



DETERMINANTS OF FINANCIAL INCLUSION IN SUB-SAHARAN AFRICA (SSA) COUNTRIES (1999-2023)

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Abstract

This study examined the determinants of financial inclusion in Sub-Saharan Africa (SSA) countries between 1999 and 2023. Specifically, the study computed a comprehensive financial inclusion index for 45 countries in the SSA region and identified the core determinants of financial inclusion in the region. Data were collected from the International Monetary Fund's (IMF's) and World Bank's World Development Indicators (WDI). The study employed Principal Component Analysis (PCA) for the computation of the financial inclusion index and estimated the model using Panel Ordinary Least Squares Regression. The computation revealed that Sao-Tome and Principe have the highest financial inclusion penetration per thousand among the

SSA countries considered during the period of the study. The result also showed that the majority of the independent variables have statistically significant coefficients (p -values = 0.0000). The study concluded that financial inclusion efforts currently witnessed in the SSA countries are not having a trickling-down effect on the poor societies in the countries. Secondly, the study established that most of the independent variables have statistically significant coefficients (p -values = 0.0000). This study concluded that the independent variables included in the study are important determinants of financial inclusion in Sub-Saharan Africa (SSA) countries.

Keywords: Determinants, Financial Inclusion, Financial Inclusion Index, Sub-Saharan Africa, dimensions of financial inclusion, Banking penetration

INTRODUCTION

Financial inclusion may be seen as a driving force behind economic progress, especially in underdeveloped nations (Pradhan and Sahoo, 2021). However, financial exclusion, or limited access to financial goods and services, is commonly linked to inequality and poverty (Beck et al., 2007) at the individual and regional levels (Demirgüç-Kunt and Klapper, 2013). Information and communication technologies (ICTs) have developed and been used much more in the past ten years. Their adoption is impacting every aspect of our everyday lives. The internet and smartphones have particularly changed the supply and demand sides of the financial business. Digital financial services provide a singular chance for the FI of society's most vulnerable groups to overcome barriers like cost, distance, and transparency to satisfy financial demands (Kulkarni and Ghosh, 2021). ICTs' crucial role in achieving financial inclusion has given rise to a new study area rapidly expanding (Gallego-Losada et al., 2023). Several models have been devised and implemented worldwide to foster financial inclusion. Nevertheless, financial inclusion remains low in many developing nations, such as Mexico, Nigeria, Egypt, Vietnam, Brazil, Bangladesh, Indonesia, and Pakistan, with significant percentages of the population unable to access financial services. Access to a bank account, deemed essential for financial well-being in developed countries, remains elusive for many in developing nations (Noor, 2016). Moreover, small developing countries with substantial emigrant worker populations, such as Jordan, Guyana, and the Dominican Republic, experience higher levels of financial inclusion due to remittances sent through the banking system. In Ghana, determinants of financial inclusion include low levels of financial literacy, individuals' social status, lack of confidence in financial institutions, insufficient information about financial products and services, high transaction costs,

distance to financial institutions, lack of documentation, low income levels, and social networks (Noor, 2016).

Given that all the SSA countries are on the same continent and have similar economic structures, it is useful to examine why they have different financial inclusion levels. Furthermore, because the nature and scope of financial inclusion are affected by different factors, many scholars are still trying to identify the main determinants of financial inclusion (Akileng, Lawino, and Nzibonera, 2018). Based on existing literature, the following three factors have been identified: penetration, availability and usage dimensions. More explicitly, these factors include penetration dimension (such as number of accounts in banks and MFI 1000 adults), availability dimension (such as number of banks and MFI branches, ATMs, mobile bank users and agent banks per 100,000 adults and usage dimension (such as outstanding loans and deposits with banks and MFI as a percentage of GDP). Most studies in the past have focused on these three dimensions of financial inclusion, neglecting the joint impacts of financial technology. This study will show the extent of the impact of financial technology on driving financial inclusion.

Though computation of an appropriate financial inclusion has witnessed some research activities over the years (see, for instance, Asuming et al., 2019; Chikalipah, 2017; Irankunda & Van Bergeijk, 2020; Lakew & Azadi, 2020; Soumaré et al., 2016; Ulwodi & Muriu, 2017 used account ownership at financial institutions as a proxy to measure financial inclusion. Ajide (2017) used the number of automated teller machines as a proxy for financial inclusion. However, GDP per capita, literacy, and financial and business freedom are found to be important indicators of financial inclusion, but were not included in the previous studies. Therefore, the study developed a financial inclusion index, which is a composition of twelve indicators for SSA countries from 1999 to 2023. This provided a broader perspective of computing a comprehensive financial inclusion, unlike the narrow approach employed by previous studies. Furthermore, for the SSA countries to identify the drivers and barrier factors of financial inclusion, which is very prominent for understanding the depth of financial inclusion in the continent, an assessment of the determinants of financial inclusion was carried out in this study in the context of Sub-Saharan Africa

LITERATURE REVIEW

Financial Inclusion

Financial inclusion has emerged as a key priority in the policy agendas of many developing nations. This is evident from various G20 declarations and the establishment of financial inclusion units within Central Banks and Ministries of Finance, alongside specific

targets for financial inclusion. However, a crucial aspect of policy-making involves the ability to measure progress towards these objectives. Over the past decade, significant advancements have been made in evaluating financial inclusion globally. This capability for measurement has been vital in tracking advancements resulting from financial innovation and policy interventions. AfDB defines financial inclusion as ensuring that all individuals have access to appropriate financial products and services to improve their financial and economic well-being. Importantly, financial literacy and capabilities play a pivotal role in facilitating access to these services. Financial capability encompasses both the understanding of managing finances and familiarity with financial products, ensuring that vulnerable groups have access to necessary financial products and services at an affordable cost, equitably and transparently. There are diverse perspectives regarding the definition of financial inclusion. It is commonly understood as the ability of individuals to access and utilise essential financial services like savings, loans, and insurance in a manner that is convenient, reliable, and adaptable. Traditional viewpoints emphasise the provision of diverse and affordable financial services as a catalyst for economic growth. Alternatively, financial inclusion can be viewed as the provision of banking services at reasonable costs to disadvantaged and low-income groups, ensuring fair access to financial services across society.

Determinants of Financial Inclusion

The World Bank (2012) has outlined three essential pillars for financial inclusion: dedication from both private and public sectors, a supportive legal and regulatory environment, and sufficient infrastructure in financial information and communications technology (Inim, Samuel, & Prince, 2020). As depicted in Figure 2.1, these foundational elements form the groundwork for critical factors driving access and usage, such as a variety of financial products and services, easily reachable service points, awareness and financial literacy, and the utilisation of high-volume recurring payment channels. Factors such as the distribution of population across regions and the distances to transaction points like banks and ATMs significantly impact the extent of financial inclusion (Kumar, 2014). Financial institutions encounter challenges in establishing branches in sparsely populated areas due to high costs, yet the absence of physical access to banking facilities poses a potential barrier to financial inclusion (Demirguc-Kunt, Asli, Leora, & Douglas, 2014; Shankar, 2013). Countries with low population density face physical obstacles to financial inclusion because the ratio of branches and ATMs to the population remains restricted.

In emerging economies, infrastructure-related obstacles pose significant challenges. Furthermore, the lack of reliable fixed and mobile telephone communication, as well as inadequate transportation networks to bank branches and ATMs, hinders financial inclusion. Without access to secure and dependable payment and settlement systems, achieving financial inclusion becomes difficult (Miethe & Pothier, 2016). Fungacova and Weill (2015) examined factors crucial for financial awareness and literacy, discovering that individuals who are wealthier, more educated, and older tend to be more financially included. While there is extensive knowledge about financial inclusion globally, emerging nations must grasp and implement financial inclusion principles to benefit from the SME sector (Allen, Demirgüç, -Kunt, Klapper & Peria, 2016). In South Africa, Kotsov et al. (2015) found that aspirations and financial literacy influence decision-making and financial inclusion. Interestingly, individuals who are wealthier, more educated, older, urban, employed, and married or separated are more likely to have accounts at formal financial institutions and save with them. Early development theories advocate for promoting income inequality to fuel growth by putting more money into the hands of higher-income groups, assuming they would invest more. However, this approach excludes grassroots MSMEs, as they lack savings to join this inclusive group (Yoshino & Morgan, 2016).

Measurement of Financial Inclusion

Financial inclusion has emerged as a crucial topic in global social policy discussions, spanning both developed and developing nations, as it is viewed as essential for individuals to participate in societal activities and improve their well-being. However, despite its significance, there remains a lack of a comprehensive metric to assess the extent of financial inclusion, as noted by Hannig and Jansen (2010). Developing a robust measurement of financial inclusion is vital for understanding the associated factors and the effects of policies on the welfare of consumers of financial services. Sarma (2008) introduced a "multi-dimensional" Index for Financial Inclusion (IFI), inspired by the UNDP's Human Development Index (HDI), which evaluates accessibility, availability, and usage to gauge financial inclusion. Scholars like Kumar and Mohanty (2011) and Mehrotra et al. (2009) have utilised this index to explore the relationship between inclusion and development, examining how socioeconomic factors such as income, financial literacy, and infrastructure impact financial inclusion. Arora (2010) and Chakravarty and Pal (2012) adapted Sarma's IFI to create the Financial Access Index (FAI), incorporating additional variables to comprehensively measure financial access. However, these indices often

prioritise certain dimensions and overlook usage, which is a critical aspect of assessing financial inclusion. Usage of financial services for economic improvement and welfare enhancement, emphasised by Sahrawat (2010), is crucial for achieving financial inclusion, not just mere ownership of financial products. Amidžic, G., et al (2014) propose three dimensions for measuring financial inclusion: access, usage, and quality of financial services. Access evaluates the physical and geographical availability of financial services, with rural areas typically having fewer service points compared to urban areas. Usage assesses an individual's ability to derive ongoing utility from financial products, while quality measures the relevance of financial products to daily needs. These dimensions have been employed in demand-side studies by various scholars to comprehensively measure financial inclusion. Despite efforts to develop robust measures of financial inclusion, ongoing refinements are necessary to realistically account for both supply and demand-side factors. Additionally, there is a need to consider moderating variables such as individual and societal capabilities, including financial attitude, self-efficacy, literacy, social networks, and subjective norms, which may significantly influence financial inclusion, particularly in developing country contexts.

Empirical Review

Ajide (2017) conducted a study examining the factors influencing financial inclusion, with a specific focus on institutional factors across eighteen (18) sub-Saharan African (SSA) countries. The research employed a dynamic system of Generalised Method of Moments (SYS-GMM) to analyse the dataset. The findings consistently emphasised the importance of institutions, along with other control variables like GDP per capita, inflation, bank concentration, and z-score, as crucial drivers of financial inclusion. Additionally, the study emphasised the significance of utilising dimension-specific indicators of governance, alongside a composite governance index, instead of relying solely on the latter for guiding policy decisions, as they produce different policy implications. A similar study conducted by Chikalipah (2017) in the context of Sub-Saharan Africa investigated the determinants of financial inclusion using World Bank country-level data from twenty SSA countries for the year 2014. The empirical results indicated that illiteracy significantly hinders financial inclusion in SSA. The insights from this research offer valuable insights for governmental agencies and international development organisations, aiding in the enhancement and acceleration of financial inclusion strategies among SSA countries. Asuming, Osei-Agyei, & Mohammed (2019) also conducted a comparative analysis of financial inclusion in 31 Sub-Saharan African countries using data from the global Findex database. The study observed

a notable increase in the overall level of financial inclusion between 2011 and 2014, albeit with variations in both the level and pace of improvement among the countries. Individual-level factors such as age, education, gender, and wealth, as well as macroeconomic indicators like GDP growth rate and the presence of financial institutions, along with Business Freedom, were identified as significant predictors of financial inclusion. The findings suggest that financial inclusion policies should target specific demographics such as women and young people.

From a country perspective, the study by Sanderson, Mutandwa, & Le Roux (2018) evaluated the factors influencing financial inclusion in Zimbabwe. The study identified age, education, financial literacy, income, and internet connectivity as positively associated with financial inclusion. However, the research found that the documentation required for opening bank accounts and the distance to the nearest access point had a negative effect on financial inclusion. A similar study by Bekele (2023) conducted a comparative analysis of the determinants of financial inclusion in Kenya and Ethiopia at both macro and micro levels. The study employed a generalised linear model to examine the factors influencing and hindering financial inclusion, drawing on data from the 2017 Global Findex Database. Additionally, a descriptive analysis was utilised to explore macro-level disparities. Kenya exhibited a higher level of financial inclusion compared to Ethiopia. Various macro-level differences, including variations in financial liberalisation policies, GDP, the proportion of rural population, and the expansion of mobile money services, contributed to this discrepancy. At the micro level, disparities in literacy rates and payment receipt methods, such as government transfers, elucidated some of the distinctions between the two countries. Furthermore, gender, age, employment status, and mobile phone ownership demonstrated significant and positive associations with financial inclusion. However, challenges such as a lack of documentation, trust issues, and financial constraints posed notable barriers to financial inclusion in both contexts.

METHOD

The computation of the financial inclusion index in this study is a summary measure of demand and supply factors that measure financial inclusion in any society. Notably, the computed financial inclusion index made use of three dimensions of financial inclusion as shown in Figure 1, which include the banking penetration dimension, availability of banking services dimension and usage of banking services dimension. This study adopted the approach of the Z-sum score in the computation of the financial index. Notably, the Z-sum score is a standardised score, which has a different mean and different variance for each indicator.

According to Kothari (2004) and Ullah and Kiani (2017), the normalised Z value is calculated as follows:

$$Z = \frac{X - \mu}{\sigma}$$

Where;

Z - Standard variate or number of standard deviations from X to the mean of the Distribution;

X - Value that will be normalized; μ - mean of the distribution;

σ - Standard deviation (S.D) of the distribution

The mark of standardised values must be changed for indicators that are inversely related to development, so that negative values become positive and positive values become negative. This is accomplished by multiplying the Standardized value by negative one (-1). For this study, the following indicators are considered to relate inversely to Inclusive growth.

After finding the Z-sum score, the average of the area under the curves, already normalised, is evaluated. These values are considered as an inclusive growth index by the following:

FII = the average of the Z score is divided by the number of observations; $0 < \text{FII} < 1$

The values of the FII index vary between 0 and 1. The Decision rule is that if Values close to 0 indicate a very low level of financial Inclusion. On the other hand, values close to 1 indicate a very high level of financial inclusion. Each indicator has an assigned equivalent weight in the index.

Steps involved in the computation of FII for SSA: the Inclusive growth index will be calculated using the following steps-

Step 1 - Determine (goalposts) values

Step 2 - Calculate the standardised values (X, mean, standard dev.) for each indicator in SSA countries.

Step 3 - Find the area under the standard normal curve (using Z table)

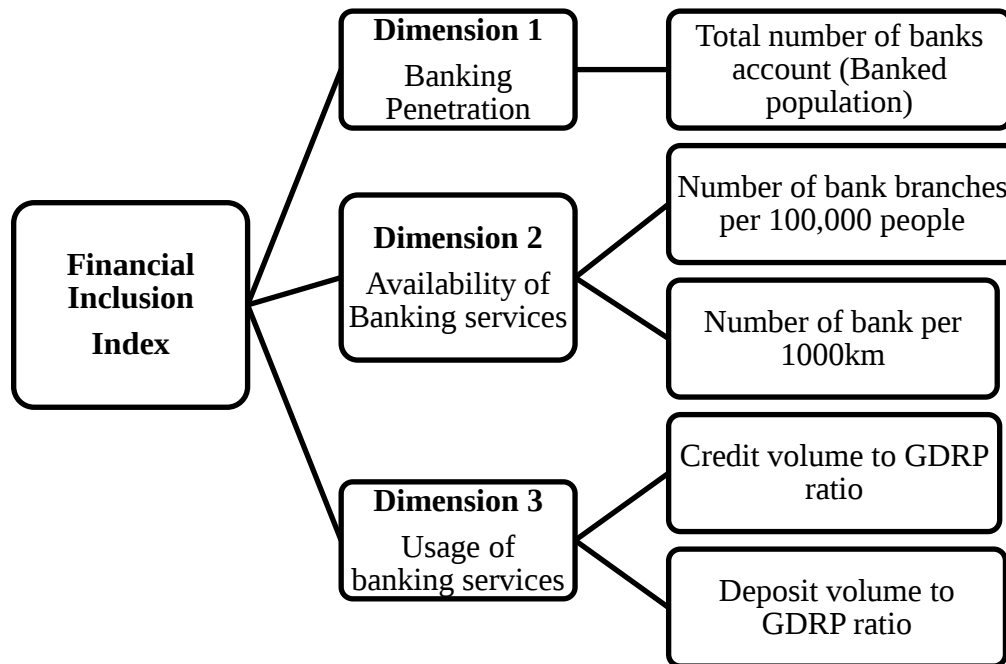
The standard normal distribution is a normal distribution with a mean of 0 and a standard deviation of 1. Fifty per cent of the total area under the curve is to the left of 0, and 50% of the total area under the curve is to the right of 0. The total area under a standard normal curve is exactly 1.0.

Step 4 - Calculate the average of the values under the standard curve for the indicators in each index.

Step 5 - Aggregate the sub-indices to produce the Inclusive growth index.

Decision rule: Values close to 0 indicate that SSA has a very low level of poverty. On the other hand, values close to 1 indicate high poverty.

Figure 1: The Three Dimensions of Financial Inclusion



Source: Adopted from Ong'eta (2019)

The second objective investigated the determinants of financial inclusion in the 45 SSA countries. The model to determine the drivers of financial inclusion in 45 SSA countries will be anchored on (Evans 2016) The model is as follows.

$$FII_{i,t} = \tau_0 + \tau_1(GDPC_{i,t}) + \tau_2(M_2GDP_{i,t}) + \tau_3(CREDIT_{i,t}) + \tau_4(INTEREST_{i,t}) + \tau_5 INFLATION + \tau_6 USERS + \tau_7 SERVERS + \epsilon_{i,t}$$

Where; FII is financial inclusion (number of depositors with commercial banks per 1,000 adults); GDPC is GDP per capita; M2GDP is money supply (% of GDP), and CREDIT is the credit to the private sector (% of GDP). INFLATION is headline inflation, USERS is the number of internet users, SERVER is secure internet servers, and INTEREST is the deposit interest rate. The subscript i is the i -th country and the subscript t the t -th year.

Table 1: *A priori expectation for objective two*

S/N	Variable	Measurement	Expected Sign
1	GDP per capita	Quarterly	+
2	M2GDP is money supply (% of GDP)	Quarterly	+
3	CREDIT is the credit to the private sector (% of GDP).	Quarterly	+/-
4	INTEREST is the deposit interest rate	Quarterly	+/-
5	INFLATION is headline inflation	Quarterly	+/-
6	USERS is the number of internet users	Quarterly	+/-
7	SERVER is a secure internet server	Quarterly	+/-

The study covers the period from 1999 to 2023 because it captures the major phases of financial sector reforms, technological advancements, and digital financial service expansion across Sub-Saharan Africa. The selected timeframe also provides sufficient longitudinal data to examine the evolving determinants of financial inclusion and to assess how economic, institutional, and technological changes have influenced financial inclusion outcomes over time. Furthermore, the period encompasses the rapid growth of mobile banking and fintech innovations that have significantly transformed financial access in the region, thereby providing a comprehensive basis for understanding the drivers of financial inclusion in SSA countries. Data used in the study were obtained from the International Monetary Fund (IMF) and the World Bank's World Development Indicators (WDI).

The computation of the financial inclusion index for Sub-Saharan African countries for the period 1999 to 2023 was conducted using Principal Component Analysis (PCA), a dimensionality reduction technique that simplifies complex data sets by transforming them into a lower-dimensional space while preserving the most important information. Analysis of the determinants of financial inclusion was conducted using Panel Ordinary Least Squares Regression, a statistical technique for estimating relationships in panel data, where observations are made over multiple time periods for multiple individuals, regions, or other entities.

RESULTS

Computation of the Financial Inclusion Index for the SSA countries from 1999 to 2023

Figure 2 presents the graphical representation of the SSA countries' financial inclusion index from 1999 to 2023.

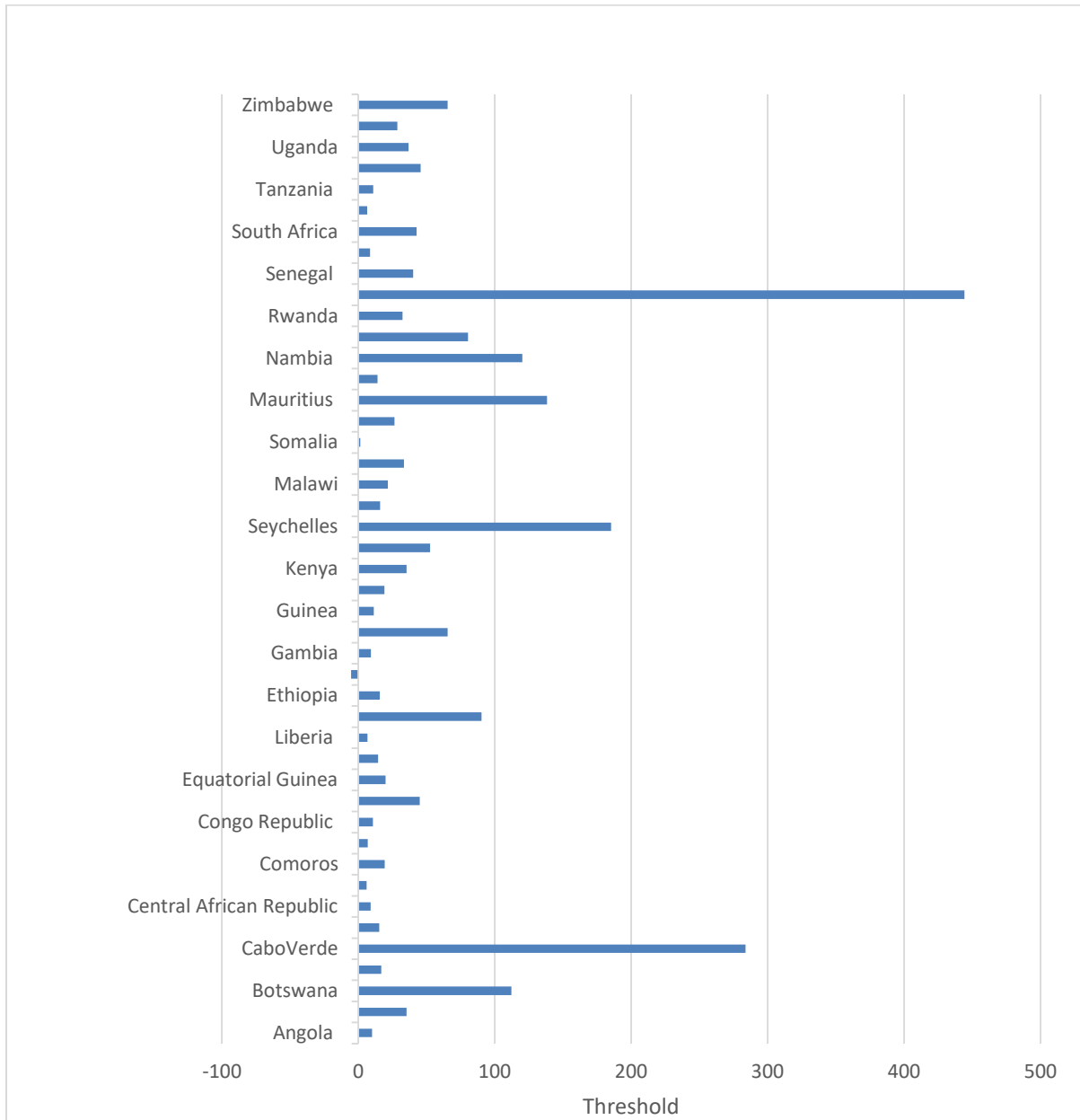
Decision rule - A value for FII close to zero shows a low financial inclusion index (0-49), a medium financial inclusion index (50-69), and a value close to one denotes a high financial inclusion (70- above) for the study period.

Table 2: SSA Financial Inclusion average for the periods of 1999 to 2023

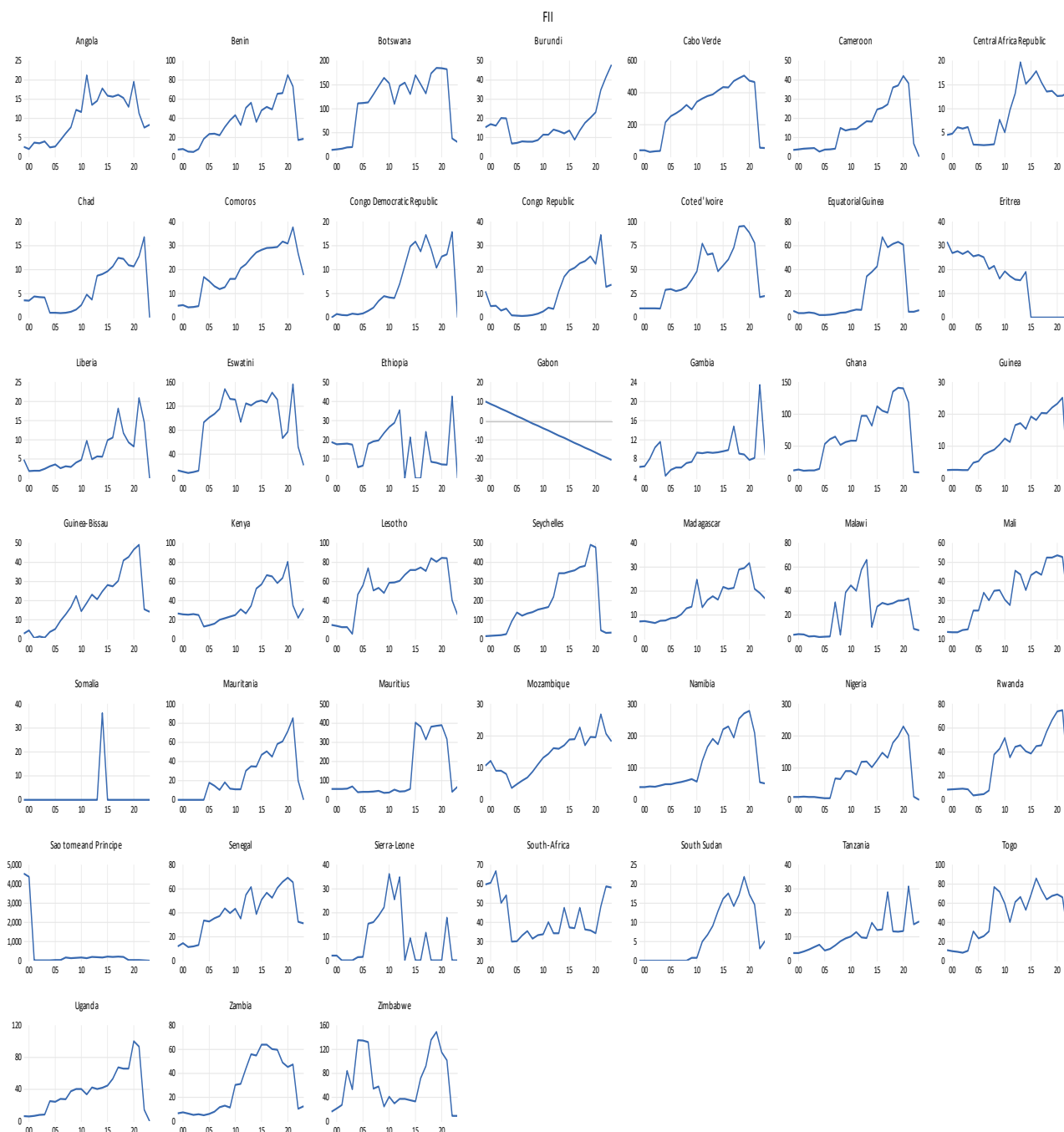
S/N	Financial inclusion rate average for the period of study	Discussion on the financial inclusion index numbers
1	Angola	10.08- Angola has low financial inclusion
2	Benin	36.01- Benin has low financial inclusion
3	Botswana	112.04- Botswana has a high financial inclusion rate
4	Burundi	16.71- Burundi has low financial inclusion
5	Cabo-Verde	283.85- Cabo-Verde has high financial inclusion
6	Cameroon	15.23- Cameroon has a low financial inclusion growth rate
7	Central African Republic	9.40- The Central African Republic has a low financial

		inclusion growth rate
8	Chad	6.30- Chad has a low financial inclusion growth rate
9	Comoros	19.19- Comoros has a low financial inclusion growth rate
10	Congo, Democratic Republic	7.44- The Democratic Republic has a low financial inclusion growth rate
11	Congo Republic	10.63- The Congo Republic has a low financial inclusion growth rate
12	Cote d'Ivoire	45.03- Cote d'Ivoire has a low financial inclusion growth rate
13	Equatorial Guinea	19.86- Equatorial Guinea has a low financial inclusion growth rate
14	Eritrea	22.61- Eritrea has a low financial inclusion growth rate
15	Liberia	6.95- Liberia has a low financial inclusion growth rate
16	Eswatini	90.17 Eswatini has a high financial inclusion growth rate
17	Ethiopia	16.35- Ethiopia has a low financial inclusion growth rate
18	Gabon	20.70- Gabon has a low financial inclusion growth rate
19	Gambia	-5.24- Gambia has a low financial inclusion growth rate
20	Ghana	9.11- Ghana has a low financial inclusion growth rate
21	Guinea	65.30- Guinea has a high financial inclusion growth rate
22	Guinea- Bissau	11.18- Guinea-Bissau has a low financial inclusion growth rate
23	Kenya*	19.02 Kenya has a low financial inclusion growth rate
24	Lesotho	35.34 Lesotho has a low financial inclusion growth rate
25	Seychelles	52.65- Seychelles has a medium financial inclusion growth rate
26	Madagascar	185.17- Madagascar has high financial inclusion
27	Malawi	15.84- Malawi has a low financial inclusion growth rate
28	Mali	21.57- Mali has a low financial inclusion growth rate
29	Somalia	33.47- Somalia has a low financial inclusion growth rate
30	Mauritania	1.45- Mauritania has a low financial inclusion growth rate
31	Mauritius	26.28- Mauritius has a low financial inclusion growth rate
32	Mozambique	138.24- Mozambique has a high financial inclusion growth rate
33	Namibia	13.98-Namibia has a low financial inclusion growth rate
34	Nigeria	120.07- Nigeria has a high financial inclusion growth rate
35	Rwanda	83.71- Rwanda has a high financial inclusion growth rate
36	São Tomé and Príncipe	444.11- Sao Tome and Principe has a high financial inclusion growth rate
37	Senegal	32.30- Senegal has a low financial inclusion growth rate
38	Sierra-Leone	40.08- Sierra Leone has a low financial inclusion growth rate
39	South Africa	43.69- South Africa has a low financial inclusion growth rate
40	South- Sudan	6.48 - South Sudan has a low financial inclusion growth rate
41	Tanzania	10.80- Tanzania has a low financial inclusion growth rate
42	Togo	45.51- Togo has a low financial inclusion growth rate
43	Uganda	36.74 - Uganda has a low financial inclusion growth rate
44	Zambia	28. Sierra-Leone has a low financial inclusion growth rate
45	Zimbabwe	40.08- Sierra Leone has a low financial inclusion growth rate

Figure 2: A snapshot of the average financial inclusion in Sub- Saharan Countries (SSA)



From the result above, Sao Tome and Principe has the highest financial inclusion growth rate with a value of four hundred threshold (400) and is distantly followed by Cabo Verde, recorded above two hundred and fifty threshold (250). Furthermore, to support this finding, the author further proceeded to compute an index through Principal Component Analysis (PCA) using the variables used in the computation of average financial inclusion. The result of the index computed using Principal Component Analysis (PCA) is presented below in graphical format:

Figure 3: *Computed index from (PCA)*

The above PCA-generated graph of financial inclusion among SSA countries from 1999 to 2023 further affirms that São Tomé and Príncipe has the highest financial inclusion penetration per thousand among the SSA countries considered during the period of the study.

Determinants of financial inclusion in Sub-Saharan Africa (SSA) countries for the period of 1999Q1 to 2023Q4

Table 3: *Summary of Descriptive statistics for the determinants of financial inclusion
in Sub-Saharan Africa from 1999Q1 to 2023Q4*

	FII	GRO	INFLATION	INTEREST	MONEY_SS	SERVER	USERS	CREDIT
Mean	-0.041256	1892.733	10.79987	7.169801	9280711.	2884324.	11.53038	25.60602
Median	-0.087514	1970.806	8.852001	7.515166	8620274.	2539324.	7.792917	20.33727
Maximum	0.648972	2081.402	25.90511	12.29314	24548843	11167173	39.09950	126.7493
Minimum	-0.744988	1480.209	4.962776	-0.835607	146170.9	38242.24	0.375663	12.90419
Std. Dev.	0.439787	193.2027	5.173066	2.539896	7198294.	2483485.	10.60089	24.79943
Skewness	0.007513	-0.921824	1.077461	-1.052691	0.207020	0.859214	0.971504	3.416490
Kurtosis	1.540643	2.331389	3.221861	4.749774	1.695759	3.498321	2.795621	13.30854
Jarque-Bera	6.123605	15.54458	18.96717	30.28963	7.567915	12.93867	15.42726	618.1956
Probability	0.046803	0.000421	0.000076	0.000000	0.022733	0.001550	0.000447	0.000000
Sum	-2.846676	183595.1	1047.587	695.4707	9.00E+08	2.80E+08	1118.446	2483.784

Table 3 indicates that all variables used as endogenous variables for financial inclusion are positive. This reveals that, on average, all the endogenous variables are positive. FII has a mean of -0.041, indicating a slight average decline over time with a high volatility (Std. Dev = 0.439), with a wide range from -0.745 to 0.649. Its skewness is close to zero (0.0075), indicating a roughly symmetric distribution. As regards the GRO variable, it has a mean of 1892.733, with a median close to the mean (1970.806), suggesting a somewhat normal distribution with a negatively skewed (-0.92), meaning more frequent lower values. Jarque-Bera test p-value (0.00042) suggests non-normality. The Inflation variable has a mean 10.8%, median: 8.85%, suggesting inflation is often below the mean with a positively skewed (1.08) distribution, meaning more frequent lower inflation values but occasional high spikes, while with a leptokurtic (Kurtosis = 3.22) distribution, indicating a fat-tailed distribution. The Interest Rate has a mean 7.17%, a median 7.52%, with a negatively skewed distribution (-1.05), meaning rates were often on the higher side but had occasional low values, plus high kurtosis (4.75), suggesting extreme variations. The Money Supply (MONEY_SS) has a large standard deviation (7,198,294) due to scale differences with a moderately skewed (0.207) and low kurtosis (1.69), suggesting a relatively normal distribution. The Server variable (SERVER) has a mean: 2,884,324 servers, but a significant standard deviation (2,483,485. It's positively skewed (0.86),

meaning some periods had extreme increases in server counts. Internet Users (USERS) have a mean 11.53% of the population. Positively skewed (0.97) and moderately kurtotic (2.80), meaning rapid adoption in certain periods. Credit Availability (CREDIT) has a mean of 25.6%, with a median lower at 20.33%. It is highly skewed (3.41) and extremely kurtotic (13.31), indicating outliers and extreme values. Jarque-Bera test ($p = 0.000$) strongly suggests non-normality.

Table 4: *Correlation Matrix for determinant of financial inclusion in SSA countries*

	FII	GRO	INFLATION	INTEREST	MONEY_SS	SERVER	USERS	CREDIT
FII	1.000000							
GRO	0.700179	1.000000						
INFLATION	0.622426	0.119306	1.000000					
INTEREST	-0.138922	0.133885	-0.630536	1.000000				
MONEY_SS	0.78681	0.731496	0.601884	-0.114270	1.000000			
SERVER	0.72262	0.676330	0.660588	-0.154292	0.994840	1.000000		
USERS	0.23371	0.469773	0.769953	-0.335839	0.930461	0.955021	1.000000	
CREDIT	0.17431	0.842239	0.461236	0.049484	0.945626	0.923776	0.775942	1.000000

Table 4 presents the correlation matrix of the variables used in the model. The correlation matrix shows the degree of association and direction of relationship among variables. The dependent variable (average of four financial inclusion proxies). Results in Table 4 show that the interest rate has a negative relationship with financial inclusion. Other variables such as headline inflation, economic growth, money supply (% of GDP), secure internet servers, number of internet users, and credit to private sector (% of GDP) have a positive relationship with financial inclusion. This positive relationship between financial inclusion and other independent variables indicate that a rise in any of the aforementioned variables will increase financial inclusion while a rise in headline inflation and interest rate will retard financial inclusion. While positive relationship exist between financial inclusion and GDP per capita, money supply (% of GDP), secure internet servers, number of internet users and credit to private sector (% of GDP), the degree of association shows that all independent variables can be included in the model without the fear of multicollinearity.

Table 5: *Panel unit root tests for the Determinant for
SSA countries' financial Inclusion*

Group unit root test:				
Summary				
Series: FII, GRO, INFLATION, INTEREST, MONEY_SS, SERVER, USERS, CREDIT				
Sample: 1999Q1 2023Q4				
Exogenous variables: Individual effects				
Automatic selection of maximum lags				
Automatic lag length selection based on SIC: 1 to 5				
Newey-West automatic bandwidth selection and Bartlett kernel				
Method	Statistic	Prob.**	Cross- sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.88412	0.1883	8	716
Null: Unit root (assumes individual unit root process)				
Im, Pesaran, and Shin W-stat	-1.41163	0.0490	8	716
ADF - Fisher Chi-square	44.4368	0.0002	8	716
PP - Fisher Chi-square	30.7190	0.0146	8	740
** Probabilities for Fisher tests are computed using an asymptotic chi-square distribution. All other tests assume asymptotic normality.				

Various studies such as (Anifowose, 2019) Among others, they have advised researchers to always use more than one method of the panel unit root test in order to be sure of the order of integration of the variables to be included in a particular model. The reason behind this might not be unconnected to the fact that a non-stationary variable constitutes an outlier among other variables, and the inclusion can significantly influence the outcome of the empirical analysis. For this study, both the LLC and ADF methods of Panel unit root tests are adopted for consistency's sake. Their results are presented in Table 5. It is evident from Table 5 that since Fisher-type tests (IPS, ADF, and PP) indicate stationarity at 5% significance, we lean towards rejecting the null hypothesis and conclude that the panel data is likely stationary.

ARDL Long Run Form and Bounds Test for the determinant of financial inclusion in SSA countries

Table 6: ARDL Long Run Form results for the Determinant
for SSA countries' financial inclusion

ARDL Long Run Form and Bounds Test				
Dependent Variable: D(FII)				
Selected Model: ARDL(2, 2, 0, 1, 2, 4, 2, 4)				
Case 2: Restricted Constant and No Trend				
Sample: 1999Q1 2023Q4				
Included observations: 67				
Conditional Error Correction Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.505076	0.434291	3.465590	0.0012
FII(-1)*	-0.136809	0.036295	-3.769301	0.0005
GRO(-1)	-5.39E-05	6.61E-05	-0.816407	0.4189
INFLATION**	-0.006309	0.002001	-3.153015	0.0030
INTEREST(-1)	-0.012219	0.004672	-2.615168	0.0123
MONEY_SS(-1)	3.32E-08	9.05E-09	3.673038	0.0007
SERVER(-1)	2.23E-07	7.50E-08	2.969995	0.0049
USERS(-1)	-0.025282	0.007718	-3.275851	0.0021
CREDIT(-1)	-0.097019	0.024898	-3.896570	0.0003
D(FII(-1))	0.455416	0.115839	3.931449	0.0003
D(GRO)	-0.001608	0.000235	-6.846907	0.0000
D(GRO(-1))	0.000350	0.000221	1.584207	0.1206
D(INTEREST)	-0.037013	0.007193	-5.145718	0.0000
D(MONEY_SS)	4.04E-09	2.84E-08	0.142113	0.8877
D(MONEY_SS(-1))	-7.48E-08	2.73E-08	-2.740982	0.0090
D(SERVER)	2.42E-07	1.06E-07	2.281234	0.0277
D(SERVER(-1))	-3.92E-07	1.09E-07	-3.613780	0.0008
D(SERVER(-2))	-3.51E-07	1.18E-07	-2.969054	0.0049
D(SERVER(-3))	-3.28E-07	1.14E-07	-2.870425	0.0064
D(USERS)	-0.063022	0.014954	-4.214435	0.0001
D(USERS(-1))	0.014010	0.012736	1.099974	0.2776
D(CREDIT)	-0.082344	0.030962	-2.659521	0.0110
D(CREDIT(-1))	0.069839	0.027438	2.545362	0.0147

D(CREDIT(-2))	0.075904	0.024298	3.123822	0.0032
D(CREDIT(-3))	0.069292	0.024077	2.877916	0.0063
* p-value incompatible with t-Bounds distribution.				
** Variable interpreted as $Z = Z(-1) + D(Z)$.				
Levels Equation				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
GRO	-0.000394	0.000537	-0.734878	0.4665
INFLATION	-0.046115	0.014387	-3.205418	0.0026
INTEREST	-0.089317	0.035303	-2.530032	0.0152
MONEY_SS	2.43E-07	6.89E-08	3.522228	0.0010
SERVER	1.63E-06	6.49E-07	2.510227	0.0160
USERS	-0.184801	0.072087	-2.563599	0.0140
CREDIT	-0.709156	0.220032	-3.222965	0.0025
C	11.00133	4.087184	2.691665	0.0102
EC = FII - (-0.0004*GRO -0.0461*INFLATION -0.0893*INTEREST + 0.0000*MONEY_SS + 0.0000*SERVER -0.1848*USERS -0.7092*CREDIT +11.0013)				

The essence of pooled regression analysis is to verify if there will be a need to use panel data analysis for the estimation of the equation or not. Panel data application might not be necessary if there is no problem of cross-sectional dependence. In other words, if the estimated pool regression model does not have a specific effect, then pool regression will suffice for the analysis, but if otherwise, then panel data analysis is more suitable to be used for the estimation. One of the shortcomings of the pool regression is the problem of heterogeneity, which is not present in the panel data. In the short-run dynamics, the result indicates that Growth, interest rates, and credit fluctuations significantly affect FII in the short run, while Server capacity and money supply matter in both the short and long run. The above long run result revealed that GRO is insignificant indicating it has no long-run impact on FII, inflation has negative & significant denoting that higher inflation reduces FII; Interest has negative & significant that is higher interest rates reduce FII; Money Ss has positive & significant indicating that More money supply increases FII; SERVER has positive & significant thus denoting that more server capacity increases FII; USERS result that negative & significant that is more users reduce FII, show that most bandwidth (internet penetration) is poor to serve the current number of SSA users therefore discouraging more people to switch to online financial products and

services. Lastly, the CREDIT variable shows that the current type and sector where credit is channelled in most SSA countries does not promote financial inclusion. Furthermore, the model Error Correction Term (ECT) captured in the FII (-1) Coefficient = -0.136809 with a t-Statistic = -3.7693 ($p = 0.0005$, highly significant). This indicates there is a negative and significant coefficient confirming a long-run equilibrium relationship. The speed of adjustment is 13.68% per quarter, meaning FII corrects 13.68% of disequilibrium each quarter. In conclusion, inflation (-0.0461) and interest (-0.0893) have a negative impact, meaning higher rates reduce FII. On the flip side, Money Supply ($2.43E-07$) and Server Capacity ($1.63E-06$) positively influence FII, while Users (-0.1848) and Credit (-0.7092) have a significant negative effect on FII.

DISCUSSION OF FINDINGS

The study computed a unique financial inclusion index for SSA countries from 1999 to 2023, as well and graphically supported. The decision adopted is that if a value for FII close to zero shows a low financial inclusion index (0-49), a medium financial inclusion index (50-69), while a value close to one denotes a high financial inclusion (70- above) for the study period. Data were collected through secondary sources, including the World Bank (WB), international Monetary Fund (IMF) reports for 1999–2024 and International Monetary Fund, 2020. A new, detailed index of financial inclusion measurement, termed the overall FI index, was built based on the study. To the best of the knowledge of the author, this is the first mathematically computed financial inclusion using availability, accessibility, concentration and usability variables for measuring the four dimensions of financial inclusion. Although the author acknowledges existing financial inclusion indices, such as Tram et al (2023). Notwithstanding, some other authors have used the methods adopted for this computation in their previous works, and the results formed the basis on which useful inferences were made. Moreover, the method is currently gaining a lot of ground as many researchers are now using it for the computation of indices (Anifowose, Omolade and Mukorera 2021). The computation revealed that Sao-Tome and Principe have the highest financial inclusion penetration per thousand among the SSA countries considered during the period of the study. Objective two, which examined the determinants of financial inclusion in Sub-Saharan Africa, found that the majority of the independent variables have statistically significant coefficients (p -values = 0.0000), indicating a strong relationship with the dependent variable (FII). The result is in line with the findings of Bashiru, Shani, et al. (2023) despite the fact that the study was based on only the South-Western States in Nigeria. In the same vein, Ajide (2017) discovered that all the variables used in this study have a significant impact on financial inclusion, but the study of Ajide (2017)

further emphasised socio-economic status as a very important factor that affects financial inclusion. Although the study used 18 SSA countries, most of their findings are the same.

CONCLUSION AND RECOMMENDATIONS

This study established that the forty-five countries have different financial inclusion trajectories during the period under review. Financial inclusion penetration in SSA countries is low; as such, the study concluded that financial inclusion efforts currently witnessed in the SSA countries are not having a trickling-down effect on the poor in the countries. Secondly, the study established that most of the independent variables have statistically significant coefficients (p -values = 0.0000), indicating a strong relationship with the dependent variable (FII), reflecting that independent variables included in the study are important determinants of financial inclusion in Sub-Saharan Africa (SSA) countries. The study recommends that policymakers in Sub-Saharan Africa shift from merely increasing financial access indicators to promoting inclusive financial usage that directly benefits low-income populations. This can be achieved through targeted interventions aimed at reducing financial exclusion among vulnerable groups, strengthening digital financial infrastructure, improving financial literacy, and enhancing the socioeconomic and institutional factors identified as significant determinants of financial inclusion. Furthermore, given the heterogeneous financial inclusion trajectories observed across countries, national governments should adopt context-specific financial inclusion strategies rather than relying on uniform regional approaches. Such measures would improve both the depth and inclusiveness of financial sector development and ensure that financial inclusion contributes more effectively to poverty reduction and inclusive economic growth in the region.

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