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Banking Sector Development and Agricultural Productivity in Central African Economic and Monetary Community (CEMAC)

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Abstract: There is high pressure for investment capital and financial services for agricultural activities necessary for poverty reduction, economic growth, sustainable development and food security. This study investigated the long-term causation between banking sector development and agricultural productivity in the six Central African Economic and Monetary Community (CEMAC) states from 1990 to 2018, hypothesizing no causation between banking sector and agriculture output. With the autoregressive distributed lag (ARDL) model and vector error correction model (VECM), the study demonstrates that banking sector and agricultural productivity in the CEMAC region are related. It implies long-run relationship exists between banking sector and agricultural productivity in the CEMAC zone. The results reveal that bidirectional causality exists between banking sector and agricultural productivity in the CEMAC region. This is insinuating that in the CEMAC region, agricultural productivity and banking sector development are operating in mutualism. The findings indicate the reason to establish the banking sector using proper macroeconomic, legal and regulatory policies to boost agricultural productivity by creating incentive systems that channel more credit to agricultural investment and promoting the banking system.

Key words: Agricultural productivity, banking sector development, economic growth, agricultural financing, investment, sustainable development.

1. Introduction

There is high pressure for investment capital and financial services for agricultural activities necessary for poverty reduction, economic growth, sustainable development and food security. Specifically, smallholder farmers and entities in emerging economies have limited investment capital and financial access, which leads to low agricultural productivity coupled with inefficiency. With inefficiency, low incomes and high losses are realized [1]. The World Bank maintains that demand and supply factors of investment capital are introducing rapid changes in agriculture and agribusiness in sub-Saharan Africa that will push the sector into an estimated US$1 trillion economy in 2030, rising from US$313 billion in 2010.

These motivate the question: do countries with more advanced banking sector exploit agricultural resources more efficiently? To solve this problem, significant investment is needed in the agriculture sector [2]. Clearly, much is required to raise agricultural productivity, to relieve the rural people's poverty and hunger through increased food production that in turn reduces food prices, especially in the continent hinterlands to benefit the growing urban poor masses. The rate of world population growth, with the 2008 global financial crisis' lessons motivates research on how farmers can access bank credit in order to boost productivity and fight hunger [3].

According to Food and Agricultural Organization (FAO) [3], hunger is habitually calculated using the frequency of undernourishment, which is the inability to acquire enough food to meet energy dietary requirements of human beings. Recent statistics still point to an increase in world hunger after a protracted

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decline. In 2017, approximately 821 million people worldwide still lack sufficient food to eat and live an actively healthy life, roughly one out of nine persons. Additionally, statistics from the Food Insecurity Experience Scale (FIES) indicate that close to 10% of the world population is exposed to abject food insecurity, which are about 770 million people. The prevalence rate of world undernourishment improved from 13.1% in 2007 to 10.9% in 2017 while the prevalence rate of severe food insecurity worsened from 8.9% in 2016 to 10.2% in 2017 [3]. About 45% of Central African Economic and Monetary Community (CEMAC) population suffers from malnutrition, and 10% of this population suffers from an extreme food deficit [4].

The CEMAC region which has been depending on petroleum for growth, received heavy shocks from the oil price decrease [5]. Its growth dropped from 1.6% in 2015 to 0.2% in 2016 and increased to 2.2% in 2017. The growth values do not reveal the region's disparities like: Equatorial Guinea and the Congo Republic had recessions, Cameroon and the Central African Republic (CAR) witnessed strong economic growth of 4.0% and 4.7%, respectively, in 2017. Additionally, the oil prices drop affected the trade balance of the community, with a deficit of 15% in both 2015 and 2016 [6].

The gross domestic product (GDP) agricultural value added had great regional variations from 2.6% of GDP value added in Equatorial Guinea to 50% in Chad. Two countries secured an important share of the agricultural value added, Chad and the CAR with 50% and 43%, respectively. The other countries had agricultural GDP values below 20%, with Cameroon at 17% [1]. Agriculture provides employment to larger population in most CEMAC countries. Over 62% of the population is employed in agriculture in Cameroon, 72% in CAR, 77% in Chad and 41% serve in agriculture in Congo Republic. However, agriculture employs only 19% in Equatorial Guinea and 16% in Gabon [7].

With the forgoing statistics, the CEMAC's agricultural policy strategy is based on strengthening the agricultural sector's competitiveness and productivity, comprising increased sustainable food production. This strategy prioritizes infrastructural development to ease trade, communication, movement of persons and commodities. The policy also allows structural improvements like training, new technology, support services which are extension, advisory, input supply, credit, savings, veterinary services, quality control etc. Thus, CEMAC's agricultural policy is to coordinate and harmonize agricultural policies of its member states [2].

The understanding of the relationship between banking sector development and agricultural productivity in the CEMAC region aids policy makers, decision makers, managers, government and other stakeholders to design targeted policies and programs that will help increase productivity, food security, reduce malnutrition and poverty level of the citizens. This will also improve the performance and profitability of financial institutions. Due to time lag in returns to agricultural investment, alongside the effects of climate and environmental factors from global warming, it is necessary to determine the financial links to agricultural productivity [8]. Thus, this study investigates the long-term causation between banking sector development and agricultural productivity in the six CEMAC states from 1990 to 2018 and hypothesizes no relationship between banking sector and productivity.

Beginning in mid 1980s, many African countries introduced reforms in their financial sectors. These reforms emanated from International Monetary Fund (IMF) and World Bank structural adjustment program (SAP), meant to restructure and privatize state-owned banks. The reforms came alongside auxiliary policies which facilitated capital controls, interest rates and the entry and exit restrictions, with a renovated supervisory and regulatory framework in the banking sector. As the economic benefits of SAP are being

debated by experts, it is confirmed that the policies have given rise to a more efficient private deposit taking financial institutions that direct financial resources to more productive sectors, reducing the risk ratios and supporting private sector growth [9].

From the World Bank, & IMF [10], CEMAC's regional financial system in 2006 was elementary and access to finance was the lowest among world regions. This financial system had one Central Bank which is Bank of Central African States (BEAC), 33 commercial banks, one development bank, 16 non-bank financial institutions and over 1,000 microfinance institutions. Currently, the CEMAC region has a Central Bank, BEAC, 50 commercial banks distributed as follows: 14 banks in Cameroon, four in CAR, eight in Chad, 11 in Republic of Congo, five in Equatorial Guinea and eight in Gabon. The number of microfinance institutions has decreased below 1,000 due to stringent structural policies and reforms from the Central African banking commission [11].

The banking sector is highly liquid and very cautious in giving credit. High income repatriation and surrendered foreign exchange reserves largely increase the banks' deposits [9]. As such, broad money supply increased to 11% in 2018, while credit supply stagnated around zero in 2018 given that banks' balance sheets were weakened by high non-performing loans (NPLs) leading to sluggish economic activities. Generally, after monetary operations, the excess liquidity in the banking sector elevated to about 2.2% of CEMAC's GDP. This could be favourable to the productive sectors like agriculture. Also, persistent segmentation and limited confidence hinders the growth of interbank market operations, causing some banks to depend only on the central bank's liquidity provision which is detrimental to productivity [9].

According to Aluko and Ajayi [12], banking sector is an integral part of the financial sector which plays a vital role in the financial intermediation services of most emerging and emerged economies' growth process. This signifies that the financial sectors of most economies are bank dominated. From Levine [13], banking sector is a key section in many countries, which necessitates implementation of adequate policy and reforms such that the banking sector functions efficiently and effectively. Furthermore, Levine [13] maintains that the banking sector plays five functions to ease productivity and economic growth. The functions include: deposits mobilization, provision of information on investments and capital allocation, investments monitoring and credit follow-up, risk diversification and management and facilitation of trading.

In this light, banking sector development is the increase ability of the banking sector to efficiently execute these functions [14]. This is done in accordance with the debt accumulation hypothesis. Many literature reviews maintain that banking sector development promotes productivity and economic growth [14-18]. Banking sector development enhances entrepreneurial activities and promotes market competition among enterprises [19]. With this, it is believed that banking sector development can improve agricultural productivity in the CEMAC region. Furthermore, emphasis is laid on the banking sector intermediation mechanism that could lead to the increase of agricultural productivity.

Generally, literature is debating on the relationship linking bank credit and agricultural output. In literature review, the studies can be segregated into categories: studies that hold that agriculture credit has a significantly positive impact on agricultural productivity [20-30]; studies that postulate that the impact of bank credit on agricultural output cannot be directly established [31]. Others say the influence linkage is insignificant [32-34]. Raza and Siddiqui [35] insist that bank credit has an indirect significant effect on agricultural output. This set of studies revealed that there exist both short- and long-run relationships between agricultural productivity and bank credit

[36-38]. Tamga [39] found that there is bidirectional relationship between banking sector development and agricultural development.

Studies have been conducted in related areas to this study in other African regions with limited studies done in the CEMAC zone. However, most of the studies are limited in terms of time frame, variables, the dataset, region and the methodology used. This study is necessary to reduce the literature lacuna and adopts a yearly series of analysis. Furthermore, it establishes the connection between banking sector development and agricultural productivity, utilizing key proxies to capture banking sector development and the agricultural sector output as published by World Development Indicators (WDI).

Majority of the studies employed methodologies different from autoregressive distributed lag (ARDL) model, probably due to the integration of variables. This study applies the vector error correction model (VECM), panel analysis and uses the Wald coefficient diagnostics test for confirmation. Moreover, this model allows the investigation of short-run and long-run associations. It equally permits the use of variables integrated at different orders, produces robust results [40] and is appropriate when a sample size is small [41]. Previous researches in CEMAC excluded recent financial and economic dynamics up to 2018. This study is useful to determine whether the result obtained differs from result of earlier methodologies.

2. Contextual Overview of CEMAC

The CEMAC region consists of six states, namely Cameroon, Congo, Gabon, Equatorial Guinea, Chad and the CAR, geographically located within the latitudes: 24° north and 5° south, longitudes: 8° west and 28° east. It maps a surface area of approximately three million square kilometers, with Chad occupying 1.24 million square kilometers. Due to its strategic position, the CEMAC region enjoys five diverse agro-ecological zones as shown in Table 1.

Agriculture is the main economic activity in the CEMAC states measuring up with the petroleum sector which is produced in five of the six CEMAC countries. Generally, over 50% of the CEMAC citizens rely on agriculture. With variations from one country to another, the agricultural sector employs roughly 65% of the active population, contributing approximately 25% of the sub-regional GDP and ensuring food security [4].

Table 1 Central African Economic and Monetary Community (CEMAC) agro-ecological zones.

S/N	Zone	Country	Vegetation/rainfall	Production type
1	Saharan desert	Chad	Desert 2/3 of Chad, oasis, bare soil, rangelands Rainfall: 0 -300 mm	Palm, nomadism, goats and camels
2	Sahelian	Far North Cameroon, South Chad	Dry area, herbaceous (shrubs), oasis Rainfall: 300-700 mm	Dates, camels, donkeys
3	Sudano-Sahelian-Sudanian	North Cameroon, Central African Republic (CAR), South Chad	Shrub type vegetation Rainfall: 700-1,200 mm	Cereals like maize, rice, sorghum, millet, vegetables & fruit, cotton, oilseeds sesame, groundnut, livestock on traditional pastures
4	Sudano-Guinean-Guinean	Central Cameroon, West & Center CAR, South & West Congo, South Gabon	High woodlands vegetation, sparse forests Rainfall: 1,200-1,600 mm	Roots & tubers (cassava, yam, taro, potato), cereals (maize, sorghum, rice) and cattle breathing in pastures
5	Equatorial forest	South Cameroon, CAR, North & Central Congo, Gabon, Equatorial Guinea	High humidity area Rainfall: 1,600-2,500 mm, at times 4,000 mm (Coastal & South West Cameroon), also 12,000 mm (Debundscha at foot of Mount Cameroon)	Roots & tubers (cassava, yam, taro, cocoyam), fruits (avocado, mango, etc.), bananas, plantain and cash crops (coffee, cocoa, palm oil, rubber, tea), forest resources (wood), fish and wildlife

Source: Rebuilding West Africa's Food Potential, A. Elbehri (ed.), FAO/IFAD [2].

2.1 Cash Crop Production

The main agricultural cash crops are: Arabica and Robusta coffee, cocoa, cotton, rubber, sugar cane, tobacco and banana. The cocoa and coffee sectors have huge production potentials. For instance in Cameroon, the implementation of policy programs to improve production like seedlings supply, treatment and price stabilization led producers to cultivate the crop. The local artisanal processing is experiencing a boom especially in the cocoa butter and powder manufacturing with a performance of three times greater than raw cocoa beans [42].

The bulk of cotton is produced in Cameroon and Chad with the sector performing poorly. Due to low producers' profits, the cultivated areas are abandoned, yields are poor and production is reduced. In Cameroon, the areas used for cotton cultivation are reduced by 43%, moving from 231,993 ha in 2005 to 133,000 ha in 2008. At the same time, the number of producers fell from 300,000 to 218,000, a 27% decrease [43].

In the CEMAC zone, the largest producer of palm oil is Cameroon cultivating a surface area of 70,000 ha in 2010. Most of the production is done by private companies. Palm oil is an essential factor in food security since it is used in preparing many dishes. International demand for palm oil rises by 4% yearly indicating a bright future for the sector's growth, with all its under-utilized by-products in the region. The restrictions on access to land, improving the methods and rate of oil extraction alongside regenerating orchards are some of the challenges producers encounter in this sector. Banana from the region faces some challenges in the global market. The banana sector is well developed in Cameroon contributing nearly US$50 million in export revenues [43].

Rubber cultivation is developing in Cameroon and Gabon by giant agribusiness companies. The global economic crisis caused a decline in the demand for rubber following a drop in vehicle sales in USA and Europe. This sector needs special attention given that it generates many jobs and contributes to trade balance [2].

2.2 Food Crop Production

Food crop cultivation is the main source of food and population's survival, although it is highly subsistence. The sector's products vary from: cereals (maize, millet and sorghum, paddy, etc.), roots and tubers (cassava, cocoyam, taro, potato, yam, etc.), oilseeds like groundnut, cottonseed, etc., fruits and vegetables like citrus, pineapple, tropical fruits, legumes, pulses, spices, condiments, leafy vegetables, mushrooms, plants and ornamental flowers etc. [2].

Some of these products are exported in limited quantities to certain markets in Europe and the United States like manioc paste, pineapple, papaya, flowers, pepper etc. Dewbre and Battisti [44] identified that tariffs on exports and imports could hamper the flow of income to agriculture producers and other sectors' manufacturers. The import dependency rate of CEMAC countries varies from country to country. Gabon imports more than 70% of basic food like milk and dairy products, wheat, potatoes, oils and fats, vegetables, maize, etc. Rice importation is 100% and 95% for beef, pork and poultry (WFP [45]).

The main crops in Chad which is in the Sahel are millet, sorghum and maize. The crops are permanently subjected to climate changes like low and erratic rainfall, locusts etc. that negatively affect production and expose the citizens to starvation. Production capacity is also hindered by civil insecurity from armed conflicts in the country and border nations, which aggravates food insecurity. Chad faces widespread poverty and food insecurity [45].

There is an important beef production sector in CAR. Generally, food supply is insufficient for the population needs. The country permanently imports cereals like rice, flour and other foods like sugar, onions and oils. The CAR is gradually rebuilding its economy and returning stability after the conflict that had disastrous consequences on the population [40].

Both Equatorial Guinea and Gabon rely on imported food, purchased with revenues from oil production mostly from Spain and France, their former colonial powers. Consequently, these nations suffer both under nutrition (malnutrition deficiency) and hyper nutrition (excess malnutrition). They import food items such as rice, maize, plantain, various tubers, oils etc.

Cameroon is relatively food self-sufficient with over 75% of imported rice consumed, despite considerable cultivation potentials. Cameroon is CEMAC's breadbasket supplying food like plantain, cocoyam, cassava, tomatoes and various vegetables etc. to Gabon, CAR and Guinea in food crops. Food insecurity in Cameroon is mostly observed in rural areas, specifically in northern regions [45].

Generally, the CEMAC countries have not been able to ensure their food security so as to greatly reduce food importations. Despite the CEMAC's geographical position's potentials, food crop cultivation is still poorly developed. This is due to inefficient production systems and ineffective policies to support agricultural development; especially food crop production which sustains majority of the population. The main challenge in agriculture production is to get into intensive rural production that ensures food security, food self-sufficiency, supply the industrial sector, create internal markets, customer base for commodity sectors and increase exports to improve trade balance [46].

Hence, Nkendah [47] posits that provision of capital and credit to smallholders, which have been a perennial challenge and a subject of debates in the last decades, need to be reviewed. Small farmers in Africa, work in risky environments that are expensive for financial institutions to serve. Most have little or no usable collateral and little experience in financial services. A history of public intervention in the credit markets created expectations that defaults on agricultural loans carry little penalty to the borrower. These challenges for financial institutions outreach to small farmers are relevant for young farmers and are compounded by the fact that young farmers have little experience in agriculture and agriculture credit.

3. Methodology

3.1 Research Design

The study employs quantitative method on the *ex post facto* (after the event) research design utilizing secondary data. From Onwumere [48] a research design is a plan or blue print which directs the researcher in the exploration and data analysis. The *ex post facto* research design according to Onwumere [48] is utilized when the researcher has no control over the variables. The variables need to exist and be analyzed in their published form. The time series data cover the period of 1990-2018. The base year is set at 1990 due to the restructuring of the banking sector and the economic reforms of the SAP by the Breton Wood institutions in the 1990.

3.2 Sources and Nature of Data

Secondary time series dataset is sourced from the WDI, World Bank Database 2018 for the six CEMAC countries. The time series data for the study cover 29 years, from 1990 to 2018. The data are mined into panel data using Microsoft excel before importing into the electronic view software (E-Views 9).

3.3 Sampling and Sample Population

Following, Onodugo *et al.* [49], a population is the totality of items which meet a given set of criteria. The sample population consists of six African countries that make up the CEMAC region. Four countries: Cameroon, Chad, Congo Republic and Gabon were purposively chosen for analysis given data limitations for agricultural value added to GDP in CAR and Equatorial Guinea.

3.4 Material and Methods

The study applies the Cobb-Douglas production function, with method of analysis being co-integration and causality. This study uses the ARDL since it

applies irrespective of whether the variables are I (0), I (1) or mutually co-integrated. It is efficient and consistent with small and finite sample size observations [50, 51]. The ARDL technique gives unbiased estimates of the long-run model with valid *t*-statistics as it accepts both endogenous and exogenous lagged regressors [52] and the VECM for analysis. Several studies used Cobb-Douglas production function to see the impact of agricultural credit on productivity [22, 27-29, 53]. It is a production function giving the association between the input variables and output [54].

Generally, productivity analysis utilizes Cobb-Douglas production function with two inputs which are assumed to be constant in output scale. Nonetheless, other production factors are incorporated in the function [55]. The Cobb-Douglas function is stated as:

$$Y_{it} = \mathrm{A}K_{it}^{\alpha} L_{it}^{\beta} \mathrm{e}^{\mu_{it}} \quad (1)$$

where Y is agricultural productivity, A is the constant term, K is capital and L is labour; the parameters α and β are the capital and labour elasticity coefficients on agricultural productivity respectively which lie between 0 and 1, i.e., $0 < \beta < 1$ and $0 < \alpha < 1$; i is the number of countries, t is time period and μ is random error term. The study investigates the link between banking sector and agricultural productivity, considering that banking sector development plays a vital role in agricultural productivity. Incorporating banking sector development (BSD) in the function, Eq. (1) gives:

$$Y_{it} = \mathrm{A}K_{it}^{\alpha} L_{it}^{\beta} \mathrm{BSD}_{it}^{\gamma} \mathrm{e}^{\mu_{it}} \quad (2)$$

The parameter γ is the elasticity coefficient of banking sector development on agricultural productivity which lies between 0 and 1, i.e., $0 < \gamma < 1$. Applying logarithm to Eq. (2), it becomes:

$$\ln Y_{it} = \beta_0 + \alpha \ln K_{it} + \beta \ln L_{it} + \gamma \ln \mathrm{BSD}_{it} + \mu_{it} \quad (3)$$

where, ln$Y$ represents agricultural productivity, proxied by agricultural value added; β_o is the intercept; K is the physical capital; L stands for labour force.

Apart from banking sector development, other factors influence agricultural productivity like inflation and land. After inclusion of other variables Eq. (3) forms:

$$\mathrm{AgrVA}_{it} = \beta_0 + \beta_1 \mathrm{DCPSB}_{it} + \beta_2 \mathrm{INF}_{\mathrm{it}} + \beta_3 \ln\mathrm{Labour}_{it} + \beta_4 \ln\mathrm{Land}_{it} + \pi_{it} + \mu_{it} \quad (4)$$

where AgrVA is agricultural value added (% GDP); $\ln\mathrm{Labour}_{it}$ represents labour which is human capital; DCPSB_{it} is domestic credit to the private sector by banks; $\ln\mathrm{Land}_{it}$ stands for agricultural land measured in square kilometer; INF_{it} is inflation rate in the economy; μ_{it} is the stochastic error term; π_{it} captures the specific effects in the panel; β_0 is the constant term and β_1-β_4 are coefficients of the respective independents variables that each coefficient precedes.

Theoretical explanation of the independent variables is as follows: Banking sector development is expected to improve agricultural productivity as bank credit to farmers stimulates agricultural productivity. Banking sector development reduces the financial constraints via saving mobilization, bank credit and agricultural investment activities, which raise output. Studies show a positive link between banking sector development and agricultural productivity [56]. Inflation is the constant and continuous increase in the general price level in the economy signals macroeconomic stability. Inflation as measured by the consumer price index reflects the percentage change in the cost of acquiring a basket of goods and services that may be fixed or vary at specified intervals. Inflation is calculated as the percentage of GDP deflator. It is believed to reduce agricultural productivity.

Labour is calculated in hours of work per worker and it is expected to improve agriculture productivity [53, 57, 58]. However, over utilization of labour has a negative effect on agricultural productivity [59]. Land is measured in square kilometers of surface area which is believed to improve agricultural productivity given that it plays a key role in the agricultural process. In order to control factors that have influence on

agricultural productivity across the CEMAC countries besides banking sector development, land and labour are used as control variables. All the variables used in the models are converted either into percentages or ratios to equalize differences in scales and various nations' economic characteristics.

4. Results and Discussion

4.1 Panel Unit Root Test

Panel analysis like the one utilized in this study usually displays deterministic or stochastic time tendency, which make them non-stationary. This implies the variables means, variances and covariances are not time-constant. From Engle and Granger [60], the use of ordinary least square (OLS) or generalized least square (GLS) to non-stationary data gives spurious regression results.

The study analysis begins with stationarity test of the variables, utilizing Levin *et al.* [61], Im *et al.* [62], Augmented Dickey Fuller (ADF)-Fisher Chi-square and Philip Peron (PP), Fisher Chi-square tests used by Choi [63] and established by Levin *et al*. [61]. With an automatic lag chosen by Schwarz Information Criteria (SIC), including intercept with no trend produced the results are shown in Table 2. The results reveal that agricultural value added (AgrVA) and inflation are I (0) stationery, that is stationary at level. Domestic credit to the private sector by banks (DCPSB), physical capital, income level (INCM), labour force, land, physical capital (PHKAP) and political stability (POSTAB) are stationary at first difference, I (1). These outcomes predict a long-run relationship between the variables and agricultural productivity given that a majority of the variables are integrated of order one.

4.2 Correlation Analysis

4.2.1 Correlation Results

From the correlation results shown in Table 3, DCPSB which is the proxy for banking sector development, capital, income, inflation and political stability have negative coefficients revealing negative relationships with agricultural value added in the CEMAC zone. Labour and land have positive coefficients indicating positive association with AgrVA.

4.2.2 Hausman Test

Given that panel data are utilized in this study, the different countries' specific fixed effects and random effects are considered and tested using the Hausman test to determine whether the fixed effects or random effects are appropriate. The Hausman test is used to test exogeneity of unobserved error components [64]. After performing the Hausman test, the results show that the fixed effects model is more appropriate than the random effects model since the null hypothesis is rejected because the chi-square probability value is

Table 2 Panel unit root test summary.

Variables	Levin, Lin & Chu	Im, Pesaran and Shin W-stat	ADF-Fisher Chi-square	PP-Fisher Chi-square	Integration order
AgrVA	-3.27960***	-3.07795***	27.3522***	12.8899	I (0)
DCPSB	-4.67446***	-4.78311***	38.1947***	43.7008***	I (1)
PHKAP	-9.51674***	-8.75531***	70.0405***	87.1726***	I (1)
INCM	-10.0325***	-9.66153***	79.4049***	88.9358***	I (1)
INF	-9.82282***	-8.22137***	66.9739***	68.1128***	I (0)
lnLabour	-1.66863**	-1.60428*	13.4387*	12.2007	I (1)
lnLand	-5.69487***	-5.84947***	39.5236***	45.9538***	I (1)
POSTAB	-29.9266***	-29.8149***	102.304***	100.742***	I (1)

AgrVA: agricultural value added; DCPSB: domestic credit to the private sector by banks; PHKAP: physical capital; INCM: income level; INF: inflation rate in the economy; lnLabour: labour which is human capital; lnLand: agricultural land measured in square kilometer; POSTAB: political stability.

Source: author's compilation from E-Views 9; ***, ** and * represent 1%, 5% and 10% significance level, respectively.

Table 3 Correlation output.

	AgrVA	DCPSB	PHKAP	INCM	INF	lnLabour	lnLand	POSTAB
AgrVA	1.000000							
DCPSB	-0.208315	1.000000						
PHKAP	-0.549963	0.047730	1.000000					
INCM	-0.562784	-0.050790	0.121412	1.000000				
INF	-0.020676	-0.264732	0.005151	-0.003737	1.000000			
lnLabour	0.504077	0.045599	-0.409090	-0.689442	-0.088732	1.000000		
lnLand	0.896083	-0.287390	-0.348196	-0.651553	-0.003216	0.501210	1.000000	
POSTAB	-0.553221	0.172360	0.032923	0.529962	0.032581	-0.499753	-0.595474	1.000000

AgrVA: agricultural value added; DCPSB: domestic credit to the private sector by banks; PHKAP: physical capital; INCM: income level; INF: inflation rate in the economy; lnLabour: labour which is human capital; lnLand: agricultural land measured in square kilometer; POSTAB: political stability.
Source: author's compilation from E-Views 9.

Table 4 Correlated random effects—Hausman test.

Test summary	Chi-Sq. statistic	Chi-Sq. d.f.	Prob.
Cross-section random	370.622418	5	0.0000

Source: author's compilation

below 0.05 in Table 4 at five degrees of freedom with a chi-square statistical value of 370.622.

4.3 ARDL Model

The method utilized is the pooled mean group (PMG) estimation, proposed by Pesaran *et al.* [65]. The model applies the co-integration form of the panel ARDL equation by permitting the intercepts, short-run coefficients and co-integrating terms to be different within the cross-sections. Firstly, estimation of the short-run relationship between the variables is done with a generated residual series. Secondly, the residual is subjected to a unit root test. Given the short-run dynamics, the estimation of the short-run and long-run relationships is done with the ARDL technique as established by the Newey-West heteroskedasticity and autocorrelation consistent (HAC) method. This is to eliminate residual serial correlation problems. The model is stated with the difference operators as:

$$\Delta Y_{it} = \alpha_0 + \sum_{j=1}^{p-1} \alpha_{1i}\ \Delta Y_{it-1} + \sum_{j=0}^{q-1} \alpha_{2i}\ \Delta BSD_{it-1} + \alpha_{3i}\phi_{it} + \omega_{it} + \varepsilon_{it} \quad (5)$$

$$\Delta BSD_{it} = \beta_0 + \sum_{j=1}^{p-1} \beta_{1it}\ \Delta BSD_{it-1} + \sum_{j=0}^{q-1} \beta_{2it}\ \Delta Y_{it-1} + \beta_{3it}\psi_{it} + \lambda_{it} + \mu_{it} \quad (6)$$

where Y_{it} is the dependent variable, α_0 is the constant term, α_{1i} represent of the lagged regressand, α_{2i} is the coefficient of lagged key variable, α_{3i} is the coefficient of vector, ϕ and ψ are vectors of variables; ε_{it} and μ_{it} are the uncorrelated white noise residuals and Δ is the difference operator. ω_{it} and λ_{it} stand for unit specific fixed effects, i represents the units (countries), t is the time period, p and q are the lag lengths of dependent and independent variables which run from $j = 0$ to N. β_0 denotes the intercept, β_{1it} is the coefficient of the lagged dependent variable, β_{2it} being coefficient of the lagged regressors and β_{3it} is the coefficient of vector.

4.4 Panel ARDL Estimation Using PMG

Table 5 presents the results of the two ARDL models (5) and (6) in the long and short runs. The results show that DCPSB which is the proxy for banking sector development has a significantly positive effect on agricultural value added in the long run with an insignificantly negative effect in the short run. The long-run coefficient shows that 1% increase in banking sector development increases agricultural

productivity by 37.4% and reduces productivity by 53% in the short run. The results corroborate the findings of Owuor and Shem [66] in Nigeria, Obilor [67] in Nigeria, Alvaro *et al.* [68] in Chile, Chisasa and Makina [54] in South Africa who found that bank credit has a significantly positive impact on agricultural productivity. This finding agrees with the debt accumulation and moral hazard principles.

This finding is in opposition with Ubah [34] who found that the role of agricultural credit in agricultural productivity is statistically negligible and Izhar and Tariq [33] found that commercial banks' credits are not significant to promote agricultural production. The results confirm the economic expectation. Inference from the results indicates bidirectional causality between banking sector and agricultural output. This implies that agricultural productivity causes banking sector development and vice versa in the CEMAC region. This is in line with the findings of Tamga [39] that showed bidirectional relationship between banking sector development and agricultural development.

Table 5 Panel autoregressive distributed lag (ARDL) estimation using pooled mean group.

Long-run coefficients			
Variables	AgrVA	Variables	BSD
DCPSB	0.374030*** (5.762765)	AgrVA	-27.32145 (-0.183406)
PHKAP	0.790054 (1.265814)	PHKAP	-47.60812 (-0.216566)
INCM	8.19E-05*** (5.184689)	INCM	0.003594 (0.192220)
INF	-0.857778*** (-3.788586)	INF	-27.18778 (-0.193689)
lnLabour	-78.07888*** (-6.626062)	lnLabour	-2,748.018 (-0.189886)
lnLand	-70.63662** (-2.557070)	lnLand	186.9252 (0.179117)
POSTAB	2.691981* (1.976796)	POSTAB	158.6787 (0.199227)
Short-run coefficients			
ECT_{t-1}	-0.084740 (-1.010310)	ECT_{t-1}	-0.010634 (-1.046632)
D(DCPSB)	-0.530551 (-1.132558)	D(AgrVA)	-0.376220 (-0.567687)
D(PHKAP)	0.207223 (0.828497)	D(PHKAP)	0.568338 (0.652327)
D(INCM)	2.78E-05 (1.350890)	D(INCM)	1.72E-05 (0.993546)
D(INF)	-0.004291 (-0.414430)	D(INF)	-0.008997 (-0.726923)
D(lnLabour)	-102.0302 (-0.987601)	D(lnLabour)	-115.4391* (-1.757063)
D(lnLand)	559.8076 (1.455468)	D(lnLand)	-6,233.344 (-1.004392)
D(POSTAB)	-1.124945 (-1.449643)	D(POSTAB)	0.076378 (0.123860)
C	171.5705 (1.022388)	C	428.5749 (1.037560)

AgrVA: agricultural value added; BSD: banking sector development; DCPSB: domestic credit to the private sector by banks; PHKAP: physical capital; INCM: income level; INF: inflation rate in the economy; lnLabour: labour which is human capital; lnLand: agricultural land measured in square kilometer; POSTAB: political stability; ECT_{t-1}: the error correction term which defines the equilibrium adjustment speed; D: the "D" that precedes the short run variables signifies differencing or difference operator; C: the constant or intercept.

Source: author's compilation from E-Views 9; ***, ** and * represent 1%, 5% and 10% significance level, respectively; *t*-statistics values in parenthesis.

The use of physical capital has an insignificant positive effect on agricultural productivity in the long term, implying that in the long run as productivity increases only little capital may be required. Level of income gives a significantly positive impact on productivity in the long term, indicating that in the long run as income level increases, it motivates agricultural productivity.

Inflation has a negative and significant impact in the long run with an insignificantly positive impact in the short run on agricultural productivity. This correlates with the economic expectations in both the short and long runs. The results reveal that a unit increase in inflation in the long run decreases productivity by 0.85 units and in the short run, a unit rise in inflation increases agricultural output by 0.004 units. This is in accordance with economic theory that an increase in inflation rate leads to general price increase of agricultural inputs which causes a drop in output. High inflation discourages investments given that interest rates increase, thereby reducing the credit return and the demand for private credit. This is in agreement with the results of Alter and Yontcheva [69].

Labour exhibits short-run negative and insignificant effects on agricultural productivity and a negatively significant impact in the long run. This supports its economic expectations. The associated agricultural labour elasticity affects negatively and significantly agriculture productivity in CEMAC. It implies that labour plays a long-run negative and significant role in agriculture output. That is a 1% increase in agricultural labour reduces agricultural productivity by 78% in the long run and 102% in short run. This is probably so due to the level of illiteracy in the farming population who provide the labour force in the region, and poor and limited entrepreneurial skills.

Land exhibits negative and significant effects on agricultural output in the long run. This disagrees with the economic expectation. This implies that available agriculture land has a negatively significant impact on agricultural productivity in CEMAC region. This is justified by the fact that the level of mechanization of agriculture is low. There is available vast land mass for agricultural use that still remains uncultivated. This explains the low productivity of the available land for agricultural use in CEMAC zone. Political stability reveals a positive significant effect on productivity only at 10% level. This shows that the political climate in the region influences agricultural output to an extent.

From the banking sector development model, agricultural value added indicates a significantly positive influence on banking sector development in the long run with an insignificantly positive impact in the short run. Inflation shows a significantly negative impact on banking sector development in the long run with a positive and significant effect in the short run. The results also infer that there is long-run bidirectional causality between banking sector development and agricultural productivity given the significance of the coefficient of banking sector development in the agricultural value added model and agricultural value added coefficient in the banking sector development model at 5% level. The error correction term indicates that there are no short-run causal influences among the explanatory and dependent variables.

4.5 Vector Error Correction Model (VECM)

Table 6 presents that the error correction term has a negative but statistically insignificant coefficient in the agricultural value added equation, indicating that there is weak causal relationship between the independent variables and the dependent variable. This implies that in the long run the agricultural value added and banking sector development converge to equilibrium position at an adjustment speed of 0.76% annually, which is very insignificant. In the banking sector development equation, the error correction term exhibits a negative and statistically significant coefficient, showing that there is convergence in the

Table 6 Vector error correction model.

Variables	AgrVA	Variables	BSD
ECT_{t-1}	-0.007691 (-0.654100)	ECT_{t-1}	-0.389624*** (-8.925051)
D(AgrVA(-1))	-0.220033** (-2.175436)	D(DCPSB(-1))	0.137836** (2.011845)
D(DCPSB(-1))	0.158261 (1.206770)	D(AgrVA(-1))	0.035585 (0.673451)
D(PHKAP)	0.158261 (-1.121656)	D(PHKAP)	0.092494*** (2.664450)
D(INCM)	-0.074533 (-0.474083)	D(INCM)	1.04E-06*** (3.370761)
D(INF)	-2.79E-07 (0.512797)	D(INF)	-0.042920*** (-2.643163)
D(lnLabour)	0.015939 (-0.825517)	D(lnLabour)	1.808320*** (5.625450)
D(lnLand)	-0.507958 (-0.031180)	D(lnLand)	0.961497** (2.252470)
D(POSTAB)	-0.025477 (-0.566318)	D(POSTAB)	0.354510 (0.772827)
C	8.873275 (0.553040)	C	-40.09713*** (-4.783758)

AgrVA: agricultural value added; BSD: banking sector development; DCPSB: domestic credit to the private sector by banks; PHKAP: physical capital; INCM: income level; INF: inflation rate in the economy; lnLabour: labour which is human capital; lnLand: agricultural land measured in square kilometer; POSTAB: political stability; ECT_{t-1}: the error correction term which defines the equilibrium adjustment speed; D: the "D" that precedes the short run variables signifies differencing or difference operator; C: the constant or intercept; (-1) after each variable denotes the first lag of the variable.

Source: author's compilation from E-views 9; ***and ** represents 1% and 5% significance level, respectively; *t*-statistics values in parenthesis.

long run at an adjustment speed of 38.9% yearly, contributed by the explanatory variables. The short-run parameters' dynamics are captured via the individual coefficients of the variables in the equations using the Wald coefficient test as confirmatory check of short-run causality among the variables.

5. Conclusions

The growing importance of agricultural productivity is attracting researches on the relationship between banking sector and agricultural output. This study investigated the long-term causation between banking sector development and sustainable agricultural productivity in CEMAC utilizing multi-causality test within the framework of ARDL and VECM. Co-integration association among the variables did not exist since the panel unit root results revealed level stationarity. Within the VECM framework bidirectional causality links exist, between banking sector development and agricultural productivity in the CEMAC region. The lessons drawn from these findings include: policies should be designed to improve both banking and agricultural sectors' efficiency and effectiveness in a mutually beneficial fashion.

These policies may involve consolidation and improvement on current financial intermediation and agricultural investment patterns in the CEMAC economies to improve financial market development which in turn boosts economic growth. In this light, the findings of this research are highly significant for the current economic situation in the CEMAC zone. Finally, this study contributes to reducing the existing knowledge gap given the limited studies conducted within the CEMAC region in this area applying different methodologies, parameters and time frame to demonstrate causation between banking sector development and agricultural productivity.

References

[1] World Bank. 2016. *World Development Indicators Database.*

[2] Achancho, V. 2013. "Review and Analysis of National Investment Strategies and Agricultural Policies in Central Africa: The Case of Cameroun." In *Rebuilding West Africa's Food Potential*, edited by Elbehri, A. Rome: FAO/IFAD.

[3] FAO. 2018. *World Food and Agriculture; 2017 Statistical Pocketbook*. Rome: FAO.

[4] World Bank. 2018. *Breaking down the Barriers to Regional Agricultural Trade in Central Africa*. The World Bank Group, www.worldbank.org.

[5] Lando, S., Leduc, S., Martin, E., Perinet, M., Rosa, S., and Suc, G. 2019. *International Monetary Fund*; *Country Report No. 19/2 Central African Economic and Monetary Community (CEMAC).* Selected Issues, December 2018.

[6] Banque de France. 2016. *Franc Zone Annual Report*, Paris: Eurosystem. (in French)

[7] World Bank. 2017. *World Development Indicators Database.*

[8] Onoja, J. J. 2017. "Financial Sector Development and Agricultural Productivity." Master's thesis, University of Sanfrancisco, 238. https://repository.usfca.edu/thes/238.

[9] Nyantakyi, E. B., and Mouhamadou, S. 2015. "The Banking System in Africa: Main Facts and Challenges." *Chief Economist Complex, AEB* 6 (5): 1-13.

[10] World Bank & International Monetary Fund (IMF). 2008. *2008 Annual Meetings Board of Governors*, IMF, World Bank Group.

[11] Central African Banking Commission (COBAC). 2015. *COBAC 2015 Annual Report.*

[12] Aluko, O. A., and Ajayi, M. A. 2017. "Determinants of Banking Sector Development: Evidence from Sub-Saharan African Countries." *Borsa Istanbul Review* 18 (2): 122-39. https://doi.org/10.1016/j.bir.2017.11.002.

[13] Levine, R. 2005. "Finance and Growth: Theory and Evidence." NBER Working Paper No. w10766.

[14] King, R., and Levine, R. 1993. "Finance and Growth: Schumpeter Might Be Right." *The Quarterly Journal of Economics* 108 (3): 717-37.

[15] Beck, T., and Levine, R. 2004. "Stock Markets, Banks and Growth: Panel Evidence." *Journal of Banking & Finance* 28 (3): 423-42.

[16] Estrada, G., Park, D., and Ramayandi, A. 2010. "Financial Development and Economic Growth in Developing Asia." Asian Development Bank working paper, No. 233.

[17] Hassan, M. K., Sanchez, B., and Yu, J. S. 2011. "Financial Development and Economic Growth: New Evidence from Panel Data." *The Quarterly Review of Economics and Finance* 51 (1): 88-104.

[18] Levine, R. 1997. "Financial Development and Economic Growth: Views and Agenda." *Journal of Economic Literature* 35 (2): 688-726.

[19] Guiso, L., Sapienza, P., and Zingales, L. 2009. "Does Local Financial Development Matter? The Banks and the Italian Economy." Heidelberg: Physica-Verlag HD, 31-66.

[20] Ahmad, N. 2011. "Impact of Institutional Credit on Agricultural Output: A Case Study of Pakistan." *Theoretical and Applied Economics* 10 (10): 99-120.

[21] Kareem, R. O., Bakare, H. A., Raheem, K. A., Ologunla, S. E., Alawode, O. O., and Ademoyewa, G. R. 2013. "Analysis of Factors Influencing Agricultural Output in Nigeria: Macro-economics Perspectives." *American Journal of Business, Economics and Management* 1 (1): 9-15.

[22] Bashir, M. K., Mehmood, Y., and Hassan, S. 2010. "Impact of Agricultural Credit on Productivity of Wheat Crop: Evidence from Lahore, Punjab, Pakistan." *Pakistan Journal of Agricultural Sciences* 47 (4): 405-9.

[23] Ekwere, G. E., and Edem, I. D. 2014. "Evaluation of Agricultural Credit Facility in Agricultural Production and Rural Development." *Global Journal of Human-Social Science Research* 14 (3): 19-26.

[24] Nwankwo, O. P. 2013. "Agricultural Financing in Nigeria: An Empirical Study of Nigeria Agricultural Co-operative and Rural Development Bank (NACRDB): 1990-2010." *Journal of Management Research* 5 (2): 28.

[25] Kumar, A., Mishra, A. K., Saroj, S., and Joshi, P. K. 2017. "Institutional versus Non-institutional Credit to Agricultural Households in India: Evidence on Impact from a National Farmers' Survey." *Economic Systems* 41 (3): 420-32.

[26] Rehman, A., Chandio, A. A., Hussain, I., and Jingdong, L. 2017. "Is Credit the Devil in the Agriculture? The Role of Credit in Pakistan's Agricultural Sector." *The Journal of Finance and Data Science* 3: 38-44.

[27] Rima, N. S. 2014. "Agricultural Credit Flow of Commercial Banks and Impact on Agricultural Production in Nepal." *Scholars Journal of Art, Humanities and Social Science* 2 (2): 372.

[28] Saleem, M. A., and Jan, F. A. 2011. "The Impact of Agricultural Credit on Agricultural Productivity in Dera Ismail Khan (District) Khyber Pakhtonkhawa Pakistan." *European Journal of Business and Management* 3 (2): 38-44.

[29] Udih, M. 2014. "Bank Credits and Agricultural Development: Does It Promote Entrepreneurship Performance?" *International Journal of Business and Social Science* 5 (11): 102-7.

[30] Villanueva, J. P. B. 2014. "Impact of Institutional Credit

to Agricultural Output in the Philippines: A Cobb-Douglas Production Function Empirical Analysis." Ph.D. thesis, Saint Louis University.

[31] Sriram, M. S. 2007. "Productivity of Rural Credit: A Review of Issues and Some Recent Literature." *International Journal of Rural Management* 3 (2): 245-68.

[32] Holmes, D., and Mosley, P. 1996. *Finance against Poverty*, Vol. 2. Routledge: London, 1-31.

[33] Izhar, A., and Tariq, M. 2009. "Impact of Institutional Credit on Aggregate Agricultural Production in India during Post Reform Period." MPRA paper No. 17075. http://mpra.ub.uni-muenchen.de/17075.

[34] Ubah, C. C. 2009. "Impact of Agricultural Credit on Agricultural Output in Nigeria." M.Sc. thesis, Nnamdi Azikiwe University.

[35] Raza, J., and Siddiqui, W. 2014. "Determinants of Agricultural Output in Pakistan: A Johansen Co-integration Approach." *Academic Research International* 5 (4): 30-46.

[36] Ikenna, O. 2012. "Financial Deregulation Bounding to Credit Mobilization in Nigeria: A Case for the Real Sectors and SMEs." *IOSR Journal of Humanities and Social Science* 5: 40-59.

[37] Nnamocha, P. N., and Eke, C. N. 2015. "Bank Credit and Agricultural Output in Nigeria (1970-2013): An Error Correction Model (ECM) Approach." *British Journal of Economics, Management and Trade* 10 (2): 1-12.

[38] Ogbuabor, J. E., and Nwosu, C. A. 2017. "The Impact of Deposit Money Bank's Agricultural Credit on Agricultural Productivity in Nigeria: Evidence from an Error Correction Model." *International Journal of Economics and Financial Issues* 7 (2): 513-7.

[39] Tamga, M. R. D. 2017. "The Impact of the Banking Sector Development on Agricultural Development: The Case of Cameroon." M.Sc. thesis, Eastern Mediterranean University.

[40] Narayan, S., and Narayan, P. 2005. "An Empirical Analysis of Fiji's Import Demand Function." *Journal of Economic Studies* 32 (2): 158-68.

[41] Odhiambo, N. 2008. "The Dynamic Causal Linkage between Financial Development and Economic Growth: Empirical Evidence from Ethiopia." *International Economics* 70 (1): 73-102.

[42] World Food Program (WFP). 2015. "WFP and Nutrition: Find Out Why Nutrition Interventions Are an Important Component of Integrated Services for Mothers and Children, and What WFP Is Doing in This Area." World Food Programme.

[43] FAO/IFAD. 2013. *Annual Report on FAO's Projects and Activities in Support of Producer Organizations and Cooperatives*. Rome: FAO.

[44] Dewbre, J., and Borot de Battisti, A. 2008. "Agriculture Progress in Cameroon, Ghana, Mali: Why It Happened and How to Sustain It." OECD Food, Agriculture and Fisheries Working Papers, No. 9, 10-59. doi: 10.1787/241275631215.

[45] World Food Program (WFP). 2017. *The State of Food Security and Nutrition in the World (SOFI) Report*.

[46] Djiofack, C. 2018. "Using a Dynamic Global CGE Model (ENVISAGE) to Model the Impact of Removing Petty Harassment Costs (Tracasseries) on Intra-regional Trade and Growth in CEMAC." Background Paper to the CEM, World Bank.

[47] Nkendah, R. 2013. "Estimating the Informal Cross-Border Trade of Agricultural and Horticultural Commodities between Cameroon and Its CEMAC Neighbours." *Food Policy* 41: 133-44.

[48] Onwumere, J. U. J. 2009. *Business and Economic Research Methods.* Enugu: Vougasen Ltd.

[49] Onodugo, V. A., Ugwuonah, G. E., and Elijah, S. E. 2011. *Social Science Research: Principles, Methods and Applications.* Enugu: El'Demark.

[50] Samargandi, N., Ghosh, S., and Fidrmuc, J. 2014. "Financial Development and Economic Growth in an Oil-Rich Economy: The Case of Saudi Arabia." *Economic Modelling* 43: 267-78.

[51] Zermeño, R. D. V., Chimenos, J. M., Formosa, J., and Martínez, M. 2014. "Aggregate Material Formulated with MSWI Bottom Ash and APC Fly Ash for Use as Secondary Building Material." *Waste Management* 33 (3): 621-7.

[52] Harris, R., and Sollis, R. 2003. *Applied Time Series Modeling and Forecasting*. Chichester: John Wiley and Sons.

[53] Iqbal, M., Ahmad, M., Abbas, K., and Mustafa, K. 2003. "The Impact of Institutional Credit on Agricultural Production in Pakistan." *The Pakistan Development Review* 42 (2): 469-85.

[54] Chisasa, J., and Makina, D. 2013. "Bank Credit and Agricultural Output in South Africa: A Cobb-Douglas Empirical Analysis." *International Business and Economics Research Journal* 12 (4): 387-98.

[55] Echevarria, C. A. 1998. "Three-Factor Agricultural Productions Function: The Case of Canada." *International Economic Journal* 12: 63-75.

[56] Shahbaz, M., Tiwari, A., Hye, Q. M. A., and Leitão, N. C. 2013. "Economic Growth, Energy Consumption, Financial Development, International Trade and CO_2 Emissions in Indonesia." MPRA Paper 43272, University Library of Munich, Germany.

[57] Chisasa, J., and Makina, D. 2015. "Bank Credit and Agricultural Output in South Africa: Cointegration, Short Run Dynamics and Causality." *Journal of Applied Business Research* 31 (2): 489-500.

https://doi.org/10.19030/jabr.v31i2.9148.

[58] Narayanan, S. 2016. “The Productivity of Agricultural Credit in India.” *Agricultural Economics* 47 (4): 399-409.

[59] Tijani, A. A. 2006. “Analysis of the Technical Efficiency of Rice Farms in Ijesha Land of Osun State, Nigeria.” *Agrekon* 45: 126-35.

[60] Engle, R. F., and Granger, C. W. J. 1987. “Co-integration and Error Correction: Representation, Estimation and Testing.” *Econometrica* 55 (2): 251-76.

[61] Levin, A., Lin, C. F., and Chu, C. S. J. 2002. “Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties.” *Journal of Econometrics* 108: 1-24.

[62] Im, K. S., Pesaran, M. P., and Shin, Y. 2003. “Testing for Unit Roots in Heterogeneous Panels.” *Journal of Econometrics* 115: 53-74.

[63] Choi, I. 2001. “Unit Root Tests for Panel Data.” *Journal of International Money and Finance* 20 (2): 249-72.

[64] Igbinosa, S. O., and Ogbeide, S. O. 2016. “Banking Sector Development and Performance of the Nigerian Economy.” *International Journal of Management Science Research* 1 (1): 1.

[65] Pesaran, M. H., Shin, Y., and Smith, R. J. 2001. “Bounds Testing Approaches to the Analysis of Level Relationships.” *Journal of Applied Econometrics* 16: 289-326.

[66] Owuor, G., and Shem, A. O. 2012. “Informal Credit and Factor Productivity in Africa: Does Informal Credit Matter?” Presented at the International Association of Agricultural Economists’ Triennial Conference, Foz do Iguaco, Brazil, August 18-24, 2012.

[67] Obilor, S. I. 2013. “Impact of Commercial Banks Credit to Agriculture on Agricultural Development in Nigeria: An Econometrics Analysis.” *International Journal of Business, Humanities and Technology* 3 (1): 85-95.

[68] Alvaro, R., Lensink, R., Kuyuenhoven, A., and Moll, H. 2012. “Impact of Access to Credit on Farm Productivity of Fruit and Vegetables Growers in Chile.” Presented at the International Association of Agricultural Economists (IAAE) Triennial Conference, Foz Doiguagu, Brazil.

[69] Alter, A., and Yontcheva, B. 2015. “Financial Inclusion and Development in the CEMAC.” IMF working paper, No. 15/235.