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An Econometric Analysis of the Effect of Agricultural Funding on Selected Tuber Crops Output in Nigeria (1999 -2020)

Okidim, I. A. & Ben-Elijah, I. A.
Department of Agricultural and Applied Economics, Rivers State University Nkpolu-Oroworukwo, Port Harcourt
ebinaebi@cavallauniversity.education

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Abstract
This study determined the influence of agricultural funding on selected tuber crops output in Nigeria within the period 1999-2020. The study adopted ex-post factor research design and relied on time series data. Pre and post -estimation diagnostics tests were adopted to check for reliability of the data used. The regression results showed that Agricultural Credit Guaranteed Scheme Fund (ACGSF) (-2.456020), had a negative and significant influence on Cassava production (CSVPD), Bank of Industry (BOI) (-0.023170) had a negative and significant influence on Cassava production (CSVPD), while Bank of Agriculture (BOA) (0.014092) had a positive and significant influence on cassava production (CSVPD). Bank of Industry (BOI) (-0.038446), International fund for Agriculture Development (IFAD) (-0.248212) and Public recurrent expenditure to agriculture (PREXPA) (-187.3435) all had negative and significant relationship with yam production during the period under study. On the other hand, Agricultural Credit Guaranteed Scheme Fund (ACGSF) (1.068221) and Public Capital Expenditure to Agriculture (PCEXPA) (79.71212) did have a positive and significant influence on yam output. Public Capital Expenditure to agriculture (PCEXPA) (1.477366) and public recurrent expenditure to agriculture (PREXPA) (6.558832) had significant and positive relationship with potato production. The study concluded that the agricultural funding schemes have not been properly maximized to boost tuber crop production and sustainability, and recommended that Agricultural Credit Guaranteed Scheme Fund (ACGSF) and Bank of Industry (BOI) funding should be given attention with regards to cassava production and Bank of Industry (BOI), International fund for Agriculture Development (IFAD) and Public recurrent expenditure to agriculture (PREXPA) should be properly managed with regard to yam production so they can have positive influence on the output of yam in the country.

Keywords: *Agric. Funding, Tuber Crops, Cassava, Yam, Sweet Potatoe*

INTRODUCTION

Agriculture has been identified as a critical sector with huge potential for promoting inclusive growth by stimulating economic growth, reducing poverty, and creating employment for a large number of people in developing countries. Rapid agricultural growth based on sustained productivity increase has been widely accepted as an essential requirement for achieving inclusive growth (Briones, 2013).

The Food and Agricultural Organization (FAO) recommends that 25 per cent of government capital budget be allocated to agricultural development. This has not been achieved by the various administrations of Nigeria, thereby affecting government programmes and policies for the sector. While agricultural spending expressed as a share of total spending is generally low in African countries compared to other developing countries, Nigeria fares unfavorably even within the African context. When public spending in agriculture in Nigeria is benchmarked relative to public spending in other sectors, the value of the indicator for agriculture is lower than the values of all other sectors, such as industry, construction, trade, and services (Mogues*et al*., 2008).

The crop sub sector's contribution to GDP declined from 24% in 2001 to 21% in 2014. Lower productivity, underutilized agricultural land, and lost opportunities for value addition has increased poverty and food insecurity in Nigeria (AfDB, 2016). Most farmers lack access to financial services to allow them to scale up their businesses, buy equipment, purchase agro-chemicals and improve their living standards. Farmers are often cash-constrained, hindering their ability to make improvements, upgrades or uptake new farming technologies. Many factors are implicated for poor agricultural productivity in Nigeria. The decline in agricultural spending was considered to be a major contributing factor to the cause of low and slow growth in agriculture (Islam, 2011; Alabi, 2014). Kalibata (2010) is of the opinion that improved public expenditure in agriculture will help to provide the farmers with improved inputs including seeds as well as agrochemicals. A well-managed public spending in agriculture can be used to provide rural infrastructure such as road that will link them to markets. The public financial resources will enable the farmers to access agribusiness credit and storage facilities to reduce their estimated 50% percent post-harvest losses (Oguntade, 2014).

Objectives of the Study

The broad objective of this study was to determine the effect of agricultural funding on selected tuber crops output in Nigeria from 1999 -2020 and determine the trend of the dependent and independent variables, the specific objectives are to:

i. ascertain the effect of agricultural funding (ACGSF, BOA, BOI, IFAD, PCEXA & PREXA) on cassava production in Nigeria.
ii. find out the effect of agricultural funding (ACGSF, BOA, BOI, IFAD, PCEXA & PREXA) on yam production in Nigeria.
iii. find out the effect of agricultural funding (ACGSF, BOA, BOI, IFAD, PCEXA & PREXA) on sweet potato production in Nigeria.

METHODOLOGY

Research Design

This study adopted the quasi-experimental research design. The choice of this approach emanated from its suitability in assessing the impact of multivariate explanatory variables on a single dependent variable.

Data Collection

Secondary data was used for this study. Specifically, Bank of Agriculture (BOA), Bank of Industry (BOI), Public Capital Expenditure to Agriculture(PCEXPA), Public Recurrent Expenditure to Agriculture(PREXPA), International Funding for Agricultural Development and selected tuber crops. Data on Cassava, Yam and Sweet potatoe, were gotten mainly from the publications of Central Bank of Nigeria (CBN) namely; Statistical Bulletin and World Bank that covers from 1999 – 2021.

Data Analysis

The estimation method adopted for the models were the Auto Regressive Distributed Lag and Error Correction Model (ARDL-ECM).

Model Specification

The model is expressed explicitly as

Model for Cassava

$CSVPD = f$ (ACGSF,*BOA, BOI, IFAD,PCEXPA,PREXPA*) (1)

Where:

CSVPD = Cassava output
ACGSF = Agricultural Credit Guarantee Scheme Fund
BOA = Bank of Agriculture
BOI = Bank of Industry
IFAD = International Fund for Agriculture Development
PCEXPA= Public Capital Expenditure on Agriculture
PREXPA= Public Recurrent Expenditure on Agriculture

Equation (1) is an implicitly expressed econometric model

The model for the regression is specified explicitly as follows

$InCSVPD = a_0 + a_1 InACGSF_t + a_2 InBOA + a_3 InBOI + a_4 InIFAD + a_5 InPCEXPA + a_6 InPREXPA + u_t$ (2)

Where:

a_0 = Constant
$a_1 - a_6$ = Coefficients
u_t = stochastic error terms
In = natural log notation

Specifying equation (2) in ARDL Cointegration model by incorporating the lag and lead of each of the explanatory variables into the model as part of the explanatory variables.

In the short run:

$\Delta Y_t = \alpha + \sum_{i=1}^{p} \Delta Y_t + \sum_{i=1}^{q} \Delta\beta_1 B_{t-1} + \sum_{i=1}^{q} \Delta\beta_2 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_3 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_4 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_5 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_6 C_{t-1} \mu_t$ (3)

In the long run the error correction term is introduced:

$Y_t = \alpha + \sum_{i=1}^{p} Y_t + \sum_{i=1}^{q} \beta_1 B_{t-1} + \sum_{i=1}^{q} \beta_2 C_{t-1} \sum_{i=1}^{q} \Delta\beta_3 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_4 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_5 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_6 C_{t-1} + \lambda ECT_{t-1} + \mu t$ (4)

Now adopting the model to the study, with indication of co-integration in the long run of the variables we have:

$CSVPD_t = \psi + \sum_{i=1}^{p} CSVPD_{t-1} + \sum_{i=1}^{q} \alpha_1 ACGSF_{t-1} + \sum_{i=1}^{q} \alpha_2 BOA_{t-1} + \sum_{i=1}^{p} BOI_{t-1} + \sum_{i=1}^{p} IFAD_{t-1} + \sum_{i=1}^{p} PCEXPA_{t-1} + \sum_{i=1}^{p} PREXPA_{t-1} + \sum_{i=1}^{q} \Delta CSVPD_{t-1} + \sum_{i=1}^{q} \beta_1 \Delta ACGSF_{t-1} + \sum_{i=1}^{q} \beta_2 \Delta BOA_{t-1} + \sum_{i=1}^{p} \beta_3 \Delta BOI_{t-1} + \sum_{i=1}^{p} \beta_4 \Delta IFAD_{t-1} + \sum_{i=1}^{p} \beta_5 \Delta PCEXPA_{t-1} + \sum_{i=1}^{p} \beta_6 \Delta PREXPA_{t-1} + \lambda ECT_{t-1} + \mu_t$ (5)

Where: ψ = intercept

$\alpha_{1,2,3,4,5,6}$= parameter estimates of the regressors in the long run

$\beta_{1,2.3,4,5,6}$= parameter estimates of the regressors in the short run

u_t= stochastic error terms.

ECT = Error Correction Term (ECM)

λ= Speed of Adjustment with a negative sign (-)

μ= stochastic term ($Y_{t-1} - \Theta X_t$)

Model for Yam

*YAMPD = f (*ACGSF, *BOA, BOI, IFAD, PCEXPA, PREXPA*) (6)

Where:

YAMPD = Yam output
ACGSF = Agricultural Credit Guarantee Scheme Fund
BOA = Bank of Agriculture
BOI = Bank of Industry
IFAD = International Fund for Agriculture Development
PCEXPA= Public Capital Expenditure on Agriculture
PREXPA= Public Recurrent Expenditure on Agriculture

Equation (6) is an implicitly expressed econometric model

The model for the regression is specified explicitly as follows

$In\ YAMPD = a_0 + a_1 InACGSF_t + a_2 InBOA + a_3 In\ BOI + a_4\ InIFAD + a_5\ InPCEXPA + a_6 InPREXPA + u_t$ (7)

Where:

a_0 = Constant
$a_1 - a_6$ = Coefficients
u_t = stochastic error terms
In = natural log notation

Specifying equation (3.32) in ARDL Cointegration model by incorporating the lag and lead of each of the explanatory variables into the model as part of the explanatory variables.

In the short run:

$\Delta Y_t = \alpha + \sum_{i=1}^{p} \Delta Y_t + \sum_{i=1}^{q} \Delta\beta_1 B_{t-1} + \sum_{i=1}^{q} \Delta\beta_2 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_3 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_4 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_5 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_6 C_{t-1} \mu_t$ (8)

In the long run the error correction term is introduced:

$Y_t = \alpha + \sum_{i=1}^{p} Y_t + \sum_{i=1}^{q} \beta_1 B_{t-1} + \sum_{i=1}^{q} \beta_2 C_{t-1} \sum_{i=1}^{q} \Delta\beta_3 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_4 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_5 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_6 C_{t-1} + \lambda ECT_{t-1} + \mu t$ (9)

Now adopting the model to the study, with indication of co-integration in the long run of the variables we have:

$YAMPD_t = \psi + \sum_{i=1}^{p} YAMPD_{t-1} + \sum_{i=1}^{q} \alpha_1 ACGSF_{t-1} + \sum_{i=1}^{q} \alpha_2 BOA_{t-1} + \sum_{i=1}^{p} BOI_{t-1} + \sum_{i=1}^{p} IFAD_{t-1} + \sum_{i=1}^{p} PCEXPA_{t-1} + \sum_{i=1}^{p} PREXPA_{t-1} + \sum_{i=1}^{q} \Delta YAMPD_{t-1} + \sum_{i=1}^{q} \beta_1 \Delta ACGSF_{t-1} + \sum_{i=1}^{q} \beta_2 \Delta BOA_{t-1} + \sum_{i=1}^{p} \beta_3 \Delta BOI_{t-1} + \sum_{i=1}^{p} \beta_4 \Delta IFAD_{t-1} + \sum_{i=1}^{p} \beta_5 \Delta PCEXPA_{t-1} + \sum_{i=1}^{p} \beta_6 \Delta PREXPA_{t-1} + \lambda ECT_{t-1} + \mu_t$ (10)

Where: ψ = intercept

$\alpha_{1,2,3,4,5,6}$= parameter estimates of the regressors in the long run

$\beta_{1,2.3,4,5,6}$= parameter estimates of the regressors in the short run

u_t= stochastic error terms.

ECT = Error Correction Term (ECM)

λ= Speed of Adjustment with a negative sign (-)

μ= stochastic term ($Y_{t-1} - \Theta X_t$)

Model for Sweet Potato

*POTOPD = f (*ACGSF,*BOA, BOI, IFAD, PCEXPA, PREXPA*) (11)

Where:

POTOPD = Potato Output
ACGSF = Agricultural Credit Guarantee Scheme Fund
BOA = Bank of Agriculture
BOI = Bank of Industry
IFAD = International Fund for Agriculture Development
PCEXPA= Public Capital Expenditure on Agriculture
PREXPA= Public Recurrent Expenditure on Agriculture

Equation (11) is an implicitly expressed econometric model

The model for the regression is specified explicitly as follows

$In\ POTOPD = a_0 + a_1 InACGSF_t + a_2 InBOA + a_3 In\ BOI + a_4\ InIFAD + a_5\ InPCEXPA + a_6 InPREXPA + u_t$ (12)

Where:

a_0 = Constant
$a_1 - a_6$ = Coefficients
u_t = stochastic error terms
In = natural log notation

Specifying equation (12) in ARDL Cointegration model by incorporating the lag and lead of each of the explanatory variables into the model as part of the explanatory variables.

In the short run:

$\Delta Y_t = \alpha + \sum_{i=1}^{p} \Delta Y_t + \sum_{i=1}^{q} \Delta\beta_1 B_{t-1} + \sum_{i=1}^{q} \Delta\beta_2 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_3 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_4 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_5 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_6 C_{t-1} \mu_t$ (13)

In the long run the error correction term is introduced:

$Y_t = \alpha + \sum_{i=1}^{p} Y_t + \sum_{i=1}^{q} \beta_1 B_{t-1} + \sum_{i=1}^{q} \beta_2 C_{t-1} \sum_{i=1}^{q} \Delta\beta_3 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_4 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_5 C_{t-1} + \sum_{i=1}^{q} \Delta\beta_6 C_{t-1} + \lambda ECT_{t-1} + \mu t$ (14)

Now adopting the model to the study, with indication of co-integration in the long run of the variables we have:

$POTOPD_t = \psi + \sum_{i=1}^{p} POTOPD_{t-1} + \sum_{i=1}^{q} \alpha_1 ACGSF_{t-1} + \sum_{i=1}^{q} \alpha_2 BOA_{t-1} + \sum_{i=1}^{p} BOI_{t-1} + \sum_{i=1}^{p} IFAD_{t-1} + \sum_{i=1}^{p} PCEXPA_{t-1} + \sum_{i=1}^{p} PREXPA_{t-1} + \sum_{i=1}^{q} \Delta POTOPD_{t-1} + \sum_{i=1}^{q} \beta_1 \Delta ACGSF_{t-1} + \sum_{i=1}^{q} \beta_2 \Delta BOA_{t-1} + \sum_{i=1}^{p} \beta_3 \Delta BOI_{t-1} + \sum_{i=1}^{p} \beta_4 \Delta IFAD_{t-1} + \sum_{i=1}^{p} \beta_5 \Delta PCEXPA_{t-1} + \sum_{i=1}^{p} \beta_6 \Delta PREXPA_{t-1} + \lambda ECT_{t-1} + \mu_t$ (15)

Where: ψ = intercept

$\alpha_{1,2,3,4,5,6}$= parameter estimates of the regressors in the long run

$\beta_{1,2.3,4,5,6}$= parameter estimates of the regressors in the short run

u_t= stochastic error terms.

ECT = Error Correction Term (ECM)

λ= Speed of Adjustment with a negative sign (-)

μ= stochastic term ($Y_{t-1} - \Theta X_t$)

RESULTS AND DISCUSSION

DATA PRESENTATION

YEAR	ACGSF	BOA	BOI	IFAD	PCEXPA	PREXPA	CSVPD	YAMPD	POTOPD
1999	24183	25515006.00	80811133 4.00	960000	6912.6	31,347 .20	32697 000	25873 000	573000
2000	36144	30315222.00	902,212,33	111000	5761.7	4,834. 70	32010 000	26201 000	599000
2001	72854 5.4	33122211 0.00	60632203 3.00	120000	57879	7,064. 90	32068 000	26232 000	599000
2002	10509 82	40211120 3.00	33262100 0.00	165000	32,364	12,439 .40	34120 000	27911 000	637000
2003	11510 51	20551333 1.00	36240205 9.00	341000	8510.9	7,534. 30	36304 000	29697 000	678000
2004	20837 45	20811120 3.00	60031151 1.00	270000	48047. 8	11,725 .60	38845 000	31776 000	726000
2005	94938 55	31011123 3.00	61671255 2.00	501000	79393. 4	10,858 .80	41565 000	34000 000	776000
2006	42624 30	31631345 7.66	62904680 3.04	441000	15176. 8	18,739 .80	45721 000	36720 000	838000

2007	4425462	52361021 0.00	71531133 4.00	6660000	22518.5	15,781 .40	43410 000	31136 000	662000
2008	6497959	62692465 9.79	50660023 4.00	6490000	58453.1	65,415 .20	44582 000	35017 000	1105000
2009	8328566	93492313. 15	70931680 5.00	5530000	35879.3	22,440 .10	36822 248	29091 980	1000000
2010	6567357	241407.52 6.35	73768947 7.20	2800000	47098.1	28,221 .50	42533 180	37328 180	1026311
2011	7312700	15987404 6.35	60833132 2.00	8350000	63056.3	41,201 .30	46190 248	33134 172	1077058
2012	8150030	50266755 3.75	81066155 5.00	1403000	74215.6	33,304 .10	50950 292	32318 900	1085139
2013	10005594	175,005,0 0.00	80533122 2.00	8880000	69871.7	39,436 .40	47406 770	35618 420	1124985
2014	10234166	412,480,5 52,00	70231547 0.00	3440000	86025.8	36,700 .40	56328 480	45151 589	1173146
2015	12432130	42076482 5.00	61232747 9.00	1098000	72367.9	41,271 .20	57643 271	45677 939	1240446
2016	10890630	54010877. 00	68319898 2.00	1960000	76088.5	39,136 .00	59565 916	51362 900	1179526
2017	11326255	84176482 5.00	71314333 5.00	3084000	79132.04	40701.44	55068 732	54083 100	1197706
2018	11779305	33607884 3.16	10061607 94.00	3207360	82297.32	42329.49	55867 727	50000 000	1205893
2019	12250478	34952199 6.89	10464072 25.76	3335654	85589.22	44022.96	59411 510	50000 000	1194375
2020	12740497	36350287 6.76	10882635 14.79	3469080	89012.78	45783.87	60001 531	50052 977	1199324

Source: Central Bank Statistical Bulletin (2020)
National Bureau of Statistics (2020)
Development Finance Department Central (2020)
Bank of Nigeria (2020)
Bank of Agriculture (2020)
Bank of Industry (2020)
Food and Agriculture Organization (FAO) (2020)

Table 1 presents the time series data of the dependent and independent variables, the dependent variables being Cassava output (CSVPD), Yam output (YAMPD) and Potato Output (POTOPD) measured in tons for models one to three, while the independent variables which are Agricultural Credit Guarantee Scheme Fund (ACGSF), Bank of Agriculture (BOA), Bank of Industry (BOI), International Fund for Agriculture Development (IFAD), Public Capital Expenditure on

Agriculture (PCEXPA) and Public Recurrent Expenditure on Agriculture (PREXPA) measured in dollars covering the time period from 1999 to 2020.

Trends in the Dependent and Independent Variables

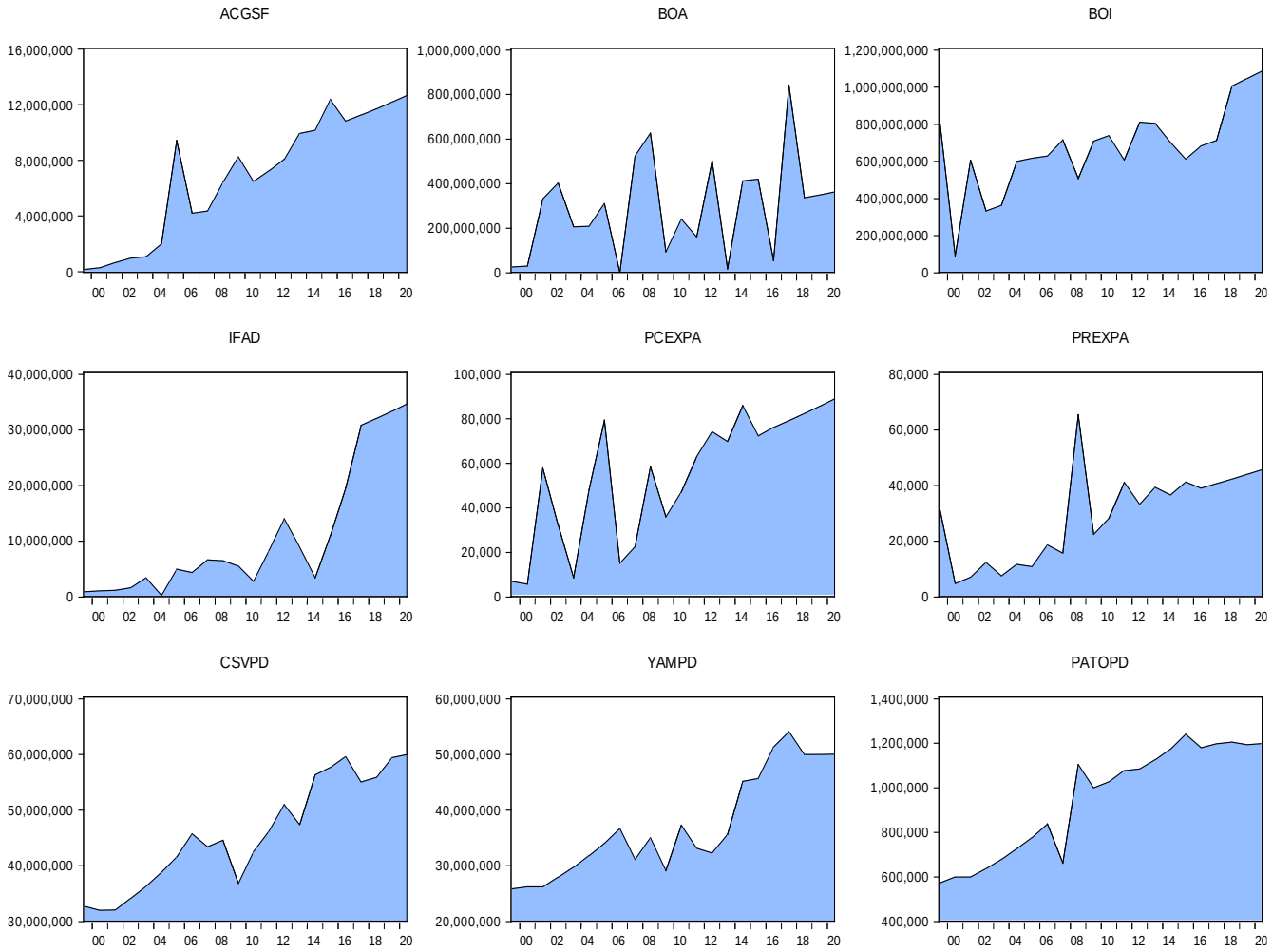

Figure 1: Trends in selected Dependent and Independent Variables over the period 1999-2020

The trend shows that funding of agriculture through the ACGSF had been on the increase over the period of study, with slight fluctuations. This shows consistency on the part of government to finance agriculture for improved performance of the agricultural sector in the country. This is in agreement with Okidim and Eze (2018), who attributed increase in ACGSF to national economic empowerment and development strategy instituted in 2002. Despite this increasing funding to agriculture through agricultural credit scheme, it had negative influence on cassava output and did not have significant in influence on output on other selected tuber crops in this study.

The funding of agricultural development in Nigeria through the bank of agriculture as shown from the trend analysis in Figure 1 has been fluctuating. Based on the trend it can equally be stated that

the bank of agriculture was consistent to a large extent on their funding of the agriculture sector in Nigeria. Funding from BOA should be steady and increasing because it has the potential of increasing output as in the case of cassava where BOA had positive significant influence on cassava output with a unit increase in agricultural funding in cassava production as shown in the regression result.

The funding from the bank of industry based on the trend have relatively been on the same level for the most part of the time period under study but picked up from 2017, and have been on the increase significantly since then. Despite this increase in funding from the bank of industry, it showed a negative relationship with cassava and yam output, as shown in the regression result. This means that BOI funding in the agricultural sector does not bring about meaningful growth in cassava and yam production.

Trends for International Funding for Agriculture Development showed that funding through (IFAD) was low until 2012 when they began to pick up, dropped in 2014, and then increased at an increasing rate. IFAD funding had significantly negative relationship with yam production. It showed no significant influence on the other selected tuber crops for this study, as shown in the regression result. This goes to say that funding from IFAD do not have the desired effect on tuber crop production in the country.

Figure 1 showed the trend in governments capital expenditure on agriculture for the period under study being 1999 to 2020, and it could be seen from the trend that capital expenditure to the agricultural sector over the study period is marred with steep fluctuation, implying that the government have not been consistent with allocating resources to capital projects in agriculture, some years the values are on the increase and then followed by sharp decreases in funding.

Trend in Public Recurrent Expenditure to the Agriculture sector from 1999 to 2020, from the trend it could be seen that 1999 and 2008 recorded higher allocation by the government to recurrent expenditure in the agriculture sector, there were fluctuations also in the allocations over the study period, but they were not as much as the fluctuations in the capital expenditure allocation on the average, it can be said based on the trend that governments allocation to recurrent expenditure in agriculture have been on the increase over the years. PREXPA had a negative influence on maize output, and a positive influence on potatoe output as shown in the regressive result of Table 4.9 and 4.10. The result of the regressions in this study depicts mostly no influence of PREXPA on most of the selected staple crops under study.

From Figure 1, the trend in cassava production shows a steady rise in cassava output, with some fluctuations (decline in production) in some years. This increase in cassava output is not a direct function of the selected funding to agriculture in this study, this was so because it was only BOA that had a significant positive influence on cassava production as shown in the regressive result of Table 4. This upward trend in cassava production may be as a result of factors other than funding, maybe use of improved varieties, fertilizers, use of more lands for production.

Yam is one of the major staple crops in Nigeria that provides the daily calorie intake for its citizens, the trend analysis in Figure 1 shows the output of yam production in Nigeria over the study period (1999 to 2020). From the trend, there is a steady increase in yam output until 2005 where there was a sharp decline followed by fluctuations in production output, then a steady rise in output from 2012 till 2016, when there was decline in production. Yam is majorly produced in the northern

and middle belt regions of Nigeria; some eastern states equally produce yam in sizable quantities. From 2013, there was a steady growth in yam production, ACGSF and PCEXPA were the two sources of funding that had positive influence on yam output as shown in the regressive result of Table 5. To some extent it can be said that funding to agriculture is responsible for the upward trend in yam output.

As observed from the graph, sweet Potato yield varied between the period of 2000 and 2008. This is a pointer that sweet potato yield over the period has been largely unstable. It was further observed from the graph that sweet Potato yield witnessed unstable movement between the period of 2009 and 2015. This could be linked to inefficient funding to staple crop production.

Unit Root Test for Stationarity

The test for unit root preceded the estimation of the model due to its usefulness in exposing the time series properties of the variables. The stationarity test result is presented in Table 2.

Table 2 Unit Root Test Result

Variable	ADF		ADF		Order of Integration
	Levels	Sig.	1st Diff.	Sig.	
ACGSF	-4.408493	0.0113			1(0)
BOA	-5.664398	0.0002			1(0)
BOI	-6.518993	0.0002			1(0)
IFAD	0.300054	0.9724	-3.454890	0.0210	1(1)
PCEXPA	-6.302897	0.0003			1(0)
PREXPA	-5.593436	0.0010			I(0)
CSVPD	-0.778745	0.8045	-5.744696	0.0002	1(1)
YAMPD	-0.863444	0.7793	-6.067761	0.0001	1(1)
POTOPD	-1.210434	0.6486	-8.328077	0.0000	1(1)

Source: Author's Compilation, using E-views 10, 2023

The Augmented Dickey Fuller (ADF) test was the test type used to carry out the unit root test. The order of integration shows that Agricultural credit guaranteed scheme fund (ACGSF), Bank of Agriculture (BOA), Bank of industry (BOI), public capital expenditure to agriculture (PCEXPA) and public recurrent expenditure to agriculture (PREXPA) were stationary at levels I(O), while International funding for agricultural development (IFAD), Cassava production (CSVPD), Yam production (YAMPD) and Potatoe production (POTOPD) became stationary at first difference I (1).

Co-integration Test

The mixture of I (0) and I (1) order of integration implies that the most suitable estimation technique is the ARDL method. However, it is necessary to test further for long-run cointegrating

relationship amongst the variables, hence the test for Cointegration. The results for the various models are presented thus;

Table 3 ARDL Bounds Cointegration Test Results

Model	F-statistic	Signif.	I(0)	I(1)
CSVPD	8.248396	10%	1.75	2.87
		5%	2.04	3.24
		2.5%	2.32	3.59
		1%	2.66	4.05
YAMPD	19.52151	10%	2.12	3.23
		5%	2.45	3.61
		2.5%	2.75	3.99
		1%	3.15	4.43
POTOPD	2.114099	10%	**1.75**	2.87

Source: Author's Compilation, using E-views 10, 2023

From the result in Table 3, the bounds Cointegration tests showed that there is Cointegration (long-run relationship) among the variables, agricultural funding and the selected tuber crops. This is so because the F-statistics values were greater than the lower I (0) and the higher I (1) bounds coefficients, thus, the null hypothesis of no level relationship was rejected. From the results, Cassava with a F-statistic value of (8.248396) is greater than the lower I (0) and the higher I (1) bounds coefficients, at the 10%, 5%, 2.5% and 1% level of significance, thus, the null hypothesis of no level relationship is rejected. Yam had an F-statistic value of (19.52151) which was greater than the lower I (0) and the higher I (1) bounds coefficients, at the 10%, 5%, 2.5% and 1% level of significance, thus, the null hypothesis of no level relationship is rejected, while potato had F-statistic value was (2.114099) which was greater than the lower I (0) bounds coefficient at the 10% level of significance, thus, the null hypothesis of no level relationship is rejected. Therefore, there is long run cointegrating relationship amongst the variables in the models. To that effect, the error correction model (ECM) is included to determine the speed of adjustment or the degree of convergence to equilibrium in the long-run from disequilibrium in the short-run.

Regression Results for the Various Models

Table 4 Regression Result for Model One

ARDL-ECM Coefficients				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D (CSVPD (-1))	0.016892	0.081059	0.208390	0.8431
D (CSVPD (-2))	-0.164391	0.089069	-1.845651	0.1242
D (CSVPD (-3))	-0.459631	0.084254	-5.455284	0.0028
D(ACGSF)	-2.456020	0.256329	-9.581514	0.0002
D(BOA)	0.014092	0.001447	9.741638	0.0002
D(BOI)	-0.023170	0.002959	-7.830040	0.0005
CointEq (-1)*	-0.209006	0.018544	-11.27055	0.0001
R-squared	0.926781			
Adjusted R-squared	0.886844			
S.E. of regression	1329639.			

Sum squared resid	1.94E+13			
Log likelihood	-274.9161			
Durbin-Watson stat	2.255155			
Long Run Coefficients				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
ACGSF	-2.223045	2.650258	-0.838803	0.4398
BOA	0.141643	0.065213	2.172001	0.0819
BOI	0.035997	0.016877	2.132903	0.0861
IFAD	-1.005340	0.582148	-1.726949	0.1448
PCEXPA	1474.661	872.1869	1.690763	0.1517
PREXPA	-1801.455	1075.301	-1.675303	0.1547

Source: Author's computation using E-views 10, 2023.

Table 4 shows ARDL-ECM Regression output. The result shows that the Agricultural Credit Guaranteed Scheme Fund (ACGSF), Bank of Agriculture (BOA) and Bank of Industry (BOI) were the independent variables that had significant effect on Cassava production for the period under study. From the table, Agricultural Credit Guaranteed Scheme Fund (ACGSF), had a negative and significant influence on Cassava production (CSVPD), this is so because the significance (p-value) of (0.0002) is less than 0.05. It could be deduced from the sign and magnitude of the coefficient that a unit increase in (ACGSF) brought about a (-2.456020)-tones reduction in cassava production. This means that funding from (ACGSF) did not bring about increase in cassava output, despite the funding from (ACGSF) cassava production recorded a reduction in output for the period under study. Agricultural Credit Guaranteed Scheme Fund was not efficient in bringing about increase in output of cassava. This finding is contrary to Tiamiyu, Bwala and Alamode (2017) in their study on how best to explore and exploit the potential of Agricultural Credit Guarantee Scheme Fund (ACGF) in revitalizing the Nigeria economy that was under recession, concluded that the ACGSF is a suitable policy strategy to stimulate agricultural production in order to achieve sustainable growth of GDP in Nigeria. Bank of Agriculture (BOA) had a positive and significant influence on cassava production (CSVPD) with a p-value of 0.0002 which is less than 0.05 at the 5 percent level of significance.BOA had a coefficient value of (0.014092), meaning that a unit increase in Bank of Agriculture (BOA) funding brought about a 0.014092-tons increase cassava production (CSVPD). This means that Bank of Agriculture (BOA) funding brought about increase in cassava production during the period under study. More of Bank of Agriculture funding should be made available to cassava farmers as it is seen from the result to impact positively on the growth of cassava output. Bank of Industry (BOI) had a negative and significant influence on Cassava production (CSVPD), this is so because the significance (p-value) of (0.0005) is less than 0.05. It can be deduced from the sign and magnitude of the coefficient that a unit increase in (BOI) brought about a (-0.023170)-tones reduction in cassava production. This means that funding from Bank of Industry did not bring about increase in cassava output, despite the funding made available from Bank of Industry, cassava production recorded a reduction in output for the period under study. The R-squared of 0.92 shows the model was a good fit for estimation and that variations of cassava production (CSVPD) was explained by the independent variables Agricultural Credit Guaranteed Scheme Fund (ACGSF), Bank of Agriculture (BOA) and Bank of Industry (BOI),

implying that ACGSF, BOA and BOI funding is 68% responsible for changes in cassava production in the Nigeria for the period under study and 32% was not explained but was accounted for by error or disturbance term. The cointegrating equation coefficient shows an average speed of adjustment of -0.209006 convergence to equilibrium. Implying that it will take a speed of adjustment of 20.90% for all variables to converge at equilibrium in the long run. The system is said to correct its previous period of disequilibrium at a speed of20.90% annually.

Table 5 Regression Result for Model Two

ARDL-ECM Coefficients				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	34365505	1854712.	0.000000	0.0000
D(YAMPD(-1))	-0.211940	0.052593	-4.029769	0.0100
D(ACGSF)	1.068221	0.153969	6.937889	0.0010
D(BOA)	0.001483	0.000665	2.230515	0.0761
D(BOI)	-0.038446	0.002246	-17.11856	0.0000
D(IFAD)	-0.248212	0.049277	-5.037027	0.0040
D(PCEXPA)	79.71212	13.88879	5.739312	0.0023
D(PREXPA)	-187.3435	20.37959	-9.192701	0.0003
CointEq(-1)*	-0.546697	0.031530	-17.33872	0.0000
R-squared	0.977575	Durbin-Watson stat		1.892740
Adjusted R-squared	0.961266			
S.E. of regression	807826.9			
Sum squared resid	7.18E+12			
Log likelihood	-294.4425			
F-statistic	59.94030			
Prob(F-statistic)	0.000000			
Long Run Coefficients				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
ACGSF	5.521825	2.283022	2.418647	0.0602
BOA	-0.001414	0.015250	-0.092696	0.9297
BOI	-0.074884	0.046128	-1.623411	0.1654
IFAD	**0.832269**	**0.280645**	**2.965558**	**0.0313**
PCEXPA	-41.29643	66.51130	-0.620893	0.5619
PREXPA	-560.8531	223.7115	-2.507038	0.0540

Source: Author's computation using E-views 10, 2023.

Table 5 shows the ARDL-ECM Regression output. The result shows that Agricultural Credit Guaranteed Scheme Fund (ACGSF), Bank of Industry (BOI), International funding for Agricultural Development (IFAD), public capital expenditure to agriculture (PCEXPA) and public recurrent expenditure to agriculture (PREXPA) were the financial variables that had significant effect on yam production for the period under study. This was so because their respective p-values ACGSF (0.0010), BOI (0.0000), IFAD (0.0040), PCEXPA (0.0023) and PREXPA (0.0003) were all below 0.05. BOI, IFAD and PREXPA all had negative and significant relationship with yam production during the period under study. This was evidenced by their respective coefficients BOI

(-0.038446), IFAD (-0.248212) and PREXPA (-187.3435). This implies that a-unit increase in BOI funding resulted in a 0.038446 decrease in yam output. Also a-unit increase in IFAD funding resulted in a 0.248212 decrease in yam output. Equally, a-unit increase in PREXPA funding resulted in a 187.3435 decrease in yam output. This implies that funding to agriculture from BOI, IFAD and PREXPA had no positive effect in increasing the output of yam for the period under study. On the other hand, Agricultural Credit Guaranteed Scheme Fund (ACGSF) and Public Capital Expenditure to Agriculture (PCEXPA) had a positive and significant influence on yam output. This was established based on the signs and magnitude of their respective coefficients ACGSF (1.068221) and PCEXPA (79.71212). The implication of their coefficients is that a-unit increase in Agricultural Credit Guaranteed Scheme Fund brought about a 1.068221-unit increase in yam output while a-unit increase in public Capital Expenditure to Agriculture brought about a 79.71212-unit increase in yam output. The implication of this findings is that public capital expenditure to Agriculture and Agricultural Credit Guaranteed Scheme Fund do have influence on yam production in Nigeria for the period under study. This finding is similar to Purokayo and Umaru (2012) who reported public capital expenditure to agriculture to have a positive impact on agricultural output in Nigeria. The R-squared of 0.97 shows the model is a good fit for estimation and that variations of yam production (YAMPD) was explained by the independent variables Agricultural Credit Guaranteed Scheme Fund (ACGSF) and Public Capital Expenditure to Agriculture (PCEXPA) implying that ACGSF and PCEXPA funding is 97% responsible for variations in yam production in the Nigeria for the period under study. The cointegrating equation coefficient shows an average speed of adjustment of -0.546697 convergence to equilibrium. Implying that it will take a speed of adjustment of 54.66% for all variables to converge at equilibrium in the long run. The system is said to correct its previous period of disequilibrium at a speed of54.66% annually. In the long run, none of the explanatory variables had significant influence on maize production for the period under study, except for International Fund for Agriculture Development (IFAD), which had a positive and significant relationship with yam production. In the long run (IFAD) brought about a 0.832-unit increase in Yam production.

Table 6 ARDL-ECM Regression Result for Model Three

ARDL-ECM Coefficients				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(BOA)	8.02E-05	4.68E-05	1.712722	0.1148
D(PCEXPA)	1.477366	0.573500	2.576053	0.0258
D(PREXPA)	6.558832	0.822229	7.976897	0.0000
CointEq(-1)*	-0.117476	0.024565	-4.782333	0.0006
R-squared	0.799278			
Adjusted R-squared	0.763856			
S.E. of regression	54118.61			
Sum squared resid	4.98E+10			
Log likelihood	-256.4566			
Durbin-Watson stat	2.083845			
Long Run Coefficients				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**

ACGSF	-0.098261	0.132966	-0.738995	0.4754
BOA	0.001741	0.002255	0.772225	0.4563
BOI	-0.000858	0.001950	-0.440102	0.6684
IFAD	-0.029863	0.030880	-0.967058	0.3543
PCEXPA	17.83384	19.42117	0.918268	0.3782
PREXPA	43.42070	40.88560	1.062005	0.3110

Source: Author's computation using E-views 10, 2023.

From the ARDL-ECM Regression output in Table 6, Public Capital Expenditure to agriculture (PCEXPA) and public recurrent expenditure to agriculture (PREXPA) had significant and positive relationship with potato production. Public Capital Expenditure to agriculture (PCEXPA) in its current period had a positive and significant relationship with potatoe production, with a p-value of (0.0258) and a coefficient of (1.477366), implying that increase in public capital expenditure to agriculture brought about a 1.477-unit increase in potato output.This finding is similar to Purokayo and Umaru (2012) who in their study on Global Food Crisis: Public Capital Expenditure and Agricultural Output in Nigeria, reported public capital expenditure to agriculture to have a positive impact on agricultural output in Nigeria. Also from the result, public recurrent expenditure to agriculture (PREXPA) with a p-value of (0.0000) and a coefficient of (6.558832), implies that an increase in (PREXPA) brought about a 6.558832-unit increase in potatoe production. This implies that the funding scheme do encourage growth in potatoe production. The R-squared of 0.79 shows the model is a good fit for estimation and that variations of potato production (POTOPD) was explained by the independent variables Public Capital Expenditure to agriculture (PCEXPA) and public recurrent expenditure to agriculture (PREXPA) implying that PCEXPA and PREXPA funding is 79% responsible for variations in yam production in the Nigeria for the period under study, the remaining 21% could be attributed to other factors of production. The cointegrating equation coefficient shows an average speed of adjustment of -0.117476convergence to equilibrium. Implying that it will take a speed of adjustment of 11.74% for all variables to converge at equilibrium in the long run. The system is said to correct its previous period of disequilibrium at a speed of11.74% annually.

Post Estimation Tests

The post estimation test was used to determine further the statistical characteristics of the residuals in the models.

Serial Correlation and Heteroskedasticity Test for Each Region

Models	**Serial correlation (Breusch-Godfrey LM Test F-Stat. p-value)**	**Heteroskedasticity (Breusch-Pagan -Godfrey F-Stat. p-value)**
Model one	0.1593	0.2065
Model two	0.8662	0.9446
Model Three	0.7182	0.0898

Source: Author's computation using E-VIEWS 10.0, 2022

The tests for serial correlation and Heteroskedasticity showed that the models were free from serial correlation, this is so because the F-probability values were greater than 0.05. The residuals of the

models were homoscedastic with no problem of Heteroskedasticity, since the F-probability values were greater than 0.05. Meaning the error term is constant throughout the series of the model.

Conclusion

From the findings of the study, the various agricultural lending schemes do have influence on tuber crop production in Nigeria both negatively and positively, it was concluded that the agricultural funding schemes have not been properly maximized to boost staple crop production and sustainability, evidenced by the negative coefficients of some of the funding scheme on the selected tuber crops and the exclusion of several funding schemes in the ARDL-ECM models meaning they did not contribute either positively or negatively in such situations.

Recommendations

Based on the findings of the research work, the following recommendations are made:

1. Agricultural Credit Guaranteed Scheme Fund (ACGSF) and Bank of Industry (BOI) should be properly managed with regard to cassava production so they can have positive influence on the output of cassava in the country.
2. Bank of Industry (BOI), International fund for Agriculture Development (IFAD) and Public recurrent expenditure to agriculture (PREXPA) should be properly managed with regard to yam production so they can have positive influence on the output of yam in the country.

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