

Financial inclusion, poverty, and economic growth in Sub-Saharan Africa

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Keywords

Financial Inclusion, Poverty, Economic Growth, Causality, Unemployment

Abstract

This study examines financial inclusion, which is defined as the provision of affordable financial services to low-income individuals and vulnerable groups. This highlights its role in promoting economic growth in Africa, particularly through mobile monetary initiatives that reduce poverty. This study reviews theories and empirical studies on the relationship between financial inclusion, poverty alleviation, and economic growth, and often notes inconclusive results. Early theories suggest that access to financial services influences employment and production choices. This study aims to investigate the causality between financial inclusion, poverty, and economic growth in the sub-Saharan African context, emphasizing the need for further research.

Introduction

Financial inclusion is an important issue for governments and policymakers, particularly in developing countries. Generally, financial inclusion is defined as the process of bringing individuals, especially low-income earners and the vulnerable, and businesses under one umbrella to access useful and, more importantly, affordable financial services and products – transactions, payments, savings, credit, and insurance – delivered in a responsible and sustainable way. Financial inclusion is important because it tends to enhance economic growth (Cull et al., 2014).

Several countries across Africa and sub-Saharan Africa have made conscious efforts to promote financial inclusion. For instance, the introduction of mobile money by some African countries is a good initiative to advance financial inclusion, reduce poverty, and improve economic growth (Abor et al., 2018). Various theories and empirical studies explain the nexus between financial inclusion, poverty, and economic growth in different jurisdictions (Aghion and Bolton, 1997; Newman and Banerjee, 1999; Mehrotra et al., 2009; Kpodar and Jeanneney, 2011; Beck et al., 2007). However, the results are either inconclusive or conflicting. For instance, early theories posit that access to financial services is likely to influence individuals' employment and production choices, which will in turn reduce poverty levels (Aghion and Bolton, 1997). Mehrotra et al. (2009) also assert that people's savings from financial institutions have a multiplier effect on GDP. As stated by Rajan (2009), access to and usage of financial services increase the living standards of the poor, thereby reducing poverty. In their recent study, Subrahmanyam and Acharya (2017) argued that financial inclusion is key to economic growth.

Although financial inclusion has increasingly become a topical issue for policymakers and governments in Africa, the literature on financial inclusion is still in its infancy. Therefore, further studies on the financial inclusion nexus with other macroeconomic variables are needed. This study examines the causal relationship between financial inclusion, poverty, and economic growth in Sub-Saharan Africa.

Literature Review

Research on financial inclusion has gained much more attention since the 2008 global financial crisis, in part because of its significance in fostering economic growth. According to certain studies, financial inclusion and economic growth are positively correlated (King & Levine, 1993; Levine, 1997, 2007). Some researchers (Pearce, 2011; Samir and Naceur, 2007; Bhattari, 2015) discovered a negative correlation between financial inclusion and economic growth, whereas others (Natamba et al, 2013; Craigwell and Moore, 2003) found no association. Although some are inconclusive, empirical research on the relationship between financial inclusion and economic growth has yielded mixed findings.

Furthermore, although some research has found a unidirectional relationship between financial inclusion and economic growth (Lenka and Sharma, 2017; Sharma, 2016), other studies have found a bi-causality relationship (Apergis et al., 2007; Kim et al., 2017), and some research has found no causality relationship (Neaime and Gaysett, 2018).

The lack of research on the tripartite causal relationship between financial inclusion, poverty, and economic growth in sub-Saharan Africa serves as an impetus for this investigation.

The researcher is yet to locate a study on the tripartite causality relationship between financial inclusion, poverty, and economic growth in the sub-Saharan African context, although some studies have examined the causality relationships between financial inclusion and financial sector development (Anarfo et al., 2018), financial inclusion and migrant remittances (Anarfo et al., 2019), and financial inclusion and economic growth (King & Levine, 1993; Levine, 1997; 2007). Additionally, the fact that this study accounts for poverty, a significant factor in determining financial inclusion and economic growth in Sub-Saharan Africa (SSA), motivates researchers.

The objective of this study is to examine the tripartite causality relationship between financial inclusion, poverty, and economic growth from the standpoint of Sub-Saharan Africa, as the main goal of this research.

- i. Examine the connection between poverty, economic progress, and financial inclusion.
- ii. Establish the causal link between poverty, economic growth, and financial inclusion.
- iii. Determine how shocks affect the endogenous variables of economic growth, poverty, and financial inclusion.

We discuss theories of financial inclusion, positing that the delivery of financial services to the general population should be treated as a public good, and that access to financial services should be for all but not the privileged few. This ensures that everyone has free access to basic financial services. This theory gives every member of a population an equal opportunity to access financial services. Under the public good theory, banks and other financial institutions do not charge transaction costs for the usage of Automated Teller Machines (ATMs) and other general banking charges. The government provides subsidies to banks to compensate for the forfeited charges. In addition, the government supports the opening of a formal bank account for every individual to encourage savings. This theory has two main advantages. First, every member of the population is considered equally important as far as access to financial services is concerned. Second, the government has the opportunity to promote financial inclusion in a manner that it desires, because they are the main initiator of the financial inclusion process.

Aside from these advantages, there are a few disadvantages; thus, there is a tendency for financial inclusion to be unsustainable if it is given a public good status. This is because end users of financial services may not value the privileges given to them. After all, they do not cost them anything.

Moreover, the government is likely to use a major part of its budget for financial inclusion at the expense of other sectors of the economy, which are equally important.

Dissatisfaction Theory of Financial Inclusion

This theory suggests that financial inclusion should be targeted at those who were formerly using financial services but had to stop because of a bad customer experience. The theory posits that if people stop patronizing financial services or products due to bad customer experience, then it would be easier to convince them to change their minds once their complaints are resolved. Compared to those who have never previously patronized financial products or services, it is easier to convince individuals of voluntary financial exclusion (Cull et al., 2013). This theory prioritizes those who were formerly financially included,

ahead of those who had never been on any financial product. One of the advantages of this theory is that there is a conscious effort to deal with voluntary financial exclusion, which is a major issue in financial inclusion. The theory can also boast of not using public funds to finance financial inclusion initiatives since this theory can be pursued through negotiation and persuasion.

The theory has the following disadvantages. First, it does not give every member of the population equal opportunity to be financially included. However, it prioritizes voluntary financial exclusion of people ahead of any other group in the population.

Empirical Review

This section reviews previous studies on financial inclusion, poverty, and economic growth. This section reviews what other academics have done regarding the area's financial inclusion and sets the tone for this study.

Research on the relationship between financial inclusion and economic growth has yielded conflicting results. Using data from India, Lenka and Sharma (2017) discovered a positive correlation between financial inclusion and economic growth. Omojolaibi (2017) also conducted research in Nigeria and discovered that financial inclusion lowers poverty and increases per capita GDP. According to Angardi (2007), enhanced financial infrastructure is likely to increase economic growth. Neal and North (2009) support these findings, arguing that a healthy financial institution tends to encourage economic growth.

While many studies suggest that financial inclusion boosts economic growth, others have found the opposite. Pierce (2011), for example, claims that although financial inclusion increases productivity, it does not always translate into economic growth, as some academics have claimed.

Pearce (2011) discovered a negative correlation between economic growth and the expansion of banks and private sector lending in the MENA nations. According to Brune et al. (2011), excessive financial inclusion, particularly in developed nations, may have a detrimental impact on economic growth. Using the global financial crisis as an example, the authors discovered that the overuse of financial goods, especially mortgages, was one of the main reasons for the 2008 financial catastrophe. Arestis et al. (2001) demonstrated an unfavorable relationship between financial inclusion and economic growth, which supports the conclusions of Brune et al. (2011).

The causal relationship between financial inclusion and economic growth is another point of debate. While some academics believe that the two variables are causally related in a unidirectional manner, others believe that the causal relationship is bidirectional, implying that both economic growth and financial inclusion are caused by one another. Sharma (2016) discovered both unidirectional and bidirectional bank deposits and GDP per capita. Lenk and Sharma (2017) discovered a unidirectional causal relationship between financial inclusion and economic growth. Apergis et al. (2007) and Kim et al. (2017) discovered a two-way causal relationship between economic growth and financial inclusion.

Given the contradictory findings regarding the relationship between financial inclusion and economic growth, as well as the causality between the two variables, more research is required to confirm or disprove previous findings. This research should consider the econometric estimation method, additional control variables, and the study's jurisdiction.

This study investigates the connection between poverty, economic growth, and financial inclusion in SSA. The causal relationships between these three variables were further investigated in this study.

Methodology

Data Sources and Description of Variables

This section discusses the data and describes the variables used in this study. Data were obtained from the International Financial Statistics (IFS) and World Development Indicators (WDI). The sub-Saharan Africa sample comprises 48 countries. This study employs panel data from 2000 to 2019. The Description of variables is shown in Table 1.

Table 1: Description of Variables

Variable	Notation	Description	Data Sources
Financial Inclusion Index	FINDEX	An index of ATMs for each hundred thousand grown-ups, bank branches for each hundred thousand grown-ups, commercial bank branches for each hundred thousand grown-ups, bank accounts for each thousand grown-ups, borrowers from banks for each hundred thousand grown-ups, and depositors with banks for each thousand grown-ups	IFS
FI	ATMSEHTG	ATMs for each hundred thousand grown-ups	IFS
FI	BBEHTG	Bank branches for each hundred thousand grown-ups	IFS
FI	CBBEHTG	Commercial bank branches for each hundred thousand grown-ups	IFS
FI	BFCBEHG	Borrowers from a commercial bank for each hundred grown-ups	IFS
FI	BAETG	Bank accounts for each thousand grown-ups	IFS
FI	DCPTA	Depositors with banks for each thousand grown-ups	IFS
Poverty	PHC190	Headcount ratio of Poverty at \$1.90 a day as a % of the population of country (i) at time (t).	WDI
Economic Growth	GDPPCGR	Gross domestic product per capita growth rate (annual %)	WDI

Principal Component Analysis (PCA)

This study employed a principal component analysis estimation technique to construct the financial inclusion index (FINDEX). This index consists of six selected measures of financial inclusion: ATMSEHTG, BBEHTG, CBBEHTG, BFCBEHG, BAETG, and DCPTA.

The PCA equation is specified as follows;

$$FINDEX_K = W_{K1} X_1 + W_{K2} X_2 + \dots + W_{KN} X_N \dots \dots \dots (1)$$

Where FINDEX represents the financial inclusion index, W_K is the weight of the parameter, X is the respective component value, and N is the total number of variables contained in the equation. The index was constructed using the supply- and demand-side factors of financial inclusion. The supply-side factors are composed of ATMSEHTG, BBEHTG, and CBBEHTG, and the demand-side factors are composed of BFCBEHG, BAETG, and DCPTA.

The function of the index was specified as follows;

$$FINDEX = f(ATMSPHTA, BBPHTA, CBBPHTA, BFCBPHA, BAPTA, DCPTA).$$

Panel Vector Autoregressive Model (VAR) Estimation Technique

This study employed a panel VAR to model the relationship between financial inclusion, poverty, and economic growth in SSA. Panel VAR was chosen ahead of other techniques because it addresses endogeneity problems that affect other estimation techniques, such as ordinary least squares (OLS). Christopher Sims introduced VAR models in 1980 to model the joint dynamics and causal relationships among macroeconomic variables. Since then, VAR has been extensively used by econometricians to model the relationships between variables and determine causality. Most often, when econometricians anticipate a tripartite relationship among variables, they use VAR. A VAR model explains the relationship between a variable and its lags (past) and the lags of the other variables. It treats all variables as endogenous variables. VAR is employed for short-run analysis, while the vector error correction model (VECM) is a specialized form of VAR employed when a long-run relationship exists among the variables.

Variance Decomposition (VD) and Impulse Response Functions (IRF)

To determine how the dependent variable responds to shocks from the other variables in the model, we employed VD and IRF. The VD of the forecast error shows unexpected changes or variations in each

variable because of shocks from other variables in the model. The VD also assesses the economic significance of the impact as a percentage of the forecast error. The study also employs IRF to explain the reaction of the system in response to external shocks. In VAR modelling, IRF explains the reaction of an endogenous variable to one of its innovations. Thus, it traces the effects on the present and future values of the endogenous variable of a standard deviation shock to one of its innovations.

Model Specification

This study employs panel vector autoregression to assess the relationship and causality between financial inclusion, poverty, and economic growth. Panel VAR was chosen because it resolves the endogeneity issue. The researcher anticipates that a bi-causality relationship exists among the variables under study; hence, pVAR is preferred since it treats all variables as endogenous.

The pVAR model based on Love and Zicchino (2006) is given by;

$$Z_{it} = Z_{it-1} + f_i + d_i + e_{it} \dots\dots\dots (2)$$

Where Z_{it} is [FINDEX, POV, GDPPCGR], f_i is the fixed effects, d_i is the time dummy of each country that indicates each macro shock, and e_{it} is a random error term iid

The pVAR equations are specified as follows;

$$\begin{aligned} \text{FINDEX}_{it} = & \sum_{j=1}^P \phi_{1j} \text{FINDEX}_{it-j} + \sum_{j=1}^P \phi_{2j} \text{POV}_{it-j} \\ & + \sum_{j=1}^P \phi_{3j} \text{GDPPCGR}_{it-j} + f_i + d_i + e_{it} \dots\dots\dots (3) \end{aligned}$$

$$\begin{aligned} \text{POV}_{it} = & \sum_{j=1}^P \phi_{1j} \text{POV}_{it-j} + \sum_{j=1}^P \phi_{2j} \text{FINDEX}_{it-j} \\ & + \sum_{j=1}^P \phi_{3j} \text{GDPPCGR}_{it-j} + f_i + d_i + e_{it} \dots\dots\dots (4) \end{aligned}$$

$$\begin{aligned} \text{GDPPCGR}_{it} = & \sum_{j=1}^P \phi_{1j} \text{GDPPCGR}_{it-j} + \sum_{j=1}^P \phi_{2j} \text{FINDEX}_{it-j} \\ & + \sum_{j=1}^P \phi_{3j} \text{POV}_{it-j} + f_i + d_i + e_{it} \dots\dots\dots (5) \end{aligned}$$

VECM equations are specified as follows;

$$\begin{aligned} \Delta \text{FINDEX}_{it} = & \lambda_1 \text{ECT}_{t-1} + \sum_{j=1}^{P-1} \phi_{1j} \Delta \text{FINDEX}_{it-j} + \sum_{j=1}^{P-1} \phi_{2j} \Delta \text{POV}_{it-j} \\ & + \sum_{j=1}^{P-1} \phi_{3j} \Delta \text{GDPPCGR}_{it-j} + f_i + d_i + e_{it} \dots\dots\dots (6) \end{aligned}$$

$$\begin{aligned} \Delta \text{POV}_{it} = & \lambda_2 \text{ECT}_{t-1} + \sum_{j=1}^{P-1} \phi_{1j} \Delta \text{POV}_{it-j} + \sum_{j=1}^{P-1} \phi_{2j} \Delta \text{FINDEX}_{it-j} \\ & + \sum_{j=1}^{P-1} \phi_{3j} \Delta \text{GDPPCGR}_{it-j} + f_i + d_i + e_{it} \dots\dots\dots (7) \end{aligned}$$

$$\begin{aligned} \Delta \text{GDPPCGR}_{it} = & \lambda_3 \text{ECT}_{t-1} + \sum_{j=1}^{P-1} \phi_{1j} \Delta \text{GDPPCGR}_{it-j} + \sum_{j=1}^{P-1} \phi_{2j} \Delta \text{FINDEX}_{it-j} \\ & + \sum_{j=1}^{P-1} \phi_{3j} \Delta \text{POV}_{it-j} + f_i + d_i + e_{it} \dots\dots\dots (8) \end{aligned}$$

Where ECT is the error correction term, λ_i is the speed of adjustment parameter

P-1 is the lag length reduced by 1

ϕ_{ij} is short-run dynamic coefficients of the model's adjustment long-run equilibrium

Data Analysis

This section presents the data analysis and discussion of the results. This section includes the output of the statistical analysis of descriptive statistics, results of the unit root test, Granger causality test, optimal lag length selection, panel VAR estimates, variance decomposition results, impulse response functions, normality test, heteroscedasticity results, and VECM estimates. The chapter also discusses the findings in relation to the existing literature and theory.

Descriptive Statistics

This section presents the descriptive statistics of the study. This includes the mean, median, maximum, minimum, standard deviation, skewness, and kurtosis.

Table 2: Descriptive Statistics

	ATMS	BFCB	CBB	DWCB	PHC190	GDPPCGR
Mean	11.510	57.630	6.260	290.550	42.080	1.800
Median	4.830	24.480	3.370	150.840	43.000	2.030
Maximum	89.990	334.240	55.070	2424.750	94.300	56.790
Minimum	0.000	0.020	0.140	0.470	0.200	-47.590
Std. Dev.	16.690	75.550	8.900	409.050	21.540	5.300
Skewness	2.140	1.740	3.290	2.750	0.030	-0.250
Kurtosis	7.070	5.070	14.690	10.850	2.260	30.320
Jarque-Bera	865.950	280.150	5063.530	1932.360	22.290	28505.990
Probability	0.000	0.000	0.000	0.000	0.000	0.000
Observations	596.00	409.00	676.00	505.00	960.00	916.00

Source: Researcher's Construct (2024)

Descriptive statistics of the variables used in this study are shown in Table 2. The mean ATMS, BFCB is 57.63, CBB is 6.26, and DWCB values were 11.51, 57.63, 6.26, and 290.55, respectively. The PHC90 and GDPPCGR were 42.08 and 1.80, respectively. However, because the mean value is mostly influenced by outliers, we considered the median value in our discussions. The median value of 4.83 for ATMS per hundred thousand adults in SSA was low. This indicates a low penetration of financial inclusion in SSA. In addition, the range of 89.99 for ATMS per hundred thousand adults shows a wide variation in the dataset. The remaining variables that measure financial inclusion have a median; thus, BFCB, CBB, and DWCB have medians of 24.48, 3.37, and 150.84, respectively. The median headcount ratio of poverty at \$1.90 a day as a percentage of the population of the country is 43, while the median GDP per capita growth rate is 2.03. The standard deviation for the GDPPCGR is 5.30, which indicates that the variation between the mean and GDPPCGR variables is not wide. However, the standard deviation for DWCB is 409.05, which indicates that the data points for DWCB are farther away from the mean.

Results of Unit Root

In panel data analysis, it is imperative to test the stationarity of the variables to prevent spurious and misleading findings. Panel data are said to be stationary if their probability distribution remains the same over time. In other words, the distribution should be mean-reverting rather than following a particular trend. Panel data that follows a certain trend is said to have a unit root or non-stationary, while panel data that reverts around the mean is stationary or has no unit root. Econometricians are required to test the stationarity of each data series before estimating their models. This was done to avoid spurious or misleading estimates. In addition, the variable order of integration is useful in selecting an appropriate model to compute parameter estimates. Several estimation techniques have been employed by different authors to test for unit roots in the panel data. For instance, Im et al. (2003) employed Im Pesaran and Shin (IPS) in their estimation of unit roots, while Levin et al. (200) used the Levine-Lin Chu (LLC) unit root test. This study employs both IPS and LLC, in addition to ADF and PP. Using a panel test for stationarity has some advantages over using a singular time-series-based unit-root test. This is because the panel data-based unit root test has more predictive power than the univariate stationarity tests. The researcher deemed a four-panel unit root test fit for this study because the traditional ADF is not more robust when testing for a panel unit root. In addition, the panel root test makes room for country-level fixed effects and time variations for the coefficients in the panel. The results of the panel root test are shown in Table 3.

Table 3: Unit Root Test

LEVEL	FINDEX	PHC190	GDPPCGR
LLC	-1.360	-8.540***	-17.960***
IPS	2.250	-5.300***	-15.660***
ADF	40.310	215.520***	415.085***
PP	48.700	196.430***	433.360***
FIRST DIFFERENCE	FINDEX	PHC190	GDPPCGR
LLC	-18.000***	36.000***	-41.810***
IPS	-9.140***	-23.600***	-35.570***
ADF	111.900***	691.390***	1054.090***
PP	218.550***	833.620***	3379.360***

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

The results of the unit-root tests, as shown in Table 3, two of the variables (poverty and GDP per capita growth) were stationary at levels or integrated order zero, I (0), except for the financial inclusion index, which was stationary at integrated order one, I (1). As shown in Table 3, not all variables used in the study were stationary at levels.

Optimal Lag Length Selection

Prior to estimating the panel VAR, we determine the optimal lag length to be selected for the model. This is important because determining the optimal lag prevents the loss of DOF. It also helps prevent multicollinearity among the independent variables, serial correlation in the disturbance terms, and misspecification of errors. The number of lags used in a model is an empirical issue. However, it can also be determined using the Akaike information criterion (AIC), Schwarz information criterion (SC), and Hannan-Quinn information criterion (HQ). Normally, we choose a lag length that corresponds to the information criterion that has been asterisked with the minimum value. This is the optimal lag used for estimating the model.

Table 4: Optimal Lag Length Selection

Endogenous variables: DFINDEX PHC190 GDPPPCGR

Lag	LogL	LR	FPE	AIC	SC	HQ
1	-452.804	N/A	11.963	10.995	11.256*	11.100*
2	-444.418	15.574	12.147	11.010	11.531	11.219
3	-438.289	10.945	13.029	11.078	11.860	11.392
4	-433.688	7.887	14.517	11.183	12.225	11.602
5	-431.333	3.869	17.103	11.341	12.643	11.865
6	-414.063	27.138	14.168	11.144	12.707	11.773
7	-392.426	32.456	10.616*	10.843*	12.667	11.576
8	-386.218	8.868	11.535	10.910	12.993	11.748

Notes: LR: Sequential modified LR test statistic (each test at the 5% level); FPE: Final Prediction Error, AIC is Akaike information criterion; SC, Schwarz information criterion; HQ, Hannan-Quinn information criterion.

As shown in Table 4, the researcher chose lag length one (1), as determined by Schwarz information criteria and Hannan-Quinn information criteria. These criteria were chosen because, per the results, they were asterisked, indicating that they had the minimum information. Even though AIC and FPE were also asterisked, the researcher settled on a lag length of one. As indicated by Obi (2015), when the information criteria have the same number of asterisks, it is up to the researcher to determine which information criterion to use. This forms the basis for the researcher choosing a lag of 1.

Panel VAR Estimation

We employed a panel vector autoregression (VAR) estimation technique to model the relationship between financial inclusion, poverty, and economic growth in Sub-Saharan Africa. Panel VAR was chosen

ahead of other estimation techniques because it resolves the endogeneity problems that affect other estimation techniques, such as ordinary least squares (OLS). Christopher Sims introduced VAR models in 1980 to model the joint dynamics and causal relationships among macroeconomic variables. Since then, VAR has been extensively used by econometricians to model the relationships between variables and determine causality. Most often, when econometricians anticipate a tripartite relationship among variables, they use VAR. A VAR model explains the relationship between a variable and its lags (past) and the lags of the other variables. It treats all variables as endogenous variables.

Table 5: Vector Autoregression Estimates.

	DFINDEX	PHC190	GDPPCGR
DFINDEX (-1)	0.195*** (0.065) [3.001]	-4.188** (2.125) [-1.970]	3.164** (1.608) [1.967]
PHC 190 (-1)	0.001** (0.000) [2.294]	0.984*** (0.001) [124.198]	0.029*** (0.006) [4.839]
GDPPCGR (-1)	0.003 (0.002) [1.438]	-0.121* (0.068) [-1.780]	0.235*** (0.052) [4.552]
R- squared	-0.037	0.946	0.060
Adjusted R-squared	-0.045	0.945	0.052
Sum. Sq. residuals	6.970	7428.612	4253.780
F-Statistic	-4.480	2180.661	7.930

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

From Table 5, it is clear that there is a significant positive relationship between financial inclusion and lags. This implies that past levels of financial inclusion positively influence current levels of financial inclusion, with all other things being equal. The study also reveals a negative relationship between poverty and the lag in financial inclusion. This result is statistically significant at the 5% level. The researcher explained this by asserting that an improved financial inclusion system that allows many more people to be included in the financial sector (banks, microfinance institutions, mobile money, credit unions, insurance, etc.) will lead to a reduction in poverty levels in Sub-Saharan Africa. This result is consistent with the findings of Honohon (2008), who found that financial access has an inverse relationship with poverty in 162 countries. This result is also no different from that of Park and Mercado, who found a negative relationship between financial inclusion and poverty levels in 177 countries across the world, 37 Asian countries. This result is also in agreement with Burgess and Pande (2005), who find that access to financial services leads to a reduction in poverty levels and improves economic growth.

Our results differ from those of the previous studies. While other studies have focused on the unidirectional causality relationship between financial inclusion and poverty, this study establishes a bi-causal relationship between the two variables. This is important for policymakers to treat both variables as outcome and predictor variables in policy formulation, since both variables depend on each other.

However, the findings of this study are in contrast with those of other empirical studies. The study results differ from those of Neaime and Gaysett (2018), who found that the impact of financial inclusion on poverty levels is insignificant. By employing data from eight MENA countries and employing the generalized method of moments (GMM) estimation technique, these authors found a statistically insignificant effect of financial inclusion on poverty.

Furthermore, this study finds a positive relationship between economic growth and the lag in financial inclusion. This finding is statistically significant at the 5% level. This implies that a country that includes many more people in the financial sector will create an enabling environment that fosters economic growth, all else being equal. This finding concurs with that of Kim et al. (2017), who found that

financial inclusion positively impacts economic growth. A few other studies have supported the findings of this study. For instance, Lenka and Sharma (2017) find a positive relationship between financial inclusion and economic growth using data from India. Angardi (2007) established that an improved financial infrastructure is likely to boost economic growth. This finding is supported by Neal and North (2009), who argued that a well-functioning financial institution has a tendency to promote economic growth.

However, this study argues contrary to the findings of Pierce (2011), who stated that even though there is an increase in productivity due to financial inclusion, this does not necessarily lead to economic growth, as asserted by several researchers. He posits that an increase in banks and credit to the private sector of MENA countries has an inverse relationship with economic growth. Brune et al. (2011) posit that excessive financial inclusion can negatively affect economic growth, especially in developed countries. Citing the global financial crisis as an example, the author found that one of the major causes of the 2008 financial crisis was the excessive patronage of financial products, particularly mortgages. Arestis et al. (2001) confirm Brune et al.'s (2011) findings by showing that there is an inverse relationship between financial deepening and economic growth. Our study, therefore, found contrary results to Pierce (2011), Brune et al. (2011), and Arestis et al. (2001).

This study makes inferences that the first lag of financial inclusion has a short-run causal effect on poverty in SSA, as indicated by a t-statistic of -1.97047. This means that financial inclusion helps predict the poverty levels in Sub-Saharan Africa. In addition, the study found reverse causality from poverty to financial inclusion. Indicating poverty levels could predict the level of financial inclusion in a subregion. The study also inferred that the lag in financial inclusion has a short-run causal effect on economic growth, as indicated by a t-statistic of 1.96740. This means that financial inclusion is essential for predicting economic growth in a sub-region. This finding suggests that policymakers and governments in the sub-region should invest their efforts and resources to expand the financial sector to make it attractive for many more people to be captured into the financial sector. This eventually increases the economic growth of the subregion. However, the study found no causal relationship between economic growth and financial inclusion, as indicated by the statistically weak significance of 1.43788. This makes our study different from the works of Kim et al. (2017) and Apergis et al. (2007), who find a bi-causal relationship between financial inclusion and economic growth.

Additionally, the study found reverse causality between the lag of poverty and economic growth. This implies that not only does economic growth affect poverty levels in the sub-region, but poverty levels can also impact economic growth. This means that policymakers and governments in Sub-Saharan Africa should not only consider poverty as an outcome variable, but also as a predictor variable. The reverse causality between these variables, poverty, and GDPFCGR makes economic sense: This is because when the economy is booming, demand for goods and services will increase, all other things being equal; hence, companies are likely to hire more people to increase production to meet demand. This increase in employment leads to a reduction in poverty levels, *ceteris paribus*.

On the other hand, the economy is in recession with high poverty levels. The government can decide to expand its economy through lower interest rates and by increasing government expenditure. This will lead to an increase in investment and the production of goods and services, leading to an increase in economic growth.

Variance Decomposition

Forecast error variance decomposition (FEVD) shows unexpected variation in percentage terms in the endogenous variables caused by innovations or shocks from other variables. The VD also explains the relative impact of one variable on another.

Table 6: Variance Decomposition of DFINDEX

Period	S.E.	DFINDEX	PHC190	GDPPCGR
1	0.167	100.000	0.000	0.000
2	0.170	99.440	0.036	0.524
3	0.171	99.298	0.093	0.609
4	0.171	99.229	0.156	0.615
5	0.171	99.167	0.219	0.615

6	0.171	99.106	0.279	0.615
7	0.171	99.048	0.337	0.615
8	0.171	98.993	0.391	0.616
9	0.171	98.940	0.443	0.617
10	0.171	98.890	0.493	0.617

Source: Researcher's Construct (2021)

As shown in Table 6, the results of the FEVD of DFINDEX show that in the first year, 100% of the variation in DFINDEX is explained by DFINDEX. That is, in the short run, the variation in financial inclusion is explained by financial inclusion itself. However, in the long run (10 years), 0.493% and 0.617% of the variation in DFINDEX is explained by PHC 190 and GDPPCGR shocks, respectively. This implies that both GDPPCGR and PHC190 had a strong exogenous impact on DFINDEX.

Table 7: Variance Decomposition of PHC190

Period	S.E.	DFINDEX	PHC190	GDPPCGR
1	5.451	1.857	98.143	0.000
2	7.760	4.448	95.139	0.414
3	9.497	5.952	93.288	0.760
4	10.910	6.847	92.165	0.988
5	12.105	7.414	91.447	1.139
6	13.141	7.796	90.961	1.242
7	14.056	8.069	90.614	1.317
8	14.873	8.273	90.355	1.372
9	15.609	8.430	90.156	1.415
10	16.278	8.554	89.997	1.448

Source: Researcher's Construct (2021)

As shown in Table 7, the FEVD of PHC190 results, we observe that in the short run, in the first year, 1.857% and 0.000% of the variation in PHC190 is explained by DFINDEX and GDPPCGR shocks, respectively. However, in the long run, in 10 years' time, 8.554% and 1.448% of the variation in PHC 190 is explained by DFINDEX and GDPPCGR shocks, respectively.

Table 8: Variance Decomposition of GDPPCGR

Period	S.E.	DFINDEX	PHC190	GDPPCGR
1	4.125	0.319	0.030	99.652
2	4.277	2.019	0.192	97.789
3	4.294	2.207	0.417	97.376
4	4.299	2.203	0.658	97.139
5	4.305	2.207	0.894	96.900
6	4.310	2.220	1.119	96.660
7	4.315	2.237	1.333	96.430
8	4.320	2.254	1.536	96.210
9	4.325	2.271	1.728	96.001
10	4.330	2.288	1.909	95.804

Source: Researcher's Construct (2021)

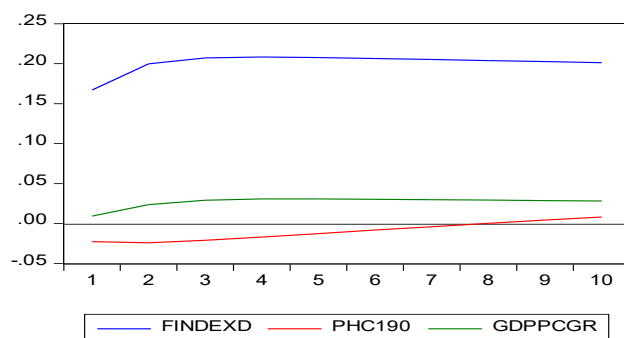
As shown in Table 8, the FEVD of GDPPCGR results, we observe that in the short run, in the first year, 0.319% and 0.030% of the variation in GDPPCGR is explained by DFINDEX and PHC 190 shocks, respectively. However, in the long run, in 10 years' time, 2.288% and 1.909% of the variation in GDPPCGR is explained by DFINDEX and PHC 190 shocks, respectively.

After using three normality tests, we found that all the variables, DFINDEX, PHC190, and GDPPCGR, were jointly normally distributed, as shown by the joint probability values of 0.1330, 0.1211, and 0.1193 in all three results.

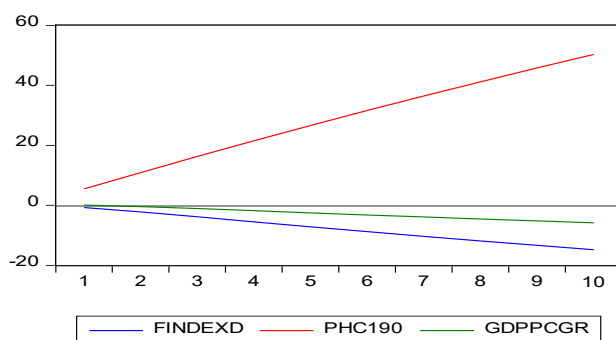
Impulse Response Function

As shown in Figure 1, generally, IRF explains the reaction of a system in response to external shocks. In VAR modelling, IRF explains the reaction of an endogenous variable to one of its innovations. Thus, it

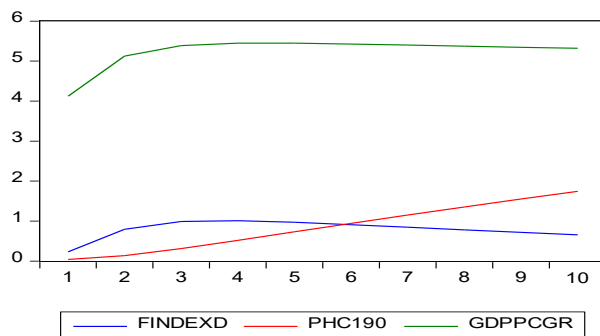
Accumulated Response of FINDEXD to Generalized One S.D. Innovations



Accumulated Response of PHC190 to Generalized One S.D. Innovations



Accumulated Response of GDPPCGR to Generalized One S.D. Innovations



traces the effects on the present and future values of the endogenous variable of a standard deviation shock to one of its innovations. IRF is used to describe the evolution of the variable of interest along a specified time horizon after a shock at a given moment. It is a very important tool in empirical causal and policy effectiveness analyses. Estimating the IRF is important because individual coefficients in the VAR models are often not sufficient for policy decision-making or formulation, as they do not describe reactions of the endogenous variables due to shocks. Therefore, this study ran the IRF of DFINDEX, PHC190, and GDPPCGR. Figure 1 shows the IRF results of the IRF of this study. The results show that a one standard deviation shock or innovation (increase) in GDPPCGR will result in an increase in DFINDEX in the first year.

However, from years 2 to 6, GDPPCGR remained stable, resulting in the stability of DFINDEX. After the 6th year, there was a diminishing decline in GDPPCGR, which led to a decrease in DFINDEX. In addition, a one standard deviation shock (decrease) in PHC190 resulted in an increase in DFINDEX in the first year. After the second to the long run (10th year), poverty increases at a diminishing rate, causing financial inclusion to fall at a diminishing rate. With regard to PHC 190, it was observed that a one-standard-deviation shock (fall) in DFINDEX and GDPPCGR will result in an increase in PHC 190. In the long run, shocks in GDPPCGR and DFINDEX are associated with a sharp rise in poverty levels. The response of GDPPCGR revealed that in the first year, a one standard deviation impulse in DFINDEX leads to a rise in GDPPCGR, while from the 2nd year to the long run, a diminishing fall in DFINDEX results in a fall in GDPPCGR. In addition, a one standard deviation shock (increase) in PHC 190 results in an increase in GDPPCGR in the first year. However, after the third year, an increase in PHC 190 led to a decrease in the GDPPCGR.

Figure 1: Impulse Response Function

Cointegration Tests

The core objective of this study was to examine whether there is a causal relationship between financial inclusion, poverty, and economic growth in Sub-Saharan Africa. This study also sought to simulate shocks in the VAR system and trace the effects of shocks on endogenous variables.

After achieving these objectives, it was necessary for the researcher to ascertain whether there was a long-term relationship among the variables; hence, there was a need for cointegration tests. This study employed Johansen cointegration tests using trace and maximum eigenvalues. Table 9 presents the results of the cointegration tests.

Table 9: Cointegration Tests of Series: DFINDEX, PHC 190, GDPPCGR

Hypothesized No. of CE(s)	Eigen Value	Trace Statistic	Critical Value (0.05)	Probability**
None*	0.304	139.618	29.798	0.000
At most 1*	0.226	59.981	15.495	0.000
At most 2	0.017	3.683	3.841	0.055
Hypothesized No. of CE(s)	Eigen Value	Max-Eigen Statistic	Critical Value (0.05)	Probability**
None*	0.304	79.637	21.132	0.000
At most 1*	0.226	56.298	14.265	0.000
At most 2	0.017	3.683	3.841	0.055

Note: Trace statistic test indicates 2 cointegration equations at 0.05 significance level

The Max-Eigen statistic test indicates 2 cointegration equations at a 0.05 significance level.

As shown in Table 9, the results, both Trace and Max-Eigen statistics, reveal that there are at most two cointegration equations in the model. This implies a long-run relationship between the variables. This is indicated by a probability value of 0.055 for both Trace and Max Eigen. In view of these results, it is necessary to run a Vector Error Correction Model (VECM) to estimate the long-run model.

Vector Error Correction Model (VECM)

The VECM is a specialized form of the VAR model that estimates the long-term relationships between variables. The study proceeded to run the VECM after establishing a long-run relationship between variables. It is important to mention that the VECM also estimates the short-run coefficients; however, this study specifically runs a VAR to examine whether there is a causality relationship among the variables and to simulate shocks in the VAR system and trace out the effects of shocks on the endogenous variables. Hence, running VAR before VECM was intended to achieve the objectives of this study. The VECM results are shown in Table 10.

Table 10: Vector Error Correction Model (VECM)

Vector Error Correction Estimates

Sample (adjusted): 2007 2019

Cointegrating Eq:	CointEq1
FINDEXD(-1)	1.000
PHC190(-1)	0.002 (0.001) [1.456]
GDPPCGR(-1)	0.067 (0.008) [8.326]

C	-0.282		
Error Correction:	D(DFINDEX)	D(PHC190)	D(GDPPCGR)
CointEq1	-0.133 (0.048) [-2.780]	-4.651 (1.368) [-3.401]	-7.880181 (0.96390) [-8.17527]
D(DFINDEX(-1))	-0.418 (0.062) [-6.740]	-1.449 (1.772) [-0.818]	3.805 (1.249) [3.046]
D(PHC190(-1))	0.005 (0.002) [2.315]	-0.077 (0.062) [-1.236]	-0.106 (0.042) [-2.438]
D(GDPPCGR(-1))	0.002 (0.002) [0.757]	0.102 (0.069) [1.473]	0.010 (0.049) [0.209]
C	0.011 (0.013) [0.887]	-1.293 (0.360) [-3.597]	-0.292 (0.253) [-1.151]
R-squared	0.270	0.067	0.284
Adj. R-squared	0.256	0.050	0.271
Sum sq. resids	7.255	5915.673	2938.893
S.E. equation	0.184	5.245	3.697
F-statistic	19.869	3.866	21.353

$$ECT_{t-1} = [1.000FINDEX_{t-1} + 0.002PHC190_{t-1} + 0.067GDPPCGR_{t-1} - 0.282]$$

The results, as shown in Table 10 and the VECM, are presented above. This section focuses on interpreting the long-run results only because the short-run results have already been interpreted after estimating the VAR model. From the results, we establish that the preceding year's deviation from the long-run equilibrium is adjusted at a speed of 13.3%.

Conclusion

In conclusion, this study provides a nuanced understanding of the intricate relationship between financial inclusion, poverty reduction, and economic growth in Sub-Saharan Africa. The findings indicate a bi-causal relationship between financial inclusion and poverty, suggesting that not only does increased access to financial services contribute to poverty alleviation, but also that lower poverty levels can enhance financial inclusion. This reciprocal dynamic underscores the importance of viewing financial inclusion and poverty as interconnected variables in policy formulation.

This research highlights that financial inclusion serves as a catalyst for economic growth by creating an enabling environment that fosters investment and productivity. As evidenced by the significant positive relationship between financial inclusion and economic growth, it is clear that enhancing access to financial services can lead to increased economic activity, job creation, and ultimately, a reduction in poverty levels. This aligns with the findings of previous studies, such as those by Kim, Yu, and Hassan (2017), which also support the notion that financial inclusion positively impacts economic growth.

However, the study also acknowledges the conflicting results present in the literature, where some researchers have found insignificant or even negative correlations between financial inclusion and economic growth. This highlights the need for further empirical research to explore the contextual factors

that may influence these relationships, particularly in diverse economic environments across sub-Saharan Africa.

Given the critical role of financial inclusion in driving economic development and reducing poverty, policymakers are urged to prioritize strategies that enhance access to financial services for marginalized populations. This includes investing in financial literacy programs, improving the financial infrastructure, and leveraging technology to expand outreach. By treating financial inclusion and poverty as both outcome and predictor variables, governments can develop more effective policies that address the root causes of poverty, while simultaneously promoting sustainable economic growth. Ultimately, the findings of this study advocate for a holistic approach to financial inclusion that recognizes its potential to transform lives and economies in sub-Saharan Africa.

Policy recommendations

Based on the findings of this study, several policy recommendations are proposed to enhance financial inclusion, reduce poverty, and stimulate economic growth in sub-Saharan Africa.

1. Enhance Financial Literacy Programs: Governments and financial institutions should prioritize the development and implementation of comprehensive financial literacy programs aimed at educating the population, particularly poor and marginalized groups. These programs should focus on basic financial concepts, savings, credit management, and the benefits of formal financial services. By improving financial literacy, individuals are better equipped to make informed financial decisions, thereby increasing their participation in the financial system.

2. Leverage Technology for Financial Services: The rapid advancement of technology, particularly mobile technology, presents a unique opportunity to expand financial inclusion. Policymakers should encourage the development of mobile banking and digital financial services to cater to the needs of underserved populations. This includes creating a regulatory environment that supports fintech innovations, while ensuring consumer protection and data security.

3. Strengthen Financial Infrastructure: Investment in financial infrastructure is crucial for enhancing access to financial services. Governments should improve the physical and digital infrastructure necessary for financial institutions to operate effectively, particularly in rural and underserved areas. This includes expanding the network of bank branches, ATMs, and agent-banking services.

4. Promote Inclusive Financial Products: Financial institutions should be incentivized to develop and offer products tailored to the needs of low-income individuals and small businesses. This includes microloans, savings accounts with no minimum balance, and affordable insurance. Policymakers can facilitate this by providing subsidies or guarantees that encourage banks to serve these markets.

5. Foster Public-Private Partnerships: Collaboration between the government, private sector, and non-governmental organizations is essential for promoting financial inclusion. Policymakers should create platforms for dialogue and partnerships that bring together stakeholders to share best practices, resources, and innovative solutions to enhance financial access.

6. Monitor and Evaluate Financial Inclusion Initiatives: Establishing a robust framework for monitoring and evaluating the impact of financial inclusion policies is vital. This will help to identify successful strategies, understand challenges, and make data-driven adjustments to policies and programs.

By implementing these recommendations, policymakers can create a more inclusive financial ecosystem that not only reduces poverty but also fosters sustainable economic growth in sub-Saharan Africa.

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