The Effects of Financial Sector Development on Agricultural Growth in CEMAC region

[1]Kedju Robert Nembo, [2]Dobdinga Cletus Fonchamnyo, [3]Tambi Daniel Mbu

[1,2]Faculty of Economics and Management Sciences, University of Bamenda, North West, Cameroon

[3]Higher Institute of Transport and Logistics, University of Bamenda, North West, Cameroon

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ABSTRACT

The objective of this study was to investigate whether variations in financial sector development affect agricultural sector growth for both crops and livestock productions in CEMAC Region. Panel data for 25years spanning from 1996 to 2020 was used, employing Panel Corrected Standard Errors (PCSE) and Driscoll-Kraay standard errors estimation techniques. Findings revealed that financial institutions development positively and significantly determine crop and livestock productions. Financial market development positively and significantly affects crop productions, however positive but insignificant for livestock production. In conclusion, financial sector development is an important economic indicator that can be fine-tuned to foster agricultural sector growth of CEMAC region. The authors recommend that policy makers should prioritise deepening financial intermediation targeted at agriculture by expanding rural banking infrastructure and strengthening bank agricultural credit schemes. This implies policies should focus on bank credit accessibility, reducing collateral requirements, and designing sector-specific loan products for agriculture in CEMAC member states.

Keywords: Agricultural Finance, Crop Production, Livestock Production, Financial Sector Development, Agribusiness, CEMAC

INTRODUCTION

Agriculture is an important sector of economic activity and livelihoods in developing countries, particularly in Sub-Sahara Africa where the sector employs large share of labour force and contributes substantially to Gross Domestic Product (GDP). Despite this central role, agricultural growth in many African countries has remained persistently low and volatile resulting in chronic food insecurity, rural poverty and slow structural transformation (Barrett *et al*., 2017; Gollin, 2015; Senbet and Simbanegavi, 2017; Bjornlund *et al.*, 2022;). Thus Paradox – abundant agricultural potential coexisting with weak agricultural performance continues to challenge governments and international development partners. Wudil *et al*. (2022) further justified that agricultural productivity growth in Sub-Sahara Africa has lagged behind that of other developing regions, contributing to rising food insecurity since the mid-2010s. The Food and Agricultural Organisation (FAO) reports that millions of people in Africa remain undernourished, with food production growth failing to keep pace with population growth (FAO, 2024; FAO and OECD, 2023). Low agricultural out undermines farmers' incomes, constraints agro-processing industries through inadequate raw material supply, reduces export earnings and weakens the overall contribution of agriculture to economic growth. Given that agriculture accounted for approximately 15.4% of Africa's GDP in 2023 – far higher than in developed regions such as Europe, weak performance in the sector has severe macroeconomic and welfare implications (Sasu, 2024; World Bank, 2024).

To address these agricultural production challenges, agricultural has been prioritized in global and continental development agendas. At the global level, the United Nations' Sustainable Development Goals (SDGs) placed the eradication of hunger and promotion of sustainable agriculture at the core of Agenda 2030 (United Nations,

2015). At the continental level, the African Union's agenda 2063 identifies modernized agriculture and increased productivity as critical pathways to inclusive growth and sustainable development (Dlamini-Zuma, 2015). Earlier initiatives, such as the Comprehensive Africa Agriculture Development Program (CAADP), committed African governments to allocating at least 10% of national budgets to agriculture and achieve annual agricultural growth rate of 6% (AU-NEPAD, 2003). Despite these policy commitments, agricultural growth outcomes across the continent and particularly in Central African Countries remain disappointing. Although the Central African Economic and Momentary Community (CEMAC) region is endowed with vast arable land, favourable climatic conditions and significant water resources, agricultural productivity remain low and food imports continue to rise. The World Bank Group (2018) estimated that approximately 45% of the CEMAC population suffers from undernourishment, with a significant proportion experiencing severe food deficits. This situation persists despite the adoption of regional policies and national agricultural investment plans aimed at boosting production, improvement in rural incomes and strengthening value chains (Achancho, 2013).

A growing body of development economics literature suggests that the problem of weak agricultural growth in developing regions extends beyond traditional factors such as land, labour and technology. Increasing attention has been paid to the role of financial sector development in facilitating agricultural investment and productivity growth. A well-functioning financial system mobilises savings, allocates credit efficiently, manages risks and enable farmers and agribusinesses to invest in modern inputs, irrigation, storage, and processing technologies (World Bank Group, 2022). However in many developing regions and CEMAC in particular, the financial sector remains shallow, concentrated and weakly integrated with the agriculture sector (Akittoby and Coorey, 2017). Farmers-particularly small holders face limited access to credit, high borrowing costs, and stringent collateral requirements constraining productive agricultural investments. However, empirical studies provide evidence that financial sector development can stimulate agricultural growth. For instance, Hassan (2017) finds a significant positive relationship between financial development and agricultural growth in Pakistan, while Akpaeti (2015) and Oladotun and Ladanu (2015) report similar findings in Nigeria. Massaquoi *et al*. (2025) digressed the evidence to show how financial institutions can promote agricultural productivity in Sierra Leon. While Manasseh *et al*. (2025) and Kwaghe *et al*. (2025) showed how the capital market can promote agricultural production in Nigeria and South Africa. These empirical evidences suggest financial deepening and targeted credit expansion with advancing capital markets can enhance agricultural productivity and output. Never the less, the extent to which these findings apply to the structurally distinct economies of the CEMAC region remains unclear. More so, research has focused on how financial sector can enhance agricultural output aggregate undermining the specific policy needs of various agricultural subsectors. This paucity of empirical evidence on the nexus between financial sectors and agricultural sub-sectors including crop and livestock productions still creates a compelling gap in agricultural research and policy insight.

Therefore, the core problem addressed by this study is that agricultural output levels in the CEMAC region remains persistently low despite substantial policy commitment initiatives, potentially due to underdeveloped financial sector. The absence of regional specific empirical evidence whether financial sector development can resolve this problem by promoting agricultural output for both crops and livestock productions in the region constitutes a significant gap in the literature. Without a clear understanding on whether financial sector development can effectively stimulate agricultural growth in CEMAC region policy interventions risk being ineffective and misdirected. Consequently, this study seeks to empirically investigate and answer the following core questions: (i) what are the effects of financial institutions development and financial market development on crop production in CEMAC region? (ii) What are the effects of financial institution development and financial market development on livestock production in CEMAC region? By answering these questions with six CEMAC countries over 1996–2020 and distinguishing crop from livestock production, the study provides sector-specific evidence that can inform targeted agricultural financial reforms.

LITERATURE REVIEW

Conceptual review

Financial sector development refers to the improvement in the size, efficiency, access, and stability of financial

institutions and financial markets in mobilising savings and allocating resources to productive investments (Svirydzenka, 2016). It encompasses the development of financial institutions such as commercial banks and microfinance institutions, as well as financial markets including stock and bond markets. According to Levine (2005), a well-developed financial system facilitates economic growth by mobilising savings, reducing transaction and information costs, allocating capital efficiently, managing risks, and facilitating the exchange of goods and services. In the agricultural sector, these financial functions enhance farmers' access to credit and investment capital, enabling the adoption of improved technologies, mechanisation, irrigation, and other productivity-enhancing inputs that ultimately stimulate agricultural growth. In this study, financial sector development is examined through two dimensions: financial institutions development and financial market development indices. The financial depth, financial access, and financial efficiency are all assessed by each of these indices providing a comprehensive measure of financial sector development. Agricultural growth refers to the sustained increase in agricultural output and productivity over time, reflected in improvements in crop and livestock production resulting from technological progress, capital investment, efficient resource utilisation, and institutional support (Byerlee *et al*., 2009; de Janvry and Sadoulet, 2010). This study infers to agricultural growth as the amount or level of agricultural output produced rather the rate of growth. Agricultural growth level is therefore captured through agricultural production levels using Crop Production Index and Livestock Production Index for CEMAC countries.

Theoretical review

This study is anchored on the Financial Liberalisation Theory of McKinnon (1973) and Shaw (1973) and the Solow-Swan Neoclassical Growth Theory by Solow (1956) and Swan (1956). The Financial Liberalisation Theory argues that reducing financial repression enhances savings mobilisation, improves credit allocation, and promotes investment in productive sectors. In agriculture, improved access to finance enables farmers to adopt productivity-enhancing agricultural technologies. The Neoclassical Growth Theory posits that long-run growth depends on capital accumulation and technological progress. Accordingly, a well-developed financial sector facilitates capital formation and technological adoption, thereby stimulating sustainable agricultural growth. The integration of these two theories provides a robust theoretical basis for examining the relationship between financial sector development and agricultural growth in CEMAC countries. While the Financial Liberalisation Theory explains the mechanisms through which financial systems mobilise and allocate resources efficiently, the Neoclassical Growth Theory explains how these investments generate long-term improvements in agricultural productivity and output of the region.

Empirical review

Ifeacho (2025) examined the effect of financial development on agriculture and economic growth in Sub-Saharan Africa using the Autoregressive Distributed Lag (ARDL) bounds test and Vector Autoregressive (VAR) Granger causality approaches. The findings revealed that financial development significantly enhances agricultural performance and economic growth in both the short and long runs, although capital accumulation negatively affects agricultural performance in the long run while positively influencing economic growth. Massaquoi *et al*. (2025) investigated the impact of financial credit on agricultural productivity in Sierra Leone using the Vector Autoregressive (VAR) and Error Correction Model (ECM) techniques. The results showed that financial credit exerts a positive and significant long-run effect on agricultural productivity by increasing agricultural output. From capital market perspective, Manasseh *et al*. (2025) researched on the relationship between stock market development agricultural sector development in Nigeria and South Africa. The employed ARDL and FMOLS methodologies and the findings revealed market capitalization had a significant positive long run relation with agricultural development. These findings are consistent with that of Kwaghe *et al*. (2025) who equally investigated the effects capital market fundamentals on agricultural sector performance in Nigeria using Fully Modified Ordinary Least Squares (FMOLS) methodology. The result revealed that stock market performance had a positive and significant effect on agricultural sector growth. Ojo *et al*. (2022) assessed the impact of financial sector development on agricultural output in Nigeria using annual data from 1981–2020 and the Autoregressive Distributed Lag (ARDL) bounds test model. The study found that agricultural sector loans negatively affect agricultural output in both the short and long runs, whereas money

supply exerts a positive long-run effect, suggesting that financial sector development influences agricultural productivity.

Christophe *et al*. (2012) analysed the relationship between financial development and economic growth in CEMAC countries using panel data from 1980–2005 and employing static panel OLS and Feasible Generalised Least Squares (FGLS). The results indicated that financial development exerts a negative but statistically insignificant effect on economic growth. Puatwoe and Piabuo (2017) examined the effect of financial sector development on economic growth in Cameroon using the Autoregressive Distributed Lag (ARDL) technique. The findings revealed positive short-run effects of money supply and government expenditure on economic growth, while all financial development indicators exerted positive and significant long-run effects. Tabi *et al*. (2011) investigated the finance-growth nexus in Cameroon using the Johansen cointegration technique. The study established that financial development positively influences economic growth in the long run through efficient resource allocation and confirmed the existence of long-run causality running from financial development to economic growth.

Critically, a substantial body of empirical research has examined the role of financial sector development in stimulating agricultural growth across different regions of Africa. These studies employed robust estimation techniques and largely suggests that financial sector development generally promotes agricultural productivity and economic growth. However, a critical literature gap remains as no study to date has systematically investigated the nexus between financial sector development and agricultural growth within the CEMAC region. Given the unique structural challenges of the CEMAC region such as weak financial depth, fragmented capital markets, and government bottlenecks, the findings from other regions cannot be directly generalised. More distinctively, previous studies have largely treated agriculture as a single sector, overlooking the distinct responses of crop and livestock productions to financial sector development. Haven considered these in this study, this research brings in a new orientation into agricultural production research such that economic research policy recommendations can address unique issues of various agriculture sub sectors.

METHODS AND PROCEDURES

Data and Description of Variables

Data for this study was collected from various secondary sources for all the six CEMAC countries for 25years spanning from 1996 to 2020. Description of variables and sources of data are summarised in the table below:

Table 3.1. Sources of Data and Description

Variables	Meaning	Sources of Data
Crop Production Index	Index of all crops produced	WDI (2022)
Livestock Production Index	Index of all livestock products	WDI (2022)
-Financial Institution Development	Index of Credit Market Development	IMF (2022)
-Financial Market Development	Index of Capital Market Development	IMF (2022)
Agricultural Capital	Capital Investment in agriculture	FOODSTAT (2022)
Agricultural Labour Force	Employment in agricultural sector	FOODSTAT (2022)
Agricultural Foreign Direct Investment	Foreign direct investment directed to the agricultural sector	FOODSTAT (2022)
Gross Domestic Product	Measure of economic growth	WDI (2022)

***Source**: Computed by Authors 2026*

The dependent variable is agricultural growth measured through agricultural production levels using Crop Production Index (CPI) and Livestock Production Index (LPI) obtained from the World Development Indicators (WDI). These indices capture variations in agricultural output levels over time in CEMAC countries. The main explanatory variable is financial sector development, measured using the Financial

Institutions Development (FID) Index for the credit market or banking sector, and Financial Market Development (FMD) Index for the capital market all obtained from the IMF Financial Development Database.

Control variables include agricultural capital which refers to investment into the agricultural sector measured by Gross fixed Capital Formation in agriculture, forestry and fishing. It considers machinery and equipment, farm buildings and storage facilities, irrigation infrastructure, permanent crops and plantations. Another is agricultural labour force referring to employment in agricultural sector.

It embodies both male and female employment measured by headcounts. Agricultural Foreign Direct Investment is foreign direct investment directed to the agricultural sector, measured in million US dollars. Gross domestic product is the measure of economic growth and when an economy grows all sectors of the economy become vibrant including the agricultural sector.

Model Specification

Model specification explains the theoretical or econometric linear relationship between agricultural production and financial development including control variables. Two models are tested where the first investigates whether variations in financial institution development and financial market development can influence agricultural productions in both crops and livestock sub sectors estimated in equations 3.1 and 3.2 respectively. Therefore the effects of financial institutions development and financial market development on crop production are linearly modelled as:

$$lCPI_{it} = \alpha_0 + \alpha_1 lFID_{it} + \alpha_2 lFMD_{it} + \alpha_3 lK_{it} + \alpha_4 lL_{it} + \alpha_5 lAFDI_{it} + \alpha_6 lGDP_{it} + \varepsilon_{it} \ldots\ldots 3.1$$

Also, the effects of financial institutions and financial market development on livestock production are modeled as:

$$lLPI_{it} = \beta_0 + \beta_1 lFID_{it} + \beta_2 FMD_{it} + \beta_3 lK_{it} + \beta_4 lL_{it} + \beta_5 lAFDI_{it} + \beta_6 lGDP_{it} + \mu_{it} \ldots\ldots 3.2$$

Where: l=log; lCPI=log of Crop Production Index; lLPI=log of Livestock Production Index; lFID=log of Financial Institution Development; lFMD=log of Financial Market Development; lK=log of Capital Invested in Agriculture; lL=log of Agricultural labour force; lAFDI= Foreign Direct Investment into the Agricultural Sector; lGDP=log of Gross Domestic Product; and Ɛ and μ are error terms.

Estimation Techniques

In order to estimate the models, Pre-tests for test of cross-sectional dependence, namely the Pesaran (2004) CD test and the Friedman rank test, are conducted to investigate whether there is cross sectional correlation among units of the panel. This study adopts the Im, Pesaran and Shin (2003) tests of unit root for Stationarity of series in Panel data.

This is because capital invested in agricultural sector has some missing values creating an unbalanced panel and the Im, Pesaran and Shin (IPS) test for unit root is robust to unbalanced panel. According to Hurling (2004), the IPS test under the null hypothesis considers heterogeneity of the autoregressive and also the relative heterogeneity when there is evidence of unit root in the panel and accounts for autocorrelation of residuals.

The Cross-sectional Augmented IPS (CIPS) unit root test by Pesaran (2007) is also conducted which accounts for cross sectional dependency in a panel. Given that there is evidence of econometric problems of cross sectional correlation, heteroskedasticity and autocorrelation in the panels, the Panel Corrected Standard Errors (PCSE) estimation techniques by Greene (2018) is employed. It is robust and produces consistent and efficient estimates even in the presence of these econometric problems. From a linear cross sectional time serial model, the PCSE is calculated using the OLS or Winsteen regression.

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Therefore, when calculating standard errors, the PCSE rely on the assumptions that; there exist heteroskedasticity or none constant variance, serial correlation as well as cross sectional dependence in the panel. Given the model;

$Y_{it} = X_{it}\beta + \varepsilon_{it}$

Where: Y_{it} = Vector of Agricultural production (Crops and livestock)

X_{it} = Matrix of Financial Sector development, capital and labour for agriculture, agricultural foreign direct investment and gross domestic product.

β = Vector of coefficients of independent variables

i = 1,…..m is number of units or panel

t = 1,….,T: Ti is the number periods or time span in the panel

ε_{it} is the disturbance which may be autocorrelated along *t* or correlated across panel *i*.

Given that: $E(\varepsilon) = 0, \quad Var(\varepsilon) = \Omega = \sum \otimes I_{T_i}$

Where $\sum$ is the m *x* m contemporaneous covariance matrix across panels

I_T is the T *x* T identity matrix

$\otimes$ is the Kronecker Product

Thus the panel covariance matrix given as;

$$\Omega = \sum mxm \otimes I_{T_i x T_i}$$

$\sum is\ the$ panel-by-panel (unit-by-unit) covariance matrix and *I* is the identity matrix,

With the presence of autocorrelation, the error structure is denoted as;

$\varepsilon_{it} = \rho\varepsilon_{i,t-1} + \mu_{it}$, where ρ_i is the estimated autocorrelation coefficient for panel *i*.

The Panel Correlated Standard Error (PCSE) estimator is given as;

$$\hat{\beta}_{PCSE} = (X'X)^{-1}X'Y$$

While the panel corrected –covariance matrix by OLS or Prais-Winsten coefficients is given as

$$Var(\hat{\beta}_{PCSE}) = (X'X)^{-1}X'\hat{\Omega}X(X'X)^{-1}$$

Where $\hat{\Omega}$ is the estimated covariance matrix of the panel disturbances which allows for panel heteroskedasticity, contemporaneous correlation, and, where specified, first-order serial correlation (AR(1)).

To account for country-specific heterogeneity, country fixed effects were incorporated into the PCSE specification through country indicator variables, with Cameroon serving as the reference dummy category. This approach controls for unobserved, time-invariant differences while estimating the relationships between the explanatory variables and agricultural production.

RESULTS AND DISCUSSION

Trends in agriculture and financial development indicators

Results start by examination of trends for stylised facts into the analysis.

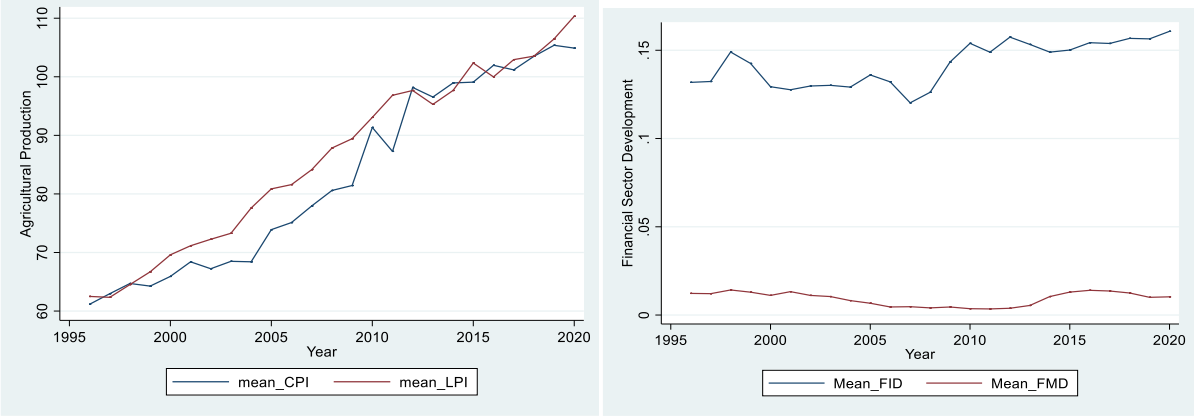


Figure 4.1. Trends in agriculture and financial development indicators
Source: *Computed by the Authors 2026*

Key: CPI = Crop Production Index; and LPI = Livestock Production Index FID= Financial Institution Development; and FMD= Financial Market Development

Figure 4.1 presents pooled average trends of agricultural productions and financial sector development in the CEMAC region over the study period of 25 years. The figure reveals a general upward movement in agricultural production, accompanied by pronounced volatility across time. Crop production displays relatively stronger and more persistent growth compared livestock production, while livestock output is characterised by greater fluctuations. These patterns suggest that agricultural performance in the region is subject to common shocks and structural vulnerabilities that vary across countries and over time. The presence of volatility and potential cross-country co-movements motivates the adoption of panel based estimation techniques that are robust to heteroskedasticity, serial correlation and cross-sectional dependence. From the financial sector, the figure indicates gradual improvement in financial sector development over time, with financial institutions evolving more steadily than financial markets. The divergence reflects the bank (FID) dominated structure of the financial systems in the region and highlights the uneven progress across financial components. The slow pace of financial deepening and likelihood of contemporaneous movements across countries underscore the relevance of panel estimation approaches that explicitly address cross-sectional correlation and heteroskedasticity, as implemented through PCSE.

.2. Descriptive Statistics

Descriptive gives an insight into the characteristics of data used for analysis. Data is characterised in original form that is in the form presented in the databases.

Table 4.1. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Crop Production Index	150	82.754	19.242	37.75	118.3
Livestock Production Index	150	85.998	21.006	34.91	129.89
Financial Institutions Development	150	.142	.044	.037	.228
Financial Market Development	150	.009	.011	0	.039
Agricultural capital stock	120	.381	.205	.073	1.893
Agricultural Employment	150	1551.075	1649.937	98.61	5035.22
Agriculture Foreign Direction Investment	150	566.394	839.318	17.28	5220.099
Gross Domestic Product	150	7.837e+09	9.806e+09	168.118	3.760e+10

Source*: Computed by Authors 2026*

Table 4.1 presents descriptive statistics from which financial market development has a minimum value of zero. According to IMF methodological working paper by Svirydzenka (2016), when data is unavailable, the value may be set to zero indicating non existing market data or inaccessibility to market data or that the efficiency of properties are very poor. With this consideration, the descriptive statistics retains the raw data zero values for the financial market development as originally presented in IMF database. But the zero values are considered and treated as missing observations thus removed when logged. This indicates that there will be differences in the number of observations reported by descriptive statistics in table 4.1 and regression results in tables 4.6 and 4.7. Also, the Pearson correlation matrix presented in the Appendix indicates there are no problems of multicorreniality in all the models.

4.2. Cross Sectional Dependency Test

The cross sectional dependency test investigates whether units in the cross section of countries under study are

correlated to each other. It is based on the null hypothesis (Ho) that there is cross sectional independence otherwise, there exist cross sectional dependence (Ha).

Table 4.2. Cross Sectional Dependency Test for Cross Sectional Correlations of Units

	Crop Production	Livestock Production
Pesaran's test	6.998, Pr = 0.0000	3.308, Pr = 0.0009
Friedman's test	57.143, Pr=0.0000	30.686, Pr = 0.0000

***Source**: Computed by Authors 2026*

From table 4.2, Pesaran and Friedman test indicate probability values of 1% significant level for crop production and livestock production respectively. Therefore, there exist cross sectional dependency in the models for crops and livestock productions in the panel. Given the problem of cross sectional dependency, the Modified Wald test for heteroskedasticity by Greene (2000) and the test for autocorrelation of errors by Woldridge (2002) and Drukker (2003) are also conducted to check the issues of heteroskedasticity and autocorrelation of residuals in the models.

Test for Heteroskedasticity and Autocorrelation

The test for Heteroskedasticity reveals whether the models under study exhibit constant variance or not. The test for heteroskedasticity is conducted under the null hypothesis (Ho) of homoskedasticity otherwise there exist Heteroskedasticity (Ha).

Table 4.3. The Modified Wald Test for Groupwise Heteroskedasticity in Panel

	Crop Production	Livestock Production
Chi2 (6)	2365.47	2604.05
Prob>chi2	0.0000	0.0000
H0: sigma(i)^2 = sigma^2 for all i		

***Source**: Computed by Authors 2026*

Table 4.3 indicates that there exist heteroskedasticity in all the two models of crop and livestock productions which are significant at 1% statistical level.

Autocorrelation establishes whether there is correlation amongst residuals. It is conducted under a null hypothesis (Ho) of no first order autocorrelation otherwise Ha, there exists first order autocorrelation.

Table 4. 4. Wooldridge test for Autocorrelation in Panel

	Crop Production	Livestock Production
F(1, 5)	0.082	10.916
Prob > F	0.7856	0.0214
H0: no first-order autocorrelation		

***Source**: Computed by Authors 2026*

The result of autocorrelation from table 4.4 indicates that crop production model does not have problem of autocorrelation while livestock production model exhibit problem of autocorrelation with P-value significant at 5% level.

Unit Root Test

Table 4. 5. Im-Pesaran-Shine (IPS) and Cross-section Augmented (CIPS) Unit Root Test for Stationary

	IPS		**CIPS**		**Order of Integration**
Variables	**Statistic**	**P-Value**	**Statistic**	**P-Value**	
lCPI	-5.0244	0.0000	-4.301	0.000	I(0)
lLPI	-1.9657	0.0247	-1.777	0.038	I(0)
lFID	-3.8234	0.0001	-2.384	0.009	I(0)
lFMD	-5.4697	0.0000	-2.458	0.039	I(0)
lK	-1.8135	0.0349	-1.805	0.032	I(0)
lL	-1.9657	0.0247	-1.943	0.026	I(0)
lAFDI	-7.1161	0.0000	-2.736	0.003	I(0)
lGDP	-2.0893	0.0183	-2.582	0.005	I(0)

***Source**: Computed by Authors 2026*

Results of IPS and CIPS unitroot test from table 4.5 reveal that all variables are stationary at levels I(0). Therefore the order of integration of the series in the panel is I(0). Since the series are integrated at I(0), the empirical specification is therefore interpreted as a level relationship among stationary variables rather than a long-run cointegrated relationship.

Regression Results

There is no issue of multicollinearity in all the models evidenced by Pearson's correlation matrix in appendix 2. But given the presence of cross sectional dependency, heteroskedasticity in all the models and presence of autocorrelation in livestock production model, regression results will be biased and inefficient. Therefore an econometric technique that is robust to these econometric problems must be employed to obtain efficient and consistent estimates. Such a technique is the Panel Corrected Standard Errors (PCSE) estimation method by Greene (2018).

Table 4.6. PCSE Regression Results for Crops and Livestock Production Models

VARIABLES	**Crop Production (Model 1)**	**Livestock Production (Model 2)**
	PCSE	**PCSE**
lFID	0.275***	0.435***

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	(0.0491)	(0.0655)
lFMD	0.109***	0.0152
	(0.0248)	(0.0209)
lK	0.232***	0.288***
	(0.0585)	(0.0581)
lL	-0.00625	0.0240**
	(0.0144)	(0.00970)
lAFDI	0.0609**	0.0589***
	(0.0283)	(0.0222)
lGDP	0.00585**	-0.0103***
	(0.00258)	(0.00227)
Constant	5.251***	5.390***
	(0.349)	(0.294)
Observations	79	79
R-squared	0.488	0.633
Number of C_id	6	6
Wald chi2(6)	95.56	106.19
Prob > chi2	0.0000	0.0000
Country Specific Effects		
2. CAR	0.431***	2.149***
	(0.695)	(0.526)
3.TCD	0.576***	0.721***
	(0.146)	(0.134)
4.COG	0.145	2.870***
	(0.768)	(0.582)
5.GNQ	3.265***	5.596***
	(1.054)	(0.946)
6.GAB	0.220	4.489***
	(1.212)	(0.938)
Constant	-0.0619	-7.420***
	(2.531)	(2.231)

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: *Computed by the Authors 2026*

Where CAR=Central African Republic; TCD=Chad; COG=Congo Republic; GNQ=Equatorial Guinea; and GAB=Gabon

The regression results in table 4.6 reveal the R-Squared for crop production model is 0.488 indicating that 48.8% variations in the amount of crop produced is determined by changes in the regressors included in the

model. While for livestock production model, R-Square is 0.633 implying variations in the amount of livestock produced is 63.3% determined by changes in the independent variables included in the model. All the models exhibit very good goodness fit with global P-values significant at 1% level indicating the independent variables chosen are good predictors of crops and livestock productions.

The coefficients of the regressors for crop production model reveal that financial institution development is positive with a coefficient of 0.275. This implies a 1% improvement in the level of financial institution development is associated with about a 0.275% increase in crops production and this result is significant at 1% level. Financial market development is also positive with a coefficient of 0.109.

This implies a 1% improvement in the level of financial market development is associated with about a 0.109% increase in crop production in the CEMAC region which is significant at 1% statistical level. From the control variables agricultural capital stock is positive with a coefficient of 0.232. Thus a 1% increase in agricultural capital stock is associated with about a 0.232% increase in crop production which is statistically significant at 1% level of significance. Next, the coefficient of agricultural labour force is negative and insignificant with a negligible coefficient of -0.00625.

Foreign direct investment to the agricultural sector is positive with a coefficient of 0.0609. Therefore, a 1% increase in foreign direct investment to the agricultural sector is associated with about a 0.0609% increase in the amount of crops produced which is significant at 5% level of significance. Lastly, gross domestic product has a coefficient of 0.00585. Thus, a 1% increase in economic growth of CEMAC countries is associated with about a 0.00585% increase in the amount of crops produced which is significant at 5% level of significance.

From livestock production model, financial institution development is also positive with a coefficient of 0.435. This implies a 1% improvement in the level of financial institution development is associated with about a 0.435% increase in livestock production and this result is significant at 1% level. Comparatively, livestock production is more responsive to financial institution development than crop production. Financial market development is also positive with a coefficient of 0.0152. This implies a 1% improvement in the level of financial market development is associated with about a 0.0152% increase in livestock production in the CEMAC region, however it is statistically insignificant.

Therefore, the capital market can source out significant finance for crop production than livestock production. From the control variables agricultural capital stock is positive with a coefficient of 0.288. Thus a 1% increase in agricultural capital stock is associated with about a 0.288% increase in livestock production which is statistically significant at 1% level of significance. Next, the coefficient of agricultural labour force is positive with a coefficient of 0.0240.

Thus a 1% increase in employment in agriculture is associated with about a 0.0240% increase in livestock production which is statistically significant at 1% level of significance. Foreign direct investment to the agricultural sector is positive with a coefficient of 0.0589. Therefore, a 1% increase in foreign direct investment to the agricultural sector is associated with about a 0.0589% increase in the amount of crops produced which is significant at 5% level of significance.

The country-specific effects test reveals significant heterogeneity across CEMAC countries relative to Cameroon (CMR), the reference category. For crop production, the coefficients for the central Africa Republic (CAR), Chat (TCD) and Equatorial Guinea (GNQ) are positive and statistically significant with 0.43, 0.576 and 3.265 magnitudes respectively indicating significant differences in their intercepts compared to Cameroon.

While those of Republic of Congo (COG) and Gabon (GAB) are positive but insignificant indicating insignificant differences in their intercepts with that of Cameroon. With livestock production, all five countries are positive and statistically significant revealing heterogeneity in their intercepts with Cameroon. These differences suggest persistent country characteristics that are not explicitly included in the model, such as differences in income structures, infrastructure, economic structure and other factors.

Table 4.7. Robust Tests Regression Results for Crops and Livestock Production Models

	Driscoll-Kraay	
VARIABLES	lCPI	lLPI
lFID	0.107**	0.200**
	(0.0622)	(0.0717)
lFMD	0.114***	-0.0208
	(0.0242)	(0.0321)
lK	0.190**	0.101**
	(0.0579)	(0.0255)
lL	-0.0085	1.277***
	(0.263)	(0.251)
lAFDI	0.045	0.0202
	(0.0304)	(0.0248)
lGDP	0.218***	0.0573
	(0.0408)	(0.0389)
Constant	0.471	-4.994**
	(1.43)	(1.584)
Observations	79	79
Within R-squared	0.583	0.7365
Number of groups	6	6
F-Statistic	159.53	99.52
Prob > F	0.0001	0.0003
Country Specific Effects		
CAR	0.431***	2.149***
	(0.633)	(0.744)
TCD	0.576***	0.721***
	(0.0919)	(0.133)

COG	0.145	2.870***
	(0.537)	(0.53)
GNQ	3.265***	5.596***
	(0.646)	(0.874)
GAB	0.22	4.489***
	(0.856)	(0.846)
Constant	-0.0619	-7.420**
	-1.763	-1.967

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Computed by the Authors, 2026

The regression results in table 4.7 present Driscoll-Kraay standard error estimates as a robust test for the PCSE result of table 4.6. R-Squared improve to 58.3% and 73.65% for crops and livestock productions respectively relative to PCSE estimates. While the F-tests of global significance are consistent with PCSE tests with significant level of 1%. The test of coefficients also reveals differences in magnitudes and levels of significance for FID, FMD, K, L. The magnitude of FID has dropped to from 0.275 to 0.107 and significance dropped from 1% to 5% for crop production and from 0.435 to 0.0200 for livestock production. The magnitude of FMD also dropped to from 0.109 to 0.114 and significance is consistent at 1% for cop production while consistently insignificant for livestock production. Given that both methodologies are consistent in direction and significance for FID and FMD provides evidence of consistent estimates. Although they are varied in magnitudes and level of significance, it is expected because PCSE and Discoll-Kraay use different approaches to account for dependence and other characteristics indicating that their estimated coefficients, standard errors and p-values may differ.

In like justification, K is consistent in direction and significance though a drop a magnitude from 0.232 to 0.190 for crop production and from 0.288 to 0.101 for livestock production. While L remains in insignificant for crop production but improves from 0.0240 to 1.277 in magnitude and from 5% to 1% in significance for livestock production. Therefore, consistency in direction and evidence of statistical significance of Driscoll-kraay robust test of these variables reveals evidence of unbiased estimates of PCSE estimation especially for FID and FMD which are the main independent variables. However estimates of AFDI and GDP which are control variables are inconsistent. With the Country specific effects, all coefficients in PCSE are the same with coefficients of Dricoll-Kraay estimation. They only differ in their standard errors, where Cameroon remains the reference dummy category, thus showing heterogeneity within the panel.

These results confirm to a priori expectation of a positive effect of financial sector development on agricultural production. They are also consistent with the findings of Ifeacho (2025), Addai *et al.* (2024), Appiah-Otoo *et al.* (2024) and Zheng and Jean-Petit (2023) on Sub-Sahara which all concluded that financial development can play significant role in enhancing agricultural production. João and Castro (2023), investigated on Angola, found that agricultural credits significantly improve agricultural output. Similarly, Exaud and Mwaitete (2022) reported that financial institutions' credits positively influence agricultural development in Tanzania, emphasizing the role of institutional finance. While Ehigiamusoe and Lean (2019) and Obialor *et al.* (2022) showed that capital market development measured by market capitalisation and value traded positively and significantly affects Nigerian's agricultural output, reaffirmed by the findings of Manasseh *et al*. (2025) and

Kwaghe *et al*. (2025) on Nigeria and South Africa. These findings also align with the theoretical predictions of McKinnon (1973) and Shaw (1973) who posit that financial liberalization and deepening increases saving mobilisation and channels funds toward productive investments, particularly in capital-constraint sectors such as agriculture.

CONCLUSION AND RECOMMENDATIONS

This study was aimed at investigating whether variations in financial sector development of the CEMAC region affect agricultural productions of both crops and livestock. Data for the study was collected from WDI, IMF and Foodstat databases spanning from 1996 to 2020, and the Panel Corrected Standard Errors (PCSE) and Driscoll-Kraay estimation techniques were employed. Two models were estimated establishing the effect financial institutions development and financial market development on crop and livestock productions. Results of analysis revealed that financial institutions development, referring to the banking sector or credit market and financial market development referring to the capital market all positively and significantly determine crop production in the region. Financial institutions development also positively and significantly determines livestock production while financial market development is positive but insignificant. In a nut shell, financial institutions have the potential to enhance crop and livestock productions; while the financial market has the potential to enhance crop production. The fundamental conclusion derived from this study is that financial sector is an important economic sector that can be improved to foster agricultural sector growth of CEMAC region.

The empirical findings of this study provide important policy insights for enhancing agricultural production in the CEMAC region through financial sector reforms. Given the positive and significant effects of financial sector development on crop and livestock productions, policy makers should prioritise deepening financial intermediation targeted at agriculture and agribusiness. This can be achieved by expanding rural banking infrastructure, strengthening agricultural credit schemes and promoting inclusive financial service tailored to farmers' needs in the CEMAC region. Particular emphasis should be placed on strengthening financial institutions, as the findings indicate that institutional finance has a more consistent effect across agricultural subsectors than financial markets. This implies policies should focus on bank credit accessibility, reducing collateral requirements, and designing sector-specific loan products for agriculture in the region. Crop production companies with agro-related manufacturing industries and agribusiness companies in CEMAC countries should also consider the capital markets of the region as an important source of finance.

REFERENCES

1. Achancho, V. (2013). Review and Analysis of National Investment Strategies and Agricultural Policies in Central Africa. The Case of Cameroon. In: Rebuilding West Africa's Food Potential, A. Elbeheri (ed) FAO/IFAD.
2. Addai, K.A,. Yufenyuy, M., & Kifem, F.L. (2024). Do Green Finance and Digital Technology Matter for Sustainable Agricultural Development? Insights from Sub-Sahara Africa. *Discover Agriculture, 2*(29)
3. Akpaeti, A.J. (2015). Impact of Financial Reforms on Agricultural Growth in Nigeria. A Vector Autoregressive (VAR) Approach. *American Journal of Experimental Agriculture* ,7(1), 17-35.
4. Aktitoby, B., & Coorey, S. (2017). The CEMAC's Macroeconomic Challenges.
5. Appiah-Otoo, I., Ntiamoah, E.B., Chen, X, & Twumasi, M.A. (2024). Impact of Climate Change on FOod Security in Sub-Suharan Africa: Can Financial Development Offset the Damages? *Congent Food & Agriculture, 10*(1).
6. Asongu, S.A. (2012). Financial sector competition and knowledge economy: Evidence from SSA and MENA countries. *Working paper, 12*(021).
7. AU-NEPAD (2003). Comprehensive African Agriculture Development Programme. ISBN 0-620-30700-5
8. Barrett, C. B., Christiaensen, L., Sheahan, M., & Shimeles, A. (2017). On The Structural Transformation of Rural Africa. *Journal of African Economies, 26*(1), i11–i35. https://doi.org/10.1093/jae/ejx009

9. Bjornlund, V., Bjornlund, H., & Van-Rooyen, A. (2022). Why Food Insecurity Persists in Sub-Saharan Africa: A Review of Existing Evidence. *Food Security, 14*(4), 845–864. https://doi.org/10.1007/s12571-022-01256-1
10. Byerlee, D., de Janvry, A., & Sadoulet, E. (2009). Agriculture for development: Toward a new paradigm. *Annual Review of Resource Economics, 1*(1), 15–31. https://doi.org/10.1146/annurev.resource.050708.144239
11. Christophe, K.T., Luc, N.N., & Edward T.E. (2012). Financial Development and Economic Growth in CEMAC Countries. *Global Journal of Management and Business Research, 12*(1).
12. de Janvry, A., & Sadoulet, E. (2010). Agricultural growth and poverty reduction: Additional evidence. *The World Bank Research Observer, 25*(1), 1–20. https://doi.org/10.1093/wbro/lkp015
13. Dlamini-Zuma, N. (2015). The Africa We Want. A shared strategic Framework for Inclusive Growth and Sustainable Development and a Global Strategy to Optimize the use of Africa's Resources for the Benefit of all Africans. Agenda 2063.
14. Drukker, D. M. (2003). Testing for Serial Correlation in Linear Panel-Data Models. *Stata Journal 3*(2), 168-177.
15. Ehigiamusoe, K.U., & Lean, H.H. (2019). The Nexus between Capital Market Development and Agricultural Output in Nigeria. *Journal of Developing Areas, 53*(3), 101-114.
16. Estrada, G., Park, D., & Ramayandi, A. (2010). Financial Development and Economic Growth in Developing Asia. *ADB Economics Working Paper Series,* No: 233
17. Exaud, N., & Mwaitete, C. (2022). Assessment of Financial Institution Credits on Agriculture Sector Development in Tanzanian: A Case of Arumeru District. *The Accountancy and Business Review, 14*(1), 1-10.
18. FAO & OECD (2023). Organisation for Economic Co-operation and Development, & Food and Agricultural Organisation of the United Nations. OECD-FAO Agricultural Outlook 2023-2032. https://doi.org/10.1787/08801ab7-en
19. FAO (2024). Global Information and Early Warming Systems (GIEWS) on Sudan. *Country Briefs*.
20. Finstats. (2015). Data base. http://finstats.com/newsite/
21. FOODSTAT (2022). Food and Agricultural Organisation Statistical Database. https://www.fao.org/faostat/
22. Gollin, D. (2015). Agriculture as an Engine of Growth and Poverty Reduction: Lessons for Africa. In A. McKay & E. Thorbecke (Eds.), *Economic Growth and Poverty Reduction in Sub-Saharan Africa: Current and Emerging Issues*. pp91–121. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780198728450.003.0004
23. Greene, W. (2000). Econometric Analysis. New York:Prentice-Hall.
24. Greene, W. H. (2018). *Econometric Analysis*. 8th ed. New York: Pearson.
25. Hassan, M.R. (2017). The Impact of Financial Sector Development on Agricultural Growth; Empirical Evidence From Pakistan. *College of Management Science , XII*(2). https://mpra.ub.uni-muenchen.de/34162/
26. Hurlin, C. (2004). Testing Granger Causality in Heterogeneous Panel Data Models with Fixed Coefficients. Document de Recherche, LEO, N 2004-05, Orléans: Université d'Orléans.
27. Ifeacho, C.I. (2025). Agricultural Finance and Financial Development on Economic Growth. *ACTA ECONOMICA, 23*(43), 39-61
28. Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for Unit Roots in Heterogeneous Panels. *Journal of Econometrics*, 115: 53-74
29. IMF. (2015). Annual Report. Tackling Challenges Together. http://www.imf.org/external/pubs/ft
30. IMF. (2022). International Monetary Fund Financial Development Data Base. https://data.imf.org/?sk=F8032E80-B36C-43B1-AC26-493C5B1CD33B&ref=mondato-insight&sId.
31. João, M.A.C., & Castro, A.M. (2023). The Impact of Agricultural Credit on the Growth the Agricultural Sector of Angola. *Sustainability 15*, 14704
32. Kwaghe, J.B., Ezie, O., & Ologunla, S.E. (2025). The performance of Agricultural Sector in Nigeria from caipta market fundamentals. *South Asian Journal of Social Studies and Economics, 22*(6), 86 – 102.
33. Levine, R. (2005). *Finance and growth: Theory and evidence*. In P. Aghion & S. N. Durlauf (Eds.), *Handbook of Economic Growth 1*: 865–934. Elsevier. https://doi.org/10.1016/S1574-0684(05)01012-9

34. Manasseh, C. O., Logan, C.S., Okanya, O.C., Ede, K.K., Onuselogu, O.C., Olelewe,C., & Nwakoby, I.C. (2025). Nexus between stock market and agricultural sector development in Nigeria and South Africa: Accounting for Three-regime marginal-threshold effects. *Scientific Africa*, 27, Article e02575
35. Massaquoi, S. M., Mande, Z., Ge, D., & Bah, A. S. (2025). Does financial credit obtained from financial institutions influence agricultural productivity while balancing economic growth and sustainability? Empirical evidence from Sierra Leone using the VAR approach. *SAGE Open, 15*(2).
36. McKinnon, R.I. (1973). Money and Capital in Economic Development. (Brookings Institution, Washington DC).
37. Obialor, C.B.M., Ibe, C.C., & Offor, O. C. (2022). Capital Market and agricultural sector output in Nigeria. *International Journal of research in Management, 4*(2), 12-20
38. Ojo, A.K., Mustapha, R.A., Ismaila, A. (2022). Impact of Financial Sector Development on Agricultural productivity in Nigeria. *Lapai Journal of Economics, 6*(1).
39. Oladotun, A., & Ladanu, W.K. (2015). The Role of Commercial Banks in Agricultural Growth in Nigeria. *International Journal of Entrepreneurer Development, Education and Science Research, 3*(2), 59.
40. Pesaran, M.H. (2004). General Diagnostic Tests for Cross sectional Dependence in Panels. *IZA Discussion Paper,* No.1240.
41. Pesaran, M.H. (2007). A simple panel unit root test in the presence of cross-sectional dependence. *Journal of Applied Econometrics, 22*(2), 265-312
42. Puatwoe, J.T., & Piabuo, S.M. (2017). Financial sector development and economic growth: evidence from Cameroon. *Financial Innovation, 3*(25) DOI 10.1186/s40854-017-0073-x
43. Sasu, D.D. (2024). Value Added by Agriculture to Gross Domestic Product (GDP) in Africa from 2015 to 2023. *Statista*.
44. Senbet, L. W., & Simbanegavi, W. (2017). Agriculture and structural transformation in Africa: An overview. *Journal of African Economies, 26*(. 1), i3–i10. https://doi.org/10.1093/jae/ejx012
45. Shaw, E.S. (1973). Financial deepening in economic development. Oxford University Press, New York.
46. Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics, 70*(1), 65–94. https://doi.org/10.2307/1884513
47. Svirydzenka, K. (2016). Introducing a New Broad-Base Index of Financial Development. *International Monetary Fund Working Paper*, *16*(15).
48. Swan, T. W. (1956). Economic growth and capital accumulation. *Economic Record, 32*(2), 334–361. https://doi.org/10.1111/j.1475-4932.1956.tb00434.x
49. Tabi, A., Njong, A., & Neba, C. (2011). Financial Development and Economic Growth in Cameroon. *Journal of Economics and International Finance, 3*(6), 367–375.
50. United Nations (2015). Transforming Our World: The 2030 Agenda for Sustainable Development A/RES/701.
51. WDI. (2022) World Development Indicators. https://databank.worldbank.org/source/world-development-indicators.
52. Wooldridge, J. M. (2002). Econometric Analysis of Cross Section and Panel Data. Cambridge, MA: MIT Press.
53. World Bank (2024). GDP Share of Agriculture - Country Rankings. The Global Economy.com
54. World Bank Group (2018). Breaking Down The Barriers to Regional Agricultural Trade in Central Africa; (CEMAC 2009). IRAD-IDA, 1818 H Street NW. Washington DC 20433.
55. World Bank Group (2022). Agricultural Finance and Agricultural Insurance. Worldbank.org
56. Wudil, A.H., Usman, H., Rosak – Szyrock, J., Pilar, L. & Boye (2022). Reversing Years of Global Food Security: A Review of Food Security Situation in Sub-Sahara Africa (SSA). *International Journal of Environmental Research and Public Health, 19*(22): 14836.
57. Zheng, C., & Jean-Petit, S. (2023). The Effects of Interactions Between Agro-Production, Economic and Financial Development on Bank Sustainability. *SAGE Open, 13*(2).

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APPENDIX. PEARSON CORRELATION MATRIX

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) lCPI	1.000							
(2) lLPI	0.608	1.000						
(3) lFID	0.177	0.543	1.000					
(4) lFMD	0.496	-0.253	-0.329	1.000				
(5) lK	0.099	0.229	0.077	-0.434	1.000			
(6) lL	-0.225	-0.164	-0.253	-0.186	-0.106	1.000		
(7) lAFDI	0.323	0.426	0.370	0.255	0.133	-0.465	1.000	
(8) lGDP	-0.334	-0.133	-0.051	-0.462	-0.009	0.246	-0.084	1.000