

The Impact of Financial Inclusion on Economic Growth and Poverty Reduction: Empirical Evidence from sub-Saharan Africa

Abdul Karim Kamara 

Abstract

This study examines the impact of financial inclusion (FI) on economic growth (EG) and poverty reduction in 18 sub-Saharan Africa (SSA) over the period from 2014 to 2021. The study employs fixed effects, random effects, panel-corrected standard errors (PCSE), Driscoll Kraay standard errors, the generalized method of moments (GMM), and quantile regression. A FI composite index was created using principal component analysis (PCA). According to the findings from all the models, FI has a significant positive effect on EG, and it also reduces poverty in SSA. The findings from the quantile regression indicate that countries with a higher Human Development Index (HDI) have a more significant decline in poverty. Therefore, governments and policymakers must prioritize the implementation of policies that facilitate the accessibility, availability, and usability of financial products and services. Such measures will contribute to fostering inclusive economic growth and poverty reduction in SSA.



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1. Introduction

The financial system plays a crucial role in the economy by performing various functions, including savings, borrowing, payment processing, risk management, and facilitating equity investments. These functions highlight the significance of establishing financial institutions in sub-Saharan Africa (SSA). The effectiveness of a financial system can be evaluated by its performance in each of these functions. Despite notable progress made by financial institutions, such as loan institutions, microfinance, savings, banks, credit unions, and cooperative societies in expanding financial services, a substantial portion of the global adult population still lacks access to formal financial services. According to the World Findex Report 2021, approximately 1.4 billion remain excluded from the formal financial system Worldwide, and in SSA, financial services fail to reach or cover approximately 45% of its adult population (Demirgüç-Kunt et al., 2021)

Financial inclusion (FI) refers to the state in which there is broad and affordable availability of financial aid, financial literacy, and comprehensive financial services for all economic sectors, geographical regions, and social demographics (Kama & Adigun, 2013). The primary goal of FI is to foster reasonable and balanced economic growth (EG) by facilitating savings and investment accumulation. This, in turn, enables the efficient allocation of resources of resources from sectors facing scarcity to sectors facing surplus in society. FI guarantees the availability of financial services, promotes the freedom and self-sufficiency of marginalized individuals, and enables their integration into society (Imboden, 2005). It is considered a pivotal component in achieving the Millennium Development Goals (MDGs) established by the UN in 2000 and is recognized as a means to fulfill the agenda of the Sustainable Development Goals (SDGs) agenda set by the UN in 2015. The primary objectives of FI initiatives align with the eradication of poverty and the mitigation of economic disparity. Since 2000, the majority of African governments have been implementing FI initiatives in line with the MDGs to reduce poverty and income inequality.

African countries have made significant progress in accessing financial services during the last two decades. With the growth of the financial sector in several African countries, households and businesses now enjoy an expanded array of financial services, encompassing savings, credit, and alternative payment methods. Furthermore, the financial sector has integrated innovative technologies such as mobile money and internet banking to expand the range of savings and payment services. Several African countries are implementing deregulation and liberalisation measures to remove constraints on financial transactions. After deregulation and liberalisation, African countries transitioned to a market-oriented economy, resulting in positive impacts on the growth of both state- and privately-owned financial sectors. The effectiveness of FI in stimulating EG and poverty reduction has been proved by other researchers. It is crucial to concentrate and place greater emphasis on granting poor people and all levels of businesses access to cheaper financial services. FI is crucial for fostering EG, tackling income inequality, alleviating poverty by ensuring equitable access to finance, and curbing the prevalence of predatory financial institutions (Adedokun & Ağa, 2021; Honohan, 2004, 2008; Sarpong et al., 2022). The limited presence of banks in SSA countries can be addressed through the widespread use of mobile phones, which has the potential to enhance financial inclusion by making financial services accessible to individuals across different income levels. According to the Groupe Speciale Mobile Association (GSMA) 2023 report, the use of mobile phones in African countries has witnessed a significant increase, contributing to improved financial inclusion. Presently, there are 489 million mobile subscribers in SSA. As a result, countries in SSA have capitalised on this trend by leveraging mobile phones for financial

inclusion. For instance, Kenya has implemented M-PESA (mobile money) services, Sierra Leone has orange money, and Uganda, Ghana, Nigeria and Zambia have Mobile Telecommunications Network (MTN) Mobile Money, among other countries. Mobile phones have a substantial impact on enhancing information interchange and providing cost-effective financial services to individuals who previously lacked access to banking services. Consequently, the progress in financial technology (FinTech) and mobile phone services is expected to facilitate financial inclusion, foster EG, and mitigate poverty (Andrianaivo & Kpodar, 2012; Hassan et al., 2019). Several researchers have found that FI is a critical component in increasing EG and reducing poverty (Baidoo & Akoto, 2019; Bateman et al., 2019; Koomson et al., 2020a; Tran et al., 2022). Policymakers worldwide are placing a high focus on attaining FI by integrating the "unbanked" and "underbanked" populations into the formal financial system. The significant attention and ongoing discussions on this topic in international forums stem from its promising implications for mitigating extreme poverty, fostering EG, and reducing income inequality. As a result, ensuring universal access to financial services has become an important objective in the development plans of emerging economies.

This study examines the impact of FI on both EG and poverty reduction. Previous studies have confirmed the significance of FI in alleviating poverty based on income (Beck et al., 2007; Burgess et al., 2005; Emara, 2022). However, income alone is an inadequate indicator of poverty as it neglects to include the absence of several fundamental human necessities, including those that cannot be attained through monetary means. Poverty encompasses not only financial insufficiency but also difficulties in obtaining healthcare, education, and other vital resources. To address this gap, this study utilized the HDI, which considers multiple dimensions of poverty, including health, education, and income (Omar & Inaba, 2020; Park & Mercado, 2015). Ahmad et al (2021) have used it as a proxy measure for poverty reduction. The HDI, as defined by the UNDP, is a comprehensive composite indicator that evaluates a nation's average accomplishments in three fundamental domains of human development: education, healthcare, and standard of living. Education is assessed by the adult literacy rate and the aggregate gross enrollment ratio for primary, secondary, and tertiary education; health is quantified by the metric of life expectancy at birth; and the measurement of standard of living is determined by the GDP per capita, which considers the purchasing power in US dollars.

This study contributes to the existing knowledge by creating a FI index using data from multiple countries and employing principal component analysis (PCA) to generate a FI index. Additionally, it specifically evaluates countries in SSA, which has the largest share of the poor population. Furthermore, it analyse the influence of FI on both poverty alleviation and EG. This study employs fixed effects (FE), random effects (RE), Driscoll Kraay standard errors, PCSE, system GMM, as well as quantile regression. The subsequent section of this paper is structured in the following ways: Section 2 provides a review of the theoretical and empirical investigations. Section 3 presents a comprehensive summary of the data and methodologies. Section 4 presents the empirical findings and discussions, while Section 5 focuses on the conclusion and recommendations.

2. Literature Review

Financial inclusion (FI) encompasses the accessibility of a wide array of financial services, such as various payment methods, savings accounts, credit opportunities, insurance protection, and retirement schemes. FI refers to the condition in which adults have easy access to a wide range of financial services that are tailored to their needs and provided at reasonable prices. The product range includes payments, savings, credit, insurance, etc. The accessibility aspect of financial products and services implies that products should be readily accessible to all

customers without the necessity of rigorous Know-Your- customer (KYC) procedures, documentation, or other constraints commonly enforced by banks. Ensuring affordable access to a diverse array of financial products and services is crucial for consumers who lack traditional banking options. It is important that these financial services are financially sustainable for individuals with low income, especially when compared to informal alternatives. Recently, there has been a notable surge in the availability of financial products and services. As a result, consumers and businesses have been able to take advantage of the increasing range of financial services available to them. For instance, the proportion of adults with accounts at formal financial institutions increase from 51% in 2011 to 62%, 69%, and 76% in 2014, 2017, and 2021, respectively (Asli Demirgüç-Kunt, Leora Klapper, Dorothe Singer, 2021; Demirguc-kunt et al., 2015; Demirgüç-kunt et al., 2020; Demirguc-kunt & Klapper, 2012). Research suggests that financial services are vital for fostering EG (Adedokun & Ağa, 2021; Williams et al., 2017). Furthermore, individuals and organizations that possess the ability to utilise financial services exhibit enhanced capacity to withstand financial upheavals and are more adept at mitigating poverty in comparison to those lacking such access (Demirgüç-Kunt et al., 2021; Suri & Jack, 2016). Therefore, the existence of a comprehensive financial system is crucial for the economic expansion and sustained growth of any economy. It guarantees that every segment of society, especially those who are economically challenged, can obtain financial services at a reasonable cost.

2.1 Selected Empirical Literature

2.1.1 Financial inclusion and economic growth

Adedokun and Ağa (2021) performed an empirical analysis to assess the correlation between FI and EG in SSA nations during the time span from 2004 to 2017. The researchers utilised GMM and Dumitrescu-Hurlin's causality test for their analysis. The researchers PCA to create an inclusive measure of financial inclusion, considering multiple aspects of financial inclusion. Their research illustrates that FI has a favorable and substantial effect on the EG of the SSA. Further evidence indicates a causal association between EG and FI in the short run. Ugwuanyi et al (2022) conducted comprehensive research to assess the influence of FI on the EG of 29 countries in Sub-Saharan Africa (SSA). The study performed a comprehensive investigation of the effects of both digital finance and traditional finance, employing data from 2012 to 2020. The study utilised generalised least squares and system GMM techniques, together with the panel vector autoregression Granger causality test. The findings indicate that both digital and traditional FI have a positive and substantial impact on EG. However, traditional FI has a greater impact than digital financial inclusion, as demonstrated by the dimensions of access. The researchers suggest that, although digital finance is a new concept in developing countries, it is crucial not to disregard the current financial infrastructure. Ifediora et al (2022) examine the impact of FI on EG by utilising panel data from 22 sub-Saharan African states spanning the years 2012 to 2018. The study employed the GMM approach. The researchers found that the presence, reach, and overall characteristics of FI have a substantial and beneficial impact on EG. However, the influence of the utilisation aspect is only slightly improved and lacks significance. The existence of bank branches and ATMs exerts a beneficial and significant influence on the growth of the economy. Deposit accounts and outstanding loans do not have a significant effect on EG, although, they are positive. In contrast, outstanding deposits have a detrimental effect on EG.

Van et al (2019) conducted a thorough analysis on the relationship between FI and EG in developing economies. They initially employed the multidimensional index methodology proposed by Sarma & Pais (2011) and Park & Mercado (2015) to construct the index. After creating the index, they utilised the panel econometric technique, incorporating fixed effects

and GMM, to assess the impact of FI on EG. Their research reveals a direct relationship between FI and EG. Countries with low incomes and limited FI exhibit a more pronounced correlation in their connections. Sharma (2020) examined the relationship between FI and EG in the developing Indian economy. The results indicate a positive correlation between EG and many aspects of financial inclusion, such as the level of access to banking, the availability of banking services, and the usage of banking services in terms of deposits. The findings suggest a strong connection between expanding geographical reach and economic advancement, indicating that they have a mutually reinforcing impact on one another. Moreover, there exists a mutual correlation between the expansion of geographical coverage and the advancement of EG. However, there is a unidirectional correlation between the quantity of deposit and loan accounts and the GDP. The findings support the implementation of social banking programmes in India, which would enhance the resilience of financial institutions.

The extensive examination of research on the link between FI and EG reveals that research in this field has advanced in various areas, starting with the development of concepts, addressing specific concerns and challenges related to the economy, and subsequently moving towards the establishment of an index for evaluating financial inclusion. The existing research clarifies the process used to create an index and the impact of that index on EG. A comprehensive examination of the correlation between finance and EG enables us to comprehend the various facets of this association and underscores the pivotal significance of formal financial institutions in fostering financial development. The literature review has enabled the development of research questions and the recognition of appropriate methodologies to address current issues.

2.2 Financial inclusion and poverty reduction

The United Nations has identified the eradication of poverty in all its forms as a paramount objective to be achieved by 2030, as discussed during the 2015 summit. African nations confront a substantial obstacle in addressing poverty, which is defined by a scarcity of financial means to sustain a fundamental level of well-being. The dominant consensus among the majority is that poverty is a deplorable condition that manifests in diverse ways, such as hunger, malnutrition, financial scarcity, inadequate housing, poor education, underdeveloped infrastructure, dysfunctional healthcare facilities, prevalent diseases, insecurity, and numerous other factors (Koomson et al., 2020b; Tita & Aziakpono, 2017). Nirav's (2018) analysis indicates that the poverty rate in SSA has reached an average of 41%, exhibiting an increase in the number of poor individuals in the region from 278 million in 1990 to 413 million in 2015. In 2015, most of the poor population worldwide lived in SSA. Among the 28 poorest countries globally, 27 are situated in SSA, all of which exhibit a poverty rate beyond 30 percent (Nirav, 2018). Choudhury & Bagchi (2016), in their study on financial exclusion, proposed that the persistent state of poverty and economic hardship in developing countries might be partly ascribed to financial exclusion. Churchill & Marisettey (2020) examine the relationship between financial inclusion and poverty among a sample of forty-five thousand households. The researchers create a comprehensive gauge of FI and analyse its impact on several poverty indicators, such as household deprivation scores, the poverty line and the Household Poverty Probability Index. The researchers employed ordinary least squares (OLS), 2SLS, and propensity score matching techniques. FI has been demonstrated to have a substantial effect on poverty reduction. This finding remains constant across many poverty indices and diverse approaches for measuring financial inclusion. Alimi & Okunade (2020) examined the influence of FI and ICT diffusion on the alleviation of poverty in 27 SSA nations from 2004 to 2017. The researchers employed a non-stationary heterogeneous panel estimation approach, notably utilising fixed effect estimators, pooled mean groups, and mean groups. The findings derived

from the pooled mean group estimator indicate that there is a persistent effect of FI, measured by the ratio of commercial branches per 100,000 individuals, on mitigating poverty. Nevertheless, it does not have an instantaneous effect on the alleviation of poverty.

Khan et al (2021) examined the influence of FI on poverty levels, financial stability, and income inequality across 54 African countries. The study used HDI as a measure to evaluate the reduction of poverty. The study utilises panel-fixed effects and the system GMM technique. The study employed commercial bank deposits (per 1000 individuals) and ATM density (number of ATMs per 100,000 adult population) as metrics for measuring financial inclusion. The researchers identified a strong association between these variables and a reduction in income disparity and poverty, as well as an enhancement in financial stability. Nsiah et al (2021) examined the impact of FI on poverty reduction in Sub-Saharan Africa (SSA) by analysing the threshold effect. The study utilised data spanning from 2010 to 2017 to ascertain the threshold of FI at which poverty levels decline. The researchers employed Hansen's estimation and different GMM methodologies for their analysis. Furthermore, the study examined the factors that impact FI. The findings indicate that once the level of FI exceeds 0.365, it results in a decrease in poverty. Furthermore, a rise in the money supply has a positive and significant impact on reducing poverty. The findings also indicated that an increase in domestic credit directed towards the private sector had a positive impact on the growth of FI. A thorough review of the literature on FI and poverty reduction clearly shows that FI has been extremely effective in alleviating poverty. However, the researchers in the literature have made use of several components of financial inclusion. Therefore, the literature review has enabled the identification of appropriate variables and models for studying the relationship between poverty reduction and FI in SSA.

3. Data and Methodology

3.1 Financial Inclusion Measurement

The study commenced by creating the FI index for the 18 selected countries in SSA, and subsequently examines the impact of FI on both economic growth and poverty reduction. The FI index, which is calculated, is then used as a proxy for FI. The rationale for calculating the FI index lies in the recognition that evaluating FI merely based on a single indicator, such as the number of accounts, yields limited or inadequate information and may also result in a distorted understanding of its impact on the economy. The indicators of FI encompass the rate of adult borrowing from formal financial institutions, adult ownership of accounts, and the rate of adult deposits in formal financial institutions. Diverse approaches are employed to evaluate the extent of FI in the realm of finance and economics. At present, there is a lack of consensus over a universally accepted method for quantifying the FI index. After conducting a comprehensive analysis of the literature, it is clear that there are two primary methods, specifically the parametric approach and the non-parametric approach, employed to develop a FI index. Researchers using the non-parametric method can impartially allocate weight to indicators depending on their expertise to construct a FI index. In contrast, the parametric technique applies weights to indicators based on the covariance between indicators in the chosen sample datasets. A group of scholars has recently developed a FI index utilising two statistical methods: principal component analysis (PCA) and confirmatory factor analysis (CFA). This was done to answer the objection that the non-parametric method has a clear basis for determining significance. Cáamara & Tuesta (2014) propose an indexing methodology that employs the PCA model. This approach does not depend on making critical assumptions about the selection of the underlying raw data. Therefore, this study employed PCA to create a FI index. The study indicates that the unobservable variable FII is determined linearly, as outlined below.

$$FII_{it} = W_1 A_{it} + W_2 B_{it} + W_3 C_{it} + \varepsilon_{it} \dots\dots\dots 1$$

Where FII_{it} = FI index of country i at time t, W_1 , W_2 and W_3 are the relative weights of each variable, A= Accounts (% age 15+), B= adult borrowed from a formal financial institution (% age 15+), S= Saved at a financial institution (% age 15+) and ε_{it} is the error term

3.2 Financial inclusion and economic growth

3.2.1 Specification of empirical model

The proposed model for evaluating the impact of FI on EG in SSA is as follows:

$$LnGDP_{it} = \beta_0 + \beta_1 Fii_{it} + \beta_2 LnPop_{it} + \beta_3 LnAge Dep_{it} + \beta_4 LnTrade_{it} + \beta_5 Polstab_{it} + \beta_6 LnInflation_{it} + \varepsilon_{it} \dots\dots\dots 2$$

Where

β_0 is the coefficient of the empirical model

$LnGDP_{it}$ is the log of Gross Domestic Product (GDP) per capita which represent EG for country i at time t which serves as the dependent variable.

Fii_{it} is the FI index for country i at time t

$LnPop_{it}$, $LnAge Dep_{it}$, $LnTrade_{it}$, $Polstab_{it}$, and $LnInflation_{it}$ are log of population growth, log of age dependency ratio, log of trade, political stability and log of inflation for country i at time t respectively

ε_{it} represents the error term that encompasses all unobservable factors that may impact EG

3.2.2 Estimation Technique

Four econometric models were used. The researcher first applies random effects (RE) and Driscoll-Kraay standard error models. Next, the Panel Corrected Standard Errors (PCSE) model is used to address issues of heteroskedasticity, autocorrelation, and cross-sectional dependency. Finally, the researcher employed system GMM to control for endogeneity. When employing the GMM, it is essential to perform a panel unit root test to evaluate the stationarity characteristics of the dataset and ascertain its appropriateness for the estimation technique. Nevertheless, Kitamura & Phillips (1997) and Okafor et al, (2015) contend that when the sample size is limited and the number of observations surpasses the study's time frame, the lack of stationarity in a variable does not undermine the precision of the estimations. This phenomenon arises as a result of the reduction of serial correlation in this specific situation. Therefore, the researcher employed the Arellano-Bover/Blundell-Bond system GMM estimator without performing the unit root test. The nature of the economic growth model in finance usually has a dynamic effect. According to Arellano & Bond (1991), it is recommended to take into account the dynamic consequences of measuring growth in empirical analysis. In order to reduce the serial autocorrelation of the error term, one can use lagged dependent variable as an explanatory variable. The study employed system GMM estimation, following the methods outlined by Arellano & Bover (1995) and further developed by Blundell & Bond (1998). The system GMM estimator effectively addresses the issue of endogeneity by generating estimates that are simultaneously consistent and efficient. Panel studies with a larger sample size (N) relative to the number of time periods (T) offer a clear benefit. Blundell & Bond (1998) found that using System GMM reduces bias and improves prediction accuracy. System GMM employs a model that incorporates lagged dependent variables to examine the dynamic characteristics of both the dependent and independent variables while also accounting for endogeneity. The GMM model is given below:

$$LnGDP_{it} = \beta_0 + \beta_1 LnGDP_{it-1} + \beta_2 Fii_{it} + \beta_3 LnPop_{it} + \beta_4 LnAge Dep_{it} + \beta_5 LnTrade_{it} + \beta_6 Polstab_{it} + \beta_7 LnInflation_{it} + \varepsilon_{it} \dots\dots\dots 3$$

3.3 Financial Inclusion and Poverty Reduction

The proposed model for evaluating the impact of FI on poverty reduction in SSA is as follows:

$$HDI_{it} = \beta_0 + \beta_1 FII_{it} + \beta_2 LnGDP_{it} + \beta_3 Education_{it} + \beta_4 LnPop_{it} + \varepsilon_{it} \dots \dots \dots 4$$

Where

HDI_{it} is Human Development Index for country i at time t which serves as the dependent variable.

3.3.1 Estimation Strategy

In the first stage of the investigation, the researcher utilised FE and RE models. In the second stage, the researcher employed the GMM to address endogeneity biases and other econometric issues that may arise in FE and RE models. Finally, do quantile regressions to examine the potential disparities in the influence of FI on poverty reduction across countries, based on different index levels.

The GMM model is presented below.

$$HDI_{it} = \beta_0 + \beta_1 HDI_{it-1} + \beta_2 FII_{it} + \beta_3 LnGDP_{it} + \beta_4 Education_{it} + \beta_5 LnPop_{it} + \varepsilon_{it} \dots \dots \dots 4$$

The study utilised quantile regression. The quantile estimator can be obtained by solving the optimisation problem described in the study of Altunbaş & Thornton (2019)

$$\sum_{i \in \{i: y_i \geq x' i \sigma\}} \sigma |y_i - x' i \Omega| + \sum_{i \in \{i: y_i < x' i \sigma\}} 1 - \sigma |y_i - x' i \Omega|$$

for the σ th quantile ($0 < \sigma < 1$), the dependent variable y_i modelled as a function of the explanatory variables x_i which is a k by 1 vector of explanatory variables. The dependent variable for this model is HDI.

3.4 Data

The empirical analysis of this study utilised data from four separate sources: the UNDP for HDI data, the World Development Indicators for EG and control variables, the Global FI Database (Findex) for the FI variables, and the Worldwide Governance Indicator. Data was gathered from 18 SSA countries, covering the time period from 2014 to 2021.

3.4.1 Dependent Variable

Two variables are dependent on the investigation. The initial dependent variable is EG, which is quantified as the annual percentage change in per capita GDP. The second factor is HDI, a comprehensive composite indicator that the UNDP uses to evaluate a nation's overall performance in three crucial areas of human development: education, health, and living conditions. Evaluating education involves analysing the adult literacy rate and the comprehensive gross enrollment ratio for elementary, secondary, and higher education. Health is assessed by analysing the statistics of life expectancy at birth. The assessment of living standards is established by assessing the per capita GDP, which is adjusted to consider buying power parity in US dollars. This study employs the HDI as a measure of poverty, as it considers various aspects of poverty, including education, health, and income (Omar and Inaba, 2020; Park and Mercado, 2018). Khan, Iftikhar, *et al.* (2022) have employed the HDI as a measure of poverty.

3.4.2 Main variable of interest

As stated by Allen *et al.* (2015), Demir *et al.* (2022), Sarpong and Nketiah-Amponsah (2022), and other researchers, the main goal of this study is to examine FI impact. We employ diverse metrics of FI to measure the extent of access to and utilisation of financial services. The

variables encompass the adult ownership rate of formal financial institution accounts, the percentage of adults who save at formal financial institutions, and the proportion of the adult population that acquires loans from formal financial institutions. In order to evaluate the influence of FI on both poverty reduction and EG, the researcher employed PCA to construct a FI index. This indicator functions as a proxy for evaluating the extent of financial inclusion.

3.4.3 Control Variables

The control variables in our study encompass the following indicators: trade, quantified as the proportion of exports and imports relative to GDP; inflation, gauged by the consumer price index; population growth, computed by the annual percentage change in population; education, represented by the rate of primary school enrollment; age dependency ratio, determined by the ratio of the population dependent on others (those below 15 or above 64) to the working-age population; and political stability, evaluated based on perceptions regarding the likelihood of political instability and politically motivated violence, as well as terrorism.

4. Empirical Findings and Discussion

4.1 Summary statistics

Table 1. Summary Statistics

Variable	Observation	Mean	Std. Dev.	Minimum	Maximum
Human Dev Index	144	.5574028	.1013949	.389	.817
GDP	144	2583.19	2772.153	455.64	11643.5
Age Dep Ratio	144	80.07215	14.48302	40.42	103.09
Education	111	104.9657	17.89011	75.6	156.45
Savings	144	12.48514	9.125435	2.53	35.53
Account	144	41.17868	22.63896	6.96	90.53
Inflation	144	10.40424	51.19946	-2.43	557.2
Trade	144	67.02375	20.98715	27.24	119.5
Borrow	144	8.998958	6.024068	2	25.15
Population Growth	144	2.462631	.7408179	.002291	3.56999
Political Stability	144	6.611111	1.078143	4	8

Table 1 presents the summary statistics, indicating that all the data included in this analysis demonstrates a positive average value. Furthermore, it is apparent that the data demonstrates a substantial skewness, since numerous variables reveal a notable disparity between their mean and median values. Therefore, the data at these levels were transformed into logarithms in order to achieve a more equitable distribution and to ensure that the average and middle value of the variable were substantially similar.

4.1.1 Vector Inflation Variance (VIF)

Table 2. Vector Inflation Variance

Variables	VIF	1/VIF
LnAge Dep Ratio	8.85	0.112963
LnPopulation	5.33	0.187777
Financial Inclusion	2.72	0.367518
LnTrade	1.98	0.503901
Education	1.53	0.653703
Political Stability	1.43	0.697518
LnInflation	1.12	0.895146
Mean VIF	3.56	

The study employed the VIF to evaluate the extent of collinearity between an individual predictor and other predictors, with the aim of ascertaining the level of collinearity among variables. The VIF is a measure that demonstrates the existence of multicollinearity among the different components. A VIF value less than 10 indicates the absence of multicollinearity. Based

on this fundamental concept, the present study determines that there is no notable multicollinearity among the variables, as seen by the VIF result provided in table 2.

4.1.2 Hausman Test

Table 3: Hausman test result

Variables	Fe	Re	Difference
Financial Inclusion	.0896864	.1015385	-.0118521
LnPopulation	.0164724	-.0027855	.019258
LnAge Dep Ratio	-1.160916	-2.262909	1.101993
LnTrade	.1116847	.1698935	-.0582087
Political Stability	.03528	.0608454	-.0255654
LnInflation	-.0003051	-.0080197	.0077145
p-value= 0.9810			

The Hausman Test result in Table 3 reveals a P-value of 0.9810, suggesting that it above the 5% significance level. As a result, we reject the null hypothesis and opt for the random effect model. The fixed effect model produced a poor result compared to the RE model

4.1.3 Breusch and Pagan Lagrangian multiplier test

Table 4: Breusch and Pagan Lagrangian multiplier test

chibar2(01) = 164.61
Prob > chibar2 = 0.0000

The findings from the Breusch Pagan Lagrangian Multiplier Test in Table 4 indicate the presence of panel effects. Thus, we reject the null hypothesis and proceed to employ the panel RE model.

4.1.4 Cross Sectional Dependence test

Table 5: Cross Sectional Dependence test

Variable	CD-test	P-value
Financial Inclusion	25.25	0.000
LnGDP	12.08	0.000
LnTrade	3.81	0.000
Inflation	1.66	0.096
Political Stability	29.38	0.000
LnAge Dependency Ratio	23.27	0.000
LnPopulation Growth	17.41	0.000

To determine the spatial independence of residuals obtained from estimating a regression model using fixed effects FE or RE, the researcher conducts the Pesaran (2004) CD test. The null hypothesis of the CD test states that no cross-sectional dependence is detected in the residuals. The alternative hypothesis of the test suggests the existence of cross-sectional dependence, showing that disturbances in one country may impact other economies. The Pesaran test is presented in Table 5.

4.1.5 Heteroskedasticity Test

Table 6. Modified Wald test groupwise heteroskedasticity

chi2	563.57	502.71
Prob>chi2 =	0.0000	0.0000

The Modified Wald test was utilised to evaluate the presence of heteroscedasticity in the regression and determine if the model is unaffected by this issue. The test findings displayed in table 6 reveal a p-value of 0.000 for both models, which offers strong proof to support the acceptance of the null hypothesis that heteroscedasticity exists

4.2 Impact of financial inclusion on economic growth

The researcher utilised various statistical approaches, including RE, Driscoll Kraay standard errors, PCSE, and GMM, to examine the impact of FI on EG.

Table 7: Random Effects and Driscoll Kraay Standard Errors results

VARIABLES	RE Economic Growth	Driscoll-Kraay Economic Growth
Financial Inclusion	0.102** (0.0396)	0.102** (0.0349)
LnPopulation Growth	-0.00279 (0.0166)	-0.00279 (0.00718)
LnAge Dep Ratio	-2.263*** (0.559)	-2.263*** (0.474)
LnTrade	0.170 (0.122)	0.170* (0.0754)
Political Stability	0.0608*** (0.0189)	0.0608*** (0.00892)
LnInflation	-0.00802 (0.0144)	-0.00802 (0.0147)
Constant	16.20*** (2.706)	16.20*** (2.180)
Observations	129	129
Number of countries	18	18

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

Source: Author computation

The results of the regression analysis on RE and Driscoll-Kraay standard errors are presented in Table 7. The results confirm that FI has a substantial and positive effect on EG in both models. The impacts demonstrate uniformity across all models, except for trade. Although trade does not demonstrate statistical significance in the RE model, it does show significance in the Driscoll-Kraay standard errors model. Both models indicate that a 5-percent enhancement in FI leads to a 0.102% rise in EG. The implication of this findings is that increasing FI in all dimensions or indicators is intended to promote saving, facilitate business activities, and provide capital, ultimately leading to improved and accelerated economic growth. This findings is in line with both single countries and cross countries studies (e.g. Adedokun & Ağa, 2021; Sarpong et al., 2022; Sharma, 2020; Ugwuanyi et al., 2022). Population growth has a negative effect on economic growth, this is because if the rate of population growth surpasses the rate of resource production it can result in scarcity of resources. Additionally, rapid population growth can lead to an increase in the labour force. If the economy is unable to generate enough jobs to accommodate the growing population, it will result in higher unemployment rates, which negatively affects economic growth. A one percent increase on the age dependency ratio leads to a decrease in EG by 2.263%, the negative effects on economic growth arises from a higher dependency ratio within the working population. This hinders individuals from saving and engaging in productive activities due to the increased responsibility of caring for a larger number of dependents. Furthermore, it has a direct impact on the government since it incurs expenses for retirement benefits, experiences a scarcity in the labour force, and provides healthcare facilities. In the RE model, trade is not significant. Nevertheless, according to the Driscoll Kraay Standard Error Model, trade exhibits statistical significance at a 10 percent level. This is because trade opens global marketplaces for businesses. Selling abroad helps companies access more customers and increase sales. Increased market access boosts manufacturing efficiency and lowers prices through economies of scale and overall increase economic growth. Political stability has a positive and significant impact on both models. Political stability facilitates the implementation of consistent economic policies and allows governments to participate in long-term planning. Additionally, it serves as an attraction for

foreign direct investment. The level of inflation, despite being negative, is not significant in any of the models. Inflation reduces savings, investment, and the purchasing power of the population which has a negative effect on economic growth.

Table 8: The impact of financial inclusion on economic growth: PCSE results

VARIABLES	Economic Growth
Financial Inclusion	0.443*** (0.0223)
LnPopulation Growth	0.291*** (0.0737)
LnAge Dep Ratio	-2.545*** (0.360)
LnTrade	0.777*** (0.104)
Political Stability	-0.0105 (0.0290)
LnInflation	-0.197*** (0.0395)
Constant	15.38*** (1.943)
Observations	129
Number of countries	18
R-Squared	0.791

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

Source: Author computation

Table 8 shows the result of the PCSE model. The PCSE model is employed to address issues such as cross-sectional dependency, heteroskedasticity, serial correlation, and other potential problems that may arise in the models. The findings continuously demonstrate a strong and statistically significant correlation between FI and EG, particularly when using the PCSE model. In this model, a 1 percent rise in FI leads to a 0.443% increase in EG. Population growth exhibits a positive and substantial effect. The age dependency ratio remains consistently negative and quite substantial. Trade exerts a significant and positive impact. On the other hand, inflation has a negative and significant effect.

Table 9. The impact of financial inclusion on economic growth: GMM results

VARIABLES	Economic Growth
<i>Economic Growth_{t-1}</i>	0.0961** (0.0467)
Financial Inclusion	0.129*** (0.0174)
LnPopulation Growth	-0.0437* (0.0225)
LnAge Dep Ratio	-2.181*** (0.458)
LnTrade	0.0540 (0.0372)
Political Stability	0.0505*** (0.00774)
LnInflation	-0.00508 (0.00415)
Constant	15.64*** (2.106)
Observations	89
Number of countries	17

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

Source: Author computation

Table 9 presents the findings of the GMM model. The GMM analysis reveals that FI has a positive and significant effect on EG. The findings indicate a 1 percent rise in FI leads to a 0.129% improvement in EG. These findings align with other research that has also found a positive and significant impact of FI on EG (e.g. Adedokun & Ağa, 2021; Ain et al., 2020; Babajide et al., 2015; Ifediora et al., 2022; Ugwuanyi et al., 2022; Van et al., 2019). The increase in population has a significant negative effect, while the ratio of dependent individuals based on age also demonstrates a large detrimental impact. On the other hand, trade has a positive effect, although it is not significant. Inflation, however, exhibits a statistically insignificant but nevertheless negative effect.

4.3 Financial inclusion and poverty reduction

To examine the effect of FI on poverty reduction, the researcher utilised numerous models, including FE, RE, GMM, and Quantile Regression.

Table 10. The impact of financial inclusion on Poverty Reduction: FE and RE results

VARIABLES	FE	RE
	HDI	HDI
Financial Inclusion	0.0113*** (0.00223)	0.0102*** (0.00263)
LnGDP	0.0146* (0.00789)	0.0471*** (0.00743)
Education	0.000327** (0.000129)	0.000411*** (0.000150)
LnPopulation Growth	-0.00183 (0.00219)	-0.00520** (0.00254)
Constant	0.409*** (0.0596)	0.168*** (0.0581)
Observations	111	111
R-squared	0.334	
Number of id	18	18

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

Source: Author computation

The findings presented in Table 10 employed the FE and RE models. Research has shown that promoting FI is a successful strategy for reducing poverty. The measurement of poverty in this study is based on HDI. An increase in HDI is associated with a decline in poverty, while a fall in HDI results in an increase in poverty. The findings indicate that a 1 percent increase in FI is associated with a 0.0113% rise in HDI in the FE model, whereas a 1 percent increase in FI in the RE model results in a 0.0102% increase in HDI. Both models exhibit a strong and statistically significant association between GDP and education regarding HDI. Population growth demonstrates a negative relationship in both models, although not significant in the FE model, but statistically significant in the RE model. These findings are consistent with the results of previous studies cited in the literature (Alimi and Okunade, 2020; Churchill and Marisetty, 2020; Khan *et al.*, 2021; Nsiah *et al.*, 2021; Omar and Inaba, 2020; Park and Mercado, 2015).

Table 11. The impact of financial inclusion on Poverty Reduction: GMM results

VARIABLES	HDI
HDI_{t-1}	0.682*** (0.0876)
Financial Inclusion	0.00301* (0.00166)
LnGDP	0.00322 (0.00500)
Education	0.000148* (0.000793)
LnPopulation	0.00388*** (0.00142)
Constant	0.135** (0.0525)
Observations	72
Number of countries	16

Note: Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Author computation

The presence of endogeneity in the model implies that the researcher cannot just rely on the findings derived from FE and RE analyses. To address this challenge, the researcher employed the GMM system to mitigate endogeneity and other potential concerns in the model. The GMM results indicate that FI has a positive and significant effect on HDI. The GDP demonstrates a positive effect, although not significant, while both education and population growth have a positive and significant effect on HDI.

Table 12. The impact of financial inclusion on Poverty Reduction: Quantile regression results

VARIABLES	(0.1) HDI	(0.25) HDI	(0.5) HDI	(0.75) HDI	(0.9) HDI
Financial Inclusion	0.0158*** (0.00395)	0.0138*** (0.00275)	0.0111*** (0.00191)	0.00874*** (0.00235)	0.00719** (0.00308)
LnGDP	0.000400 (0.0166)	0.00691 (0.0116)	0.0152* (0.00793)	0.0227** (0.00985)	0.0276** (0.0130)
Education	0.000523* (0.000293)	0.000433** (0.000205)	0.000318** (0.000139)	0.000213 (0.000173)	0.000145 (0.000230)
LnPopulation	-0.000745 (0.00330)	-0.00125 (0.00231)	-0.00189 (0.00155)	-0.00246 (0.00195)	-0.00284 (0.00260)
Observations	111	111	111	111	111

Note: Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Author computation

The results of the quantile regression analysis are displayed in Table 12. The quantile regression presents the result for the 10, 25, 50, 75, and 90 percent quantiles. The quantile regression coefficients for FI are consistent with the results obtained from FE, RE, and GMM analyses. These findings indicate that a greater proportion of FI is associated with a rise in the HDI. An increase in HDI is correlated with a reduction in poverty, while a decline in HDI is associated with an increase in poverty. The impact of FI on HDI is more pronounced in countries that have a higher HDI. This can be observed from the findings, as the value at the 10 percent quantile exceeds the value at the 25 percent quantile, and the value at the 25 percent quantile is greater than the value at the 50 percent quantile. This pattern persists until the 90 percent quantile. The analysis using quantile regression demonstrates a clear association between an increase in FI and a decrease in poverty at all quantile levels.

5. Conclusion and Recommendations

This study examines the impact of FI on EG and poverty reduction in SSA. In order to assess the impact, the researcher constructed a FI index utilising PCA for 18 countries in SSA. The creation of this index involved the utilisation of multiple FI indicators.

The researcher utilised RE, Driscoll Kraay standard errors, and GMM models to analyse the impact of FI on EG. According to the findings, FI consistently exhibits a significant and positive impact on EG across all models. The researcher also utilised FE, RE, GMM, and quantile regression to examine the impact of FI on poverty reduction. Across all the models, FI consistently emerged as an effective instrument for poverty reduction. Specifically, the findings from the quantile regression analysis revealed that FI has a larger and more significant impact on poverty reduction, particularly in countries with higher HDI.

This study suggests several policy recommendations for SSA countries based on the findings. To foster EG and eliminate poverty, it is essential for SSA countries to strengthen their financial sector by expanding financial markets and derivatives markets. This expansion should explicitly address the requirements of the low-income population, guaranteeing the availability, accessibility, and usability of financial products and services. Governments and policymakers should enact impactful policies to improve the availability of financial services, especially in rural areas, namely by incorporating mobile money and other FinTech components. Furthermore, the financial regulator can assist financial service providers in reaching the unbanked population, thus incorporating them into the formal economy. Regulations should be enacted to facilitate access to deposit accounts for individuals and households with low incomes, as well as small enterprises. This would allow them to take advantage of the expanded availability, improved savings opportunities, and borrowing alternatives offered by formal financial services. The government and policymakers should also implement policies that effectively address obstacles to financial inclusion. Efforts to improve FI should be matched by the promotion of broad-based EG that benefits all segments of society. Providing credit to those with lower incomes improves their access to financial services, enabling their participation in productive activities and promoting a more stable spending behaviour. Finally, governments and policymakers should establish a policy aimed at removing obstacles associated with accessing private sector credit. This can be achieved by constantly expanding the options for retail and business loans, mortgages, overdrafts, credit cards, and letters of credit for the eligible adult population.

The existing data on financial inclusion lacks newly established indicators that encompass mobile banking, web pay, and the utilisation of financial services on the internet. Due to the absence of data, all of these indicators had to be omitted. However, future researchers have the option to include these variables if they become accessible. The study utilised the Human Development Index (HDI) as a metric for assessing poverty reduction due to the lack of data on poverty headcount ratios. Future studies may also consider using data on poverty headcount ratios to analyse poverty.

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