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Sherif Sulemana
Agyapomaa Gyeke-Dako
Portia Mma Akolgo

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Abstract

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Keywords: Financial resilience, financial inclusion, digital finance, IV probit.

JEL Classification: I31; O33; O55

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Sherif Sulemana
Department of Finance, University of Ghana Business School

Agyapomaa Gyeke-Dako
Department of Finance, University of Ghana Business School

Portia Mma Akolgo
Loughborough Business School, Loughborough University, UK

Abstract*

This paper investigates the nexus of inclusive finance, technology, and financial resilience, using data for 25 Sub-Saharan African countries from the fourth wave of the Global Findex database for 2021. It employs an instrumental variable probit model to test for three propositions. First, it examines the impact of the use of digital finance on financial inclusion. Second, it investigates whether digital finance and financial inclusion promote financial resilience. Finally, it estimates how digital finance and financial inclusion interact to impact financial resilience. The results show that digital finance has no impact on financial inclusion. Although saving through a digital finance platform significantly increases the likelihood of financial resilience, borrowing through such a platform significantly reduces that likelihood. Tertiary education, low and middle incomes, age, employment, and mobile ownership have significant effects on financial resilience. The paper concludes that digital finance has no significant impact on financial inclusion in Sub-Saharan Africa and that the interaction of digital finance use and financial inclusion strongly determines the likelihood that a household is financially resilient.

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Author's E-Mail Address: sherif.ywb@gmail.com

I. INTRODUCTION

Technology presents an innovative channel through which households can access formal financial services using digital financial platforms (Machasio 2020). Excluded and underserved households that previously could not access and use high-quality and affordable financial products and services now benefit from innovative and convenient financial service delivery. As a result, they are better positioned to save, borrow, invest, and make payments (Ayadi and Shaban 2020; Ozili 2018). Advancements in financial service delivery help build more financially resilient communities through inclusive policies and programs.

The global unbanked adult population stood at 1.4 billion as of the end of 2021 (Demirgüç-Kunt et al. 2021), down from a high of 2.5 billion in 2011. This decrease is attributable to efforts by global development partners and individual governments and to empirical research findings of academics (Arun and Kamath 2015; Ayadi and Shaban 2020) that have shaped and informed policy and programs aimed at enhancing financial inclusion. However, significant gaps and regional variations persist (Ayadi and Shaban 2020; Sha'ban et al. 2019). Concerns have been raised about whether individuals can effectively manage unexpected financial shocks, such as job losses, crop or business failures, and health crises (Pomeroy et al. 2020). In Sub-Saharan Africa, 45% of the adult population remains unbanked, a proportion higher than in any other region globally and almost 10 times that of high-income countries, at 4%. The region has a mobile phone use rate of 75% and considerable internet access (Demirgüç-Kunt et al. 2021). Two questions arise: has financial technology growth and innovation truly enhanced financial inclusion, and how has finance technology and financial inclusion affected financial resilience?

The debate on the role of financial services in improving household well-being within the global development community continues, with empirical studies yielding mixed and sometimes contradictory results. Since 1990, the narrative has transitioned from microfinance facilitating small loans for the poor to a broader focus on financial services that empower economically vulnerable populations. The digital revolution has increased interest in digital financial services, which offer a cost-effective alternative to traditional banking, particularly for the unbanked population (El-Zoghbi 2019). However, studies have shown that financial inclusion benefits a select few (Chipunza and Fanta 2023); individuals with formal accounts are more likely to secure emergency financing and enhance their financial resilience (Belayeth Hussain et al. 2019). Kass-Hanna et al. (2022) postulate that individuals with formal financial accounts are better positioned to secure emergency funds during crises. Although financial services are widely recognized as being positively correlated with financial resilience, there remains a limited understanding of how financial inclusion influences financial resilience, policy, and programs to deal with financial inclusion gaps (Kass-Hanna et al. 2022).

Recently, the Consultative Group to Assist the Poor reviewed existing evidence and concluded that financial services increase household well-being by helping households build financial resilience and capture opportunities (El-Zoghbi 2019). It recommended scaling up financial services that contribute to resilience, particularly through the expansion of digital payments in rural areas. A World Bank survey found that 55% of adults in high-income countries could access emergency funds within a month, but only 25% could do so in developing economies (Demirgüç-Kunt et

al. 2021). Compared with the poorest 20%, the richest 20% are about six times more financially resilient (Belayeth Hussain et al. 2019). Other studies suggest that technological advancements may improve financial resilience by offering new financial solutions (Krishnan et al. 2019).

Extant studies have examined the impact of technology on financial inclusion (Al-Smadi 2023; Ashenafi and Dong 2022; Bede Uzoma et al. 2020; Demir et al. 2022; Durai and Stella 2019; Ediagbonya and Tioluwani 2022). However, findings have been inconsistent, and most studies have not established a direct relationship between financial inclusion and technology. Other studies have explored the impact of fintech on household resilience (Suri et al. 2021), focusing only on digital loans. Again, few attempts have been made to examine the financial inclusion-financial resilience nexus (Belayeth Hussain et al. 2019; Buckland 2018; Sakyi-Nyarko et al. 2022). Existing research primarily focuses on national case studies, lacking a broader regional perspective on financial inclusion, digital finance, and resilience.

This study contributes to the literature by exploring the broader regional role of technology in financial inclusion and financial resilience, extending beyond the country level. First, it presents empirical evidence regarding the impact of digital finance on financial inclusion within the Sub-Saharan Africa regional context. Second, it explores the simultaneous impact of digital finance and financial inclusion on financial resilience. Third, it investigates how digital finance and financial inclusion interact to impact financial resilience.

The study finds that digital finance has a limited direct impact on financial inclusion in Sub-Saharan Africa. Similarly, digital finance exerts an insignificant impact on financial resilience. In contrast, savings significantly improve financial resilience, whereas borrowing reduces the likelihood of financial resilience. Saving through digital platforms increases the likelihood of financial resilience, whereas borrowing through a digital platform reduces financial resilience. Additionally, the study provides evidence that individual and socioeconomic characteristics, such as age, education, employment status, location, income, and mobile ownership, are significantly correlated with financial resilience.

The remainder of this paper is structured as follows: Section 2 reviews relevant literature, Section 3 outlines the empirical strategy, Section 4 presents the results and analysis, and Section 5 offers concluding remarks.

2. LITERATURE REVIEW

2.1 Theoretical Perspectives

2.1.1 Technology Acceptance Model

The Technology Acceptance Model is widely regarded as one of the most influential models for studying individuals' perceptions of technology and intention to adopt and use technology. Researchers have explored the factors influencing individuals' acceptance of emerging digital tools (Molino et al. 2020). Pioneered by Davis (1989), the Technology Acceptance Model states that an individual's intention to accept or reject new technologies is determined by the technology's perceived usefulness and perceived ease of use (Matemba and Li 2018). According to Molino et al. (2020), perceived usefulness is how technology will make a person's life better, and perceived ease of use is the degree and level of difficulty technology access.

Most studies of cashless transactions or e-payments have been based primarily on the Technology Acceptance Model, with additional constructs such as security, cost, trust, mobility, expressiveness, convenience, transaction speed, social reference groups, the attractiveness of alternatives, privacy, system quality, and technology anxiety. McFarland and Hamilton (2006) believe inclusion of sociocultural variables will make the model more comprehensive and complete. The "usefulness" of technology is a significant driver of its adoption because individuals are interested in the net benefit of use relative to use of traditional platforms. Because digital financial services must be perceived as an enabler of socioeconomic activities (Venkatesh and Bala 2008), studies should analyse the social, cultural, and economic impact of technology. Vargo et al. (2020) assert that the process of innovation adoption is dynamic, inclusive, and integrative and is largely influenced by the socioeconomic context.

Technology plays a pivotal role in resilience by enhancing information delivery, diversifying payment processes, and increasing flexibility (Ashiru et al. 2023). During emergencies, use of emerging technologies was shown to supersede reliance on traditional information delivery and to increase the resilience of small and medium enterprises in Nigeria (Ashiru et al. 2023).

2.1.2 Resilience Theory

Resilience is a multidisciplinary concept widely used in the field of psychology, organizational behaviour, ecology, and social sciences. Pioneer work on resilience by Holling (1973) focused on ecological systems. Researchers adopted the concept in the study of organizational resilience (Erol et al. 2010; Hussain and Papastathopoulos 2022) and household finance (McKnight 2019; Suri et al. 2021; Swamy 2019). Although there is no consensus on the definition of resilience, it has been widely referred to as competencies and capabilities of individuals to function positively in adversity. The theory of resilience has its foundations in the study of adversity and the negative impact on people of life shocks (Van Breda 2018). Resilience theory and technology are complementary concepts in probing how people make decisions that affect their well-being (Atwell et al. 2009). The Technology Acceptance Model and resilience theory work together to explain how the socioeconomic context of people enhances or constrains their financial resilience. Research on resilience revolves around three components: adversity, outcome, and mediating factors. Hence, resilience is conceptualised as a process that leads to an outcome focusing on the mediating processes.

2.1.3 Financialization of Everyday Life

No specific theory establishes a link between financial inclusion and financial resilience. However, attempts have been made to situate the discussion in the context of the financialization of everyday life, which Buckland (2018) asserts is beneficial for human well-being. Financialization presents favourable opportunities and costs to vulnerable people. Financialization has an influence on many sectors of modern life and has become an integral part of development programs, national economies, and individual livelihoods. Prior studies on financialization focused on its macroeconomic impacts in developed economies. However, the focus has shifted to the developing world and the everyday lives of the vulnerable (Gronbach 2023). Everyday financialization presents an opportunity to assess the effect of credit and economic activities on the vulnerable in society (Buckland 2018). The financialization of everyday life provides opportunities for individuals to access capital and make investments that can improve their welfare (Aitken 2007). Van der Zwan

(2014) argues that financialization of everyday life gives low- and middle-income households an opportunity to participate in financial markets and to access other financial products and in doing so to develop their risk-taking abilities. Van der Zwan further asserts that financialization of everyday life has given households an avenue to access uncertainty-insulating financial products and to decrease reliance on welfare services, employer-provided benefits, and savings accounts. Households can use investment to manage risk and prepare for unanticipated adversities.

Technology has facilitated the financialization of everyday life, making financial products and services easily accessible to people from all walks of life (Davis 2009), though Mohd Daud et al. (2021) argue that technology has widened the income inequality gap. Uptake of digital platforms, payment cards, special bank accounts, and mobile-based payment methods for social cash transfers has increased in Sub-Saharan Africa (Gronbach 2023). Ha (2022) found that digitisation is positively correlated with the development of financial institutions and markets.

2.2 Empirical Review

2.2.1 Digital Finance and Financial Inclusion

Durai and Stella (2019) studied the impact of digital finance on inclusive finance and, like Ozili (2018) and Thathsarani and Jianguo (2022), measured digital finance by internet banking, mobile banking, debit cards, and credit cards. Digital finance is financial services or products on digital devices. This study measures digital finance following Ozili (2018).

The goal of digital finance is to provide more convenient and affordable financial services, thereby allowing low-income and financially excluded populations to have access to finance to improve their welfare. The United Nations believes that financial services delivered through digital platforms have implications for financial inclusion and contribute to poverty reduction (United Nations 2016).

Digital financial services have been an instrumental accelerator of financial inclusion, particularly in Sub-Saharan Africa and Asia. Khera et al. (2022) studied digital financial inclusion in emerging markets and developing economies employing a three-stage principal component analysis. The authors computed access and use indices to develop a digital financial inclusion index to measure financial inclusion. Their study found that digital financial services have significantly impacted financial inclusion, particularly in areas where financial inclusion was decreasing. The study's weakness is that variables to compute the indices did not include debit cards.

2.2.3 Financial Inclusion and Financial Resilience

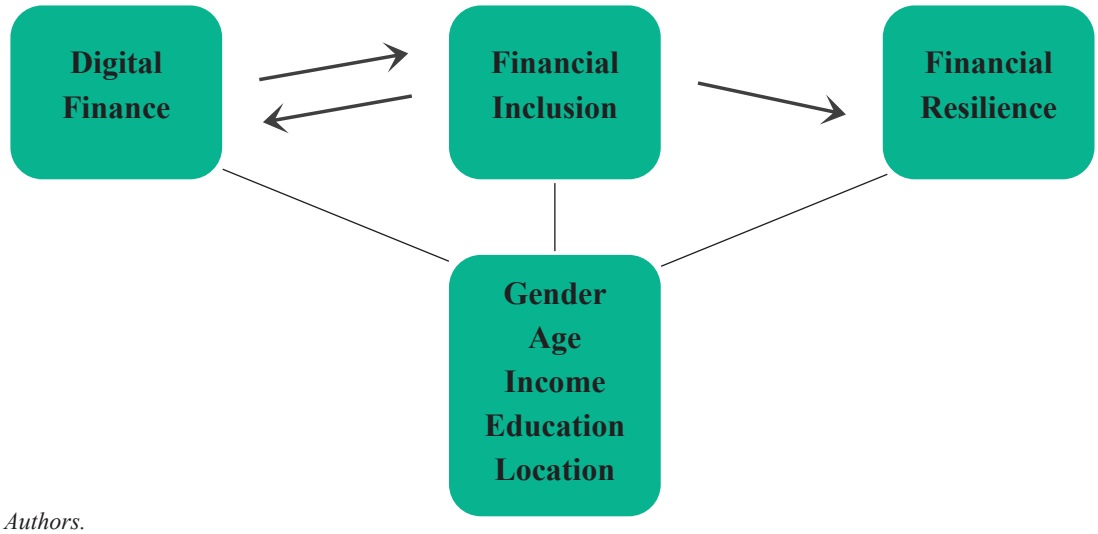
The relationship between financial inclusion and financial resilience is explored by Belayeth Hussain et al. (2019) in Bangladesh using country data from the World Bank's global financial inclusion index. The study used 1,000 representative samples for Bangladesh and employed logistic regression to estimate the effect of financial inclusion on financial resilience. The study found that households with financial accounts are more financially resilient than those without such accounts. The study showed that gender significantly impacted financial resilience; males are 1.4 times more financially resilient than females. The study failed to capture the impact of the use of mobile phone and internet access. Moreover, its findings might not hold if it expanded to multiple countries and reflected a large sample.

Tinta et al. (2022) investigated the micro determinants of financial inclusion and financial resilience using surveys of 40 African countries. They used logit and multinomial models to estimate and analyse data. They found that financial resilience among women was low but high among educated, married, and high-income earners. They further found that while financial resilience increases with age, employment increases individuals' vulnerability. In contrast, Salignac et al. (2019) found that underemployed or unemployed people are less financially resilient. Their study, which used a survey of 1,496 representative adult respondents (age 18 or older) in Australia, also found that people with low income and relatively little education and living in rental housing had low financial resilience. The study, however, found no effect of gender on financial resilience. Sakyi-Nyarko et al. (2022) also found that financial resilience does not change significantly by gender in a study on the gender differential effect of financial inclusion on financial resilience using survey data from Ghana.

Kass-Hanna et al. (2022) investigated how financial resilience can be built through financial and digital literacy in Sub-Saharan Africa and South Asia. The authors used 2017 survey microdata from InterMedia's Financial Inclusion Insights Program for three countries in South Asia (Bangladesh, India, and Pakistan) and four countries in Sub-Saharan Africa (Kenya, Nigeria, Tanzania, and Uganda)." The authors used probit regression to estimate the impact of financial and digital literacy on respondents' financial resilience-building behaviours, savings, borrowings, and risk management. The study showed that digital and financial literacy have positive impacts in building financial inclusiveness and resilience. An increase in financial and digital literacy significantly increased the likelihood of saving, borrowing, and securing life or health insurance. The study asserts that poor people are significantly less likely to save or borrow both formally and informally and that women are more likely to save both formally and informally.

Innovation in finance could significantly increase the accessibility and use of financial products and services by excluded, vulnerable, and poor households. Access to finance can lead to socioeconomic benefits, including resilience in the face of adverse financial shocks. Observed and unobserved individual socioeconomic household attributes determine the interrelationship of digital finance, financial inclusion, and financial resilience, which is illustrated in Figure 1.

Figure 1. Conceptual framework



Source: Authors.

3. Data and Methods

3.1 Empirical Model

This study examines the relationship of digital finance, financial inclusion, and financial resilience. To estimate the impact of digital finance on financial inclusion, this study employs an instrumental variable probit (IV-probit) model to address potential endogeneity concerns arising from bidirectional causality. The IV-probit estimation technique ensures that parameter estimates remain unbiased and consistent. The probit regression model is employed in studies when the dependent variable has a binary outcome (Oyekale 2021). The model estimates the probability of the parameters using the cumulative Gaussian normal distribution function. Because of the likely endogenous nature of the covariates, the standard probit model cannot be employed in this study. The instrumental variable probit technique is thus employed to deal with endogeneity concerns (Li et al. 2019). The general form of the model is expressed below.

$$FI_i^* = \beta_0 + \beta_1 digital\_finance_i + \sum \beta_i X_i + \varepsilon_i \qquad (1)$$

$$FI = \begin{cases} 1 if FI_i^* > 0 \\ 0 otherwise \end{cases}$$

FI_i^* is the financial inclusion outcome, 1 for a household that is financially included and 0 otherwise; digital finance measures the use of a mobile phone or the internet for transactions; and X_i is individual characteristics that have an influence on financial inclusion. Table 3.1 provides a detailed variable description. β_0, β_1, β_i and coefficients are to be estimated; ε_i is the random error term. Because reverse causality exists between digital finance and financial inclusion (Ozili 2018), the probit model in equation 1 overlooks the possible endogeneity and is likely to make the main predictor variable (digital finance) endogenous. The reason is that people who have formal accounts may be made aware of digital platforms for transactions and that people who are using digital platforms may tell excluded relatives or friends to sign up. Therefore, this study estimates a two-step IV-probit model to account for the likelihood of endogeneity. The IV probit is expressed as:

$$FI_i^* = \beta_0 + \beta_1 digital\_finance_i + \beta_i X_i + \varepsilon_i \qquad (2)$$

$$digital\_finance_i = \alpha_0 + \alpha_1 X_i + \alpha_2 Z_i + \nu_i \qquad (3)$$

where ε_i and ν_i are the idiosyncratic error terms with a normal distribution, and the coefficient of interest is β_1. The probit model in equation 1 produces unbiased results if the digital finance is exogenous. On the contrary, unobserved attributes of digital finance have the likelihood of determining FI. Hence, an instrumental variable approach is adopted to estimate β_1 using the variable Z_i, specific tax rates on mobile and network infrastructure, fees charged by mobile and network operators, and import duties on mobile devices. Network equipment is the instrumental

variable. Z_i should not determine FI, other than through its influence on digital finance. Countries' specific tax and fee policies for digital industry were assigned 1 or 0.

Expanded model:

$$Pr(Finc\_ = 1) = \beta_1 + \beta_2 digital\_finance_i + \beta_3 gender + \beta_3 loc_I + \beta_4 education_i + \beta_5 agegroup_i + \beta_6 wealthquintile_i + \varepsilon_i \quad (4)$$

To achieve the second objective of the study, which is the impact of digital finance and financial inclusion on financial resilience, the study estimates the regression as

$$Pr(FR\_ = 1) = \beta_0 + \beta_1 FI_i + \beta_2 digital\_finance_i + \beta_3 gender + \beta_4 loc_I + education_i + \beta_6 agegroup_i + \beta_7 wealthquintile_i + \beta_8 (FI * digital\_finance) + \varepsilon_i \quad (5)$$

where FR is the financial resilience of the household with outcome 1 if the individual can raise emergency funds and 0 otherwise. Again, the financial inclusion variable of "saved" is endogenous, and, therefore, it is instrumented with the distance of individuals from access to finance. The study uses bank branches per 1,000 square kilometres as an instrumental variable. The expectation is that distance is correlated with financial inclusion, given that the probability of saving is determined by the proximity to a financial institution (Demirgüç-Kunt et al. 2021; Hussen and Mohamed 2023).

3.2 Econometric Technique

3.2.1 Marginal Effects

Marginal analysis measures changes in a variable of interest that is associated with the changes in a relevant variable. To ascertain these changes, the relevant statistic is marginal effects (Onukwugha et al. 2015). The impact of a variable in a nonlinear model is made more meaningful through marginal effects, and categorical regressors are easier to understand (Williams 2012). The marginal effect for categorical variables estimates how the P(Y=1) changes as the variable changes from 0 to 1. For dichotomous explanatory variables, the marginal effect is the difference in the outcomes for the groups, say male and female. According to Anderson and Newell (2003), marginal effects cannot be inferred directly from the coefficient estimates because they are nonlinear functions of the coefficient estimates and the levels of independent variables. Unlike linear regression, whereby the parameter estimates of the explanatory variable measure the change in the dependent variable, marginal effects are used in the binary or categorical-dependent variable. This study, following Greene (1996), considers marginal effects after the estimation of the parameters. It estimates the marginal effects of covariates on the likelihood of being financially resilient and on the likelihood of using digital finance with probit regression.

3.3 Data Source

The study used data from the World Bank's Global Findex Survey, globally representative demand-side indicators for the financial inclusion survey conducted by Gallup, Inc. in 2021 as part of its Gallup World Poll. The Global Findex database has a significant variety of indicators on financial inclusion that may be used to examine account penetration, use of financial services, objectives, and motives, alternatives to formal finance, and so on. It also includes micro-level data such as gender, age, income, and education, all of which are included in our estimates. For the purposes of this study, data are extracted for the 25 Sub-Saharan African countries selected on the basis of the World Bank's analytical regions for the 2021 survey. The study samples 1,000 observations from each country; hence, the pooled sample size for the study is 25,000. Other studies present pooled data from Africa (Ashenafi and Dong 2022), Sub-Saharan Africa (Asuming et al. 2019), and the world (Demir et al. 2022).

Table 1. Variable definition and measurement

Variable	Definition	Source
	Digital Finance	
Use_Mob_Int.	Individuals who have used, made, or received any digital transaction = 1; 0 otherwise	Findex Database
	Financial Inclusion	Findex Database
Saved	"Saved with formal account/mobile phone": Individuals who saved with formal account/ mobile money (e.g., banks, savings, and loans company) = 1; 0 otherwise	Findex Database
Borrowed	"Borrowed with formal account/mobile phone": Individuals who have borrowed with formal account/mobile money (e.g., banks, savings, and loans company) = 1; 0 otherwise	Findex Database
	Financial Resilience	Findex Database
Emergency funds	Individuals who would find it very possible or somewhat possible to access emergency funds in the next month = 1; 0 otherwise	Findex Database
	Other Variable Definitions	Findex Database
Gender	Female = 1; male = 0	Findex Database
Phone	Phone owner = 1; no phone = 0	Findex Database
Internet access	Internet access =1; no internet access = 0	Findex Database
Location	Rural = 1; urban = 0	Findex Database
Age group	Age of respondents (5 groups)	Findex Database
Lowest 20%	Dummy equals 1 for lowest 20%, 20 if not	Findex Database

Variable	Definition	Source
Lower 20%	Dummy equals 1 lower 20%, 20 if not	Findex Database
Middle 20%	Dummy equals 1 middle 20%, 20 if not	Findex Database
Higher 20%	Dummy equals 1 higher 20%, 20 if not	Findex Database
Highest 20%	Dummy equals 1 highest 20%, 20 if not	Findex Database
Employment	Dummy equals 1 if respondent is employed, 20 if not	Findex Database
Primary education	Dummy equals 1 if respondent attained primary education, 20 if not	Findex Database
Secondary education	Dummy equals 1 for attaining secondary education, 20 if not	Findex Database

4. Empirical Results

4.1 Descriptive Statistics

Table 2 shows that 53.4% of the sample are females and 48.6% are males. A majority of the respondents, 49.9%, reported attaining secondary education; 44.1% reported attaining primary education; and 6% reported attaining at least a tertiary education certificate. Statistics on respondents' age showed that 30.8% are below the age of 25, 32.6% are between 26 and 35 years, 17.3% are between 36 and 45 years; 9.4% are between 46 and 55 years, and 9.9% are 55 years or older. With regard to respondents' income distribution, 27.3% are in the fifth quintile, 20.8% are in the fourth quintile, 18.5% are in the middle quintile, 16.7% are in the fourth quintile, and 16.8% are in the first quintile. Employment among the respondents is high: 72.1% reported being employed. Respondents are mainly located in rural areas: 55.5% are in rural areas.

Table 2. Descriptive summary statistics

Variable	Measure	Freq.	Percent	Cum.
Gender				
	Male	11,663	46.58	46.58
	Female	13,374	53.42	100
Education				
	Primary	11,042	44.1	44.1
	Secondary	12,495	49.91	94.01
	Tertiary	1,500	5.99	100
Age				
	Below 25	7,711	30.80	30.80
	26–35	8,169	32.63	63.43
	36–45	4,321	17.26	17.26
	46–55	2,363	9.44	90.13
	Above 56	2,473	9.87	100.00
Income				
	Poorest 20%	4,208	16.81	16.81
	Second 20%	4,172	16.66	33.47
	Middle 20%	4,627	18.48	51.95
	Fourth 20%	5,204	20.79	72.74
	Richest 20%	6,826	27.26	100
Employment				
	Unemployed	6,992	27.93	27.93
	Employed	18,045	72.07	100
Location				
	Urban	10,237	44.48	44.48
	Rural	12,780	55.52	100
Source of Emergency Fund				
	Savings	4,149	16.57	16.57
	Friends/Rel./Family	8,118	32.42	49
	Work	3,732	14.91	63.9
	Borrowing	1,852	7.4	71.3
	Assets	2,591	10.35	81.65
	Others	969	3.87	85.52
	Couldnt	2,731	10.91	96.43
	Dont_know	895	3.57	100

Variable	Measure	Freq.	Percent	Cum.
Saved				
	no	10,715	42.8	42.8
	yes	14,322	57.2	100
Borrowed				
	no	11,234	44.87	44.87
	yes	13,803	55.13	100
Mobile phone				
	No_mobile	5,590	22.33	22.33
	Own_mobile	19,447	77.67	100
Internet Access				
	No_access	14,415	57.57	57.57
	Access	10,622	42.43	100

Source: Authors' construct from the Global Findex Dataset 2021.

Indicators of digital finance, financial inclusion, and financial resilience show that 77.7% of the respondents owned a mobile phone and 42.4% had internet access. Regarding savings, 57.2% of the respondents reported to have saved. More people, 55.1%, borrowed. Respondents' sources of emergency funds were from family, relatives, and friends (32.4%); work (14.9%); and the sale of assets (10.4%). In times of emergency, 16.7% of respondents used their savings; only 7.4% of respondents borrowed.

4.2 Regression Results

The regression results are presented in three sections. The first part presents the impact of digital finance on financial inclusion, the second part discusses the impact of digital finance and financial inclusion on financial resilience, and the third part examines the mediating role of digital finance on the relationship between financial inclusion and financial resilience.

Impact of Digital Finance on Financial Inclusion

Table 3 presents digital finance on financial inclusion (savings and borrowing).

Table 3. Impact of digital finance on financial inclusion indicators

	Saved		**Borrowed**	
VARIABLES	**Coefficients**	**Dy/dx**	**coefficients**	**Dy/dx**
Digital finance	0.276	0.106	0.0809	0.0313
	(0.598)	(0.232)	(0.563)	(0.218)
female	0.0405*	0.0155*	-0.00964	-0.00373
	(0.0221)	(0.00873)	(0.0200)	(0.00768)
employed	0.448***	0.175***	0.329***	0.129***
	(0.0547)	(0.0216)	(0.0568)	(0.0225)
rural	-2.33e-05	-8.95e-06	0.131***	0.0507***
	(0.0285)	(0.0109)	(0.0316)	(0.0130)
Secondary_educ	0.183**	0.0700**	0.106	0.0411
	(0.0874)	(0.0313)	(0.0866)	(0.0325)
Tertiary_educ	0.283**	0.108**	0.134	0.0518
	(0.125)	(0.0446)	(0.124)	(0.0466)
Poor	0.135***	0.0517***	0.133***	0.0512***
	(0.0348)	(0.0126)	(0.0336)	(0.0124)
middle	0.261***	0.100***	0.172***	0.0666***
	(0.0440)	(0.0147)	(0.0450)	(0.0162)
rich	0.307***	0.117***	0.162***	0.0624***
	(0.0504)	(0.0165)	(0.0533)	(0.0193)
richest	0.418***	0.160***	0.127*	0.0490*
	(0.0633)	(0.0200)	(0.0716)	(0.0265)
age_26_35	0.0214	0.00820	0.0991***	0.0383***
	(0.0401)	(0.0151)	(0.0356)	(0.0130)
age_36_45	0.0437	0.0167	0.0861*	0.0333**
	(0.0488)	(0.0183)	(0.0451)	(0.0167)

	Saved		Borrowed	
VARIABLES	**Coefficients**	**Dy/dx**	**coefficients**	**Dy/dx**
age_46_55	0.00752	0.00288	-0.0405	-0.0156
	(0.0539)	(0.0205)	(0.0531)	(0.0208)
age_56above	-0.0852	-0.0326	-0.197***	-0.0760***
	(0.0683)	(0.0270)	(0.0695)	(0.0285)
Mobile owner	0.321**	0.123***	0.196	0.0755
	(0.132)	(0.0468)	(0.131)	(0.0488)
Internet access	0.392***	0.150***	0.146	0.0562
	(0.117)	(0.0404)	(0.122)	(0.0459)
Constant	-1.065***		-0.611***	
	(0.0545)		(0.0403)	
Observations	23,017	23,017	23107	23017
Wald chi-square	3210	.	1101	.
p	0	.	0	.
Loglikelihood	-26142	.	-27714	.

Note: The table shows IV-Probit results of regression of financial inclusion indicators (dependent variable) on digital finance and individual socioeconomic attributes. Measures of financial inclusion are saved and borrowed. Saved is labelled 1 if the individual saved with a formal account/mobile phone and 0, otherwise. Borrowed is labelled 1 if the individual borrowed with a formal account/ mobile phone. Digital finance is labelled 1 for use of internet/mobile phone for transactions and 0, otherwise. Gender is labelled 1 for female and 0, otherwise. Location is 1 for rural and 0, otherwise. The omitted age category is less than 25 years. The omitted education category is primary education, and the omitted income category is the poorest 20%. Mobile owner is labelled 1 for owning a mobile phone and 0, otherwise. Internet access is labelled 1 and 0, otherwise Standard errors in parentheses, *** p<0.01, ** p<0.05, and * p<0.1, imply statistical significance. dy/dx is marginal effects. The instrument variable for digital finance is digital tax/fees.

In Table 3, the first column shows savings as an indicator of financial inclusion, with the IV-Probit model estimates and the robust standard errors in parenthesis and marginal effects and the corresponding standard errors also in parenthesis. The independent variables include digital finance instrumented with taxes on digital infrastructure and services, mobile ownership, internet access, and other individual-level covariates. The results indicate that while digital finance is positively correlated with financial inclusion (savings and borrowing), the relationship is not statistically significant. This finding suggests that access to digital finance alone does not directly enhance financial inclusion, potentially due to barriers such as low financial literacy, transaction costs, or trust issues with digital platforms.

The female dummy showed a significant positive correlation with savings and a correlation with borrowing. Female respondents were 4.1% more likely to save than male respondents and 0.96%

less likely to borrow. The marginal effects show that the likelihood of saving among female respondents is 1.5% higher than that of male respondents, and the likelihood of borrowing is 0.37% lower. The findings are consistent with those of Dar and Ahmed (2021) and Asuming et al. (2019), who found that females are relatively more likely to save and less likely to borrow. The findings, however, contradict those of Mndolwa and Alhassan (2020), who found that women are less likely to save and more likely to borrow. This finding is likely attributable to the low earning capacity of women in Africa and their dependence on men. Most households in Africa are headed by men who take responsibility for welfare. Women in Sub-Saharan Africa have microfinance institutions that provide loans for them to start or expand their businesses.

Employment is positive and significantly correlated with financial inclusion. Respondents who have jobs are 44.8% more likely to save and 32.9% more likely to borrow. Their likelihood of saving is 17.5% higher than that of unemployed respondents and their likelihood of borrowing is 12.9% higher than that of unemployed respondents. People who are employed receive income and, therefore, can decide to save some for future spending. The findings are in line with those of Kumar et al. (2019), who found a negative correlation between saving and borrowing among unemployed people in India. The propensity to be financially included is high for employed people because they are in a better place to pay back borrowed funds and associated interest.

Respondents' level of education affects the probability of being financially included. The results reveal that people with secondary education are 18.3% more likely to save and 10.6% more likely to borrow. For tertiary education, the likelihood of saving is 28.3% more and that of borrowing is 13.4% more. The impact on saving is, however, more significant than on borrowing. Compared with people with no more than primary education, people with secondary education are more 7.0% more likely to save and 4.1% likely to borrow. Respondents with tertiary education are 10.8% more likely to save and 5.8% more likely to borrow. The finding that the likelihood of using formal financial services increases with educational attainment is similar to that of Kumar et al. (2019). People with a high level of education have a better appreciation of the benefits of being financially included and hence make efforts to access formal financial services. As established in the literature, financial exclusion is high among households with low levels of education.

All the income dummies are positive and significant on the indicators of financial inclusion. The impact increases across the income levels, with the richest quintile having the highest probability of saving and borrowing. The poor have a 13.5% greater likelihood of saving and a 13.3% greater likelihood of borrowing, middle-income people have a 26.1% greater likelihood of saving and a 17.2% greater likelihood of borrowing, and the rich have a 30.7% greater likelihood of saving and a 16.2% greater likelihood of borrowing. People in the richest quintile have a 41.8% greater likelihood of saving and a 12.7% greater likelihood of borrowing. Compared with the poorest quintile, the poor are 5.2% more likely to save and 5.1% more likely to borrow, middle-income people are 10% more likely to save and 6.6% more likely to borrow, the rich are 11.7% more likely to save and 6.2% more likely to borrow, and the richest are 16.0% more likely to save and 4.9% more likely to borrow. As incomes increase, the probability of saving and borrowing increases (Sakyi-Nyarko et al. 2022; Sanderson et al. 2018). People with high income are easily integrated in the financial system, in part because providers of financial products and services reach out to them in the hope of keeping their monies with them.

The ages of respondents are not as significantly correlated with the saving indicator of financial inclusion as with borrowing indicator. The youngest age group is most likely to borrow. The oldest age group is least likely to borrow. This finding shows a nonlinear relationship between age and financial inclusion (Sakyi-Nyarko et al. 2022). It reveals that younger people trying to build their lives will require financing for business, school, and investments. People between the ages of 25 to 45 years are active and may still be schooling and looking for job opportunities. They are more likely to borrow to fund their education or business. Older people are near retirement or may have retired and may have children who will take care of them and their households.

Mobile phone ownership and internet access affect saving and borrowing. Ownership of mobile phone increases the likelihood of saving by 32.1% and borrowing by 19.6%. Internet access increases the likelihood of saving by 39.2% and borrowing by 14.6%. Compared with those without mobile phones and internet access, those with mobile phones are 12.3% more likely to save and those with internet access are 15.0% more likely to save. This finding agrees with that of Abor et al. (2018), who found that mobile telephony has a positive impact on financial inclusion and inclusive growth. The likelihood of borrowing among mobile phone owners and people with internet access is insignificant.

Effects of Digital Finance and Financial Inclusion on Financial Resilience

Table 4 shows how digital finance and financial inclusion independently affect financial resilience, and Table 5 presents results on the interaction effect of digital finance and financial inclusion on financial resilience.

Table 4. Effects of digital finance and financial inclusion on financial resilience

		Financial Resilience		
VARIABLES	**Coefficients**	**Dydx(*)**	**Coefficients**	**Dydx(*)**
Saved	0.657	0.273	0.309	0.121
	(0.534)	(0.229)	(1.200)	(0.507)
Borrowed	-0.423***	-0.176***	-0.330	-0.129
	(0.0880)	(0.0413)	(0.213)	(0.123)
Digital finance	-0.156	-0.0649	-0.0606	-0.0238
	(0.185)	(0.0785)	(0.271)	(0.114)
Female			-0.0127	-0.00497
			(0.0266)	(0.0116)
Employed			-0.163	-0.0645
			(0.132)	(0.0693)
Rural			-0.0505**	-0.0198**
			(0.0216)	(0.00769)

		Financial Resilience		
VARIABLES	**Coefficients**	**Dydx(*)**	**Coefficients**	**Dydx(*)**
Secondary_Educ			-0.0314	-0.0123
			(0.0485)	(0.0225)
Tertiary_educ			0.334***	0.131***
			(0.0985)	(0.0173)
Poor			-0.0877*	-0.0344
			(0.0451)	(0.0264)
Middle			-0.145*	-0.0570
			(0.0808)	(0.0482)
Rich			-0.139	-0.0544
			(0.0978)	(0.0544)
Richest			0.107	0.0419
			(0.156)	(0.0486)
age_26_35			0.0596***	0.0234*
			(0.0229)	(0.0125)
age_36_45			0.165***	0.0649***
			(0.0292)	(0.0183)
age_46_55			0.201***	0.0789***
			(0.0344)	(0.0235)
age_56above			0.295***	0.116***
			(0.0341)	(0.0409)
Mobile owner			-0.187**	-0.0734
			(0.0774)	(0.0520)
Internet access			0.0403	0.0158
			(0.124)	(0.0441)
Constant	-0.514***		-0.226***	
	(0.121)		(0.0759)	

		Financial Resilience		
VARIABLES	**Coefficients**	**Dydx(*)**	**Coefficients**	**Dydx(*)**
Observations	25,037	25,037	23,017	23,017
Wald Chi-square	357.9	.	810.0	.
p	0	.	0	.
Loglikelihood	-30807	.	-27352	.

Note: The table shows IV-Probit results of regression of financial resilience on financial inclusion indicators, digital finance, and individual socioeconomic attributes. Financial resilience is the ability to raise emergency funds in 30 days, labelled 1 for not difficult and 0, otherwise. Measures of financial inclusion are saved and borrowed. Saved is labelled 1, if the individual saved with a formal account/mobile phone and 0, otherwise. Borrowed is labelled 1, if the individual borrowed with a formal account/mobile phone. Digital finance is labelled 1 for the use of internet/mobile phone for transactions and 0, otherwise. Gender is labelled 1 for female and 0, otherwise. Location is 1 for rural and 0, otherwise. The omitted age category is less than 25 years. The omitted education category is primary education, and the omitted income category is the poorest 20%. Mobile phone ownership is labelled 1 and 0, otherwise. Internet access is labelled 1 and 0, otherwise. Standard errors in parentheses, *** p<0.01, ** p<0.05, and * p<0.1, imply statistical significance. dy/dx is marginal effects. FI is instrumented with distance, bank branches per 1,000km2.

The variables of interest in the results in Table 4 are saved, borrowed, and digital finance. The results show that the effect of saving and digital finance is not significant on financial resilience.

With respect to borrowing, the results show a significant negative correlation between financial resilience and financial inclusion. Respondents who borrow are 42.3% less likely to be financially resilient, and the likelihood of being financially resilient among those who borrow is 17.6% lower than among those who do not borrow. This finding agrees with that of Mbouombouo Mfossa (2019) but not with that of Suri et al. (2021), who found that loans and access to credit have shock-mitigating impacts and may build financial resilience. The significant negative impact of borrowing on financial resilience suggests that individuals who rely on loans for emergencies may become more financially vulnerable due to high repayment costs, unstable income, or poor loan structuring. This finding aligns with that of Yue et al. (2022), who argue that borrowing can lead to debt cycles and financial distress. Additionally, individuals may borrow reactively rather than proactively, worsening their financial situation (Suri et al. 2021) and highlighting the need for regulated and affordable credit options that do not exacerbate financial stress.

Respondents in rural areas are 5% less likely to be financially resilient than those in urban areas, a finding significant at the 1% level. Compared with urban dwellers, rural dwellers are 1.9% less likely to be financially resilient. The result aligns with findings of Belayeth Hussain et al. (2019), Mbouombouo Mfossa (2019), and Tinta et al. (2022). Urban areas are relatively developed, with well-structured infrastructure and institutions to provide better avenues for economic activities.

Respondents with at least tertiary educational attainment were 33.4% more likely to be financially resilient than respondents with primary level of education. Compared with respondents with primary educational attainment, respondents with at least tertiary educational attainment had a 13.1% higher likelihood of being financially resilient, a finding significant at the 1% level. Tinta et al. (2022) and Belayeth Hussain et al. (2019) found that having a tertiary education increases the probability of being financially resilient. Highly educated people can plan. Moreover, educated people can understand how to invest in financial products and services to smooth their consumption

and provide a cushion in times of shocks. Secondary educational attainment was not a significant factor in financial resilience. All the age dummies were positively correlated with financial resilience and increased with increasing age. The youngest age cohort was 5.9% more likely to be financially resilient, the second-oldest age cohort was 16.5% more likely to be financially resilient, the third-oldest cohort was 20.1% more likely to be financially resilient, and the oldest age cohort was 29.5% more likely to be financially resilient. Compared with the youngest group, the other age groups are 2.3%, 6.5%, 7.9%, and 11.6%, respectively, more likely to be financially resilient. Financial resilience improves with age from the findings and as confirmed by Salignac et al. (2019).

Except for the richest 20%, income dummies showed a negative correlation with financial resilience. Poor respondents are 8.7% less likely and middle-income respondents are 14.5% less likely to be financially resilient. Compared with the poorest (reference group), the poor were 3.4% less likely to be financially resilient, and the middle-income respondents were 5.7% less likely to be financially resilient. By contrast, Salignac et al. (2019), Belayeth Hussain et al. (2019), Mbouombouo Mfossa (2019), Noerhidajati et al. (2021), and Chipunza and Fanta (2023) all found that higher income is associated with a greater likelihood of financial resilience. This study's finding is attributable to respondents' level of income dependence, which reduces their ability to accumulate precautionary savings and meet basic living expenses. They are, therefore, not prepared financially to accommodate adverse shocks. This finding is consistent with that of Handayani et al. (2016), who found that higher income increases the likelihood of financial vulnerability, hence, low resilience.

Mobile ownership is negatively correlated with financial resilience at a 10% significance level. People with mobile phones are 18.7% less likely to be financially resilient, showing that mobile phone ownership reduces the ability of people to adequately deal with adverse shocks. The reason is that mobile phones do not generate income for owners, and it may be expensive to own mobile phones. Internet access is, however, positively linked to financial resilience but not significantly so. Internet access increases the likelihood of financial resilience by 4.0%. This finding disagrees with that of Kelikume (2021), who found that mobile penetration and use of internet had a significant effect on welfare.

Interaction Effects of Digital Finance and Financial Inclusion on Financial Resilience

Table 5 presents the impact of the interaction of financial inclusion and digital finance on financial resilience.

Table 5. Interaction effects of digital finance and financial inclusion on financial resilience

	Financial Resilience	
VARIABLES	**Coefficient**	**Dydx(*)**
saved#digitalfinance	0.183***	0.0653***
	(0.0450)	(0.0172)
borrowed#digitalfinance	-0.264***	-0.0943***
	(0.0302)	(0.0121)
Female	-0.00813	-0.00290
	(0.0180)	(0.00643)
Employed	-0.156***	-0.0565***
	(0.0204)	(0.00770)
Rural	-0.0613***	-0.0219***
	(0.0190)	(0.00680)
secondary_educ	-0.0262	-0.00935
	(0.0209)	(0.00748)
tertiary_educ	0.341***	0.121***
	(0.0428)	(0.0152)
poor	-0.0867***	-0.0309***
	(0.0300)	(0.0107)
middle	-0.137***	-0.0490***
	(0.0297)	(0.0107)
rich	-0.128***	-0.0457***
	(0.0291)	(0.0105)
richest	0.126***	0.0448***
	(0.0285)	(0.0101)
age_26_35	0.0516**	0.0184**
	(0.0225)	(0.00801)
age_36_45	0.163***	0.0582***
	(0.0268)	(0.00958)

	Financial Resilience	
VARIABLES	**Coefficient**	**Dydx(*)**
age_46_55	0.206***	0.0734***
	(0.0328)	(0.0117)
age_56above	0.305***	0.109***
	(0.0327)	(0.0118)
mobileowner	-0.177***	-0.0630***
	(0.0230)	(0.00849)
internetaccess	0.0567**	0.0202**
	(0.0230)	(0.00810)
Constant	-0.275***	
	(0.0367)	
Observations	23,017	23,017
Wald Chi-square	655.1	.
ρ	0	.
Loglikelihood	-19519	.

Note: This tables shows the IV-Probit results of regression of financial resilience (dependent variable) on financial inclusion indicators, digital finance, and individual socioeconomic attributes. Financial resilience is the ability to raise emergency funds in 30 days, labelled 1 for not difficult and 0, otherwise. Measures of financial inclusion are saved and borrowed. Saved is labelled 1, if the individual has saved with a formal account/mobile phone and 0, otherwise. Borrowed is labelled 1 if the individual borrowed with a formal account/mobile phone. Digital finance is labelled 1 for the use of internet/mobile phone for transactions and 0, otherwise. Gender is labelled 1 for female and 0, otherwise. Location is 1 for rural and 0, otherwise. The omitted age category is less than 25 years. The omitted education category is primary education, and the omitted income category is the poorest 20%. Mobile owner is labelled 1 for mobile phone ownership and 0, otherwise. Internet access is labelled 1 and 0, otherwise Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1, imply statistical significance. dy/dx is marginal effects.

The results in Table 5 show the full specification of the interaction between financial inclusion and digital finance on financial resilience. The interaction between digital finance and savings is positive and highly significant at the 1% level. Households that save and use digital finance experience an 18.3% increase in their financial resilience and is significant. This finding is consistent with that of Krishnan et al. (2019), who found resilience among people who are adept technologically. This finding may be attributable to their ability to leverage the benefits of both saving and digital platforms. They earn from saving and reduce the distance, time, and cost of their transactions. The interaction between borrowing and digital finance is negatively correlated with financial resilience and is significant at the 1% level. The likelihood that households that use digital platforms for borrowing are financially resilient is reduced by 26.4%. This finding shows that

digital platform fees and charges, coupled with interest on borrowed funds, exacerbates the adverse financial situation of respondents, reducing their likelihood of being financially resilient.

5. Conclusion and Policy Implications

Researchers, policymakers, and development partners are increasingly interested in technology and innovation growth, the challenges of existing financial inclusion efforts, gaps in financial inclusion, and evidence that even financially included households may not be resilient. This study set out to identify the implications of digital finance and financial inclusion on financial resilience, using microdata from the Global Findex database for the year 2021 in 25 Sub-Saharan African countries. We found that those with mobile phones are three times more financially resilient than those without mobile phones and that about 42% of the respondents have internet access. Among respondents, 57% save and 55% borrow. Interestingly, the main source of emergency funds for respondents is from family, friends, and relatives. Only 17% saved for emergencies, and 7% borrowed in times of adverse shocks. Digital finance did not significantly impact financial inclusion, likely because of respondents' low level of digital and financial literacy and cultural beliefs. Gender, employment, education, income, mobile ownership, and internet access are strongly correlated with financial inclusion (saving and borrowing); location and age showed a significant correlation with borrowing. Therefore, stakeholders must implement programs and policies to promote digital and financial literacy and to sensitize people to the benefits of using digital platforms for financial services.

Whereas savings and digital finance do not significantly impact financial resilience, significant borrowing reduces the likelihood of being financially resilient. Gender and internet access have no significant effect on financial resilience. Location, age, education, and mobile phone ownership significantly affect financial resilience, as do tertiary educational attainment and low and middle incomes. In terms of policy implications, financial service providers should increase their services to the excluded to close gender, age, location, and income gaps. Specific products should be tailored to the needs and circumstances of these groups. Avenues for borrowing should be strengthened to curb bad borrowing behaviours.

Those who use digital finance are less likely to be financially resilient; however, the interaction between saving and digital finance shows that those who save through digital finance significantly increase their likelihood of being financially resilient. On the contrary, those who borrow through digital finance reduce their likelihood of being financially resilient. Ease of access to borrowing may allow people to pile up debts, reducing their resilience.

Because financial inclusion is not an end, this study explored its relationship to resilience moderated by digital finance. Poverty, inequality, and economic growth have been shown to have an inverse relationship with financial inclusion. Growth in technology raises the expectation of a levelled improvement in financial inclusion and its impact on inclusive growth and well-being. The focus of this study is on financial resilience in the face of life events, including loss of life, loss of wealth, loss of job, health crisis, and disasters.

Whilst there is an increase in mobile phone ownership and internet access, use of digital financial services is low and, hence, its impact on financial inclusion is low. Financial inclusion reduces the likelihood that borrowers, rural dwellers, poor and middle-income households, and mobile phone owners are financially resilient. It is also observed that people who save through digital finance

have a significant likelihood of being financially resilient, and those who borrow through digital finance significantly reduce their likelihood of being financially resilient. The direct implication is the need to ensure cautious use of mobile phones for borrowing. The study establishes the need to leverage technology for financial services, and it provides evidence of the financial inclusion and financial resilience nexus. Because technology and innovation have a positive impact on financial inclusion, efforts to increase their use should be intensified, particularly in rural areas.

The implications of this study's findings are that governments and central banks must invest in digital technology infrastructure (internet connectivity) and must make digital financial services available in rural communities. Financial service providers, such as banks and fintech firms, should reduce subscription fees and other service charges to help low-income earners use digital platforms for transactions. Commercial and rural banks, microfinance institutions, and fintech firms should close gender, age, location, and income service gaps, tailoring products to the needs and circumstances of excluded groups. Avenues for borrowing should be strengthened to curb bad borrowing behaviours. Furthermore, employed people should be provided with welfare cushions to help them withstand unexpected shocks. State pension regulators can allow for deductions in retirement benefits to help employed people deal with immediate shocks. Women should be empowered to save and build buffers and to invest in entrepreneurial ventures to improve their resilience.

This study does not incorporate all the dimensions of financial inclusion, digital finance, and financial resilience. Future studies could assess these other dimensions and could use multi-period data to establish causality among digital finance, financial inclusion, and financial resilience.

REFERENCES

Abor, J. Y., M. Amidu, and H. Issahaku. 2018. "Mobile Telephony, Financial Inclusion and Inclusive Growth." *Journal of African Business* 19 (3): 430–453.

Aitken, R. 2007. *Performing Capital: Toward a Cultural Economy of Popular and Global Finance*. New York: Springer.

Al-Smadi, M. O. 2023. "Examining the Relationship between Digital Finance and Financial Inclusion: Evidence from MENA Countries." *Borsa Istanbul Review* 23 (2): 464–472.

Anderson, S., and R. G. Newell. 2003. "Simplified Marginal Effects in Discrete Choice Models." *Economics Letters* 81 (3): 321–326.

Arun, T., and R. Kamath. 2015. "Financial Inclusion: Policies and Practices." *IIMB Management Review* 27 (4): 267–287.

Ashenafi, B. B., and Y. Dong. 2022. "Financial Inclusion, Fintech, and Income Inequality in Africa." *FinTech* 1 (4): 376–387.

Ashiru, F., F. Nakpodia, and J. J. You. 2023. "Adapting Emerging Digital Communication Technologies for Resilience: Evidence from Nigerian SMEs." *Annals of Operations Research* 327 (2): 795–823.

Asuming, P. O., L. G. Osei-Agyei, and J. I. Mohammed. 2019. "Financial Inclusion in Sub-Saharan Africa: Recent Trends and Determinants." *Journal of African Business* 20 (1): 112–134.

Atwell, R. C., L. A. Schulte, and L. M. Westphal. 2009. "Linking Resilience Theory and Diffusion of Innovations Theory to Understand the Potential for Perennials in the US Corn Belt." *Ecology and Society* 14 (1).

Ayadi, Rym, and Mais Shaban. 2020. "Digital Financial Inclusion: A Pillar of Resilience Amidst COVID-19 in the Mediterranean and Africa." EMEA Policy Paper. Euro-Mediterranean Economists Association, Barcelona.

Bede Uzoma, A., A. E. Omankhanlen, G. Obindah, A. Arewa, and L. U. Okoye. 2020. *"Digital Finance as a Mechanism for Extending the Boundaries of Financial Inclusion in Sub-Saharan Africa: A General Methods of Moments Approach."* Cogent Arts & Humanities 7 (1): 1788293.

Belayeth Hussain, A., N. Endut, S. Das, M. T. A. Chowdhury, N. Haque, S. Sultana, and K. J. Ahmed. 2019. "Does Financial Inclusion Increase Financial Resilience? Evidence from Bangladesh." Development in Practice 29 (6): 798–807.

Buckland, J. 2018. *Building Financial Resilience: Do Credit and Finance Schemes Serve or Impoverish Vulnerable People?* Cham: Springer.

Chipunza, K. J., and A. B. Fanta. 2023. "Quality Financial Inclusion and Financial Vulnerability." *International Journal of Consumer Studies* 47 (2): 784–800.

Dar, A. B., and F. Ahmed. 2021. "Financial Inclusion Determinants and Impediments in India: Insights from the Global Financial Inclusion Index." *Journal of Financial Economic Policy* 13 (3): 391–408.

Davis, F. D. 1989. “Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology.” *MIS Quarterly* 13 (3): 319–340.

Davis, G. F. 2009. *Managed by the Markets: How Finance Re-shaped America*. Oxford: Oxford University Press.

Demir, A., V. Pesqué-Cela, Y. Altunbas, and V. Murinde. 2022. “Fintech, Financial Inclusion and Income Inequality: A Quantile Regression Approach.” *The European Journal of Finance* 28 (1): 86–107.

Demirgüç-Kunt, A., L. Klapper, D. Singer, and S. Ansar. 2021. “Financial Inclusion, Digital Payments, and Resilience in the Age of COVID-19.” Global Findex Database, 225. Washington, DC: World Bank.

Durai, T., and G. Stella. 2019. “Digital Finance and Its Impact on Financial Inclusion.” *Journal of Emerging Technologies and Innovative Research* 6 (1): 122–127.

Ediagbonya, V., and C. Tioluwani. 2022. “The Role of Fintech in Driving Financial Inclusion in Developing and Emerging Markets: Issues, Challenges and Prospects.” *Technological Sustainability* 2 (5).

El-Zoghbi, M. 2019. “Toward a New Impact Narrative for Financial Inclusion.” CGAP Research and Analysis COVID-19 Briefing. Consultative Group to Assist the Poor, Washington, DC. https://www.cgap.org/research/publication/toward-new-impact-narrative-for-financial-inclusion.

Erol, O., B. J. Sauser, and M. Mansouri. 2010. “A Framework for Investigation into Extended Enterprise Resilience.” *Enterprise Information Systems* 4 (2): 111–136.

McFarland, Daniel J., and Diane Hamilton. 2006. “Adding contextual specificity to the technology acceptance model.” *Computers in human behavior* 22, no. 3: 427-447.Greene, William H. 1996. *“Marginal Effects in the Bivariate Probit Model.”* Working Paper No. EC-96-11. New York University, Leonard N. Stern School of Business, Department of Economics, New York.

Gronbach, Lena. 2023. “Social Cash Transfers in Sub-Saharan Africa: Financialization, Digitization and Financial Inclusion.” *In Financializations of Development*, edited by Ève Chiapello, Anita Engels, and Eduardo Gonçalves Gresse, 169–181. London: Routledge.

Ha, Le Thanh. 2022. “Effects of Digitalization on Financialization: Empirical Evidence from European Countries.” *Technology in Society* 68: 101912. https://doi.org/10.1016/j.techsoc.2021.101912.

Handayani, D., U. Salamah, and R. N. Yusacc. 2016. “Indebtedness and Subjective Financial Wellbeing of Households in Indonesia.” *Economics and Finance in Indonesia* 62 (2): 78–87.

Holling, C. S. 1973. “Resilience and Stability of Ecological Systems.” *Annual Review of Ecology and Systematics* 4 (1): 1–23.

Hussain, M., and A. Papastathopoulos. 2022. “Organizational Readiness for Digital Financial Innovation and Financial Resilience.” *International Journal of Production Economics* 243: 108326.

Hussen, M. S., and M. A. Mohamed. 2023. “Impact of Financial Inclusion on Household Welfare in Ethiopia.” *Future Business Journal* 9 (1): 1–12.

Kass-Hanna, J., A. C. Lyons, and F. Liu. 2022. "Building Financial Resilience through Financial and Digital Literacy in South Asia and Sub-Saharan Africa." *Emerging Markets Review* 51: 100846.

Kelikume, I. 2021. "Digital Financial Inclusion, Informal Economy and Poverty Reduction in Africa." Journal of Enterprising Communities: People and Places in the Global Economy 15 (4): 626–640.

Khera, P., S. Ng, S. Ogawa, and R. Sahay. 2022. "Measuring Digital Financial Inclusion in Emerging Market and Developing Economies: A New Index." *Asian Economic Policy Review* 17 (2): 213–230.

Krishnan, N. K., A. Johri, R. Chandrasekaran, and J. Pal. 2019. "Cashing Out: Digital Payments and Resilience Post-Demonetization." *In Proceedings of the Tenth International Conference on Information and Communication Technologies and Development (ICTD '19)*, 1–16. New York: Association for Computing Machinery. https://doi.org/10.1145/3287098.3287103.

Kumar, A., R. Pal, and R. Pal. 2019. "Usage of Formal Financial Services in India: Demand Barriers or Supply Constraints?" *Economic Modelling* 80: 244–259.

Li, C., D. S. Poskitt, and X. Zhao. 2019. "The Bivariate Probit Model, Maximum Likelihood Estimation, Pseudo True Parameters and Partial Identification." *Journal of Econometrics* 209 (1): 94–113.

Machasio, Immaculate Nafula. 2020. "COVID-19 and Digital Financial Inclusion in Africa: *How to Leverage Digital Technologies During the Pandemic."* Africa Knowledge in Time Policy Brief No. 4. World Bank, Washington, DC. https://openknowledge.worldbank.org/handle/10986/34637.

Matemba, E. D., and G. Li. 2018. "Consumers' Willingness to Adopt and Use WeChat Wallet: An Empirical Study in South Africa." *Technology in Society* 53: 55–68.

Mbouombouo Mfossa, Patrick-Hervé. 2019. "Mobile Money-Driven Financial Inclusion and Financial Resilience in Sub-Saharan Africa: Insights from Cameroon." Paper presented at *En quête d'impact: la finance inclusive au service des Objectifs du Développement Durable*, organized by ADA (Appui au Développement Autonome), October, Ouagadougou, Burkina Faso. https://hal.archives-ouvertes.fr/hal-03622403.

McKnight, A. 2019. *Financial Resilience Among EU Households: New Estimates by Household Characteristics and a Review of Policy Options*. Luxembourg: Publications Office of the European Union. https://doi.org/10.2767/472697.

Mndolwa, Fulgence D., and Abdul Latif Alhassan. 2020. "Gender Disparities in Financial Inclusion: Insights from Tanzania." *African Development Review* 32 (4): 578–590.

Mohd Daud, Siti Nurazira, Ahmad Hafiz Ahmad, and Wan Azman Sulaiman Wan Ngah. 2021. "Financialization, Digital Technology and Income Inequality." *Applied Economics Letters* 28 (16): 1339–1343.

Molino, Monica, Carlo G. Cortese, and Chiara Ghislieri. 2020. "The Promotion of Technology Acceptance and Work Engagement in Industry 4.0: From Personal Resources to Information and Training." *International Journal of Environmental Research and Public Health* 17 (7): 2438.

Noerhidajati, Siti, Achmad Baiquni Purwoko, Hanif Werdaningtyas, Achmad Imam Kamil, and Teguh Dartanto. 2021. "Household Financial Vulnerability in Indonesia: Measurement and Determinants." *Economic Modelling* 96: 433–444.

Onukwugha, Eberechukwu, Jason Bergtold, and Rashmi Jain. 2015. "A Primer on Marginal Effects—Part I: Theory and Formulae." *Pharmacoeconomics* 33: 25–30.

Oyekale, Abayomi S. 2021. "Willingness to Take COVID-19 Vaccines in Ethiopia: An Instrumental Variable Probit Approach." *International Journal of Environmental Research and Public Health* 18 (17): 8892.

Ozili, Peterson K. 2018. "Impact of Digital Finance on Financial Inclusion and Stability." *Borsa Istanbul Review* 18 (4): 329–340.

Pomeroy, Robert, Carlos Arango, Clarissa G. Lomboy, and Sarah Box. 2020. "Financial Inclusion to Build Economic Resilience in Small-Scale Fisheries." *Marine Policy* 118: 103982.

Sakyi-Nyarko, Charles, Ahmad Hafiz Ahmad, and Christopher J. Green. 2022. "The Gender-Differential Effect of Financial Inclusion on Household Financial Resilience." *The Journal of Development Studies* 58 (4): 692–712.

Salignac, Flavia, Anne Marjolin, Rebecca Reeve, and Kristy Muir. 2019. "Conceptualizing and Measuring Financial Resilience: A Multidimensional Framework." *Social Indicators Research* 145: 17–38.

Sanderson, Abel, Learnmore Mutandwa, and Pierre Le Roux. 2018. "A Review of Determinants of Financial Inclusion." *International Journal of Economics and Financial Issues* 8 (3): 1.

Sha'ban, Mohammed, Claudia Girardone, and Anna Sarkisyan. 2019. "Financial Inclusion: Trends and Determinants." *In Frontier Topics in Banking: Investigating New Trends and Recent Developments in the Financial Industry*, edited by Maria-Gabriella Baldarelli and Giuseppe Del Giudice, 119–136.

Suri, Tavneet, Prashant Bharadwaj, and William Jack. 2021. "Fintech and Household Resilience to Shocks: Evidence from Digital Loans in Kenya." *Journal of Development Economics* 153: 102697.

Swamy, Vighneswara. 2019. "Financial Inclusion and the Resilience of Poor Households." *The Journal of Developing Areas* 53 (4).

Thathsarani, Udeshika S., and Wei Jianguo. 2022. "Do Digital Finance and the Technology Acceptance Model Strengthen Financial Inclusion and SME Performance?" *Information* 13 (8): 390.

Tinta, Aminu A., Idrissa M. Ouédraogo, and Rafia M. Al-Hassan. 2022. "The Micro Determinants of Financial Inclusion and Financial Resilience in Africa." *African Development Review* 34 (2): 293–306.

United Nations 2016. “Digital financial inclusion. international telecommunication union (itu), issue brief series, inter-agency task force on financing for development.” July. *United Nations (Issue July) [online]*

Van Breda, Adrian D. 2018. “A Critical Review of Resilience Theory and Its Relevance for Social Work.” *Social Work* 54 (1): 1–18.

Van der Zwan, Natascha. 2014. “Making Sense of Financialization.” *Socio-Economic Review* 12 (1): 99–129.

Vargo, Stephen L., Melissa A. Akaka, and Helge Wieland. 2020. “Rethinking the Process of Diffusion in Innovation: A Service-Ecosystems and Institutional Perspective.” *Journal of Business Research* 116: 526–534.

Venkatesh, Viswanath, and Hillol Bala. 2008. “Technology Acceptance Model 3 and a Research Agenda on Interventions.” *Decision Sciences* 39 (2): 273–315.

Williams, Richard. 2012. “Using the Margins Command to Estimate and Interpret Adjusted Predictions and Marginal Effects.” *The Stata Journal* 12 (2): 308–331.

Yue, Peng, Aybike G. Korkmaz, Zhiguo Yin, and Hong Zhou. 2022. “The Rise of Digital Finance: Financial Inclusion or Debt Trap?” *Finance Research Letters* 47: 102604.

Headquarters
72B El-Maahad El-Eshteraky Street
Roxy, Heliopolis, Cairo 11341, Egypt
info@afreximbank.com
T +(202) 2456 4100/1/2/3/4

Abidjan Branch
3ème Etage, Immeuble CRRAE-UMOA,
Angle Boulevard Botreau Roussel –
Rue Privée CRRAE-UMOA Abidjan,
Côte d'Ivoire
abidjan@afreximbank.com
T +(225) 2030 7300

Caribbean Office
African Export-Import Bank
Banque Africaine d'Import-Export
Trident Insurance Financial center
Hastings, Christ Church,
Highway 7, Bridgetown,
Barbados BB5156
T +(246) 833 4636

Abuja Branch
Afreximbank African Trade Centre
Plot 1573, off Ralph Shodeinde
Street, Central Business District,
Abuja 900001, P.M.B 601, Garki 2,
Abuja, Nigeria
abuja@afreximbank.com
T: +(234) 9 460 3160

Harare Branch
Eastgate Building, 3rd Floor
(North Wing), Sam Nujoma Street
Harare, Zimbabwe P.O. Box CY 1600
Causeway, Harare, Zimbabwe
harare@afreximbank.com
T +(263) 4 700 904 / 941

Kampala Branch
Rwenzori Towers, 3rd Floor, Wing A,
Plot 6 Nakasero P.O. Box 28412
Kampala, Uganda
kampala@afreximbank.com
T +(256) 417 892 700
+(256) 312 423 700

Yaoundé Branch
National Social Insurance
Fund (NSIF) Headquarters Building,
Town Hall, Independence Square
P.O. Box 405, Yaoundé, Cameroon
yaoundebranch@afreximbank.com

afreximbank.com