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Sustainable development goals: Attaining sustainable living through financial inclusion in Sub-Saharan Africa

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Abstract: This study examines the effect of financial inclusion on sustainable living in 20 sub-Saharan African countries using the panel Autoregressive Distributive Lag (ARDL) model. The findings indicate that FII, the numbers of borrowers, depositors, bank branches and automated teller machines exert a significant effect on GDP per capita in sub-Saharan Africa. The Pooled Mean Group (PMG) estimates further indicate that FII (which captured the combined effect of financial access and usage) exerts a negative effect on gross domestic product (GDP) per capita in sub-Saharan Africa (SSA). However, the results of the individual measures of financial inclusion, that is, the numbers of borrowers, depositors and banking penetration exert a positive effect on gross domestic product (GDP) per capita in the long run in sub-Saharan Africa. This portends that financial inclusion is a significant contributor that can improve sustainable living conditions in sub-Saharan Africa. Based on these, the study recommends the need to improve access to and usage of financial products and services through user-friendly and service-fluent financial technologies in sub-Saharan Africa. This will help increase the number of households, smallholder farmers and businesses to access the formal financial system to meet their reoccurring and precautionary funding needs in sub-Saharan African countries.

Keywords: *Autoregressive distributive lag, Financial access, Financial inclusion, Financial usage, GDP per capita, Number of borrowers, Number of depositors, Sub-Saharan Africa, Sustainable living conditions.*

1. Introduction

In 2015, the 193-member United Nations (UN) adopted the Sustainable Development Goals (SDGs) to consolidate on the successes of the Millennium Development Goals (MDGs), to tackle the problems of poverty and disparities, and further enhance health, education, and economic growth (Kara, Zhou, & Zhou, 2021). The UN SDGs policy document highlights 17 goals and 169 targets to be achieved in the year 2030 by its member nations (United Nations, 2015).

Poverty and hunger are major constraints to the social well-being of a nation. They both render households the most vulnerable and susceptible to all forms of social, environmental, and economic shocks due to a lack of financial resources and the means to access funds from financial intermediaries. However, scholars share the opinion that access to external funds can help reduce the multidimensional effect of poverty on individuals and households (Kara et al., 2021; Kuada, 2019). Again, it helps people to observe better dieting, sanitation and general well-being (Immurana, Iddrisu, Boachie, & Dalaba, 2021).

Sustainable economic growth, decent work, innovation and sustainable industrialization are largely dependent on low-cost micro and small businesses which can add 95 million jobs and scale up the world's gross domestic product by 6% in 2025 (UNSGSA, 2018). This has the potential to enhance the living conditions of poor people through living wages. These low-cost businesses have a global funding gap of $5.2 trillion, thus bridging this funding gap may sustain growth, spur innovation and enhance socio-economic development. Consequently, growth in household income can be accentuated through

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external funding to their many ventures and can further position disadvantaged households to give quality education and training to their children and wards. For instance, women through accessible funding options can invest in income-yielding ventures or acquire modern farming implements to enhance their yields; thus, enhancing their sustainable livelihood and placing them as critical stakeholders in decision-making making thus, reducing the gender gap (Ma'ruf & Aryani, 2019). About 40% of the global labour force is made up of women and 34% of small businesses are owned by women in emerging countries (Kara et al., 2021). This can scale up their economic power and reduce gender inequality. FI is a critical tool for the actualization of some of the policy goals in less developed countries with less robust financial systems. It is argued that broadening the quality of FI to households and businesses (especially smallholder farmers and businesses) can help meet funding gaps and enhance access to health, education, and housing for all groups of people in society (Niaz, 2022). This breeds sustainable living (that is, having the basic means to live a decent and quality life), and further sets the pace for the reduction of the multifaceted troubles of poverty (Immurana et al., 2021) which are still endemic in sub-Saharan Africa. Sustainable living supports growth in access to basic amenities, health, and education and helps avert sudden shocks to individuals and their households.

However, research on the subject of the discourse is often mischaracterization of the dimensions of sustainable development (Niaz, 2022). This study would capture dimensions that depict multidimensional poverty and sustainable livelihood that translate into the attainment of other policy goals of the United Nations. This is to say that, the study proposes to empirically examine the effects of financial inclusion on the multidimensional poverty index (MPI) and per capita income (PCI) in sub-Saharan Africa (SSA). This implies that the study will determine the effects of financial access, usage and financial inclusion index on the multidimensional poverty index (MPI) and per capita income (PCI) in sub-Saharan Africa.

1.1. Conceptual Clarification

Multidimensional poverty in sub-Saharan Africa is endemic. A plethora of households are grappling with infant deaths (due to poor access to healthcare and insurance), malnutrition (due to lack of access to balanced diets), out-of-school children and lack of formal education (due to lack of access to funding options and the absence of sustainable means of livelihood), unclean water, poor housing and sanitary conditions, and non-ownership of basic assets for decent living (Alkire, Kanagaratnam, & Suppa, 2020; Niaz, 2022). Thus, the socioeconomic livelihood of economic units in the subcontinent does not support decent conditions of living and thus exposes them to all forms of economic and environmental shocks. This puts the attainment of sustainable development goals in jeopardy especially the individual-level components that trigger the attainment of the broader policy goals.

However, the United Nations amongst others identified financial inclusion as one of the key propellants for global inclusive human capital development (Gamito, 2018). The rave for financial access, usage, and quality is a result of the notion that access to affordable quality financial products and services can spur up the well-being of the people and sustain the gains in economic progress (Eze & Markjackson, 2020). Financial availability, accessibility and usage are the three basic objectives of financial inclusion. Financial usage is predicated on availability, ease of access, and the perceived benefits of it (Eze & Markjackson, 2020).

In a bid to empirically understand the effect of financial inclusion on sustainable development at the individual level using per capita income as the explained variable.

2. Theoretical Literature

The underpinnings of this study are based on the Sustainable Livelihood Approach (SLA) and the supply-leading hypothesis. The crux of the sustainable livelihood approach is that when given opportunities, individuals and households have what it takes to maximize such opportunities to their economic advantage (Norton & Foster, 2001). Thus, SLA emphasizes measures that would empower economic units at the micro-level to have access to capital (or assets) and the means to consolidate these

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opportunities to have a sustainable means of livelihood (Morse, McNamara, & Acholo, 2001). Consequently, an increase in access to, usage of, and quality of financial products and services would create the needed opportunity for households to strive in their businesses and other economic endeavours. The supply-leading hypothesis argues that inclusive growth is anchored on an efficient and competitive financial sector that has a large spectrum of access and alternative products that can meet the needs of all classes of people. In other words, financial development causes economic growth (Adeyeye, Fapetu, Aluko, & Migiro, 2015). The theory promotes better resource accumulation and inclusive allocation. It further argues that a financial sector that has depth and penetrative reach enhances and accelerates access and usage of financial instruments in an economy (Shaw, 1973). It further posits that increased usage of loan accounts and usage of other financial services is a function of the many players in the financial ecosystem that are willing to offer the same financial instruments and services at varying prices and conditions.

2.1. Empirical Literature

Gebrehiwot and Makina (2019) study found that the percentage of gross domestic product to the population (GDP/population) and internet data subscription plays a significant role in influencing access and usage of financial services in Africa. Conversely, loan accounts owned by the public sector and % of rural dwellers were found to be insignificant. The study relied on a sample of 27 African countries. The panel regression model was estimated using the generalised method of moments.

Tita and Aziakpono (2017) employed a cross-sectional regression technique to determine FI factors that stimulate growth per capita in SSA. The study relied on secondary data from the 2011 Global Findex data survey. The financial inclusion measures or explanatory variables used in the study include deposit account, use of deposit accounts, savings, digital payment, loan accounts, insurance (health), and mainstream loans for tuition fees. The results from the estimated linear model indicate that usage of deposit accounts, savings, and digital payment systems exerts a linear effect on growth per capita in SSA. Makina and Walle (2019) employed GMM to estimate the nexus between the explained variable of GDP per capita and the independent variables of loan accounts owned by private businesses (% of GDP), number of DMB branches, public expenditure (% of GDP), primary school enrollees and total trade (% of GDP). To achieve this, data was collated from 42 countries in Africa covering 2004 – 2014. The POLS findings reported that the number of loan accounts owned by private businesses (% of GDP), number of commercial bank branches (per 1,000 adults), public expenditure (% of GDP), primary school enrollees and total trade (% of GDP) significantly enhance real GDP per capita in Africa.

Okoye, Adetiloye, Erin, and Modebe (2020) investigated the relationship between financial inclusion and economic development and growth in Nigeria. Secondary data spanning from 1986 to 2015 was collated for estimation. The regressands were GDP and GDP per capita. The regressors of the first model were money supply to GDP (M2/GDP), loan accounts/GDP, loan-to-deposit ratio, and commercial bank's liquidity ratio. For the second model, rural deposit accounts (RDA), loans to rural areas (LRA), and bank branch spread (BBS). The results indicate that M2/GDP, loan-to-deposit ratio (a measure of financial inclusion), and bank liquidity were significant positive stimulants to national growth. This was not the case for loan accounts/GDP, a measure of financial deepening in the study. For the second model, the results indicate that loans to rural areas, rural deposits, and bank branch spread exert a significant linear effect on GDP per capita in Nigeria.

Olaniyi (2017) examined how financial inclusion in rural areas can influence output growth in Nigeria. To achieve this, the study used agricultural output (% of GDP) as the parameter for output growth and further used lending interest rate (cost of credit), GDP per capita, M2/GDP (broad money supply), bank branch spread, and loan accounts outstanding as the independent variables for the study. Secondary data spanning from 1981 to 2014 was collated from the WDI and CBN statistical bulletin. The estimates showed that bank branch spread (an indicator of financial access) and income per head have a linear but bear zero effect on agricultural output. Also, loan accounts outstanding and broad money supply reported a significantly positive effect on agricultural output. Findings further indicate

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that lending interest rate (an indicator of the cost of credit) exerted a nonlinear but significant effect on agricultural output in Nigeria. This infers that rural financial inclusion capped with access to and usage of financial services stimulates rural productivity.

Evans and Lawanson (2017) used bank-level and sector-level data to ascertain the link between FI and national output growth in Nigeria. The study relied on country-specific data spanning from 1981 to 2013. Models of the study were estimated using the Granger causality technique. The first model indicated that bank branch spread has a two-way relationship with agricultural output in the short run. This was the case for a number of deposit accounts and agricultural output in all instances. In the long run, the relationship was found to be one-way (from agricultural output to bank branch spread). The second model showed that there is a one-way nexus between bank branch spread and construction. The nexus between the number of deposit accounts and construction is two-way in the long run and one-way (from financial usage to construction) in the short run. Also, the results in the short-run and long-run suggested that there is a one-way nexus from number of deposit accounts to the industrial sector. The association for both the long-run and short-run averred that the relationship is two-way (bidirectional). The fourth model indicated that there is a one-way nexus (from the bank branch spread to the wholesale sector). It also indicated that the relationship between number of deposit accounts and the wholesale sector is two-way, for both periods. The last model showed that in the short run, there was a one-way nexus from the number of deposit accounts to the service sector. In the long-run, this was found to be two-way. Also, it was found that bank branch spread and the service sector have nothing in common. That is, they have no relationship in both periods. In all, the results suggest that financial access and usage have a relevant nexus with the real sector in Nigeria.

Nkwede (2015) examined the relationship between gross domestic product and loan accounts owned by small and medium-scale enterprises (SMEs), deposit and loan accounts by rural bank branch networks, and physical banking spread (bank branch networks) in Nigeria. Secondary data covering 1981 to 2013 was collated from the Central Bank of Nigeria (CBN) statistical bulletin. The time-series data was estimated using the ordinary least square (OLS) technique. The results indicate that loan accounts owned by SMEs and rural deposit accounts exert a significant but nonlinear effect on GDP. Physical banking present and rural loan accounts explained a significant and direct effect on the endogenous variable in Nigeria.

3. Methodology

This study examines the effect of financial inclusion on sustainable development in sub-Saharan Africa. That is, the study will explore how financial access, usage and financial inclusion could accelerate the improvement of sustainable living conditions in sub-Saharan Africa.

To achieve these, data (GDP per capita (constant 2015 US$), borrowers from commercial banks (per 1,000 adults), depositors with commercial banks (per 1,000 adults), commercial bank branches (per 100,000 adults), and automated teller machines (ATMs) (per 100,000 adults)) for the study were obtained from the World Development Indicators, a data repository of the World Bank.

The study further relied on the ex post facto research design to guide the research process. Given that sub-Saharan Africa comprises 46 countries, the study collated data from 20 countries. The panel data collected spans 2008 to 2021. However, missing data points were obtained through extrapolation.

The financial inclusion index (FII) was built using the indicators of financial access and usage in the study. This was done using the Principal Component Analysis (PCA).

The study employed the panel Autoregressive Distributive Lag (ARDL) technique to estimate the panel regression models. The study also carried out preliminary statistical tests like descriptive statistics, correlation analyses, Levin-Lin-Chu unit root test, and cointegration test.

The functional form of the regression models is;

$$Y = a + \beta X + u \quad (1)$$

Y represents GDP Per Capita, GDP. X depicts the explanatory variables included in the model. U is the error term of the regression model. Equation 1 is further transformed econometrically as;

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$$GDP_{it} = a_0 + \beta_1 FII_{it} + \beta_2 NBB_{it} + \beta_3 NBO_{it} + \beta_4 NDE_{it} + \beta_5 ATM_{it} + E_{it} \quad (2)$$

Where *FII* is financial inclusion index, *NBB* is the number of bank branches (per 100,000 adults), *NBO* is the number of borrowers (per 1,000 adults), *NDE* is the number of deposit accounts (per 1,000 adults) *ATM* is the number of automated teller machines (per 100,000 adults). $\beta_1, \beta_2, \beta_3, \beta_4, \& \beta_5$ are the coefficients of the explanatory variables. The subscripts *i* and *t* represent *i-th* country and *t-th* year respectively. That is, *i* is 20 cross-sections or countries, while *t* is 13 years. *E* is the error correction mechanism (ECM) of the model.

Consequently, the study hypothesizes that financial inclusion (that is, an increase in financial access and usage to all classes of households and businesses) enhances sustainable living conditions of households through increasing per capita income in sub-Saharan Africa. A description of the a priori expectation is presented in Table 1.

Table 1.
Description of a priori expectations.

Variable	Expected sign	Description
Number of bank branches (Per 100,000 adults)	+	This variable is expected to exert a positive effect on GDP per capita. That is, an increase in access to financial services will enhance sustainable growth and poverty alleviation.
Number of deposit accounts (1,000 adults)	+	An increase in the number of deposit accounts will enhance financial usage. This will in turn enable households, smallholder farmers, and micro enterprises to meet their financial needs. Thus, enhancing their productivity and reducing the many layers of poverty.
Number of borrowers (Per 1,000 adults)	+	Increased access to credit will breed increased productivity, thus an increase in the PCI and a decline in poor living and health conditions.
Financial inclusion index (FII)	+	FII is expected to exert a positive effect on the explained variable.

4. Econometric Results and Discussions

4.1. Descriptive Statistics

Table 2 presents the descriptive statistical results of the variables used for the econometric analyses.

Table 2.
Descriptive statistics.

Variable	Mean	Std. dev.	Cv	Max.	Min.	Skew	Kurt
GDP	2460.6	2658.2	1.080	14222.5	433.8	2.123	7.285
FII	0.000	1.485	Na	4.915	-1.67	1.590	4.865
NBO	64.930	80.032	1.233	345.840	0.510	1.823	5.138
NDE	285.29	276.52	0.969	1458.41	1.050	1.502	4.979
NBB	5.683	5.140	0.904	26.510	0.040	2.228	8.330
ATM	11.821	14.683	1.242	72.950	0.280	2.315	8.274

Descriptive statistics presented in Table 2 provided valuable insights into the variables used in this study. First, the GDP per capita, a fundamental indicator of an economy's size, performance and well-being of a nation's citizens had a mean value of 2460.6, while the substantial standard deviation of 2658.2 indicates a significant variation in economic performance among the observations. The coefficient of variation (cv) of 1.080 suggests moderate relative variability. The positively skewed

distribution (skewness of 2.123) indicates that the GDP per capita data is right-skewed, with a tail on the higher-value side, possibly indicating economic inequality. Also, the financial inclusion index (FII) which is an essential indicator of the length and breadth of financial development had a mean value of 0.000. This suggests that, on average, FII may not be significant, but the standard deviation of 1.485 implies considerable variation. The positively skewed distribution (skewness of 1.590) suggests that, on certain occasions, there may be significant access and usage of financial services, leading to a rightly-skewed distribution, and the kurtosis of 4.865 indicates heavy-tailed behaviour, possibly associated with extreme FII events.

Further, the number of borrowers (per 1,000 adults) (NBO) indicated a mean value of 64.930 suggesting the average number of borrowers in commercial banks, while the standard deviation of 80.032 reveals substantial variability in the number of deposit account usage. The variable is positively skewed (1.823). More so, the number of deposit accounts (per 1,000 adults) (NDE) indicated a mean value of 285.29 points while the standard deviation of 276.52 implies considerable variability. The positively skewed distribution (skewness of 1.502) suggests a right-skewed distribution, possibly indicating that a few entities hold a substantial portion of the deposits.

Lastly, the number of branches and ATMs in the financial sector (NBB and ATM) reflects access to financial services. The mean values show the average number of branches (5.683) and ATMs (11.821). The high standard deviations for both variables (5.140 and 14.683, respectively) suggest significant variability in the distribution of branches and ATMs. The positively skewed distributions and high kurtosis values for both variables indicate a right-skewed distribution with heavy tails, possibly reflecting a concentration of branches and ATMs in specific regions or institutions.

4.2. Correlation Test Results

Table 3 presents the results of the pairwise correlation statistical results of the variables used in the study.

Table 3.
Pairwise correlation statistics.

Variables	GDP	FII	NBO	NDE	NBB	ATM
GDP	1					
FII	0.569*** (11.532)	1				
NBO	0.449*** (8.369)	0.884*** (31.586)	1			
NDE	0.434*** (8.036)	0.807*** (22.821)	0.563*** (11.349)	1		
NBB	0.575*** (11.720)	0.873*** (29.869)	0.691*** (15.959)	0.537*** (10.601)	1	
ATM	0.512*** (9.934}	0.873*** (29.779)	0.810*** (23.009)	0.733*** (17.945)	0.697*** (16.222)	1

Note: The value in bracelet () is t-stat.
*** means that the level of significance is at 1%.

The correlation matrix in Table 3 reveals important economic intersections among the variables. However, focus is based on the relationship between the variables and the GDP per capita.

First, the correlation between GDP per capita and FII (financial inclusion index) is 0.569, with a statistically significant t-value of 11.532. This suggests a moderate positive correlation. In economic terms, this means that as a country's GDP increases, there is a tendency for a higher financial inclusion index. This positive correlation indicates that a growing economy tends to enhance access to and usage of financial services, which can stimulate sustainable living conditions. Also, the correlation between GDP per capita and the number of adult borrowers (NBO) is 0.449, with a significant t-value of 8.369.

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Again, this represents a moderate positive correlation, implying that as GDP increases, access to credit levels also tends to rise. In economic terms, this suggests that expansion in per capita income may cause an increase in the number of borrowers. Likewise, the correlation between GDP per capita and the number of adult depositors (NDE) is 0.434, with a significant t-value of 8.036. This signifies a moderate positive correlation, indicating that as income per capita grows, there is a propensity for higher deposit levels. In the economic context, this correlation implies that an expanding economy in terms of income levels may lead to increased savings and deposits within the banking system.

Moreover, the correlation between GDP per capita and the number of bank branches (NBB) is 0.575, with a highly significant t-value of 11.720. This indicates a moderate positive correlation, suggesting that as GDP per capita increases; there is a tendency for a higher bank spread. In economic terms, this correlation underscores the idea that economic growth may drive an expansion in the financial sector, leading to more branch openings to meet the demands of a growing economy. Finally, the correlation between GDP per capita and ATM (number of ATMs) is 0.512, with a statistically significant t-value of 9.934. This represents a moderate positive correlation, suggesting that as per capita income rises, there is a likelihood of an increased number of ATMs. In economic terms, this correlation indicates that economic growth often leads to greater financial inclusion, resulting in more ATMs to serve the expanding customer base.

It can be inferred from the above that as GDP per capita experiences growth, it tends to trigger an increase financial inclusion index, a higher number of borrowers (per 1,000 adults), a larger number of deposit accounts (per 1,000 adults), and banking spread in SSA.

4.3. Panel Unit Root Test Results

Table 4 presents Levin-Lin-Chu panel unit root test results for the variables of the study.

Table 4.
Levin-Lin-Chu panel unit root test result.

Variable	Det.	Level	Diff.	Remark
ln(GDP)	C	-1.363*	-6.217***	*I*(0)
	c + t	0.224	-5.964***	*I*(1)
FII	C	1.743	-6.438***	*I*(1)
	c + t	0.266	-5.226***	*I*(1)
ln(NBO)	C	-1.422*	-5.856***	*I*(0)
	c + t	1.176	-4.126***	*I*(1)
ln(NDE)	C	2.318	-8.705***	*I*(1)
	c + t	-2.627***	-8.685***	*I*(0)
ln(NBB)	C	-1.907**	-3.198***	*I*(0)
	c + t	3.879	-3.736***	*I*(1)
ln(ATM)	C	-4.062***	-5.827***	*I*(0)
	c + t	0.944	-3.948***	*I*(1)

Note: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 4 presents the results of the Levin-Lin-Chu panel unit root test for several economic variables, including GDP per capita, financial inclusion index (FII), number of adult borrowers (NBO), number of deposit accounts (NDE), number of bank branches (NBB) and the number of automated teller machines (ATMs).

For GDP per capita, when only the constant term is considered, the test indicates stationarity (I(0)) as the test statistic is -1.363 and significant at the 10% level. However, with the inclusion of a trend term (c + t), GDP per capita is found to be non-stationary (I(1)), as the test statistic is 0.224 and highly significant at the 1% level. In the case of FII, both tests with and without a trend term reveal it to be non-stationary (I(1)) with highly significant test statistics. NBO, when analyzed with only the constant

term, is stationary (I(0)), as indicated by a test statistic of -1.422 and significant at the 10% level. However, the inclusion of a trend term leads to non-stationarity (I(1) status), with a highly significant test statistic of 1.176.

NDE, when analyzed solely with a constant term, is non-stationary (I(1)) with a highly significant test statistic of 2.318. Interestingly, including a trend term reverses this, suggesting stationarity (I(0)) with a test statistic of -2.627 and highly significant at the 1% level. The number of Branches is stationary (I(0)) when only the constant term is considered, with a significant test statistic of -1.907 at the 5% level. However, with the trend term, it becomes non-stationary (I(1)) as indicated by a highly significant test statistic of 3.879. Lastly, the number of ATMs is stationary (I(0)) without a trend term, as shown by the highly significant test statistic of -4.062. Yet, the addition of a trend term leads to non-stationarity (I(1)) with a highly significant test statistic of 0.944.

4.4. Panel Cointegration Test Results

Table 5 presents the Westerlund panel cointegration test results of the study.

Table 5.
Westerlund panel cointegration test results.

Assumption	Time trend	Demean	AR parameter	Statistics
Some panels are cointegrated	No	No	Panel specific	-0.197
Some panels are cointegrated	Yes	No	Panel specific	1.638*
Some panels are cointegrated	No	Yes	Panel specific	0.956
Some panels are cointegrated	Yes	Yes	Panel specific	3.421***
All panels are cointegrated	No	No	Homogenous	-0.404
All panels are cointegrated	Yes	No	Homogenous	1.890**
All panels are cointegrated	No	Yes	Homogenous	-0.117
All panels are cointegrated	Yes	Yes	Homogenous	2.203**

Note: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 5 presents the results of the Westerlund panel cointegration test, which is a crucial analysis to assess the existence of cointegrating relationships among the data. Under the assumption that some panels are cointegrated, the results vary based on the inclusion of a time trend and demeaning. Without these adjustments, the test indicates that cointegrating relationships are panel-specific, but their significance is relatively weak, as indicated by a test statistic of -0.197.

However, with the inclusion of a time trend, the significance increases markedly, denoted by a test statistic of 1.638*, suggesting stronger cointegrating relationships. This is a notable result as it signifies that specific panels of the data exhibit cointegrating relationships that become more pronounced when considering the influence of a time trend. When all panels are assumed to be cointegrated, the results also depend on the presence of a time trend and demeaning. Without these adjustments, the test suggests that cointegrating relationships are homogenous across all panels, though the significance remains limited, with a test statistic of -0.404. However, the inclusion of a time trend significantly enhances the cointegrating relationships, denoted by a test statistic of 1.890**, indicating stronger and more homogenous cointegration.

In summary, the Westerlund panel cointegration test findings suggest that there are indeed cointegrating relationships within the data panels.

4.5. Static Regression Model Estimates

This section presents the model estimates of the Pooled OLS (POLS), Fixed Effects (FE), and Random Effects (RE).

Table 6.
Static regression model results of lnGDP.

Variable	POLS	FE	RE
FII	0.185** (0.094)	0.111*** (0.023)	0.112*** (0.023)
lnNBO	-0.184*** (0.046)	0.001 (0.015)	-0.001 (0.015)
lnNDE	0.043 (0.047)	0.003 (0.016)	0.002 (0.016)
NBB	0.049*** (0.015)	0.009* (0.005)	0.011** (0.005)
ATM	0.017*** (0.005)	-0.006*** (0.002)	-0.005** (0.002)
Constant	7.351*** (0.337)	7.403*** (0.093)	7.397*** (0.176)
R^2	0.511	0.982	0.172
S.E.	0.598	0.120	0.121
F-stat	57.236***	571.846***	11.373***
ORE test	1496.1***		
RFE test		346.458***	
Hausman test			11.529**

Note: Estimates in () are standard errors. The RE model result is more consistent based on the Hausman test.
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 6 presents the results of a static regression model with lnGDP as the dependent variable and various independent variables across three different model specifications: Pooled OLS (POLS), Fixed Effects (FE), and Random Effects (RE). The coefficients, accompanied by their standard errors in parentheses, as well as asterisks denoting the level of statistical significance, are outlined.

Regarding the Financial inclusion index (FII), it consistently demonstrates a positive and statistically significant relationship with lnGDP across all three model specifications. In the POLS model, FII exhibits a coefficient of 0.185 with a standard error of 0.094. In the FE and RE models, FII maintains its positive association with lnGDP, with coefficients of 0.111 and 0.112. It can thus be inferred that a unit increase in FII will result in about an 11.2%-18.5% rise in the GDP per capita on average. Conversely, the lnNBO (the number of adult borrowers) shows a noteworthy pattern. In the POLS model, it has a statistically significant negative relationship with lnGDP (GDP per capita), characterized by a coefficient of approximately -0.184 and a standard error of 0.046. This implies that a per cent rise in borrowing resulted in an 18.4% fall in the GDP per capita in SSA. However, the coefficients in the FE and RE models are close to zero and not statistically significant.

For lnNDE (the number of depositors), the coefficients are relatively small across all three models, ranging from 0.043 to 0.003. Nevertheless, none of these coefficients are statistically significant. On the other hand, the number of branches (NBB) demonstrates a consistent and significant positive relationship with lnGDP in all three models. The coefficients range from 0.049 to 0.009, and this signifies that a unit rise in the number of branches resulted in about 0.9%-4.9% rise in the GDP per capita in sub-Saharan African countries.

Finally, the result revealed that the number of ATMs has a statistically significant impact on lnGDP. However, the direction of this impact varies across the models. In the POLS model, a positive relationship is observed with a value of 0.017, while in the FE and RE models, a significant negative relationship with parameters -0.006 and -0.005 is evident. It can thus be inferred that a unit rise in the number of ATMs may result in approximately a 1% fall or 1.7% rise on average in the GDP.

4.6. Dynamic Regression Model Estimates

Table 7 presents the estimates of the panel Autoregressive Distributive Lag Model (ARDL) was estimated using Dynamic Fixed Effect (DFE), Mean Group (MG) and Pooled Mean Group (PMG) estimators.

Table 7.
Panel ARDL (1,1,1,1,1,1) model result of lnGDP.

Variable	DFE	MG	PMG
FII	0.244*	-0.836	-1.473***
	(0.144)	(0.790)	(0.319)
lnNBO	-0.256*	0.095	0.462***
	(0.136)	(0.527)	(0.106)
lnNDE	-0.182	1.312***	0.680***
	(0.115)	(0.494)	(0.680)
NBB	0.057	0.116	0.181***
	(0.038)	(0.084)	(0.032)
ATM	-0.034*	-0.007	-0.026
	(0.018)	(0.034)	(0.017)
Δ(FII)	-0.027	-0.185	-0.245
	(0.017)	(1.004)	(0.235)
ΔlnNBO	0.031***	0.570	0.049
	(0.012)	(0.552)	(0.195)
lnNDE	0.006	222.970	-1663.208
	(0.010)	(223.432)	(1663.233)
ΔNBB	0.006	-0.059	0.011
	(0.003)	(0.111)	(0.032)
ΔATM	-0.001	0.032	0.015
	(0.002)	(0.065)	(0.014)
ECM(-1)	-0.065***	-0.849***	-0.057
	(0.024)	(0.261)	(0.039)
Constant	0.616***	9.707	-116.143
	(0.180)	(19.188)	(116.123)

Note: Estimates in () are standard errors.
*** p < 0.01; * p < 0.1.

The panel ARDL regression model estimates are presented in Table 7. The error correction term for the three models showed that at most 5.7% or at least 84.9% of the disequilibrium in GDP per capita is corrected back to the normal level after an exogenous shock occurrence. It can be seen from the result that the impact of FII is only significant in the long run; however, the direction of this impact varies across the models. In the DFE model, a positive relationship is observed with a value of 0.244, while in the PMG model, a significant negative relationship with parameter -0.836 is evident. This implies that a unit increase in financial inclusion index (FII) may lead to a rise of about 24.4% or a fall of about 147% in the GDP per capita.

Also, the number of borrowers per capita has a significant positive impact on GDP per capita in the short run; the result showed that a per cent rise in access to borrowed funds from the conventional financial system brings about a 0.031% rise in the GDP per capita of sub-Saharan African countries in the short run. However, there is inconsistency in the effect of the number of borrowers in the long run. In the dynamic fixed effect (DFE) model, a negative relationship is observed with a value of -0.256 decline on the explained variable. This is consistent with the findings of Tita and Aziakpono (2017) and Okoye et al. (2020). While in the PMG model, a significant positive relationship with parameter 0.462 is evident. This implies that a unit increase in the variable may lead to a rise of about 0.46% in the GDP per capita of SSA in the long run. This was corroborated by the findings of Makina and Walle (2019), who posit that loan accounts spur income per head in Africa. This further means that access to external funds positions disadvantaged households to give quality education and training to their children and wards. For instance, women through accessible funding options can invest in income-yielding ventures or acquire modern farming implements to enhance their yields; thus, enhancing their sustainable livelihood and placing them as critical stakeholders in decision-making making thus, reducing the gender gap.

The results also indicate that there is no short-run evidence for the effect of the number of depositors in the short run. However, there is consistency in the MG and the PMG results that the

number of deposit accounts exerts a positive effect on GDP per capita in the long run. This is consistent with the conclusions drawn by Tita and Aziakpono (2017). The result shows that a per cent increase in the number of depositors (per 1,000 adults) will result in about a 0.68%-1.31% rise in GDP per capita in the long run in SSA.

Likewise, there is no short-run evidence for the short-run effect of the number of bank branches. This implies that as the length of banking operations increases, so does their ability to enhance economic activity and spur GDP per capita to increase. However, the PMG result shows that the number of branches bears a positive effect on GDP per capita in the long run in the SSA. The studies by Makina and Walle (2019); Okoye et al. (2020) and Nkwede (2015) found similar findings. The result shows that a per cent increase in the number of branches will result in about a 0.18% rise in GDP in the long run. Moreover, there is no short-run evidence for the short-run effect of the number of ATMs on per capita income in SSA. However, the DFE result shows that the number of ATMs negatively affects GDP per capita in the long run. The result shows that a per cent increase in the number of ATMs will result in about a 3.4% decrease in GDP in the long run.

5. Conclusion and Recommendations

This study examines the effect of financial inclusion on sustainable living in sub-Saharan Africa. The study collated data from 20 cross-sections spanning 2008 to 2021 in SSA. The panels were estimated using static and dynamic models. The findings indicate that financial inclusion index, the numbers of borrowers, depositors, bank branches and automated teller machines exert a significant effect on the GDP per capita in sub-Saharan Africa. The PMG model estimates further indicate that financial inclusion index (which captured the combined effect of financial access and usage) exerts a negative on GDP per capita in sub-Saharan Africa (SSA). However, the results of the individual measures of financial inclusion, that is, the numbers of borrowers, depositors and banking penetration exert a positive effect on GDP per capita in the long run in sub-Saharan Africa. This portends that financial inclusion is a significant contributor that can improve sustainable living conditions in sub-Saharan Africa. Based on these, the study recommends that the need to improve access to and usage of financial services through user-friendly and service-fluent financial technologies in SSA. This will help increase the number of households, smallholder farmers and businesses to access the formal financial system to meet their reoccurring and precautionary funding needs in sub-Saharan Africa.

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Both authors contributed equally to the conception and design of the study. Both authors have read and agreed to the published version of the manuscript.

References

Adeyeye, P. O., Fapetu, O., Aluko, O. A., & Migiro, S. O. (2015). Does supply-leading hypothesis hold in a developing economy? A Nigerian Focus. *Procedia Economics and Finance, 30*, 30-37. https://doi.org/10.1016/s2212-5671(15)01252-6

Alkire, S., Kanagaratnam, U., & Suppa, N. (2020). *The global multidimensional poverty index (MPI): 2020 revision*. Oxford: University of Oxford: Oxford Poverty and Human Development Initiative.

Evans, O., & Lawanson, O. (2017). A multi-sectoral study of financial inclusion and economic output in Nigeria. *Ovidius University Annals, Economic Sciences Series, 17*(1), 195-204.

Eze, G. P., & Markjackson, D. (2020). Determinants of financial inclusion in Nigeria. *Journal of Economics and Finance, 11*(1), 14-22.

Gamito, S. (2018). *Financial inclusion in Africa: Improving it through fintech*. Lisbon: Catolica Lisbon Business Economics.

Gebrehiwot, K. G., & Makina, D. (2019). Financial inclusion and economic growth: Evidence from a panel of selected African countries. In D. Makina (Ed.), Extending Financial Inclusion in Africa. In (1st ed., pp. 167-191). London: Academic Press.

Immurana, M., Iddrisu, A.-A., Boachie, M. K., & Dalaba, M. A. (2021). Financial inclusion and population health in Africa. *Journal of Sustainable Finance & Investment*, 1-16.

Kara, A., Zhou, H., & Zhou, Y. (2021). Achieving the United Nations' sustainable development goals through financial inclusion: A systematic literature review of access to finance across the globe. *International Review of Financial Analysis, 77*, 101833. https://doi.org/10.1016/j.irfa.2021.101833

Kuada, J. (2019). Financial inclusion and the sustainable development goals. In D. Makina (Ed.), Extending Financial Inclusion in Africa. In (1st ed., pp. 259-277). London: Academic Press. https://doi.org/10.1016/B978-0-12-814164-9.00012-8.

Ma'ruf, A., & Aryani, F. (2019). Financial inclusion and achievements of sustainable development goals (SDGs) in ASEAN. *Journal of Business Economics Review, 4*(4), 147-155. https://doi.org/10.35609/jber.2019.4.4(1)

Makina, D., & Walle, Y. M. (2019). Financial inclusion and economic growth: Evidence From a panel of selected African countries. In D. Makina (Ed.), Extending Financial Inclusion in Africa. In (1st ed., pp. 193-210). London: Academic Press. https://doi.org/10.1016/B978-0-12-814164-9.00009-8.

Morse, S., McNamara, N., & Acholo, M. (2001). *Sustainable livelihood approach: A critical analysis of theory and practice*. Reading: The University of Reading.

Niaz, M. U. (2022). Socio-Economic development and sustainable development goals: A roadmap from vulnerability to sustainability through financial inclusion. *Economic Research, 35*(1), 3243-3275. https://doi.org/10.1080/1331677x.2021.1989319

Nkwede, F. (2015). Financial inclusion and economic growth in Africa: Insight from Nigeria. *European Journal of Business and Management, 7*(35), 71-80.

Norton, A., & Foster, M. (2001). *The potential of using sustainable livelihoods approaches in poverty reduction strategy papers*. London: Overseas Development Institute.

Okoye, L. U., Adetiloye, K. A., Erin, O., & Modebe, N. J. (2020). *Financial inclusion: A panacea for balanced economic development*. Paper presented at the 28th IBIMA Conference.

Olaniyi, E. (2017). Back to the land: The impact of financial inclusion on agriculture in Nigeria. *Iranian Economic Review, 21*(4), 885-903.

Shaw, E. S. (1973). *Financial deepening in economic development*. New York: Oxford University Press.

Tita, A. F., & Aziakpono, M. J. (2017). The relationship between financial inclusion and income inequality in Sub-Saharan Africa: Evidence from disaggregated data. *African Review of Economics and Finance, 9*(2), 30-65.

United Nations. (2015). *Transforming our world: The 2030 agenda for sustainable development. United Nations, Department of Public Information*. New York: United Nations.

UNSGSA. (2018). *Igniting SDG progress through digital financial inclusion*: UNSGSA.