

## ORIGINAL ARTICLE

# Post-COVID-19 recovery for African economies: Lessons for digital financial inclusion from Kenya and Uganda

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Email: [rmugume@eprcug.org](mailto:rmugume@eprcug.org)**Abstract**

As coronavirus disease-2019 (COVID-19) and other restrictions intensified, individuals, businesses and governments turned to mobile digital platforms to reduce the financial costs and mitigate the risk of spreading the virus within the population. Drawing on lessons from Kenya and Uganda, our study examines the drivers of digital financial inclusion as a pathway for financing post-COVID-19 recovery. We find that digital financial inclusion is higher in middle-aged male digital users with more SIM cards registered in their names. Results also show that users who trust mobile money agents were likely to use more digital financial platforms than others. Based on these results, we recommend the need for government to strengthen the National Identification Systems and consumer protection policies to increase trust in digital financial services. Additionally, financial sector players such as mobile network operators and commercial banks need to innovate and roll out customized digital financial products for the marginalized/unbanked population such as women, the elderly and the youth.

**KEYWORDS**

econometrics, economic development, international economics &amp; trade

## 1 | INTRODUCTION

Digital financial services (DFS) are a powerful force driving financial inclusion, gender equality and inclusive growth in Africa (Hedricks, 2019). Notably, financial inclusion could play an important role in the reduction of income inequality and improvement of household incomes (Ibrahim & Aliero, 2020). The widespread uptake of mobile money platforms has facilitated affordable access to basic and tailored financial services for the poor, improving their livelihoods (World Bank, 2020a). First launched in 2007 by M-PESA in Kenya, mobile money platforms have rapidly increased across Africa, positioning the continent as a global leader in the industry. Recent estimates show that Africa accounts for nearly half (46%) of the global 1.2 billion mobile money accounts, with an annual growth of 12% (Global System for Mobile Communications, 2020a; Machasio, 2020). The region is also home to more than half of the mobile money service companies (55%) operating globally. Digital platforms and the increased circulation of mobile phone inflows in the digital ecosystem drive the noticeable growth in the mobile money industry.

To meet the growing demand for DFS across the continent, mobile network operators (MNOs) have intensified efforts to diversify their digital products space. Additionally, MNOs are also rapidly entering partnerships with public

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and private sector players to meet the growing financial needs such as insurance, credit access and social transfers. For instance, in 2020, the Kenyan and South African companies Safaricom and Vodacom acquired the M-PESA brand and its product development and support services from the United Kingdom's Vodafone, offering opportunities to expand M-PESA mobile money into new African markets (Shapshak, 2020).

The coronavirus disease-2019 (COVID-19) outbreak has amplified the need for digitalization more than ever before (Songwe, 2020; United Nations Economic Commission for Africa, 2020). As the pandemic intensified with lockdowns, millions of people turned to internet-enabled digital platforms to transact payments, access credit, connect with friends and family, and access education and health information (United Nations Economic Commission for Africa, 2020). In Uganda, the value of mobile money transactions steadily grew by 28.2% (US\$25 billion) in 2020 compared to 2.9% in 2019 (Bank of Uganda, 2021). In Nigeria, evidence suggests that e-commerce and digital platforms such as WhatsApp and Facebook boosted the online sales of businesses owned by low-income women during the lockdown (Iwueze, 2021). Equally, governments and multilateral organizations have dramatically adopted mobile money digital platforms to advance cash and social transfers to vulnerable populations during this crisis. Notably, Togo, Madagascar and Zimbabwe launched government-to-person (G2P) digital payments as a social welfare programme to limit the risks of personal contact and crowding (Adegoke, 2020; Gronbach, 2020).

Whereas DFS have been embraced from the onset of the pandemic, some low-income African countries are still lagging behind their counterparts. In addition, the pandemic has exposed the deep pre-existing COVID-19 digital divide in many African countries due to the limited adoption of DFS and the internet (International Monetary Fund, 2020a). For instance, estimates show that about 78% (900 million people) of Africa's population have no access to the internet (International Finance Corporation, 2021). From a gender perspective, only 27% of women in Africa have access to the internet, yet only 15% can use it (International Finance Corporation, 2021). Conversely, there exist substantial rural–urban disparities in internet access. Data also shows that the rural–urban divide is the largest in the sub-Saharan region, estimated at 60%—rural mobile internet use stood at 16%, compared to 40% in urban areas (Global System for Mobile Communications, 2020b).

Additionally, the reported cybercrime cases in the digital finance industry hinder the recent DFS innovations. On average, cybercrime in mobile-based transactions costs African businesses around US\$140 million per year (Serianu, 2017). Moreover, cybercrime increased with the outbreak of COVID-19 due to increased digitalization. Notably, cybercrime grew by 30% in 2020, mainly because of the heightened vulnerability of connections, which gave an advantage to the fraudsters to manipulate (Serianu, 2020). This has increased mistrust among mobile money users and could deter the adoption of DFS and consequently jeopardize financial inclusion efforts in Africa.

Noteworthy, whereas Africa registered notable progress towards its digital financial agenda during the past decade, substantial digital disparities undermine digitalization as a pathway for financial inclusion and economic growth (Duarte, 2021; United Nations Economic Commission for Africa, 2021). The pandemic is accelerating digitalization in many African countries; however, it is also widening the pre-existing digital disparities, thus depriving multitudes of economic opportunities. For Africa to fully benefit from digitalization, empirical evidence is critical to inform strategies that can address the digital divide exposed by the pandemic. Therefore, the pandemic presents an opportunity to kick-start a new growth cycle through digitalization and foster deeper financial inclusion in Africa (United Nations Economic Commission for Africa, 2021). Notably, building inclusive digital financial systems in all sectors would enhance productivity and job creation and accelerate economic transformation, which is key to achieving the African Union Agenda 2063 and the Sustainable Development Goals (African Union Commission, 2020).

There is limited emerging evidence addressing Africa's digital divide in light of the post-COVID-19 crisis. For instance, a few studies related to this paper include Coulibaly (2021), Ndanshau and Njau (2021), Were et al. (2021), Senou et al. (2019) and Jack and Suri (2011). However, they do not provide information on the social-economic determinants of the DFS during the COVID-19 pandemic. Furthermore, none of these studies succinctly focuses on Uganda and Kenya during the COVID-19 pandemic. Conversely, Benni (2021) and Candiya and Ntayi (2021) studied the importance of digital financial inclusion in Africa during the pandemic. However, they do not adequately explore how individual and household characteristics drive or address the digital finance divide and consequently hamper digital financial inclusion in the context of the pandemic. Furthermore, this paper controls for the effect of digital fraud during the pandemic, which previous studies have overlooked.

Using micro-level survey data from Kenya and Uganda, our study addresses these gaps by exploring different drivers and barriers to digital financial inclusion during COVID-19. By examining these factors, the study contributes to the literature on the context-specific factors that governments can harness to foster digital financial inclusion, which is key to spurring post-COVID-19 economic recovery. Specifically, our study answers the following research questions:

What socio-economic factors drive digital financial usage in the face of the pandemic? How have women, compared to men, embraced digital financial platforms during the pandemic in Africa? Did the COVID-19 pandemic trigger the usage of new digital services not used before the pandemic?

The rest of the paper is organized as follows: Section 2 reviews the related literature on digital financial inclusion in Africa. Section 3 describes the methodology used to implement the study. Section 4 presents and discusses the results. Section 5 provides the conclusion and policy implications of the study.

## 2 | LITERATURE REVIEW

The importance of financial inclusion has been emphasized through different theories as a driver of economic growth<sup>1</sup> (King & Levine, 1993; Levine, 2005) and poverty reduction and socio-economic equality (Banerjee & Newman, 1993; Clarke et al., 2006; Cull et al., 2014). Over time the number of studies examining the determinants of financial inclusion in African economies, especially in sub-Saharan Africa, has also increased.

Most of these studies adopt or modify the theories that attempt to explain the drivers of financial inclusion. These include the technology acceptance model (Davis, 1989, 1993), the theory of planned behaviour (Ajzen, 1985, 1991), the unified theory of use and acceptance of technology (Venkatesh & Davis, 2000) and the innovation diffusion theory. Earlier studies on determinants of financial inclusion focused on traditional banking services indicators, such as the number of bank branches and automated teller machines, loan and account deposits and the requirements and charges for opening and maintaining a bank account (Were et al., 2021). This was mainly because of the limited innovations such as financial technology (FinTech) and the lack of microdata on some alternative indicators. However, with the increase in financial technologies (mobile money, mobile banking and mobile insurance) and the availability of rich and accessible data sets,<sup>2</sup> new research studies emerged (Mndolwa & Alhassan, 2020). Further, the International Monetary Fund (2020a) indicates that massive data generation, advances in computer algorithms and increases in processing power explain the recent development of FinTech.

Generally, the drivers of FinTech-driven financial inclusion can either be examined from the supply (i.e., the drivers of access) or the demand (drivers of usage) side (Cheronoh, 2019; International Monetary Fund, 2020a). More specifically, the demand and supply factors can also be classified as socio-economic, regulatory, institutional and policy factors. The empirical evidence on the demand and supply factors explaining the adoption and use of DFS, such as mobile money, has grown over time, whether at the national or cross-country level. Coulibaly (2021) finds that male, older, more educated, richer and employed persons are more likely to adopt and use mobile money services in the West African and Monetary Union. These findings are similar to the results obtained by Ndanshau and Njau (2021) for Tanzania. This suggests that the least vulnerable people in society are more likely to be excluded financially. Indeed, Koloma (2021) finds that the financial inclusion of youth is mainly curtailed by the high cost of financial services and the lack of money. In contrast, Senou et al. (2019) and Jack and Suri (2011) find that younger people are more likely to adopt mobile money.

The existing gender disparities in the adoption of mobile money have been observed in other studies such as Were et al. (2021) in Tanzania, who indicate that the gender gap in financial inclusion is mainly explained by the lack of income, limited access to digital financial facilities and financial literacy. This corroborates earlier findings that indicate the limited access, affordability, lack of education, and inherent biases and socio-cultural norms still curtail women's and girls' ability to benefit from the opportunities offered by the digital transformation (Global System for Mobile Communications, 2020a; International Monetary Fund, 2020b; Mndolwa & Alhassan, 2020; World Bank, 2020b; Zins & Weill, 2016).

Cheronoh (2019) finds that financial inclusion among the rural women in Kenya increases with ownership of a mobile phone and an identification document such as a national identity card or passport, education, age, membership in a social group and employment. Murendo et al. (2018) also find that membership in a social group boosts the adoption and use of mobile financial services because of the increased awareness of such services through training. On the other hand, Tusubira and Mbabazi (2021) reason that owning a national ID increases the likelihood of adopting and using mobile money services.

There is mixed evidence of complementarities and competition between mobile financial services and banking services. For instance, Jack and Suri (2011) and Senou et al. (2019) find that having a bank account increased the adoption and usage of mobile money services. In addition, the International Monetary Fund (2020a) emphasises the complementarity between FinTech and traditional banks. On the one hand, FinTech companies benefit from the experience and expertise of traditional banks in regulatory compliance and the facilitation of scaling up. On the other hand, FinTech companies provide banks with a state-of-the-art platform for reaching out to new customers. However,

Maweje and Lakuma (2019) report that Ugandan commercial banks faced stiff competition, mainly driven by new financial technologies such as mobile money.

Other studies emphasize the importance of perceptions in influencing the adoption of mobile financial services such as mobile money. Muzurura and Chigora (2019) also emphasized the importance of the perceived usefulness, ease of use, compatibility, social influence and risk in influencing the adoption of mobile money services in Zimbabwe. These findings corroborate those obtained by Lema (2017) in Tanzania and Tobbin and Kuwornu (2011) in Ghana.

On the supply side, the International Monetary Fund (2020a) finds that better access to digital infrastructures such as the availability of the internet and mobile phones, increases in the number of mobile money agents, efficient banking systems, institutional quality and a more consumer-friendly environment facilitate the adoption and usage of digital payments and credit. Edo et al. (2019) argue that the adoption of appropriate policies that encourage more inclusive use of the internet could enhance financial development in sub-Saharan Africa. In addition, the availability of borrower information and higher protection of legal rights also support the emergence and development of FinTech credit. The role of a robust digital infrastructure in boosting the adoption of mobile financial services has also been emphasized by Senou et al. (2019), Ssonko and Kawooya (2020) and White et al. (2021).

Ssonko and Kawooya (2020) further emphasized that cost factors such as mobile money service providers' surcharges, over-the-counter taxes and the cost-benefit comparison of mobile money service and traditional brick and mortar financial service providers will affect the sustainability of the uptake of mobile money services during and after the pandemic. Before the pandemic, previous studies highlighted the role of transaction costs in deterring financial inclusion through mobile financial services (Bair & Tritah, 2019; Koloma, 2021).

Whereas the COVID-19 pandemic is associated with more digitalization, it also poses risks that could deter deeper financial inclusion. Some of the associated risks include fraud and mishandling of private data resulting in a loss of trust, bankruptcy of mobile money operators, inadequate user protection and customer over-indebtedness (Global System for Mobile Communications, 2021; International Monetary Fund, 2020a; Machasio, 2020).

Several studies also examine the policy, regulatory and institutional factors that explain the adoption of mobile money services. In Kenya, the fast adoption of mobile money is attributed to the flexible and liberal regulatory regime for MNOs, a strong public-private partnership, enablement of mobile money interoperability and the guarantee of a contestable market discouraging dominance by initial entrants and enabling competition (Ahmad et al., 2020; Kimenyi & Ndung'u, 2009; Ndung'u, 2019a). In South Africa, the development of the Socio-Economic Impact Assessment System and the Intergovernmental Fintech Working Group supported the development of FinTech by ensuring proportionate regulation for the sector (World Bank, 2019). On the other hand, Ndung'u (2019b) also argues that increasing mobile phone transaction taxes (mobile money, airtime and internet) in Kenya did not significantly raise new tax revenue. Further, mobile money transaction taxes disproportionately affect lower-income residents who revert to cash transactions, which could lead to lower financial inclusion. Studies by Global System for Mobile Communications (2020b) and Ahmad et al. (2020) draw similar conclusions for several countries in sub-Saharan Africa.

### 3 | METHODOLOGY

This section presents the data source and the survey design used to collect the data used in the study. It also specifies the different variables on digital financial inclusion and the econometric model used to estimate the drivers of digital financial inclusion in the selected countries.

#### 3.1 | Data and survey design

The study uses secondary data from household phone surveys conducted in Uganda and Kenya between August and September 2020 by the Innovation for Poverty Action, Uganda Communications Commission and the Competition Authority of Kenya under the Consumer Protection Initiative.<sup>3</sup> Data were collected from the respondents (household heads) based on the Randomised Digit Dial sampling technique from 830 and 793 mobile money users in Uganda and Kenya, respectively. In this sampling criteria, telephone numbers were drawn randomly from a pool of telephone databases provided by the MNOs. In addition, the sampling technique considered the financial inclusion trends observed in large national surveys such as the FinScope (Financial Sector Deepening, 2018) and FinAccess (Financial Sector Deepening, 2019) surveys.<sup>4</sup> Since phone ownership is mainly among the adult population, survey respondents were 18 years and above. Accordingly, the survey

respondents were asked questions about various aspects of the use of mobile financial services. These included the use of financial services (mobile purchase of voice/SMS/data, mobile money transfer, mobile loans, among others), fraud experiences and risks with using mobile money, mobile banking services and loans experienced by users.

### 3.2 | Variables and data

The study adopted several variables based on the literature on digital financial inclusion (DFI). We use DFI as the dependent variable for the study. Given that financial inclusion is unobserved, we adopt the digital financial index as a proxy measure of DFI as used in the previous studies (Cámara & Tuesta, 2014; Nguyen, 2020). The dependent variable mainly captures whether the respondent used different DFS in the last 90 days. Precisely, this question captured the different DFS transactions such as savings, sending and receiving money, mobile banking, utility payments and access to credit.

Since the survey was conducted during the COVID-19 pandemic, the dependent variable measures DFI levels during the COVID-19 crisis. Accordingly, we construct the DFI index for the different households using the principal component analysis based on a combination of DFI indicators (forms). The DFI index can be expressed as a linear combination of the different DFI indicators, as shown in the following equation:

$$DFI_i = w_1 f_i^s + w_2 f_i^c + w_3 f_i^t + w_4 f_i^u + e_i, \quad (1)$$

where  $DFI_i$  is the composite digital financial inclusion index for household  $i$ ;  $w_1, w_2, w_3, w_4$  are relative weights of each of the DFI indicators;  $f_i$  are the various DFS transacted on user's mobile phones; and  $e_i$  is the variation due to error.

The independent variables include: SIM card registration status, the level of trust of the respondents in mobile money agents, customers' experience with fraud, charging extra fees by mobile money agents, the number of SIM cards owned by mobile money users, access to mobile internet and adoption of new DFS during the COVID-19 lockdown. Additionally, the study controlled for household characteristics such as age, the income of the respondent, poverty likelihood index of the household (estimated from the National Household Survey) and the highest education level attained, and the changes in income due to the COVID-19 pandemic among others. Table 1 presents a detailed description of these variables.

### 3.3 | Model specification and estimation strategy

We examine the drivers of DFI during the COVID-19 pandemic based on the following econometric model;

$$Y_{ij} = \beta + \alpha Age_{ij} + \delta Age_{ij}^2 + \theta Education_{ij} + \mu Female_{ij} + \epsilon Income_{ij} + \gamma DFS\_COVID_{ij} + \psi Mobile\ Loan\ usage_{ij} \\ + \pi SIM\ registration_{ij} + \phi COVID-19\ fraud_{ij} + \vartheta New\ products_{ij} + \rho Extrafees_{ij} + \omega Agent\ mistrust_{ij} \quad (2) \\ + \sigma Povertylikelihood_{ij} + \Psi Number\ SIMcards_{ij} + \eta Income\ decline_{ij} + \tau Mobile\ internet_{ij} + e_{ij}$$

where  $Y_{ij}$  is the dependent variable; the digital financial inclusion index for individual  $i$  in country  $j$  in East Africa. In addition,  $\beta, \alpha, \delta, \mu, \epsilon, \psi, \omega, \phi, \vartheta, \theta, \pi, \rho, \gamma$  are the parameters of the independent variables,  $e_{ij}$  is the error term, which is normally distributed with zero mean and variance of 1. The dependent variable measure (DFI index) is a continuous variable which is normalized to lie in the range of zero to one.

The variable  $Age^2$  is included to control for a possible non-linear relationship between Mobile financial transactions and the respondent's age of the respondent. According to Allen et al. (2016), the variable  $Age^2$  captures the possibility that the dependent variable rises with an increase in age but reaches a point and declines with any further increase in age.

The variable  $Education$  is classified into three categories based on the World Bank (2017). These are primary education, secondary education and tertiary education. The variable  $Sex$  is categorized into female and male. The Female dummy took the value 1 if the respondent was a woman and 0 otherwise. The variable Mobile loan usage is a dummy variable that takes on code 1 if the respondent had obtained a loan and 0 otherwise. The SIM card registration variable,  $SIM\ registration$ , took on value 1 if the respondent had SIM card(s) that had been registered in their names and 0 otherwise. The variable COVID-19 fraud, is a dummy variable that takes on the code 1 if they had experienced fraud cases or attempted fraud and 0 otherwise. The variable poverty likelihood index,  $Poverty$ , is a continuous variable that ranges from 0 to 100 and is derived from the most recent national household survey in the two respective

TABLE 1 Description of variables used in the study

Variable name	Variable definition/measurement	Hypothesis <sup>a</sup>
Digital financial inclusion	The digital financial inclusion index is based on the number of DFS used in the last 90 days	N/A
Female	A dummy that takes 1 if the respondent is female and 0 otherwise	–
Age	The age of the respondent in years	+
Age <sup>2</sup>	Age of the respondent in years, squared	–
Education	The highest education level attained by the respondent	+
Income	The monthly income of the respondent before the lockdown	+
New products	A dummy that takes on 1 if the user took on DFS during the lockdown and 0 otherwise	+
Number SIM cards	The number of SIM cards of different providers owned by the respondent	+
Extra fee	A dummy that takes on 1 if the user paid extra fees in transactions and 0 otherwise	–
COVID-19 fraud	A dummy that takes on 1 if the user has experienced any fraud attempts during the last month	–
SIM registration	A dummy that takes on 1 if the user has a SIM card registered in their name and 0 otherwise	+
Agent mistrust	A dummy that takes on 1 if the user thinks the mobile money agent might cheat him and 0 otherwise	–
Poverty likelihood index	Poverty likelihood index of the respondent's household	–
DFS_COVID	A dummy that takes on 1 if the user used DFS more than cash transactions and 0 otherwise	+
Income decline	A dummy that takes on 1 if the user had a decline in income due to COVID-19 and 0 otherwise	+
Mobile internet	A dummy that takes on 1 if the user accesses mobile internet on mobile phone and 0 otherwise	+
Mobile loan usage	A dummy that takes on 1 if the user has used a mobile loan in the last 3 months and 0 otherwise	+

Abbreviations: COVID-19, coronavirus disease-2019; DFS, digital financial services.

<sup>a</sup>The hypotheses signs are informed by the past literature in the paper, as highlighted in the previous section.

countries, Uganda and Kenya. The variable Agent mistrust, is also a dummy. Here, respondents were asked a No/Yes question regarding whether they had had any experiences where the mobile money agents cheated them while conducting the mobile money transactions. Drawing on studies (Churchill & Marisetty, 2020; Eze & Markjackson, 2020; Nanziri, 2016), we adopt the ordinary least squares (OLS) technique to estimate Equation (2) above. However, we compare the estimates with weighted least squares (WLS) to control for possibility of varying variances of the error term-heteroscedasticity (Stock & Watson, 2003; Wooldridge, 2003). We also conduct other diagnostic tests such as the variance inflator factor (VIF) and correlation tests for multicollinearity.

## 4 | RESULTS

### 4.1 | Descriptive analysis

This section presents the data properties of all the variables used in this study. Table 2 provides the summary statistics on the variables. The data show that the DFI (digital financial index) among households in Kenya is twice (0.66)

TABLE 2 Summary statistics for variables used in the study

Samples Variable	Uganda			Kenya		
	Obs	Mean	SD	Obs	Mean	SD
Digital financial index	830	0.3355	0.1373	793	0.6665	0.1769
Female	830	0.3843	0.4867	793	0.4060	0.4914
Age	830	30.4048	10.7838	793	33.4082	12.6107
Age <sup>2</sup>	830	1040.6	847.5	793	1116.1	544.5
Primary education	829	0.2642	0.4411	793	0.2197	0.4143
Secondary education	829	0.4607	0.4987	792	0.4179	0.4935
Tertiary education	829	0.2750	0.4467	792	0.3624	0.4810
Income (UGX/KSH)	744	306,854	164,025	758	13,507	5935
New products	830	0.0879	0.2833	758	0.0634	0.2971
SIM cards	830	1.6156	0.5156	793	1.3417	0.5777
Extra fees	764	0.3939	0.4889	769	0.0572	0.2324
COVID-19 fraud	830	0.4675	0.4992	792	0.5669	0.4958
SIM registration	830	0.7192	0.4496	792	0.8484	0.3587
Income decline	762	0.7480	0.4344	788	0.6421	0.4796
Agent mistrust	806	0.4478	0.4975	769	0.3485	0.4768
Poverty likelihood index	756	1.2776	3.2440	764	18.5481	17.1788
DFS-COVID	823	0.6427	0.4794	782	0.7455	0.4358
Mobile internet	830	0.8108	0.3918	792	0.7752	0.4177
Mobile loan usage	830	0.2771	0.4478	793	0.5422	0.4985

Abbreviations: COVID-19, coronavirus disease-2019; DFS, digital financial services.

Source: Authors' computation.

as high as in Uganda (0.33). This could be explained by the fact that Kenya has higher levels of DFI since mobile money (M-PESA) originated in Kenya and was later adopted by other African countries like Uganda. Additionally, the share of female digital financial users in both countries was less compared to male at 38.4%, 40.6%, respectively. The age variable shows that the average age of the respondents was 30.4 years in Uganda and 33.4 years in Kenya, implying that most respondents were youth (18–35 years). Regarding education, most of the respondents in the study in Uganda (46.1%) and Kenya (41.7%) had attained secondary education. On average, most respondents in Uganda had two service provider SIM cards registered in their own names compared to one SIM card in Kenya.

Furthermore, more respondents (81.1%) in Uganda than in Kenya (77.5%) indicated using mobile internet. The loan usage variable shows that 54.2% of Kenyan mobile users accessed loans during the COVID-19 crisis compared to 27.7% in Uganda. Regarding trust in the mobile money agents, mobile money users in Uganda had higher levels (44.8%) of mistrust in mobile money agents than 34.9% in Kenya.

## 4.2 | DFS usage and drivers

The Pearson correlation test was conducted at a 5% level of significance to test for a causal relationship between any two variables, and control for multicollinearity during regression analysis. Tables 3 and 4 present the correlation coefficients that show the linear association between variables under study. The variables for age, age<sup>2</sup>, income, use of new products, education, the number of service SIM cards, mobile money fraud, SIM card registration status, mobile internet usage and mobile loan usage had a positive linear relationship with DFI (usage). On the contrary, being a female, experiencing a reduction in income due to the COVID-19 crisis, mistrust in the mobile money agent and

TABLE 3 Correlation matrix between the variables used in the study (Uganda)

Digital financial service usage	Age	Age <sup>2</sup>	Education	Income	New products	Number SIM cards	Charge extra fees	Female	COVID fraud	SIM registration	Income decline	Agent mistrust	Poverty like-lihood	Mobile loan usage
1														
Age	0.0637	1												
Age <sup>2</sup>	0.037	0.9794	1											
Education	0.0651	-0.0991	-0.1039	1										
Income	0.2536	0.2251	0.1815	0.1376	1									
New products	0.138	-0.0531	-0.0547	0.1288	0.0913	1								
Number SIM cards	0.1882	0.0731	0.0418	0.0716	0.1727	0.0335	1							
Extra fees	-0.1367	-0.0225	-0.0114	-0.009	-0.0474	-0.0209	0.0131	1						
Female	-0.1964	-0.0115	-0.0025	-0.0319	-0.2233	-0.0442	-0.0539	0.0242	1					
COVID-19 fraud	0.0632	0.056	0.0289	0.0421	0.0749	0.0896	-0.028	-0.1293	0.0694	1				
SIM registration	0.1461	0.3123	0.2621	0.1117	0.1625	0.0047	0.0237	0.0552	0.0028	0.049	1			
Income decline	-0.0719	0.0598	0.049	-0.0682	-0.1093	-0.041	0.0821	-0.0277	-0.0585	0.023	-0.0355	1		
Agent mistrust	-0.0551	0.0526	0.0506	0.1064	0.0269	0.0197	-0.0451	0.019	-0.062	0.0667	0.0588	-0.0402	1	
Poverty Likelihood	-0.0362	0.1206	0.1139	-0.0413	-0.0532	-0.0651	0.0038	-0.0358	0.0641	0.068	-0.0022	0.1044	-0.0867	1
Mobile internet	0.0069	0.0667	0.062	0.1707	0.0753	0.0522	-0.09	-0.0741	0.0727	0.1352	0.0012	0.0099	-0.0074	0.0585
Mobile loan usage	0.1848	0.0799	0.0448	0.1009	0.1555	0.1024	0.1588	0.0741	0.0727	0.1352	0.0012	0.0099	-0.0074	0.0585



TABLE 4 Correlation matrix between the variables used in the study (Kenya)

Digital financial service usage	Female	Age	Age <sup>2</sup>	Education	Income	Number of SIM cards	Extra fees	COVID fraud	SIM registration	Agent mistrust	Poverty likelihood	DFS_COVID	Income decline	Mobile internet usage
Digital financial service usage	1.000													
Female	-0.141	1												
Age	0.075	-0.024	1											
Age <sup>2</sup>	0.038	-0.035	0.974	1										
Education	0.188	-0.116	-0.054	-0.059	1									
Income	0.257	-0.178	0.206	0.181	0.333	1								
Number SIM cards	0.209	-0.089	0.093	0.081	0.156	0.168	1							
Extra fees	0.017	0.022	-0.002	-0.017	0.012	-0.025	1							
COVID-19 fraud	0.136	-0.018	0.077	0.069	0.119	0.115	0.005	1						
SIM registration	0.200	-0.037	0.308	0.2666	0.099	0.128	0.01	0.036	1					
Agent mistrust	-0.200	-0.07	-0.049	-0.023	-0.093	-0.026	0.065	0.038	-0.014	1				
Poverty likelihood	0.188	-0.071	0.032	0.029	0.173	0.099	0.012	0.057	0.076	-0.099	1			
DFS_COVID	-0.207	0.117	-0.101	-0.098	-0.425	-0.132	-0.008	-0.056	-0.03	0.014	0.171	1		
Income decline	-0.021	0.102	0.017	0.003	-0.037	0.009	-0.011	0.049	-0.005	0.015	-0.085	0.127	1	
Mobile internet	0.141	-0.035	-0.3039	-28	0.231	0.159	0.006	0.006	0.034	-0.036	0.109	-0.259	-0.022	1
Mobile loan usage	0.205	-0.106	0.071	0.005	0.077	0.107	0.047	0.127	0.1	0.054	0.061	-0.026	0.028	0.04

Abbreviation: DFS, digital financial services.

poverty likelihood of a respondent's household was negatively related to the DFI. More importantly, the degree of association between any two variables is less than 0.8 in absolute terms, which is a requirement for no multicollinearity (Studemund, 2001). As such, we consider all independent variables for regression analysis.

### 4.3 | Drivers and barriers of DFI

To explore the drivers of DFI, we estimate Equation (2) using OLS to obtain country-specific estimates in columns (1) and (3) in Table 5. We adopt a country analysis to account for differentials in country specific drivers of DFS. In other words, the OLS model is used as a baseline model.

To test for multicollinearity, we run the VIF test, which gives values less than 10 (O'Brien, 2007). To account for heteroscedasticity of the error term, we report OLS estimates with robust standard errors but also compare estimates with WLS whose estimates account for a varying variance of the error term (Stock & Watson, 2003; Wooldridge, 2003). We then conduct the Hausman test to ensure that the models' coefficients are not statistically different. The test shows that there is no statistical difference between the two models. Therefore, we conclude that WLS is consistent with OLS but provides more efficient estimates in columns (2) and (4). We therefore use the WLS estimates in columns (2) and (4) to estimate the drivers of DFI in Uganda and Kenya.

Our results reveal that increases in DFS are associated with an increase in the age of DFS users in both countries. For instance, a one-year increase in respondents' age is associated with a 2% and 17% growth in DFI in Uganda and Kenya, respectively. However, this effect of age increases until a certain age, when DFI starts to decline with a further increase in the age of mobile money users. This is evidenced by the negative sign in the  $Age^2$  variable, which depicts a nonlinear relationship between age and the usage of DFS.

Similarly, the results suggest that the income level of the users has a pronounced positive effect on the adoption of DFS during the COVID-19 crisis. Whereas a 1% increase in the user's income is associated with a 5% growth in digital financial usage in Uganda, the effect on DFS usage is slightly higher at 3% in Kenya. The effect of income is further emphasized by the negative effect of poverty likelihood of the respondents' household and mobile money transactions in both countries. Notably, a 10% increase in the poverty levels of the household is associated with a 0.7% and 0.3% decline in the use of DFS in Uganda and Kenya, respectively. From a gender digital perspective, the results suggest that females are 30% less likely to use digital financial transactions than their male respondents in Uganda. In Kenya, the gender disparity is smaller compared to Uganda. Notably, women are 19% less likely to use DFS than men. This gap points to the narrower gender inequalities in Kenya compared to Uganda.

Results also show that extra fees charged by mobile money agents affect the usage of DFS in Uganda while the effect is insignificant in Kenya. More succinctly, a percentage increase in the extra fees charged on DFS transactions is associated with a 19% decline in DFI in Uganda. Relatedly, the results also suggest that the pandemic deepened the use of new DFS that were not used before the COVID-19 pandemic. For instance, the pandemic was marked by a 37% rise in the number of new DFS in Uganda while the proportion of new products was only 5% in Kenya. Regarding the effect of fraud experiences by DFS users during the COVID-19 pandemic, the results were mixed and varied across the two countries. Whereas digital fraud was not significantly related to digital financial platforms in Uganda, there was a weak significant relationship in Kenya at a 10% level of significance. The results also show that mobile DFI reduces with less trust in the mobile money agents. More specifically, a 1% increase in the degree of mistrust of mobile money agents (fear of being cheated) among the digital financial users induces a 5% reduction in DFI in Uganda. However, the relationship between mistrust and mobile money usage was not significant in Kenya.

Noteworthy, the results also suggest that owning SIM cards registered in one's name increases the usage of digital platforms more than those whose cards were not registered in other persons' names. Surprisingly, education did not have a significant relationship with DFI across the two countries. Similarly, respondents with more than one SIM card from MNOs were likely to use more digital services than users of one SIM card. Overall, richer middle-aged males with SIM cards registered in their names, with more trust in mobile money agents, and who had accessed mobile loans were likely to be financially included.

### 4.4 | Discussion of results

Following the results presented in Table 5, we discuss and relate the findings with the past literature. The results suggest that DFI is higher among middle-aged mobile users than among the youth and the elderly. This could be

TABLE 5 Determinants of digital financial inclusion in Uganda and Kenya

Dependent variable: digital financial inclusion index (DFI)				
Explanatory variables	Uganda		Kenya	
	(1)	(2)	(3)	(4)
Age	0.0222** (-0.0112)	0.0224** (-0.0111)	-0.1892*** (-0.0512)	-0.1677*** (-0.0524)
Age <sup>2</sup>	-0.0002** (-0.0001)	-0.0002** (-0.0001)	-0.1892*** (-0.0512)	-0.1677*** (-0.0524)
Secondary education	-0.0739 (-0.0885)	-0.1047 (-0.0872)	0.0542 (-0.0921)	0.0388 (-0.0924)
Tertiary education	-0.0175 (-0.0986)	-0.0268 (-0.1001)	0.0514 (-0.1042)	0.0682 (-0.1024)
Income	0.0498** (-0.0174)	0.0522** (-0.0177)	0.0432*** (-0.0163)	0.0297*** (-0.0145)
New products	0.3384** (-0.126)	0.3654** (-0.1258)	0.4534** (0.1342)	0.4341*** (0.1240)
Number SIM cards	0.1181* (-0.0712)	0.1196* (-0.0659)	0.1081** (-0.0597)	0.1425** (-0.0599)
Charge extra fees	-0.1969** (-0.0705)	-0.1899** (-0.0651)	0.0427 (-0.1419)	0.0555 (-0.1936)
Female	-0.2889*** (-0.0734)	-0.3015*** (-0.0664)	-0.2103*** (-0.0706)	-0.1921*** (-0.0691)
COVID-19 fraud	-0.0302 (-0.0694)	-0.0182 (-0.0665)	0.1100* (-0.0702)	0.1043* (-0.0677)
SIM registration	0.1266** (-0.0637)	0.1586** (-0.0735)	0.2729*** (-0.1011)	0.3221*** (-0.0994)
Income decline	-0.1312* (-0.0806)	-0.1522* (-0.0791)	0.0798 -0.0718	0.0708 -0.0714
Poverty likelihood	-0.0249** (-0.0110)	-0.0235** (-0.0108)	-0.0044** (-0.0023)	-0.0041** (-0.0021)
Agent mistrust	-0.0801*** (-0.0069)	-0.0457*** (-0.0064)	-0.0012 (-0.1092)	-0.0078 (-0.1085)
DFS_COVID	0.0677** (-0.0364)	0.0622** (-0.0331)	0.1246*** (-0.0401)	0.1042*** (-0.0406)
Mobile internet	-0.0856 (-0.0904)	-0.1064 (-0.0839)	0.1491* (-0.0847)	0.1195* (-0.0807)
Mobile loan usage	0.2155** (-0.0784)	0.2259** (-0.082)	0.3071*** (-0.0692)	0.2761*** (-0.0686)
Constant	-0.2189 (-0.3741)	-0.1828 (-0.3371)	-1.8556*** (-0.3931)	-1.6954*** (-0.4157)

(Continues)

TABLE 5 (Continued)

Dependent variable: digital financial inclusion index (DFI)				
Explanatory variables	Uganda		Kenya	
	(1)	(2)	(3)	(4)
$R^2$	0.14	0.16	0.18	0.16
$N$	680	680	706	706
VIF	3.71	4.50	3.70	4.50
Hausman test	10.59 (0.877)		10.37 (0.677)	

Note: Standard errors are reported in the parentheses. \*, \*\*, \*\*\* indicate significance at the 90%, 95% and 99% level, respectively. The primary education category is the reference category in the regression model.

Abbreviations: DFS, digital financial services; VIF, variance inflator factor.

explained by the growth in access to opportunities as youth transition from high unemployment rates and limited access to economic opportunities. These findings collaborate with Ximena et al. (2013). On the contrary, DFS are lower among the elderly due to retirement and lower incomes that reduce their digital transactions. More so, the findings point us to the relevance of Modigliani's life cycle (1980) theory which shows that young people earn and save more at their tender age but retire and dis-save. This, therefore, affects their use of financial services such as savings and access to credit due to limited earnings. Relatedly, higher income is associated with growth in DFI because people with higher incomes save and transact more by making payments such as salaries and making online purchases, among others. On the contrary, the poor have limited income for consumption expenditure and with little incentive to save they also fail to qualify for access to digital loans (Akileng et al., 2018).

The results also show the increased uptake of new digital finance products during the COVID-19 crisis. More succinctly, the pandemic amplified the demand for new DFS as individuals and households adopted digitalization to meet their daily financial needs. Due to the containment measures imposed on movements in various African countries, most customers resorted to digital purchases and online financial services rather than travelling to banks, mobile money and shops to transact by cash or access credit. These results are consistent with findings by Mburu (2020) that found that the lockdown in Kenya resulted in a 35% growth in online purchases of food, pharmaceuticals (18%) and agribusinesses (54%). Additionally, the use of digital platforms was coupled with a parallel move by companies and commercial banks to invest in digital platforms and increased lending limits to their online customers (Lukama, 2020).

From a gender perspective, the results also suggest that there is more usage of digital financial platforms among men than women. Gender inequalities largely explain this due to several socioeconomic factors such as limited affordability and financial literacy skills that deter digitalization among women (Muhura, 2019). More specifically, more women than men have limited access to smartphones and mobile internet in transacting digital services such as bank deposits, credit and online purchases (Global System for Mobile Communications, 2020a). Women are constrained by higher poverty levels and are less likely to save through mobile wallets or even qualify to access credit through mobile platforms (Benni, 2021). This is largely attributed to limited employment among women, given that the majority are employed in the informal sector, which was hardest hit by the pandemic. Noteworthy, our findings show that gender disparity in digital inclusion in Kenya is lower than in Uganda, largely due to the higher levels of DFI among women in Kenya. For instance, the gender gap in mobile ownership in Kenya is only 6%, compared to 17% in Uganda (Global System for Mobile Communications, 2020a).

Results also show that ownership of a SIM card registered in one's name is associated with an increase in the usage of digital financial platforms. This could be explained by the fact that mobile money users who use SIM cards not registered in their names face hurdles during transactions. For instance, non-registered users do not qualify to make certain transactions such as mobile banking, for data privacy and incidence of cyber fraud. These findings are consistent with the studies by Martin and Taylor (2020) and Nyende and Mbabazi (2021) who underscore the importance of SIM card registration through using legal national identity cards in harnessing DFI.

The results also revealed that limited trust in the mobile money agents by the users affects DFI in Uganda. With limited trust, customers are trapped in the traditional use of cash payments for fear of fraud perpetrated by mobile agents. These results collaborate with the findings by Malady (2016), which indicated that the lack of trust in digital

financial platforms could trigger the voluntary exclusion of potential customers, especially in developing countries that have no consumer protection institutions and frameworks in place. For instance, data shows that a significant proportion (37%) of countries that use mobile money still lack data protection and privacy frameworks (Arame & Gamble, 2021). However, the effect of limited trust in mobile money agents was not significant in Kenya. This could be explained by the fact that, unlike Uganda, Kenya has established a strong consumer protection framework that enhances customers' trust in the digital financial ecosystem (Di Castri, 2013).

In contrast, our findings reveal that education has no significant effect on DFI, differing from earlier studies such as Coulibaly (2021), Girón et al. (2021) and Milton (2008), who found a positive and significant effect of education on financial inclusion. Consistent with our findings, Akileng et al. (2018) show that financial literacy—not education—drives digital inclusion, given mobile phones and digital platforms are so saturated in East Africa, increasing accessibility among the educated and the uneducated alike.

Additionally, our findings show that having more than one mobile money account (represented by the possession of more than one SIM card) from different MNOs increased the likelihood of usage of digital platforms. Having more mobile money accounts promotes consumer choice, depending on customer care, quality of service, value-added services and the cost of communicating on the provider's network (Ondiege, 2015). Indeed, Mazer and Rowan (2016) found that a competitive environment for MNOs promotes both the quality and diversity of DFS, which consequently promotes financial inclusion. Therefore, this highlights the need for governments to ensure a competitive ecosystem to facilitate the entry of MNOs to develop innovative products and high-quality services for digital customers.

## 5 | CONCLUSION AND POLICY IMPLICATIONS

The current COVID-19 pandemic has amplified the urgency to adopt digital financial platforms to build the resilience of individuals, households and businesses to meet their financial needs. Evidence shows that rapid digitalization is crucial for boosting Africa's financial inclusion efforts and accelerating post-COVID-19 economic recovery. Notably, the digital financial revolution implies that more poor people can store and increase savings, cope with unexpected economic shocks, access social benefits more cheaply and make investments leading them out of poverty. However, for this to happen, the design of these DFS has to address the pre-existing digital divide that excludes the poor and vulnerable from the modern financial sector.

Using micro-level data, our study examined the drivers and barriers to DFI in Kenya and Uganda during the COVID-19 pandemic. The results show that several factors drove the use of DFS: being middle-aged, male with higher income and access to mobile internet and credit increases the likelihood of adopting DFS. In addition, users with more mobile money accounts (from different service providers) and SIM cards registered in their names, with more confidence in mobile money agents, were likely to adopt DFS during the COVID-19 lockdown. Noteworthy, the results also showed that COVID-19 fraud is a key emerging threat in the financial sector, especially in Kenya, where the digital financial sector is more advanced than Uganda's.

These findings point to several critical strategies for Africa to turn the digital revolution into a vehicle for DFI and economic recovery from the COVID-19 pandemic.

First, governments need to invest in the national digital identification (national ID) system that enables real-time issuance and replacement of national IDs. Relatedly, efforts should address the associated administrative hurdles and bureaucracy in obtaining national IDs. This intervention is critical to address issues of legal identification and SIM card registration that limit the ownership and usage of digital accounts in the delivery of DFS, especially in rural areas.

Second, to address the supply-side gaps in the delivery of quality financial services, governments need to attract private investments in MNOs to promote a competitive environment that can stimulate the delivery of high quality DFS and address the inefficiencies of monopoly companies that charge higher transactional fees.

Third, to address the emerging threats of cyber fraud and high transactional charges in the mobile money industry, governments should establish and implement effective consumer protection policies to mitigate cybercrime. This will instil confidence in the population to adopt digital financial platforms.

Fourth, mobile network providers and commercial banks need to be more innovative and roll out tailor-made DFS beyond mobile money transfers such as mobile insurance products, mobile saving wallets and credit instead of one-size-fits-all products. This will increase the uptake of DFS among the poor and marginalized such as women, the elderly and the youth in the financial sector.

Lastly, government efforts to create employment opportunities and social nets are imperative to alleviate poverty and enhance income levels among the youth and elderly to own and use digital technologies. This will increase their participation in the digital financial economy and boost financial inclusion.

## ENDNOTES

- <sup>1</sup> Growth theorists posit that financial inclusion boosts growth via the saving and capital accumulation channels.
- <sup>2</sup> These include financial inclusion surveys such as the Global Findex Database, FinScope and FinAccess surveys.
- <sup>3</sup> The Initiative is a research facility funded by the Bill & Melinda Gates Foundation to support policymakers, financial service providers and civil society to develop and test consumer protection solutions in four emerging markets: Bangladesh, Kenya, Nigeria and Uganda.
- <sup>4</sup> FinScope and FinAccess surveys are nationally representative surveys in Uganda and Kenya that are designed to determine the financial inclusion trends of individuals 18 years or older (i.e., adults).

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