The Transformative Impact of Digital Financial Inclusion Among Marginalized Groups on Economic Growth

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Abstract

The study empirically analyzes the effect of digital financial inclusion on economic growth in Africa. The digital financial inclusion variables are ownership of digital financial devices/mobile money accounts and usage of digital financial services for female, poor, less educated, and unemployed individuals in the region. Panel data is collected from 39 African countries over three years (2014, 2017, and 2022). The Fixed Effect (Fe) Model and system Generalized Method of Moments (GMM) estimation techniques are performed. The results show a significant and positive impact of using digital financial services on the economic growth of all marginalized groups in Africa. This promising finding underscores the potential of digital financial inclusion to drive economic growth and development. Therefore, the study recommends that the government and other stakeholders formulate specific policies to ensure that marginalized groups are empowered in the digital financial world and contribute to the overall development of the countries on the continent.

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1.Introduction

The advent of digital financial inclusion in Africa in recent years has facilitated economic growth and development. Digital financial inclusion (DFI henceforth) refers to using digital devices and platforms to engage in critical financial services, including savings, credit, insurance, and payments (World Bank, 2023). This definition implies active usage and the full integration of such services into individuals' daily economic activities. Digital finance technology, such as mobile money and digital banking, has increased the number of people with access to financial services (Willige, 2023). This trend is significant for a continent where the availability of traditional banking infrastructure is low, and the gap between supply and demand for finance is wide. The prevalence and easy access to mobile devices and digital platforms offer unprecedented opportunities to promote financial inclusion, enabling more and more people to actively participate in the economy and better withstand crises of any nature (World Bank, 2023).

In the last decade, Africa has seen remarkable economic growth. This growth, however, has been far from inclusive, as a large portion of the population: women, the poor, the less educated, and the unemployed, have been excluded from the formal financial sector. As they tend to live in areas where traditional banking infrastructure has limited reach, these people lack access to financial services desperately needed to facilitate both their economic participation and resilience. The expansion of digital finance and various types of digital banking, such as mobile money, offers a revolutionary way of addressing this limitation and thus promoting financial inclusion. Nonetheless, how much digital financial inclusion contributes to economic growth, including growth per income belt, based on this poorly served population in Africa, has not been studied enough. This paper intends to fill this gap and, particularly, how the ownership of digital finance equipment or usage of mobile money accounts relates to economic growth across the continent feature known vulnerable population groups with perennial risk of exclusion from financial activities: women, the poor, the less educated, and the unemployed.

The ownership of digital financial devices, including mobile phones and mobile money accounts, serves as crucial financial inclusion indicators because ownership marks the first step towards integrating individuals into the formal financial system (Shaikh, 2024). Nevertheless, ownership is not enough by itself; implemented financial devices should be actively used by populations. This study will address how both variables, such as ownership and usage, have contributed to economic growth and development and have done so in the case of female, poor, less educated, and unemployed people. The current research aims to reveal how DFI has led to economic and developmental growth within heterogeneous African contexts by disaggregating the data by these demographic factors. Thus, the study is essential since it can inform policy. As governments, financial institutions, and development organizations actively work to improve financial inclusion that would directly result in economic growth, understanding the significance of DFI is essential. Hence, the research suggests some valuable insights about the success of enabling digital finances that reach underserved populations, contributing to achieving broader economic goals. Overall, the results of the present study can inform the development of broad efforts aimed at implementing DFI to achieve inclusive economic growth in Africa.

Due to these implications, the study significantly impacts practice and policy. As for the implications for practice, the study's findings may suggest new, more advanced ways of improving financial inclusion so that more categories of people can access and benefit from financial services.

The findings show that not all categories of people can access financial services through digital means with equality. The findings may also guide the development of policy guidelines that steer the implementation of measures that enhance financial stability among various people. Lastly, the study may be helpful to future scholars working on the same or related topics.

1. Empirical review

Other empirical studies have examined the influence of digital financial inclusion and economic growth in Africa. Kelikume (2021) examined the correlation between mobile phones, the internet, financial inclusion, the informal economy, and poverty reduction. The study found that mobile phones, financial inclusion, and internet usage positively influence the informal economy and poverty reduction. Adrianaivo and Kpodar (2012) also found that mobile phone growth promotes financial inclusion and indirectly increases the region's economic growth. The results abide with other studies by Lundqvist et al. (2014), who also examined the effect of mobile phone growth on economic growth and found that mobile phone growth positively impacts economic growth in African countries. Solomon and Klyton (2020) examined the impact of digital technology on economic growth in Africa and found that the impact is positive and significant. The results follow Yawe et al. (2022), who examined mobile money's and digital payments' influence on financial inclusion. However, Iddrisu and Chen (2022) found that digital financial inclusion does not significantly influence African economic growth. Mhlanga and Mpofu (2023) examined the benefits of adopting digital financial inclusion in Africa. The study found that digital financial inclusion in Africa influences economic growth and stability. Also, Elouaourti and Ibourk (2024) examined factors affecting digital financial services. They found that low levels of education, income, and poor infrastructure are significant barriers to digital financial inclusion in the region. But, Mhlanga (2023) found that blockchain technology is the dominant factor in promoting digital financial inclusion. Nabieu et al., (2023) examined the interrelationships between financial inclusion and regional economic growth. The study found that financial inclusion has a positive influence on economic growth. The results correspond with the study by Wale-Awe and Evance (2023), who also found that digital financial inclusion has reduced poverty and inequality and increased economic growth. Elouardighi and Oubejja (2023) analyzed the relationship between digital financial inclusion and women's labor force participation in Africa. The study found that digital financial inclusion has a positive influence on the level of women's participation in the labor market. Also, Cabeza-García et al., (2019) examined the effects of female financial inclusion on inclusive economic development in 91 countries. The study found a positive effect on economic development influenced by women's financial inclusion. These results follow other studies by Gammage et al., (2017) and Sekantsi (2019). Winful et al. (2022) examined the relationship between financial inclusion and African economic development. The study found that financial inclusion is significant in explaining economic development. The results abide with other studies by Odu (2020), Raji (2020), and Awinja and Fatoki, (2021). Ojo (2022) took a case study from four African countries, Ghana, Kenya, Namibia, and Lesotho, to examine the influence of digital financial inclusion on women's economic empowerment. The study found a significant influence of digital financial inclusion on economic development among women in those countries, which abides with other studies by Yang et al. (2022) and Mishra and Bvuma (2022). Azu et al., (2023) investigated the correlation between women's labor force participation and digital financial inclusion. The study found that the financial digital inclusion of women significantly influences their economic empowerment and labor participation rate in Africa. Ngong et al., (2024) examined the relationship between financial technology and economic growth in East African countries. The

study found a significant relationship between financial technology and economic growth. The results abide with other studies by Mavilia (2020). In Ghana, Abor et al., (2018) examined the influence of mobile money on welfare, and they found that mobile penetration and financial inclusion significantly increase household welfare in the country. Chinoda (2018) examined the determinants of financial inclusion in Africa. The study found a cointegrating relationship between financial inclusion and economic growth. Mugisha (2024) found that information and communication technologies encourage financial inclusion in rural African Communities. Mishra and Bvuma (2022) found that using mobile money promotes economic empowerment for marginalized groups in South Africa. These results contradict what Onwere and Olufemi (2023) found by estimating the relationship between the financial development and economic growth in Kenya and Nigeria. The author found that mobile banking has an insignificant impact on economic growth in the long run. Also, Appah et al., (2023) examined the relationship between digital financial services and economic growth in Nigeria. They found that automated teller machine services have no significant influence on economic growth in Nigeria. Olanrewaju and Aluko (2024) examined the accessibility of financial services and the role of digital finance in addressing the gender gap in Nigeria. The study found that more men than women have access to digital finance platforms, but digital finance has great potential to encourage financial inclusion. Mpofu (2023) studied digital financial inclusion and digital literacy in Africa and concluded that digital financial inclusion is crucial for people's empowerment and economic growth. Museba et al. (2021) examined the impact of digital financial services in Uganda and found a positive impact on mobile money in simplifying access to financial services and economic empowerment. These results abide with Shaikh et al. (2023), who also analyzed the influence of mobile money services on digital financial inclusion and found that mobile money stimulates inclusion and customer empowerment.

Thaddeus et al., (2020) analyzed the effect of digital financial inclusion on economic growth in sub-Saharan Africa. The study found a causal relationship between digital financial inclusion and economic growth in the long run. The results follow Ugwuanyi et al., (2022), who conducted a case study in Sub-Saharan Africa and found that digital financial inclusion positively and significantly impacts economic growth across income levels. Sarpong and Nketiah-Amponsah (2022) found that using financial services has more effect on inclusive economic growth than the knowledge and availability of financial services. Lyons et al., (2020) examined the impact of digital financial inclusion on poverty in Sub-Saharan countries and South Asia. The study found that financial digital inclusion is associated with significant poverty reduction. Ahmad et al., (2023) used a sample from sub-Saharan Africa and the rest of the world and found that mobile money positively influences economic growth through direct and indirect channels. Specifically, mobile money tends to improve financial inclusion, promoting growth. The results abide with other studies by Ahmad et al., (2020), which examined the effect of mobile technology on economic development and financial inclusion and found a positive significant influence of mobile money on financial inclusion and growth in Sub-Saharan countries. Also, Alhassan et al., (2021) examined the relationship between mobile money activities, financial development, and innovation growth in sub-Saharan Africa. They found that mobile money influences financial innovation and economic growth. Jungo et al., (2022) found a positive and unidirectional relationship between economic growth and digital financial innovation and that the latter affected the former. Kouladoum (2023) examined the effect of digital infrastructural development on inclusive economic growth. The study found that internet usage and the number of fixed telephone and mobile cellular subscriptions influence inclusive growth in Sub-Saharan across all income levels.

These results abide with another study by Agyemang-Badu et al., (2018). Chinoda and Kapingura (2024) found that institutional quality substantially influences the effect of digital financial inclusion on economic growth in sub-Saharan African countries. Akinola (2021) analyzed the socio-economic influence of FinTech ecosystems and electronic banking business in Sub-Saharan Africa and found that they significantly impact economic growth. Nan (2019) examined the relationship between mobile money and socio-economic development in sub-Saharan Africa. The study found a positive influence of mobile money on society's economic development. Alhassan and Koaudio (2019) examined the impact of mobile money on economic development. They found a significant positive relationship between mobile money and economic development in sub-Saharan Africa.

Taking a case study from countries outside Africa, Ozturk and Ullah (2022) examined the effect of digital financial inclusion on economic growth in one Belt and Road Initiative (OBRI). The study found that digital financial inclusion increases economic growth. Geng and He (2021) also conducted a case study on countries along the Belt and Road (B&R) and found that digital financial inclusion drives sustainable employment and economic growth. Liu et al., (2021) analyzed the influence of digital financial inclusion on economic growth in China and found that digital financial inclusion development significantly contributes to economic growth. The results follow other studies by Ahmad et al., (2021), who also took a case study in China. Tay et al., (2022) studied Asian countries and found that digital financial inclusion reduces poverty. Wang and Fu (2023) examined the effect of digital financial inclusion on poverty alleviation in China. The study found that digital financial inclusion reduces poverty alleviation significantly. Luo et al., (2022) examined the effect of digital finance inclusion on household income in China. They found that inclusion has a significant effect on increasing income and reducing consumption inequality. In Indiana States, Pradhan and Sahoo (2021) examined the relationship between financial inclusion, mobile phones, and economic growth. The study found short and long-run causal relationships between the variables. Shen et al., (2021) examined the correlation between digital financial inclusion and economic growth in developing countries. The study found that digital financial inclusion has a significantly positive effect on economic growth. Also, Omar and Inaba (2020), who examined the effect of financial inclusion on poverty reduction in developing countries, found that financial inclusion significantly reduces poverty rates and maximizes overall welfare.

While existing studies provide valuable insights into various aspects of the digital financial inclusion-economic growth relationship, there is a need for research specifically focusing on how the usage and ownership of digital financial services by marginalized and underprivileged people affect the economy in Africa. Through this analysis, this study aims to fill a gap in the literature and provide a comprehensive understanding of the role of digital finance in increasing economic growth in the region in the region. Also, by building upon existing research and addressing the regional-specific nexus of digital financial inclusion and economic growth, this study seeks valuable insights into the ongoing discourse on the issue.

2. Methodology

3.1.Sample and Data Sources

This study uses panel data from 39 African countries pooled in 3 years (2014, 2017, and 2022). The data is collected from secondary sources, whereby the dependent variable is gross domestic product data collected from the World Bank indicators. The main independent variables, ownership, and usage of digital payment for female, less educated, poor, and unemployed people

data, were also collected from the Global Findex Database. All other control variables, gross capital formation, money supply, inflation rate, infrastructure, population growth, trade openness, and level of technology, are also obtained from the World Bank indicators, except foreign direct investment, which is collected from UNCTAD.

3.2.Variables description

The GDP growth rate, our dependent variable, is measured as a percentage value. The main independent variables are the ownership of digital payment, measured by the percentage of respondents who report personally having a mobile money service in the past year, and usage of digital payment, measured by the percentage of respondents who report using mobile money, a debit or credit card, or a mobile phone to make a payment from an account. Our expectation for all independent variables is positive, suggesting that an increase in the ownership and usage of digital financial services for marginalized individuals can significantly boost economic growth in Africa. This optimistic hypothesis, supported by a wealth of literature, including Mhlanga (2023), Solomon and Klyton (2020) and Yawe et al., (2022), offers a hopeful outlook for the potential of digital financial services in Africa.

Other control variables that also affect the GDP growth rate are Gross capital formation, a proxy for domestic investment measured in percentage of GDP, the Foreign Direct Investment (FDI) inflow measured as a percentage of GDP, money supply, which is the proxy for financial deepening and is measured as a percentage of GDP, inflation rate measured in percentage growth annually, infrastructure which is proxied by air transportation, population is the number of people in the country, trade openness is the summation of import and export, and level of technology is proxied by high-technology exports as a percentage of the GDP. Our expectation for these variables is positive except for population, suggesting that an increase in gross capital formation, money supply, inflation rate, infrastructure, trade openness, and level of technology can boost the GDP growth rate. This reassuring hypothesis, supported by a substantial body of literature, including Onwere and Olufemi (2023), Appah et al., (2023), Thaddeus et al. (2020), Ugwuanyi et al., (2022), Sarpong and Nketiah-Amponsah (2022), and Ahmad et al., (2023), as well as our own study as shown in Table 1, provides a strong foundation for our research findings.

Table 1: Variable name, definition, and source and priori hypothesis

Variable	Definition	Source	Priori expectations
Gross Domestic Product (gdprate)	The annual percentage growth rate of GDP	World Bank (WDI)	
usage of digital payment services (digital)	The percentage of respondents who report using mobile money, a debit or credit card, or a mobile phone to make a payment from an account or who report using the internet to pay bills or to buy something online or in a store in the past year.	Global Findex database	+
usage of digital payment services for females (digitalf)	The percentage of respondents who report using mobile money, a debit or credit card, or a mobile phone to make a payment from an account or who report using the internet to pay bills or to buy	Global Findex database	+

	something online or in a store in the past year for female (% age 15+)		
usage of digital payment services for less educated (digitalpeduc)	The percentage of respondents who report using mobile money, a debit or credit card, or a mobile phone to make a payment from an account or who report using the internet to pay bills or to buy something online or in a store in the past year for primary educated or less (% ages 15+)	Global Findex database	+
usage of digital payment services for the poor (digitalpoor)	The percentage of respondents who report using mobile money, a debit or credit card, or a mobile phone to make a payment from an account or who report using the internet to pay bills or to buy something online or in a store in the past year for poorest 40% (% ages 15+)	Global Findex database	+
usage of digital payment services for the unemployed (digitalunemp)	The percentage of respondents who report using mobile money, a debit or credit card, or a mobile phone to make a payment from an account or who report using the internet to pay bills or to buy something online or in a store in the past year for unemployed (% ages 15+)	Global Findex database	+
ownership of digital payment service (moacc)	The percentage of respondents who report personally having a mobile money account in the past year.	Global Findex database	+
ownership of digital payment service for females (moaccf)	The percentage of respondents who report personally having a mobile money account for females in the past year.	Global Findex database	+
ownership of digital payment service for less educated (moaccpeduc)	The percentage of respondents who report personally having a mobile money account for primary education or less in the past year.	Global Findex database	+
ownership of digital payment services for poor (moaccpoor)	The percentage of respondents who report personally having a mobile money account for the poor in the past year.	Global Findex database	+
ownership of digital payment service for the unemployed (moaccunemp)	The percentage of respondents who report personally having a mobile money account for the unemployed in the past year.	Global Findex database	+
Gross capital formation (gcf)	Gross capital formation (% of GDP)	World Bank (WDI)	+
Money supply (ms)	Broad money (% of GDP)	World Bank (WDI)	+
Inflation rate (infl)	Inflation, consumer prices (annual %)	World Bank (WDI)	+

Trade	The summation of import and export (% of GDP)	World Bank (WDI)	+
Population (pop)	The number of people in the country	World Bank (WDI)	-
Infrastructure (lninfras)	Air transport, registered carrier departures worldwide	World Bank (WDI)	+
level of technology (tech)	high-technology exports (% of GDP)	World Bank (WDI)	+
Foreign direct investment (fdi)	Foreign direct investment inflow (% of GDP)	UNCTAD	+

Source: Authors' compilation, 2024

3.3.Model specification

For regression analysis, the econometric model includes the coefficients and error term. To incorporate the dynamic behavioral relationship of economic growth in each country, a fixed effect panel model is estimated. Therefore, the two econometric models (representing digital usage and ownership) are specified as follows:

$$gdprate_{it} = \alpha_0 + \alpha_1 D_{it} + \alpha_2 X_{it} + \mu_i + \varepsilon_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

$$gdprate_{it} = \alpha_0 + \alpha_1 O_{it} + \alpha_2 X_{it} + \mu_i + \varepsilon_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

Where D represents the digital usage variables, O represents the digital device ownership variables, and X represents the control variables. $\boldsymbol{\alpha_0}$ is the intercept term that measures the impact on economic growth when all the independent variables are zero. The coefficients $\boldsymbol{\alpha_1}$ and $\boldsymbol{\alpha_2}$ measure the impact magnitude of each variable has on economic growth, $\boldsymbol{\varepsilon}$ is the error term capturing all other factors that the study did not include in the model but affect the dependent variable. $\boldsymbol{\mu_i}$ represents the unobserved effect, which is country-specific. They are assumed to be different across the country ***i*** while they are fixed over time. Finally, i and t represent the specific country and period (yearly), respectively.

Although fixed and random models take into account country-specific heterogeneities, the difficulty arises when the lagged variables are correlated with the error term even if we assume that the disturbances are not themselves auto-correlated (Wintoki et al., 2012). To reduce these problems, we will employ the Arellano-Bond/Blundell-Bond estimator, which addresses the problem of omitted variable bias, endogeneity, and unit root effects in the choice of instruments (Bond 1991; Bond 1998; Bover 1995; Holtz-Eakin, 1988).

We first differentiate the variables to remove any major bias in the time-variant variable heterogeneity. Then, these first differences are used as instrument variables in an equation with level variables. (Roodman, 2009). Therefore, this system of equations where both the differenced and level variables are incorporated in one equation is called the system Generalized Methods of Moments (GMM).

$$\begin{bmatrix} gdprate_{it} \\ \Delta gdprate_{it} \end{bmatrix} = \alpha \begin{bmatrix} gdprate_{it-1} \\ \Delta gdprate_{it-1} \end{bmatrix} + \beta \begin{bmatrix} lnX_{it} \\ \Delta lnX_{it} \end{bmatrix} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Whereby Δ means the difference, and t-1 means the lag term. Arellano-Bond developed moment conditions by using the lagged levels of the dependent variables and determined variables with the first differences of the disturbances. However, according to Arellano and Bover (1995) and Blundell and Bond (1998), the lagged levels can be weak instruments if the autoregressive process is too persistent. Therefore, Arellano and Blundell suggested using extra moment conditions whereby there is an orthogonal relationship between the lagged changes of dependent variables and the level of the disturbances.

3. Estimation Results

4.1. Regression analysis between usage of digital financial service and economic growth

In Table 2, Fixed Effect (Fe) regression analysis reveals a significant finding: the usage of digital financial services has a positive and statistically significant impact on the economic growth of all African marginalized groups. The positive coefficients indicate that an increase in the usage of digital financial services for females, less educated, poor, unemployed, and overall leads to a respective increase in the economic growth rate by 0.104, 0.131, 0.116, 0.110, and 0.0982 percent. These results not only support the priori hypothesis of the study but also align with findings from other studies bySolomon and Klyton (2020), Yawe et al., (2022), Mhlanga (2023), Onwere and Olufemi (2023), Ebimobowei et al. (2023), Thaddeus et al. (2020), Ugwuanyi et al. (2022), Sarpong Nketiah-Amponsah (2022), and Ahmad et al., (2023).

Control variables that also abide by the priori hypothesis are gross capital formation (columns 2-4), money supply (columns 2 and 3), inflation rate, population growth, trade openness, and level of technology (columns 1, 3, and 4). The coefficients representing gross capital formation, money supply, inflation rate, trade openness, and level of technology are positive and significant, implying that an increase in these factors will increase the economic growth in Africa. The coefficient representing population is negative and statistically significant, indicating that an increase in population decreases the economic growth in the region.

These results underwent some diagnostic tests, which justified them. The Hausman test determines whether the random or fixed effects model is appropriate for analyzing panel data in this study. The results show the p-values are 0.0001, 0.0069, 0.0120, 0.0154, and 0.0151 for all the columns, which are less than 1 percent. This means the study rejects the null hypothesis that the difference in coefficient is not systematic and concludes that the fixed-effect model is more appropriate than the random-effect model.

Table 2: Fixed effect estimation: The dependent variable is the GPD growth rate

Model	Fe	Fe	Fe	Fe	Fe
Variables	Gdprate	gdprate	gdprate	gdprate	gdprate
digitalf	0.104**				
	(0.0435)				
digitalpeduc		0.131***			
		(0.0397)			
digitalpoor			0.116**		

			(0.0423)		
digitalunemp				0.110**	
				(0.0468)	
digital					0.0982**
					(0.0414)
gcf1	0.110	0.113*	0.114*	0.116*	0.107
	(0.0662)	(0.0613)	(0.0645)	(0.0668)	(0.0662)
ms	0.0634	0.0645*	0.0629*	0.0583	0.0632
	(0.0372)	(0.0337)	(0.0359)	(0.0381)	(0.0373)
infl	0.0576**	0.0503**	0.0527**	0.0584**	0.0558**
	(0.0225)	(0.0212)	(0.0222)	(0.0225)	(0.0227)
trade	0.0793*	0.0977**	0.0988**	0.0864**	0.0943**
	(0.0417)	(0.0383)	(0.0402)	(0.0415)	(0.0413)
lnpop	-13.84**	-14.87***	-13.41**	-12.29**	-13.52**
	(5.485)	(4.776)	(4.984)	(5.095)	(5.418)
lninfras	0.110	0.0216	0.155	0.144	0.0780
	(0.358)	(0.333)	(0.340)	(0.355)	(0.364)
tech	0.0940*	0.0691	0.0906*	0.0975*	0.0900
	(0.0542)	(0.0514)	(0.0529)	(0.0542)	(0.0545)
fdi1	-0.123	-0.137	-0.145	-0.153	-0.135
	(0.108)	(0.101)	(0.106)	(0.110)	(0.109)
Constant	218.3**	234.7***	209.8**	192.5**	212.2**
	(91.70)	(79.71)	(83.03)	(85.20)	(90.36)
Observations	61	61	61	61	61
R-squared	0.580	0.638	0.601	0.577	0.578
Number of id	26	26	26	26	26

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3 represents a system GMM analysis between the usage of digital financial services and economic growth. The results show that using digital financial services has a positive and statistically significant impact on economic growth across all African marginalized groups. The positive coefficients imply that an increase in the usage of digital financial services for females, less educated, poor, and unemployed overall increases the economic growth rate by 0.0735, 0.0884, 0.0896, 0.0901, and 0.0663 percent, respectively. The results correspond with the priori hypothesis of the study and other studies by Mhlanga (2023), Onwere and Olufemi (2023), Ebimobowei et al. (2023), Sarpong and Nketiah-Amponsah (2022), and Ahmad et al., (2023).

Table 3: System GMM estimation: The dependent variable is the GPD growth rate

Model	sys-gmm	sys-gmm	sys-gmm	sys-gmm	sys-gmm
Variables	Gdprate	gdprate	gdprate	gdprate	gdprate
L.gdprate	0.365**	0.386**	0.344**	0.356**	0.371**
	(0.170)	(0.166)	(0.173)	(0.173)	(0.168)
digital	0.0663***				

	(0.0209)				
digitalf		0.0735***			
		(0.0235)			
digitalpeduc			0.0884***		
			(0.0276)		
digitalpoor				0.0896***	
				(0.0283)	
digitalunemp					0.0901***
					(0.0284)
Observations	78	78	78	78	78
Number of id	39	39	39	39	39

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.2. Regression analysis between ownership of the digital financial account and economic growth

Table 4 represents a Fixed Effect (Fe) regression analysis between ownership of mobile money accounts and economic growth. The results show that ownership of digital financial accounts has a positive and statistically significant impact on the economic growth of all marginalized groups in Africa. The positive coefficients imply that an increase in the ownership of digital financial accounts for females, less educated, poor, and unemployed overall increases the economic growth rate by 0.120, 0.136, 0.114, 0.117, and 0.104 percent, respectively. The results correspond with the priori hypothesis of the study and other studies by Ahmad (2020), Alhassan et al. (2021), Jungo et al. (2022), and Pradhan and Sahoo (2021).

Control variables that abide by the priori hypothesis are gross capital formation (columns 1 and 2), money supply, inflation rate, population growth, trade openness (columns 2-5), and level of technology. The coefficients representing gross capital formation, money supply, inflation rate, trade openness, and level of technology are positive and significant, implying that an increase in these factors will increase the economic growth in Africa. The coefficient representing population is negative and statistically significant, implying that an increase in population decreases the region's economic growth.

These results underwent some diagnostic tests, which justified them. The Hausman test determines whether the random or fixed effects model is appropriate for analyzing panel data in this study. The results show the p-values are 0.0102, 0.0108, 0.0205, 0.0203, and 0.0144 for all the columns, which are less than 1 percent. This means the study rejects the null hypothesis that the difference in coefficient is not systematic and concludes that the fixed-effect model is more appropriate than the random-effect model.

Table 4: Fixed effect estimation: The dependent variable is the GPD growth rate

Model	Fe	Fe	Fe	Fe	Fe
Variables	Gdprate	gdprate	gdprate	gdprate	gdprate
moaccf	0.120***				
	(0.0425)				

moaccpeduc		0.136***			
		(0.0425)			
moaccpoor			0.114**		
			(0.0435)		
moaccunemp				0.117**	
				(0.0539)	
moacc1					0.104**
					(0.0391)
gcf1	0.115*	0.123*	0.108	0.109	0.105
	(0.0641)	(0.0622)	(0.0650)	(0.0674)	(0.0646)
ms	0.0757**	0.0759**	0.0757**	0.0771**	0.0744**
	(0.0345)	(0.0333)	(0.0352)	(0.0364)	(0.0351)
infl	0.0585**	0.0534**	0.0556**	0.0590**	0.0578**
	(0.0215)	(0.0211)	(0.0222)	(0.0228)	(0.0219)
trade	0.0646	0.0740*	0.0793*	0.0769*	0.0788*
	(0.0412)	(0.0392)	(0.0411)	(0.0427)	(0.0410)
lnpop	-15.10***	-14.39***	-12.10**	-12.41**	-14.07**
	(5.379)	(4.823)	(4.871)	(5.444)	(5.305)
lninfras	0.100	0.107	0.200	0.198	0.111
	(0.345)	(0.330)	(0.342)	(0.358)	(0.350)
tech	0.113**	0.109**	0.113**	0.111*	0.117**
	(0.0522)	(0.0504)	(0.0531)	(0.0549)	(0.0529)
fdi1	-0.128	-0.115	-0.124	-0.124	-0.125
	(0.105)	(0.101)	(0.106)	(0.110)	(0.106)
Constant	240.0**	227.5***	189.4**	194.5**	222.2**
	(89.97)	(80.54)	(81.35)	(90.90)	(88.60)
Observations	59	59	59	59	59
R-squared	0.615	0.640	0.601	0.573	0.604
Number of id	25	25	25	25	25

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5 represents a system GMM analysis of mobile money account ownership and economic growth. The results show that mobile money account ownership positively and statistically significantly impacts economic growth across all African marginalized groups. The positive coefficients imply that an increase in mobile money ownership accounts for females, the less educated, the poor, and the unemployed. Overall, it increases the economic growth rate by 0.0735, 0.0884, 0.0896, 0.0901, and 0.0663 percent, respectively.

Table 5: System GMM estimation: The dependent variable is the GPD growth rate

Model	(sys-gmm)	(sys-gmm)	(sys-gmm)	(sys-gmm)	(sys-gmm)
Variables	Gdprate	gdprate	gdprate	gdprate	gdprate
L.gdprate	0.404**	0.411**	0.363*	0.399**	0.408**
	(0.173)	(0.171)	(0.187)	(0.170)	(0.173)

moacc1	0.0947***				
	(0.0325)				
moaccf		0.106***			
		(0.0364)			
moaccpeduc			0.140***		
			(0.0483)		
moaccpoor				0.131***	
				(0.0438)	
moaccunemp					0.135***
					(0.0467)
Observations	76	76	76	76	76
Number of id	38	38	38	38	38

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4. Discussion and Conclusion

The findings of this research paper confirm that digital financial inclusion has a strong and transformative effect on economic growth in Sub-Saharan Africa, particularly for several disadvantaged groups like women, the poor, the less educated, the jobless, and others. As most of this population has a high rate of access exclusion, mobile-based services are breaking this barrier, and those households can now grow their economic output and increase their income-generating ability, contributing to their improved living standards. Economically, women benefit from financial inclusion by providing the financial ability to start and expand businesses, invest in their children's health and education, and secure financial independence. This has not only helped individual women and their children, but it has also spurred broader development and gender equality. Digital financial inclusion has improved access to economic opportunities among the poor and less educated. For instance, they cannot save with local institutions but with mobile money, save with banks, and choose better loans. This way, they can invest in profitable income-generating activities, upgrading the standard of living. A sufficient mobile account and other digital financial management tools give the poor the necessary resources for handling extreme risk and seizing the economic opportunities that arise. Finally, the jobless have grown through digital financial inclusion. For example, digital modes make it easier for people to work because there are no entry obstacles.

Thus, the proven positive and statistically significant influence of digital financial services on economic growth for all these marginalized groups indicates the indispensable role of financial inclusion in promoting sustainable development. This study implies that policymakers concerned with financial institutions and development-oriented organizations could use this information to develop and implement coherent strategies to increase the uptake of digital financial services among the disadvantaged. By so doing, they could fasten economic growth to related exponents, with inclusivity and socio-transformational equity forming the tower of an economy-friendly economy for everyone in Africa. From the discussion above, we assert that digital financial inclusion in Africa is a great weapon for economic growth and socio-transformation. Towards the

direction of sustainable development and inclusivity, Africa would realize some of the greatest moments, raining every potential candidate down in the stream of economic strides.

5. Policy recommendations

Based on the findings of this study, which showed that digital financial inclusion had a statistically significant positive effect on economic growth for marginalized populations in Africa, the following policy recommendations have been suggested to realize the above benefits and promote inclusive economic growth;

Digitization of Financial Infrastructure: The government should collaborate with private sector players to build and expand mobile network coverage, which is the foundation for digital access, increase internet connectivity, and make affordable digital devices widely available. As a ripple effect, this infrastructure will also make marginalized populations like women, the poor, the less educated, the unemployed, and others easy to access and use.

Promotion of Financial Literacy and Digital Skills: the government and other stakeholders should promote Financial Literacy and Digital Skills to empower marginalized populations. Governments, NGOs, and financial institutions can achieve this by implementing targeted training programs to equip people with the skills to use digital financial services effectively.

Develop inclusive services: Financial institutions must develop services that cater to the particular needs of the financially excluded. Some inclusion services include microloans, low-balance savings accounts, insurance services, and remittance services operated under a framework suitable for gender, the financially weak, the less educated, and the jobless people. The characteristics of inclusive services include usability, affordability, and reachability to ensure high adoption and engagement levels.

Strengthen regulatory guidelines: Providing fertile ground in terms of guidelines for the financial and digital market environment is critical. Such measures should also enable market passage to innovative players and digital regulations. Thus, the main recommendations for policymakers are to reexamine and correlate regulation with the fast-paced digital financial world. In addition, a reflection on user safety, the competitive nature of businesses, and the market of innovations is required. It is also crucial to simplify the licensing regime to remove the obstacles to creating and developing innovative startups.

Following the above policy recommendations, African countries may successfully promote digital financial inclusion through economies of growth and social equity. Moreover, these specific policies ensure that traditionally marginalized groups are empowered and contribute to the overall development of the countries on the continent. This way, all stakeholders are engaged and benefit from economic progress.

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