0.0208	-0.00362
	(0.0178)	(0.0166)	(0.0196)	(0.00930)
Household size	-0.0109**	-0.0102**	0.00588	-0.00207
	(0.00507)	(0.00483)	(0.00419)	(0.00278)

Age (Ref=15-25 years)				
26 - 35 years	0.175***	0.162***	0.145***	0.0110
	(0.0485)	(0.0449)	(0.0298)	(0.0145)
36 - 45 years	0.209***	0.194***	0.239***	0.0196
	(0.0457)	(0.0421)	(0.0330)	(0.0173)
46 – 65 years	0.226***	0.211***	0.257***	0.00110
	(0.0494)	(0.0456)	(0.0302)	(0.0219)
> 65 years	0.147***	0.135***	0.279***	-0.0145
	(0.0517)	(0.0471)	(0.0565)	(0.0317)
Marital status (Ref =Married monogamous)				
Married polygamous	-0.0591**	-0.0550**	-0.0976***	0.00307
	(0.0285)	(0.0274)	(0.0321)	(0.0128)
Divorced/ Separated	-0.0509	-0.0479	-0.0713*	0.00271
	(0.0447)	(0.0419)	(0.0392)	(0.0212)
Widow/ Widower	-0.0862	-0.0801	-0.0640	-0.0355
	(0.0618)	(0.0564)	(0.0446)	(0.0280)
Never married	-0.0763	-0.0714	0.0338	0.0201
	(0.0480)	(0.0447)	(0.0353)	(0.0219)

continued next page

Table 6 Continued

Variables	Bank/MDI account access (probit)	Bank/MDI account access (rbiprobit)	Bank/ MDI usage (rbiprobit)	Informal group usage (rbiprobit)
Region (Central=1)				
Eastern	0.0302	0.0288	0.178***	-0.0200
	(0.0266)	(0.0248)	(0.0463)	(0.0123)
Northern	0.00900	0.00742	0.301***	-0.0270**
	(0.0437)	(0.0418)	(0.0524)	(0.0131)
Western	0.0262	0.0249	0.0558**	-0.0796***
	(0.0353)	(0.0331)	(0.0247)	(0.0224)
Female	-0.0155	-0.0143	-0.0152	0.0118
	(0.0236)	(0.0223)	(0.0213)	(0.0117)
Log monthly HH food expenditure	0.0567**	0.0530**	0.0186	0.0117
	(0.0257)	(0.0246)	(0.0205)	(0.0112)
COVID dummy	-0.000107	-6.48e-05	0.0525**	-0.0441***
	(0.0267)	(0.0250)	(0.0255)	(0.00757)
Endog Var: Income status (Ref = Poor)				
Not Poor	0.0188			
	(0.0451)			
Exog Var: Each member owns at least two clothes (Yes=1)		-0.00990	0.0406	0.0319
		(0.0695)	(0.0399)	(0.0716)
Observations	2,495	2,495	2,495	4,002

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Note: Monthly household food expenditures in constant prices after adjusting for region difference

When we control for the COVID-19 pandemic, our results indicate that the pandemic negatively affected the usage of informal groups but positively impacted the usage of banks and MDIs. This finding might be explained by the fact that most informal groups require physical meetings or gathering of members, which were curtailed by COVID-19 containment measures. In contrast, banks and MDIs had alternative modalities of making transactions such as self-service Automated Teller Machines (ATMs). In addition, this indicates that informal groups are more susceptible to shocks such as COVID-19, considering their mode of operation. Therefore, we anticipate that similar groups which have reached a certain level of digitalization, for instance maintaining group savings on mobile money, exhibited stronger resilience.

5. Conclusion and policy implications

This paper establishes the extent to which digital financial services contribute to financial inclusion in Uganda. We present two main sets of results. First, descriptive analysis of access to and usage of digital financial services – mobile money, bank website, mobile bank applications, and agency banking services – suggests that men are proportionately more financially included than women. This implies that going by the vulnerable group theory of financial inclusion, women are the main vulnerable group. Therefore, any interventions geared towards fostering financial inclusion should target them and similar groups such as the youth, disabled and people living in rural areas. The development of digital financial services should take cognizance of the vulnerable groups to ensure equity for the financially excluded.

Relatedly, insights from the qualitative analysis indicate that financial exclusion issues are primarily driven by social norms and less by the financial market dynamics. Due to the existing social cultural structures in Uganda, women possess limited assets and/or enablers such as collateral, and majority are financially excluded because men control their finances. Reaching such excluded groups will entail tailoring the digital financial services delivery mechanisms through key community leaders such as politicians, cultural and religious leaders, as advanced by the echelon theory of financial inclusion. Furthermore, the special agent theory is relevant for delivering financial services to this group, where the national government and foreign governments rely on local bank and non-bank institutions to increase outreach to the financially excluded. Considering this, technological companies that provide platforms for increased financial inclusion are critical as special agents.

Results show that amidst the COVID-19 pandemic, the gap between men and women in access and usage of mobile money services has greatly reduced. Although the use of mobile phones or e-commerce is still low among both men and women, the use of phones and the Internet to pay bills significantly increased in the wake of COVID-19. The role of COVID-19 in boosting the adoption of digital financial services is critical to designing policies to foster financial inclusion.

The fact that more than half of Ugandans save their money at home or in secret places rather than banks, SACCOs, or MFIs demonstrates the supply-side constraints that are faced in having them included. Insights from our qualitative analysis allude to limited information, associated costs, limited proximity to banks, remoteness, social barriers, inadequate technological infrastructure, social structural barriers, low financial literacy and the lack of trust in the banks and or the digitalized system. In addition, financial institutions find it costly to adopt digital platforms or to provide

financial training. Moreover, the existing laws and policies do not sufficiently cater for all segments of the population, and government efforts to increase access remain limited. In this regard, the collaborative intervention theory of financial inclusion (argues that financial services should be delivered to the excluded population by collaborative intervention from multiple stakeholders) can be leveraged to foster financial inclusion. The government should provide an enabling environment, such as lower-cost products, the proximity of financial services, education and use of financial institutions for government payments to individuals to increase the likelihood of adopting formal financial services such as banking.

Findings clearly show that women subscribe to informal groups more than men but are more formally excluded – low percentages of women using banks and MDIs, among other formal modalities. To enhance the usage of digital financial services such as mobile money among women, we should find them where they are concentrated, moreover with tailored and targeted products. Interventions can include sensitization about digital financial services in those informal groups while creating a favourable environment for mobile phone acquisition. These groups can also be supported to formalize by banking their savings since it is more secure. Achieving this requires the intensification of collaboration between institutions and the government to elevate the informal savings groups.

The study analyses the different digital financial services that are vehicles to financial inclusion, namely mobile phone platforms, banking agents, banks, Microfinance Deposit-taking Institutions (MDIs) and informal groups, which are all privately managed. The policy direction in Uganda regarding financial inclusion stresses provision of a conducive environment for private actors to spearhead the process of reaching the financially excluded. This implies that funding financial inclusion is not a public good as propounded by the public money theory of financial inclusion owing to budget challenges. For that matter, the overall objective of the financial inclusion strategy is to create an enabling policy and regulatory environment, other than government direct funding. The government should further provide a conducive environment to foster extension of Internet to remote rural areas. The development of the new financial inclusion strategy should, therefore, among other things, consider providing a set of incentives to the private sector to innovate and invest in a broad range of new and friendly products to attract the excluded sections of the population.

Notes

1. UN Press Release (29th December, 2003). https://www.un.org/press/en/2003/dev2452.doc.htm, Retrieved on April 2, 2022.

2. The term 'Fintech' denotes 'financial technology' and is defined as the delivery of financial and banking services through modern technological innovation led by computer programmes and algorithms (Ozili, 2018). Fintech refers to digital technologies that have the potential to transform the provision of financial services. This may involve developing new technologies and models, and modifying existing business models, applications, processes, and products.

3. $E[y|X] = 0 \times (1 - F) + 1 \times F = F(\beta' X)$, the expected value of *y* given *X* is just the probability.

4. Following regulations passed in July 2017, banks in Uganda can use agency banking—an extension of services traditionally offered in bank branches whereby third parties (agents) offer these services on behalf of banks—to expand their presence, particularly in rural areas where brick-and-mortar branches are often expensive (see UNCDF-Uganda, 2019).

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