



Financial Inclusion and Economic Growth in Sub-Saharan Africa: A Panel ARDL and Granger Non-Causality Approach

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Abstract: The study examines the impact of financial inclusion on economic growth in sub-Saharan Africa from 2010-2022. The correlation analysis revealed that all coefficients of the variables were below 0.8, indicating an absence of multicollinearity issues. However, the cross-sectional dependency test findings indicated interdependence among the nations studied. Subsequently, a second-generation unit root test was employed to assess the stationarity of the variables. The unit root test revealed a mixed level of stationarity among the variables. Utilising the Augmented Mean group approach, it was found that GDPCPS, NAC, NBR, NAT, and DAT positively correlated to economic growth in the region.

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Conversely, POP, TOT, and INF are negatively related to economic growth. The causality test also revealed bi-directional causality between NAC and GDPGR, NBR and GDPGR, BRA and GDPGR, INF and GDPGR, and POP and GDPGR variables. At the same time, there is uni-causality between NAT and GDPGR, DAT and GDPGR, GDPCPS and GDPGR, TOT and GDPGR. In response to our findings, the study recommends that the government and policymakers in SSA formulate policies to ensure that all the proxies of financial inclusion are expanded as they all trigger economic growth.

Keywords: Financial inclusion; AMG; Economic growth; Sub-Saharan Africa

JEL Classification: E44, E51, O33, O40

1. Introduction

Financial inclusion has been a growing priority for academics, corporate magnates, and government officials, particularly in emerging countries. It is a socio-economic challenge for policymakers, financial markets, and institutions to ensure that individuals benefit from access to financial services. Financial inclusion enhances economic development in low-income nations by promoting expenditure and consumption among individuals, households, and businesses. According to the World Bank (2018), around one-third of the global population is economically marginalised due to their lack of access to traditional banking services.

The global population with access to financial services is expanding; nonetheless, over 1.7 billion individuals, equivalent to roughly 31% of adults, remain without a transaction account (UFA, 2020). Patharbasioglu et al. (2020) found that a mere 20% of people in the most impoverished developing countries use banking institutions to save money and that 65% of the population lacks access to this financial service. The number of individuals with a bank account in Sub-Saharan Africa (SSA) is just 33%, the lowest internationally (Demirguc-Kunt et al., 2018). The data used for this analysis was obtained from a 2017 survey done by Global Findex. Demirgüç-Kunt et al. (2017) argue that a transaction account serves as the basis for financial inclusion since it enables individuals to store money, make and receive payments, and carry out many other duties. Mobile phones have simplified the process of creating formal bank accounts for low-income families and people, particularly those in rural regions. This has contributed to reducing some of the difficulties they encounter (Andrianaivo & Kpodar, 2011; Patharbasioglu et al., 2020).

Furthermore, the advent of mobile phones and internet access has transformed our daily lives, occupations, and social interactions. Mobile financial services are becoming more popular among consumers in low-income nations as an alternative to traditional banking alternatives (Andrianaivo & Kpodar, 2011; Chinoda et al., 2019; Kim et al., 2017). The objective is to provide access to formal financial services to those who lack access. Chatterjee (2020) and Anand (2017) assert that mobile banking services have significantly enhanced financial inclusion by closing the infrastructure gap. Developing nations may facilitate the inclusion of unbanked individuals into the formal financial system by using mobile technology,

implementing a cost-effective transactional platform, offering attractive financial products, and establishing a supportive regulatory environment.

Multiple instances of mobile phone banking services exist, with M-Pesa being one of the most widely used (Jack & Suri, 2014). According to Mas and Radcliffe (2011), the average number of agents operating in each commercial bank branch in the twenty states that provide mobile money services is 47. Espinosa-Vega et al. (2020) assert that this payment method creates a new category and offers an alternate means of obtaining financial services. Abundant data indicates that inclusive finance promotes the accumulation of wealth and the progress of economic development in the long term. In addition, it encompasses several more works, including Dahiya and Kumar (2020), Inoue and Hamori (2016), Kim et al. (2017), Sethi and Acharya (2018), Sharma (2016), Lenka and Sharma (2017), and many others.

According to Abor et al. (2018), financial inclusion is a primary goal of eight of the seventeen (SDGs). One potential strategy for using digital financial services to promote health and well-being for everyone (SDG 3) is to reduce the transmission of the novel coronavirus in African communities. Digital finance aims to provide safe, affordable, seamless financial tools across ecosystems to eliminate the need for real currency transactions and conventional bank branches. Both theoretical and practical models concur that enhancing individuals' capacity to utilise financial services is crucial for stimulating economic growth. Afolabi (2020) and Demirguc-Kunt and Klapper (2012) assert that improving and reducing the cost of access to banking services in low-income areas could lead to increased investment, new business prospects, and overall economic expansion.

Evidence from research undertaken by Corrado and Corrado (2017), Sahay et al. (2015), Sotomayor et al. (2018), and Yah and Chamberlain (2018) suggests that individuals who have financial investments may possess a favourable position in terms of effectively managing their finances and planning for the future. According to the research conducted by Adedokun and Ağa (2021) and Honohan (2004), financial inclusion would reduce poverty, increase overall economic growth, and narrow the income inequality gap. This research enhances the existing literature on financial inclusion by using mobile money indicators to analyse data from 22 SSA countries from 2012 to 2018. This research is the first to investigate the influence of mobile money on economic development in sub-Saharan Africa (SSA) through digital financial services, based on this financial inclusion statistic. This is in line with the findings of Nguyen (2020) and Abdulmumin et al. (2019), who examined aspects of mobile money. An approach to quantify the ease of use of financial services.

According to Demirguc-Kunt and Klapper (2012), expanding mobile money in underdeveloped nations may enhance their accessibility to financial services. Furthermore, this research aims to enhance the existing information by examining novel policy implications via the use of bundling and unbundling methodologies.

Bundling is associated with the relationship between the availability of goods or services and the desire for them, while unbundling is connected to providing access to financial services for all individuals. The aggregated statistics may provide insights into the factors driving the economic growth of sub-Saharan Africa. At the same time, the disaggregated indicators can guide policymakers in targeting specific aspects of financial inclusion.

2. Literature Review

Since the beginning of the 21st century, there have been notable advancements in financial inclusion. The accessibility and affordability of banking products and services have proven beneficial for individuals striving to manage their finances effectively. However, there remains a scarcity of freely available data in this area. Various theoretical models have been proposed to evaluate financial inclusion indexes. Ain et al. (2020) conducted a study examining the responses of developing countries to financial inclusion. Their research, from 2004 to 2016, focused on 33 emerging countries. Utilising the GMM regression approach, they analysed the relationship between the density of commercial bank branches per 100,000 inhabitants and ATMs per 100,000 residents to understand its impact on financial inclusion.

According to their research findings, there is a positive and statistically significant correlation between the availability of financial services and the expansion of the GDP. Sethi and Acharya (2018), who used data from 31 developed and developing countries covering the years 2004–2010, further investigated the influence of financial inclusion on the expansion of GDP. Their study demonstrates a causal connection between expanded access to financial services and sustained economic development. They found a solid and statistically significant association between the gross domestic product (GDP) and the financial inclusion index, one of the most significant markers of economic progress. Kim et al. (2018) conducted further research intending to determine whether or not there is a connection between the degree of financial inclusion among OIC members and the economic performance of those members.

The proliferation of Islamic financial products has extended conventional banking services to a broader population segment in OIC countries. Their analysis revealed that increased utilisation of financial services contributes to a rise in GDP. Empirical research has consistently demonstrated that improving individuals' access to financial services positively impacts economic conditions, as evidenced by Granger causality tests. Emara and El-Said (2021) researched to evaluate the relationship between financial inclusion and GDP growth. A moderating influence of good governance was taken into consideration in their investigation. The GDP growth may

be hampered by further improvements in the financial sector after financial inclusion reaches a particular threshold (Sahay et al., 2015). Countries in the Middle East and North Africa region were the primary focus of the investigation.

Between 1990 and 2018, researchers extensively investigated forty-four nations in the MENA region, assessing households' access to financial services using the financial access index. Countries fostering financial inclusion tend to experience higher GDP per capita growth rates with increased utilisation of financial services by the population. To investigate the financial inclusion effect on the expansion of the gross domestic product, Ifediora et al. (2022) utilised panel data that included 22 sub-Saharan African nations from 2012 to 2018. In order to determine the amount of financial inclusion, they used the system GMM technique, which included merging a composite index with personal qualities. This allowed them to evaluate financial inclusion's influence on the rise of revenue.

The study found that a more extensive network of bank branches and automated teller machines significantly influenced GDP growth. Ali et al. (2021) investigated the economic performance of the 45 nations of the (IsDB) from 2000 to 2016, mainly about financial inclusion. Using a financial inclusion score, they employed various statistical methodologies, including panel vector autoregressive (VAR), (2SLS), and panel Granger causality testing. The study revealed a cause-and-effect relationship between financial inclusion indicators and economic advancement.

Bigirimana and Hongyi (2018) investigated the period from 2004 to 2016 to assess the impact of financial inclusion on Rwanda's economic development. Financial inclusion was evaluated based on three criteria: access, penetration, and usage. Obayori and George-Anokwuru (2020) used the ARDL model to investigate the impact financial inclusion had on the expansion of the gross domestic product in Nigeria between 1981 and 2018. The results of the study suggest that there is a connection between financial inclusion and GDP throughout the course of history.

Uruakpa et al. (2019) also found that both short- and long-term economies benefit when individuals have easy access to and effectively use financial services, significantly affecting GDP growth in Nigeria. In order to investigate the effect that financial inclusion has on the expansion of the country's gross domestic product (GDP), Onaolapo (2015) used financial deepening measurements such as broad money to GDP and private sector loans to GDP. According to the research findings, the ratio of private sector loans to GDP showed a negative relationship with the growth rate of GDP. The broad money indicator also demonstrates a sizeable positive association with economic growth, which is a very optimistic finding.

In contrast, Khan (2011) raised concerns that expanding access to banking services might jeopardise financial system stability and hinder economic growth. Menyelim et al. (2021) analysed data from 48 Sub-Saharan African nations spanning 1995-2017 and found that financial inclusion is inversely related to income inequality and

GDP growth. Maune (2018) focused on Zimbabwe, highlighting financial inclusion as a mitigating factor in the connection between trade and economic growth. The research suggested that financial exclusion and restricted trade openness hinder Zimbabwe's economic development. According to Nkwede (2015), financial inclusion's influence on Nigeria's GDP growth was investigated using data spanning from 1981 to 2013. According to the findings, the inclusion of financial services hinders the development of the gross domestic product in Nigeria. To gain a deeper comprehension of the connection between financial inclusion and GDP development, Nwisienyi and Obi (2020) investigated data for Nigeria spanning the years 2004 to 2018. The ARDL limits test was utilised to demonstrate a cointegration and error correction model (ECM). The researchers concluded that the economy slows down when a more significant number of people can borrow money from commercial banks or other financial institutions.

In order to investigate the connection between financial inclusion and the expansion of the South African Development Community's gross domestic product, Chiwira (2021) analysed data spanning from 1995 to 2015. Throughout the inquiry, the ARDL model's causal and cointegrating links demonstrated a significant and unfavourable correlation between having access to financial services and making development in the economy.

2.1. Theoretical Framework

Financial inclusion contributes to the explanation of economic growth, in line with the views proposed by Gurley and Shaw (1955), McKinnon (1973), and Levine (2005). According to the theory, investment, consumption, economic development, and production are all affected by shifts in the finance landscape caused by financial institutions' activities. Improved lending processes for deficit units and more straightforward financing situations generally will increase economic growth, according to Levine (2005), who states that this is the theory of the banking industry. This is because intermediaries in the financial sector have a better grasp of how to channel loan money toward initiatives that boost productivity and efficiency. Theories investigating the connection between finance and GDP growth state that as more people and businesses use formal financial services, economic development is enhanced.

By accepting deposits from new customers, banks may increase lending to deficit units, stimulating the economy and enhancing growth. Investment, consumption, and output will all rise as a consequence. One recent theoretical study that provides an alternative framework is the system theory of financial inclusion; Ozili (2020) is only one of several. According to this theory, formal financial institutions are one component of the economic system that may cooperate to achieve financial inclusion goals. That is why its outcomes will be useful for the subsystems that make financial

inclusion possible. Ozili (2020) claims that a strong economic system will profit from these discoveries, essential for financial inclusion. To investigate the link between financial inclusion and GDP development, two hypotheses will serve as a foundation: First, according to Ozili (2020), if financial inclusion indicators are improved, it will increase the threshold for formal financial institutions, which means greater financial intermediation and better economic growth and system strength. Although many studies have examined the link between financial inclusion and GDP growth, few have attempted to explain it theoretically.

3. Methodology

Annual secondary data were gathered from 2010 to 2022 for ten designated Sub-Saharan African (SSA) nations using panel data analysis methodologies and databases from the World Bank (WB) and the International Monetary Fund (IMF). Our objective was to investigate the correlation between economically integrated populations and economies in expansion. The following nations are affected: the Democratic Republic of the Congo, Ghana, Kenya, Mauritius, Mozambique, South Africa, Uganda, and Cameroon. The databases from which the statistics were compiled are International Monetary Fund and World Bank property. Numerous studies have attempted to categorise the diverse indicators of financial inclusion into three overarching domains: availability, usability, and accessibility. There are hazards associated with using specific indicators, including the potential for missing data or erroneous conclusions, as highlighted by research. These studies are illustrated by Jungo et al. (2022), Makina and Walle (2019), and Dabla-Norris et al. (2015), to name a few. Consequently, an examination is being conducted into the comprehensive financial inclusion index concept.

3.1. Model Specification

This study will adopt the model of Makina and Walle (2019) with modifications for its model specification.

$GDPGR = f(NAC, NAT, NBR, DAT, BRA, GDPCPS)$i

We will include control variables such as INF, POP, TOT.....ii

$GDPGR = f(NAC, NAT, NBR, DAT, BRA, GDPCPS, INF, POP, TOT)$iii

Transforming Equation iii into econometric form gives Equation iv

$GDPGR_{it} = \alpha_0 + \alpha_1 NAC_{it} + \alpha_2 NAT_{it} + \alpha_3 NBR_{it} + \alpha_4 DAT_{it} + \alpha_5 BRA_{it} + \alpha_6 GDPCPS_{it} + \alpha_7 INF_{it} + \alpha_8 POP_{it} + \alpha_9 TOT_{it}$ iv

Where: GDPGR= gross domestic product growth rate; NAC = Number of accounts per 1000 adults; NAT = Number of ATMs per 1000 km²; NBR = Number of branches per 1000 km²; DAT = Geographic spreads of ATMs per 100,000 adults;

BRA = Branches of commercial banks per 100,000 adults; GDPCPS = Credit to the private sector as a percentage of GDP; INF = Inflation rate; POP = Population growth rate; TOT = Trade openness.

4. Discussion of Results

4.1. Descriptive Statistics

Table 1 below represents the descriptive analysis of the ten sub-Saharan Africa. The result reveals that the mean values of GDPGR, NAC, NAT, NBR, DAT, BRA, GDPCPS, INFR, POP and TOT are 2.026, 10.851, 4.973, 2.835, -0.078, 8.093, 5.483, 15.352, 4.962 and 0.717 respectively. The result also showed that TOT is the least volatile variable while the inflation rate is the most volatile variable and that all the variables revolve around their mean. The result also showed that GDPGR, NAC, INFR, and TOT are negatively skewed, indicating that the distributions are skewed to the left. At the same time, NAT, NBR, DAT, BRA, GDPCPS and POP are positively skewed, indicating that the distributions are skewed to the right. Finally, the result showed that GDPGR, NAC, DAT, BRA, GDPCPS, INFR, POP and TOT are leptokurtic distributed, while NAT and NBR are mesokurtic distributed.

Table 1. Descriptive

Variable	GDPGR	NAC	NAT	NBR	DAT	BRA	GDPCPS	INFR	POP	TOT
Mean	2.026	10.851	4.973	2.835	-0.078	8.093	5.483	15.352	4.962	0.717
Minimum	-4.725	0.936	1.098	2.678	-2.267	3.126	2.914	8.461	2.972	0.014
Maximum	7.226	13.986	6.836	3.867	1.923	12.845	9.693	20.656	9.167	0.964
Std. Dev.	2.949	3.023	4.713	1.097	0.882	1.372	2.936	4.979	0.463	0.171
Variance	1.363	9.141	2.097	0.252	0.779	0.283	1.358	3.917	0.719	0.029
Skewness	-2.753	-2.703	2.833	1.092	0.150	4.257	2.681	-1.782	2.846	-1.552
Kurtosis	4.769	10.205	2.472	2.582	3.347	8.825	4.839	3.291	4.261	6.693

Statistics

Source: Authors' Computation (2024)

4.2. Correlation Statistics

Table 2 below represents the correlation matrix of all the variables used.

Table 2. Correlation Matrix Result

Variable	GDPGR	NAC	NAT	NBR	DAT	BRA	GDPCPS	INF	POP	TOT
GDPGR	1.000									
NAC	0.133	1.000								
NAT	-0.193	0.195	1.000							
NBR	0.402	0.041	-0.092	1.000						
DAT	0.102	-0.006	-0.419	0.703	1.000					
BRA	0.615	-0.137	-0.321	0.617	0.543	1.000				
GDPCPS	0.468	0.626	-0.356	0.361	-0.368	-0.262	1.000			
INF	-0.125	0.421	0.625	-0.529	0.194	0.483	-0.351	1.000		
POP	0.312	-0.347	0.390	0.725	-0.067	0.201	0.560	-0.692	1.000	
TOT	0.037	-0.094	-0.252	0.635	0.418	0.738	0.328	0.172	0.427	1.000

Source: Authors' Computation (2024)

The correlation statistics analysis showed that NAC, NBR, DAT, BRA, GDPCPS, POP and TOT have a positive correlation with GDPGR, while NAT and INFR have a negative correlation. The result further showed that NAT, NBR, GDPCPS, and INF have a positive correlation with NAC, while DAT, BRA, and POP TOT exhibit a negative correlation. Also, NBR, DAT, BRA, GDPCPS, and TOT positively correlate with NAT, while INF and POP exhibit a negative correlation. INF exhibits a negative relationship with NBR, while DAT, BRA, GDPCPS, POP and TOT have a positive relationship. The result further showed that there is no strong correlation among the variables, implying no multicollinearity problem in the model.

4.3. Cross-Sectional Dependence Test

Table 3. Cross-Sectional Dependence Result

Variable	GDPGR	NAC	NAT	NBR	DAT	BRA	GDPCPS	INF	POP	TOT
CD Test:	25.533	31.353	21.902	17.372	18.253	28.937	15.892	19.239	29.4726	12.8253
P-value:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Source: Authors' Computation (2024)

The cross-sectional dependence test is used to determine if there is dependence among the countries under review. As presented in Table 3, the result reveals that all the variables are significant at 1%, indicating cross-dependence among the variables in the country.

4.4. Unit Root Tests

In response to cross-dependency across countries, this study will employ a second-generation unit root test, which accommodates cross-dependency.

Table 4. Cross Section IPS (CIPS)

Variable	Level	Diff.	Order
GDPGR	-2.528*	-4.572*	I(0)
NAC	-1.728	-5.748*	I(1)
NAT	-2.158**	-4.102*	I(0)
NBR	-1.892	-3.836*	I(1)
DAT	-2.582*	-5.576*	I(0)
BRA	-2.672*	-5.127*	I(0)
GDPCPS	2.017**	4.892*	I(0)
INR	1.258	3.921*	I(1)
POP	2.105**	5.673*	I(0)
TOT	-2.852*	-5.014*	I(0)

Source: Authors' Computation (2024)

This study will employ CIPS. The result showed that GDPGR, NAT, DAT, BRA, GDPCPS, POP and TOT are stationary at level I(0) while NAC, NBR, and INF were not stationary at level but became stationary at first difference I(1). The result showed a mixed level of stationary among the variables.

4.5. Regression analysis

Table 5. AMG Analysis

Variable	Long Run Analysis	Variable	Short Run Analysis
NAC	43.458** 0.029	Δ NAC	40.260** 0.047
NAT	6.290** 0.036	Δ NAT	4.923** 0.027
NBR	0.011** 0.041	Δ NBR	0.147** 0.041
DAT	0.073** 0.042	Δ DAT	0.033** 0.017
BRA	13.547** 0.016	Δ BRA	12.901*** 0.005
GDPCPS	0.253** 0.043	Δ GDPCPS	0.208** 0.025
INF	-38.982** 0.019	Δ INF	-36.295** 0.016
POP	-5.657** 0.029	Δ POP	-3.420** 0.041
TOT	-0.109** 0.012	Δ TOT	-0.117** 0.015
		ECM(-1)	-0.649*** 0
C	36.419* 0.002	C	0.247* 0.06

Source: Authors' Computation (2024)

The findings unequivocally reveal that the (NAC) has a significant and positive impact on economic growth, both in the short and long term, even at a significance threshold of 5%. Therefore, an increasing proportion of bank accounts relative to the total population signifies a flourishing economy. Moreover, the data indicates that a 1% increase in NAC would lead to a 43.458% growth in GDP in the long term and a 40.260% increase in the short term. Similarly, the statistical significance of both short-term and long-term impacts of (NAT) on economic growth was observed at a 5% level. A robust correlation exists between economic development and an increase in the density of ATMs per square kilometer. A 1% rise in NAT would correspond to increases of 6.290% and 4.923% in GDP in the long and short term, respectively.

The impact of (NBR) on both short-term and long-term economic growth was positive and statistically significant at a 5% level. An increase in the number of branches per 1000 km² indicates economic expansion. Additionally, a 1% increase in NBR would result in a long-term GDP growth of 0.011% and a short-term gain of 0.147%.

Furthermore, it was demonstrated that the (DAT) had a significant and beneficial effect on immediate and long-lasting economic expansion, with a 5% level of statistical significance. Consequently, the economy benefits from increased ATM distribution, leading to more ATMs per 100,000 people. Moreover, a 1% rise in DAT would result in a 0.073% boost in GDP in the long run and a 0.033% gain in the short term. Moreover, the study revealed that both short-term and long-term impacts of (BRA) on economic development were statistically significant, with a confidence level of 5%. This suggests a positive relationship between economic growth and the number of commercial bank branches per 100,000 inhabitants.

Additionally, a 1% increase in BRA would result in a 13.547% long-term increase in GDP and a 12.901% short-term increase. Even at the 5% significance level, there was a positive and statistically significant relationship between (GDPCPS) and long-term economic growth. This research indicates that increasing private-sector lending relative to GDP positively correlates with economic growth. The findings also suggest that in the long run, GDP would be boosted by 0.253% and, in the short term, by 0.208%, with a 1% increase in the Number of Bank Branches per Total Population (NBR). Similarly, short-term and long-term correlations between Inflation (INF) and GDP growth were statistically significant at the 5% threshold. The rising costs are a major factor contributing to the economic downturn. Furthermore, it was shown that a 1% increase in INF would lead to a 0.253% reduction in GDP over the long run and a 0.208% decrease over the short term. Moreover, the data reveals that Population (POP) significantly impedes economic development immediately and over the long run, even at the 5% significance level. Along with the population surge, the economy appears to be declining.

Also, GDP would fall by 5.657% in the long run and by 3.42% in the short term for every 1% increase in POP. Furthermore, it was observed that Total Trade (TOT) significantly hampers short- and long-term economic growth, even at the 5% significance level. The economy seems to deteriorate as trade becomes more accessible. Additionally, a 1% increase in TOT would lead to a 0.109% long-term drop in GDP and a 0.117% short-term decline. Lastly, the Error Correction Model (ECM) outcome demonstrates that the model overcomes an out-of-equilibrium condition with a resolution of around 64.9%.

Table 6. Dumitrescu & Hurlin Causality Test

Causality Variable		Z-bar	Z-bar (P-value)	Remark
NAC	GDPGR	1.293	0.001	Homogeneous bi-causal relationship between GDPGR and NAC
GDPGR	NAC	2.417	0.032	
NAT	GDPGR	1.628	0.421	Homogeneous uni-causal relationship between GDPGR and NAT
GDPGR	NAT	6.215	0	
NBR	GDPGR	4.281	0.018	Homogeneous bi-causal relationship between GDPGR and NBR
GDPGR	NBR	7.175	0.025	
DAT	GDPGR	4.172	0.015	Homogeneous uni-causal relationship between GDPGR and DAT
GDPGR	DAT	1.073	0.283	
BRA	GDPGR	3.572	0.021	Homogeneous bi-causal relationship between GDPGR and BRA
GDPGR	BRA	4.725	0.015	
GDPCPS	GDP	0.271	0.251	Homogeneous uni-causal relationship between GDPGR and GDPCPS
GDPGR	GDPCPS	6.152	0.029	
INF	GDPGR	0.781	0.675	Homogeneous bi-causal relationship between GDPGR and INF
GDPGR	INF	7.153	0	
POP	GDPGR	0.419	0.517	Homogeneous bi-causal relationship between GDPGR and POP
GDPGR	POP	5.921	0.031	
TOT	GDPGR	6.252	0.035	Homogeneous uni-causal relationship between GDPGR and TOT
GDPGR	TOT	7.621	0.025	

Source: Researchers' Computation (2024)

The Dumitrescu and Hurlin Granger causality test examines the causal relationships between economic growth and financial inclusion in SSA. The result showed that there is bi-directional causality between NAC and GDPGR, NBR and GDPGR, BRA and GDPGR, INF and GDPGR, and POP and GDPGR, which implies that there is a feedback direction among the variables. At the same time, there is uni-causality between NAT and GDPGR, DAT and GDPGR, GDPCPS and GDPGR, and TOT and GDPGR, indicating that there is a one-way direction among the variables.

5. Conclusion and Policy Recommendations

The intricate relationship between financial inclusion and economic growth in sub-Saharan Africa during 2010-2022, as explored in this study, has been the subject of extensive research. Explicitly focusing on ten nations, including the Democratic Republic of Congo (DRC), Mozambique, Ghana, Kenya, Mauritius, and Cameroon, the study utilised data from the World Bank and the International Monetary Fund. The correlation analysis revealed that all coefficients of the variables were below 0.8, indicating an absence of multicollinearity issues. However, the cross-sectional dependency test findings indicated interdependence among the nations studied. Subsequently, a second-generation unit root test was employed to assess the stationarity of the variables. It was found that variables such as GDPGR, NAT, DAT, BRA, GDPCPS, POP, and TOT exhibited stationarity at level $I(0)$, remaining stable over time.

However, none of these variables achieved stationarity at the first difference. Utilising the Augmented Mean group approach, it was determined that GDPCPS, NAC, NBR, NAT, and DAT positively contribute to economic progress in the region. Conversely, POP, TOT, and INF were found to have a negative impact on economic growth. These findings shed light on the nuanced dynamics between financial inclusion and economic development in sub-Saharan Africa.

The causality test also revealed that there is bi-directional causality between NAC and GDPGR, NBR and GDPGR, BRA and GDPGR, INF and GDPGR, and POP and GDPGR variables. At the same time, there is uni-causality between NAT and GDPGR, DAT and GDPGR, GDPCPS and GDPGR, TOT and GDPGR. In response to our findings, the study recommends that the government and policymakers in SSA formulate policies to ensure that all the proxies of financial inclusion are expanded as they all trigger economic growth. The government should formulate policies to reduce the inflation rate in SSA as it deters economic growth. Also, government should encourage family planning and other contraceptive to manage the population dynamics as it deters economic growth in SSA.

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