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RESEARCH PAPER

Effects of demand for microfinance and commercial banks credits on agricultural productivity in Nigeria

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Abstract

This study quantifies the effect of bank credits on agricultural productivity and as well examines the extent to which government financial allocation and agricultural credit guarantee scheme fund to the agricultural sector has gone in boosting agricultural productivity in Nigeria. The study uses the generalized linear model (GLM) method to explain the explanatory variables effects on agricultural productivity. The result shows that microfinance banks 'credit, commercial banks 'credit, government financial allocation and agricultural credit guarantee scheme fund have positive impact in explaining agricultural productivity in Nigeria. The result also reveals that, even though the relationship between government financial allocation to agricultural sector and agricultural productivity is positive, but the current level of government financial allocation is not statistically significant in explaining the current level of agricultural productivity in Nigeria. The result further shows that the commercial banks is the major contributor to agricultural productivity in Nigeria. The study recommended that, government should ensure the implementation of its microfinance policy and calls for more allocation of commercial banks' credit to the agricultural sector. Also, government spend more in the sector and continue to guarantee loans given to farmers as this will encourage the banks to lend more to the sector.

Keywords: Banks Credits, Agricultural Productivity, Nigeria, GLM Method
JEL classification: G21, E23

Introduction

Agriculture is an inevitable concomitant to the economies of developing countries as it plays a key role in providing food to the population and supplying other sectors with raw materials for the production of goods and services for the industrialized and less developed world (Food and Agriculture Organisation, 2009). Agricultural productivity is measured as the ratio of agricultural outputs to agricultural inputs Lal Mervin (2013). According to the GAP Report, global agricultural productivity must increase by 1.75% annually to meet the demands of nearly 10 billion people in 2050. Global Harvest Initiative (GHI) annual assessment of global productivity growth – the GAP Index – shows the current rate of growth is only 1.66%. This shows that, global agricultural productivity growth is not accelerating fast enough to sustainably feed the world in 2050, because agricultural productivity is an important component of food security (GAP, 2018)

Improving agricultural productivity is important for many reasons. Aside from providing more food, improving agricultural productivity is important in order to improve farmer incomes, and it requires increases in yield, better productivity through the efficient utilization of resources, lowers costs for farmers, reduces loss and waste in the value chain and supplies food and agriculture products for consumers at lower prices and ensuring that farmers receive fair prices for output

Increasing the productivity of farms affects the region's prospects for growth and competitiveness on the agricultural market, income distribution and savings, and labour migration. An increase in a region's agricultural productivity implies a more efficient distribution of scarce resources. As farmers adopt new techniques and differences, the more productive farmers benefit from an increase in their welfare, while farmers who are not productive enough will exit the market to seek success elsewhere. (Mundlak, Yair, 2007)

It is not only the people employed in agriculture who benefit from increases in agricultural productivity. Those employed in other sectors also enjoy lower food prices and a more stable food supply. Increases in agricultural productivity lead also to agricultural growth and can help to alleviate poverty in poor and developing countries, where agriculture often employs the greatest portion of the population. As farms become more productive, the wages earned by those who work in agriculture increase. At the same time, food prices decrease and food supplies become more stable. Labourers therefore have more money to spend on food as well as other products. This also leads to agricultural growth. People see that there is a greater opportunity to earn their living by farming and are attracted to agriculture either as owners of farms themselves or as labourers (OECD, 2006).

One key tool in improving agricultural productivity may be in the rapidly growing area of microfinance and commercial bank credits, which refers to the provision of financial services to poor and low-income people. Indeed, it is generally recognized that credit plays a crucial role in economic development in general and agricultural development in particular; (Simtowe *et al*., 2008; CTB, 2012). Therefore, credit appears as a solution to the weakness of rural savings by allowing producers to cover the expenses related to production.

Access to credit is expected to have a positive effect on the adoption of new technologies, use of good and recommended agricultural practices and, therefore, on the productivity and farmers' livelihood. The advocates of microfinance and commercial bank credits suggest that it will highlight more opportunities for farmers or the poor to improve their productivity and, hence, quality of life.

According to Otsuka et al. (2013), on average, the sector accounts for 70% of full-time employment, 33% of national income, and 40% of total export earnings in Africa. And without a well-functioning financial market, there is unlikely to be a significant improvement in agricultural productivity and the livelihood of African rural populations. (Diagne, 1999).

In Nigeria, agriculture remains the mainstay of the economy since it is the largest sector in term of its share in employment. Agriculture, value added (% of GDP) in Nigeria was 20.76%, 20.24%, 20.63%, 20.98%, 20.85%, 21.2% and 21.91% as of 2013, 2014, 2015, 2016, 2017, 2018 and 2019 respectively (NBS, 2019). Despite the significance of the agricultural sector to poverty reduction and overall development of the Gross Domestic Product of the country, the sector is characterized by low production, very insignificant per capita contribution and poorly functioning markets for outputs. Smallholder farmers rely on rudimentary methods and technology and they have limited skills and inputs such as improved seeds that would increase yields (MoFA, 2008). Peasant and subsistence farming with the use of rudimentary technologies have been very predominant in the agricultural sector of Nigeria, resulting in low levels of production.

Since 1972 to 2016, successive governments and Central Bank of Nigeria have come up with numerous programs to address the inability of agricultural output to keep pace with the country's demand for agricultural products (Iwuchukwu & Igbokwe, 2016). But credit constraint is a crucial issue in the productivity of agriculture in Nigeria. So, sometimes it is extremely difficult for farmers to get access to credit as the credits are not collateral-free. This inadequate fund has negative impact on the agricultural productivity of the whole country. Nevertheless, microfinance institutions (MFIs) and commercial banks credits have only had a marginal impact on the agriculture sector to a great extent.

Also, there is high interest rate on agricultural loan in Nigeria and the problem of low performance of the agricultural credit guarantee scheme fund as observed by Efobi & Osabvohien (2011). In their view, agricultural credit guarantee scheme fund (AGGSF) has lofty aims especially the need to make the agricultural sector lucrative but it has not lived up to its bidding and the government's effort to fortify the Nigeria agricultural sector has not yielded the desired result also(Udensi, Orebiyi, Ohajianya & Eze, 2012). Thus, the need for further investigation in this area cannot be overemphasized. This calls to empirical assessment with a view to understanding the resultant effect from the huge investment from the government into this sector.

Many empirical studies have estimated agricultural productivity around the world, but only few focused on aggregate efficiency of microfinance and commercial banks credits (See Sunny, 2003; Nwankwo, 2013; Obilor, 2013; Egwu, 2016). This study sets out to fill this important information gap, especially by comparing the different credits in relation to agricultural output. The overall objective of this paper is to quantify the effect of banks credits on agricultural production in Nigeria and as well examine the extent to which government financial allocation to agricultural sector and agricultural credit guarantee scheme fund has gone in boosting agricultural productivity.

The study revolved around the answering of the following research questions: What extent does microfinance and commercial bank credits used influences the agricultural output in Nigeria? Does government fund allocation to agricultural sector and agricultural credit guarantee scheme loan has any significant growth in agricultural productivity? This study is significant in that it will reveals how these variables contributed to the agricultural production through the financial system in Nigeria. It will guide policy makers such as the government and the private sector in making policies that will favour the economy.

Literature Review

Udoka *et al.* (2016) examined the effect of commercial banks' credit on agricultural output in Nigeria. Estimated results showed that there was a positive and significant relationship between agricultural credit guarantee scheme fund and agricultural production. This means that an increase in agricultural credit guarantee scheme fund could lead to an increase in agricultural production in Nigeria; there was also a positive and significant relationship between commercial banks credit to the agricultural sector and agricultural production in Nigeria.

For example, Martey *et al*. (2015) determines the impact of credit on smallholders' technical efficiency of maize producing households in northern Ghana and reported that credit had positive impact on the technical efficiency of farmers and that the mean efficiency scores attained by credit beneficiaries was 62% whereas non-credit beneficiaries obtained about 53%. Sossou *et al*. (2014) examines farmers' credit allocation behaviors and their effects on technical efficiency in Benin. The findings reveal that spending credit in obtaining farm inputs has positive impact on technical efficiency and farm revenue of the borrowers, while Sihlongonyane *et al*. (2014) examines the role of agricultural credit on production efficiency of farming sector in Faisalabad, Pakistan. The results signify that farmers achieved an average technical efficiency score of about 78% showing 22% level of inefficiency among the sample farmers. The findings also revealed that education, herd size, years of experience in farming, access to farm credit and number of farming practices had significant effect on the technical efficiency level of farmers.

Chandio et al. (2016) analyzed the impact of formal credit on agricultural output in Pakistan by using secondary data from 1996 to 2015. The findings show that formal credit has a positive and significant impact on agricultural output. However, Alvaro et al. (2012) used panel data from surveys conducted in 2006 and 2008 to study the impact of access to credit on farm production of fruit and vegetable growers in Chile. The findings show that short term credit does not have an impact on agricultural productivity.

Nnamocha and Eke (2015) investigated the effect of Bank Credit on Agricultural Output in Nigeria via Error Correction Mode (ECM) using yearly data (1970- 2013). Empirical results from the study showed that, in the long-run bank credit and industrial output contributed a lot to agricultural output in Nigeria, while only industrial output influenced agricultural output in the short-run. Using OLS, Agunuwa et al. (2015) finds that there is a positive relationship between commercial banks' credit and agricultural productivity in Nigeria. Furthermore, Obilor (2014) and Enyim et,al (2013) have also made remarkable contributions, he finds that Agricultural Credit Guarantee Scheme Fund in Nigeria affected agricultural productivity positively and significantly. Using annual data for 1970-2013 and an error correction model (ECM).

According to Udih (2014) and Bank credit is expected to impact positively on the investible sectors of the economy through improved agricultural production of goods and services. He opined that sufficient financing of agricultural projects will not only promote food security, but also enhance the entrepreneurship performance of our young investors. Concluding that, this is borne out of the expectation that a good match between adequate bank credit and agricultural entrepreneurship will ensure massive agricultural productivity. Imoisi et al. (2012) and Ammaini (2012) examined the effects of credit facilities on agricultural output and productivity in Nigeria from 1970-2010. Results showed that there is a significant relationship between Deposit Money Banks loans and advances, and agricultural output. Similarly, investigated the relationship between agricultural production and formal credit supply in Nigeria.

Ahmad, Ahmad and Mariah (2014) Access to microfinance could view as in improving the productivity of farmers and contributing to uplifting the livelihoods. It also increases the production through which farmer is able to reinvest its surplus amount to gain maximum profit. Similarly, Girabi (2013) examined the impact of microfinance on smallholder farm productivity in Tanzanian and finds that agricultural credit beneficiaries have higher agricultural productivity than non-credit beneficiaries. Baffoe et al. (2014) studied the relationship between credit and agricultural production in Ghana. The results show that farmers that have access to credit had larger average profit is larger while their profitability is statistically different from farmers that do not have access to credit.

In addition, Onoja (2012) analysed the trends and pattern of institutional credit supply to agriculture during pre- and post-financial reforms (1978 - 1985; and 1986 - 2009) along with their determinants. Results obtained showed an exponentially increasing trend of agricultural credit supply in the economy after the reform began. It was also discovered that stock market capitalization, interest rate and immediate past volume of credit guaranteed by ACGSF significantly influenced the quantity of institutional credit supplied to the agricultural sector over the study period. Overall, there was a significant difference between the credit supply function during the pre-reform and post reform periods.

Adofu, Abula & Agama (2012) studied on the examination of the impact of budgetary provision of the government to the agricultural sector on its performance employing annual data from 1995-2009. Employing the ordinary least squares multiple regression model, the findings revealed that the relationship that existed between budgetary provision to agricultural sector and Nigerian agricultural production was found to be significant, strong and positive. The recommendations made from the study were that, the allocation from the budget to the agricultural sector should be increased and monitored to achieve employment, food security, and ultimately, enhanced growth and development of the Nigerian economy.

Okwocha, Asogwa & Obinne (2012) and Uger (2013) studied the effect government expenditure on the Nigerian agricultural output. The variables of this study included foreign direct investment on agricultural sector, annual rainfall, government expenditure on agricultural sector, agricultural credit guarantee scheme fund, and commercial bank loans and advances to the agricultural sector. The result of the estimated OLS model revealed that, the relationship that existed between government expenditure on agriculture and Nigerian agricultural sector output was found to significant and positive during the evaluation period.

Theoretical Framework and Model Specification

Theoretical Framework

Intensity of Credit Use: According to Schultz (1964), farmers in traditional agriculture act economically rationally within the context of available resources and existing technology. Accordingly, poor farmers allocate resources in a manner consistent with the neo-classical profit maximization model. Thus, in the context of this study the cassava farmers' decision to access credit is based on the assumption of expected utility maximization. When confronted with a choice between whether to borrow money or not, the smallholder cassava farmers would compare the expected utility of borrowing with non-borrowing. The farmers' decision to borrow is expected to be influenced by a set of household socioeconomic and demographic variables. Thus, farmer J's expected utility of access and non-access to credit can be expressed as follows:

$$EU_{kj} = \lambda_k X_j + \varepsilon_{kj} \quad (1)$$

$$EU_{mj} = \lambda_m X_j + \varepsilon_{mj} \quad (2)$$

Where EU_{kj} and EU_{mj} denote the expected utility with non-access and access to credit, respectively, and X represents a set of the cassava farmer J's socioeconomic and demographic variables. ε is a random disturbance and assumed to be independently and identically distributed with mean zero. Then the difference in expected utility may be written as:

$$EU_{mj} - EU_{kj} = (\lambda_{mj} X_j + \varepsilon_{mj}) \text{-} \ (\lambda_{kj} X_j - \varepsilon_{kj} \quad (3)$$

$$= (\lambda_m \text{-} \lambda_j) X_j + (\varepsilon_{mj} \text{ - } \varepsilon_{kj}) \ = \ \lambda X_j + \varepsilon_j \quad (4)$$

If $EU_{mj} - EU_{kj} > 0$, the cassava farmer will prefer to borrow money. Thus, the difference of the expected utility between access and non-access to credit is the potential factor that influences the farmers' decisions.

Many of the numerous studies that assessed the determinants of access to credit had treated access to credit as a binary variable and utilized the Logit, Probit, or Linear probability. Logit and Probit models are appropriate when the dependent variable is dichotomous (0, 1). In this study our objective goes beyond the determinants of access to credit to analyse the intensity of the credit use, therefore we adopt the Tobit model. This is because the Tobit model which is an extension of the Probit model is useful for continuous values that are censored at or below zero as we have in this data set. When a variable is censored, regression models for truncated data provide inconsistent estimates of the parameters.
The Tobit model assesses not only the probability of access to credit, but also the intensity or degree of access to credit measured by the total amount of credit obtained by the farmer for the production season under study in relation to the farmer's socioeconomic and demographic variables. The Tobit model supposes that there is a latent unobserved variable $g_i^{\bullet}$ that depends linearly on x_i through a parameter vector α. There is a normally distribute error term ε_i to capture the random influence on this relationship. The observed variable g_i is defined as being equal to the latent variable whenever the latent variable is above zero and equal to zero otherwise.
Tobit model is used on the assumption that efficiency scores are bounded by zero and unity with the upper limit set at one implying that the distribution is censored at both tales.

$$g_i = \begin{cases} g_i^{\bullet} & if > 0 \\ 0 \ \ if & g_i^{\bullet} \leq 0 \end{cases} \quad (5)$$

where $g_i^{\bullet}$ is a latent variable:

$$g_i^{\bullet} = \alpha x_i + \varepsilon_i, \quad \varepsilon_i N(0, \sigma^2) \quad (6)$$

If the relationship parameter α is estimated by regressing the observed g_i on x_i the resulting Ordinary Least Squares estimator (OLS) is inconsistent inefficient and biased estimates because it underestimates the true effect of the parameters by reducing the slope (Gujurati, 2003). Maddala (1983) has proven that the likelihood estimator suggested by Tobin (1958) for this model is consistent.

The likelihood function of the model (5) is given by L as follows:

$$L = \psi_0 F_i x_i (g_{0i}) \psi_1 f_i (g_i) \quad (7)$$

$$L = \psi_0 [1 - F_i (x_i \alpha / \sigma)] \psi_i \sigma^{-1} f[(g_i - x_i \alpha)/\sigma] \quad (8)$$

where f and F are the standard normal density and cumulative distribution functions, respectively. Then we can write the log-likelihood function as:

$$LogL = \sum_0 \log(1 - F(x_i \alpha / \sigma) + \sum_1 \log(\frac{1}{(2\psi\sigma^2)^{1/2}}) - \sum_1 \frac{1}{2\sigma^2}(g_i - \alpha x_i)^2 \quad (9)$$

The parameters α and σ are estimated by maximizing the log-likelihood function:

$$\begin{cases} \dfrac{\partial LogL}{\partial \alpha} = -\sum_0 \dfrac{x_i f(x_i \alpha)/\sigma}{1 - F(x_i \alpha / \sigma)} + \dfrac{1}{\sigma^2} \sum_1 (g_i - \alpha x_i) x_i = 0 \\ \dfrac{\partial LogL}{\partial \alpha^2} = \dfrac{1}{2\sigma^2} \sum_0 \dfrac{\alpha x_i f(x_i \alpha / \sigma)}{1 - F(x_i \alpha / \sigma)} - \dfrac{n_i}{2\sigma^2} + \dfrac{1}{2\sigma^4} \sum_1 (g_i - \alpha x_i)^2 = 0 \end{cases} \quad (10)$$

Since the two equations (10) are non-linear, the maximum likelihood estimator must be obtained by an iterative process (Greene, 2003).

Model Specification

With refer to the theoretical frameworks stated above, special attention is paid to factors that affect agricultural productivity and identify the most crucial important variables for the growth of the agricultural sector in Nigeria from 1992 to 2019. These credits to the agricultural sector are classified into; microfinance credit, commercial bank credit and the public sector (government) credit. On the above highlighted facts, this study will examine the efforts of some stakeholders such as the microfinance institutions, commercial banks, government policy with respect to the her financial allocation to agriculture and the Agricultural Credit Guarantee Scheme Fund in Nigeria, in relationship to the agricultural production output.
Thus, the study hypothesised that, an increase in credit to the agriculture sector by financial institutions provides investible funds needed for investment in agriculture in the country. This in turn leads to an increase in the output of agriculture. Based on this theoretical postulation, the study specified agricultural production as a linear function of credit disbursed by microfinance banks and commercial banks to agricultural sector, government expenditure on agriculture and agricultural credit guarantee scheme fund. In relation to theoretical framework above and based on these determinant factors, the empirical model adopted in this study is thus specified as;

$$LOGAGP_t = \beta_0 + \beta_1 LOGMBCA_t + \beta_2 LOGCBCA_t + \beta_3 LOGGFAA_t + \beta_4 LOGACGS_t + \mu_t \qquad (11)$$

Where AGP_t is the Agricultural Productivity measured by agricultural gross domestic product. Agricultural output as the dependent variable was being proxy by agricultural gross domestic product was used as the dependent variable to represent agricultural output. $MBCA_t$ at time t is Microfinance Banks' Credit to Agricultural Sector. $CBCA_t$ at time t is Commercial Banks' Credit to Agricultural Sector. $GFAA_t$ at time t is Government Financial Allocation to Agricultural sector. And $ACGS_t$ at time t is Agricultural Credit Guarantee Scheme Fund.

Where b_0 is constant, b_1 - b_4 are slopes and μ_t ~NIID(0,1) thus, a white noise stochastic disturbance term and time t is in annually. In order to reduce errors. In order to reduce errors and to improve on the linearity of the model, we introduced log into the model.

Given a functional as $AGP = f(\underset{+}{MBCA}, \underset{+}{CBCA}, \underset{+}{GFAA}, \underset{+}{ACGS})$. The sign beneath each variable show the expected direction of AGP in response to the corresponding explanatory variable. Therefore, we expect as the apriori expectation the parameters b_0, b_1, b_2, b_3 and b_4 to be greater than zero. Implies a positive relationship between the dependent variable. This implies that an increase in these independent variables will lead to an increase in agricultural output or otherwise. The parameters are impacts and their values are expected to be positive.

Estimation Technique and Sources of Data

Estimation Technique

As such an appropriate estimation procedure will be adopted. With the formulated models in equation 11, this study carried out the model estimations. The first step is the unit root test which involves the determination of the order of integration, using the ADF - Fisher Chi-square test statistic. The second aspect is to test for cointegration, using the Engle-Granger single-equation cointegration test. The third aspect is the impact relationship between the dependent and the independent variables which is run over the sample period 1992 - 2019, using the Generalized Linear Model (GLM) (IRLS - Fisher Scoring) method. IRLS, which stands for Iterated Reweighted Least Squares, is a commonly used algorithm for estimating GLM models. This study hypothesis were tested using the Generalized Linear Models (GLM). The fourth and final test is for Specification Errors which is carried out by Ramsey Regression Equation Specification Error Test (RESET).

The GLM approach is attractive because it provides a general theoretical framework for many commonly encountered statistical models. The canonical treatment of GLMs is Nelder and Wedderburn (1972), and this review closely follows their notation and approach. Begin by considering the familiar linear regression model, $Y_i = X_i'\beta + \varepsilon_i$, where $i = 1,...,N$, Y_i is a dependent variable, X_i is a vector of k explanatory variables or predictors, β is a k-by-1 vector of unknown parameters and the ε_i are zero-mean stochastic disturbances. Typically, the ε_i are assumed to be independent across observations with constant variance σ^2, and distributed normal. That is, the normal linear regression model is characterized by the following features:

a) A *random component* or stochastic component: specifying the conditional distribution of the response variable, *Yi* (for the *i*th of *n* independently sampled observations), given the values of the explanatory variables in the model. The Y_i are usually assumed to have independent normal distributions with $E(Y_i) = \mu_i$, with constant variance σ^2, or $Y_i \sim^{iid} N(\mu_i, \sigma^2)$

b) A linear predictor or systematic component: the covariates X_i combine linearly with the coefficients to form the linear predictor $\eta_i = X_i'\beta$. That is a linear function of regressors

$$\eta_i = \alpha + \beta_1 X_{i1} + \beta_2 X_{i2} + ... + \beta_k X_{ik} \qquad (12)$$

c) A smooth and invertible linearizing link function $g(.)$, which transforms the expectation of the response variable, $\mu_i \equiv E(Y_i)$ to the linear predictor. That is the link between the random and systematic components: the linear predictor $X_i^{'}\beta = \eta_i$ is a function of the mean parameter μ_i via a *link* function, $g(\mu_i)$. Note that for the normal linear model, *g* is an identity.

$$g(\mu_i) = \eta_i = \alpha + \beta_1 X_{i1} + \beta_2 X_{i2} + ... + \beta_k X_{ik} \quad (13)$$

The corresponding density functions for the Normal distribution from the exponential family is given by:

$$f(y_i, u_i, \sigma^2, w_i) = \left(\frac{2\pi\sigma^2}{w_i}\right)^{-\frac{1}{2}} \exp\left(\frac{-(y_i^2 - 2y_i u_i + u_i^2)}{2\sigma^2 / w_i}\right) for -\infty < y_i < \infty \quad (14)$$

Sources of Data

The research relied on secondary data for the analysis, which concentrated on microfinance credit, commercial banks credit, Government Allocation to Agriculture to agricultural productivity within the time frame of 1992 – 2019. There were sourced basically from the secondary sources such as Central Bank of Nigeria (CBN) statistical bulletins (2019), National Bureau of Statistics (NBS), 2019 and CBN statement of accounts and annual reports of various years. The choice of the data scope is determined was informed by the availability of the data as the size of the data is also believed to be large enough to bring about a robust result. The period is significant because a lot of measures were adopted following the introduction of microfinance institutions and agricultural credits, and implementation and role in financing the agricultural sector.

Analysis and Discussion of Results

These tests are used in establishing the objective of the study. The short-term movements of agricultural production and the explanatory variables are expected to be stable within the period under review.

Unit Root Test

For the existence of cointegration in data set to be established, it requires variables to be integrated of order one. This implies that, all series should be stationary in first difference but not in levels (Dickey and Fuller, 1978, 1981). This will reveal the long-run relationship between the variables. In this study, to determine the order of integration, we test for the presence of unit root, using the Augmented Dickey-Fuller (ADF) test statistic, and the summary of the results of the tests are presented in Table 1.

Table 1: Summary of Results of Unit Root Tests

Null Hypothesis: Unit root (individual unit root process)					
Series: LOGAGP, LOGMBCA, LOGCBCA, LOGGFAA, LOGACGS					
Method			Statistic		Prob.**
ADF - Fisher Chi-square			73.0598		0.0000
ADF - Choi Z-stat			-6.97569		0.0000
** Probabilities are computed assuming asympotic normality.					
Intermediate ADF test results					
Series	t-Stat	Prob.	Order of Integration	Max Lag	Obs
D(LOGAGP)	-3.8457	0.0314	I(1)	1	25
D(LOGMBCA)	-5.7527	0.0005	I(1)	1	25
D(LOGCBCA)	-5.7451	0.0005	I(1)	1	25
D(LOGGFAA)	-7.6346	0.0000	I(1)	1	25
D(LOGACGS)	-5.0634	0.0023	I(1)	1	25
Test critical values:	1% level	-3.09800			
	5% level	-2.80400			
	10% level	-2.65400			

The optimum lags length for the ADF determined by Schwarz Information Criterion (SIC).
Source: Author's Computation

From the ADF test statistics, comparing the variables p values levels with the first difference ADF unit root test statistic and various probability's, the results show all the included variables were integrated at order one, that is I(1) or they were stationary at first difference. Five variables were statistically significant at 1%, 5% and 10% critical values in first difference. From the results in the above tables' summary, there is an existence of unit root. This implies that all the series are non-stationary at levels. Therefore, the null hypothesis (ρ = 1) is accepted at levels and the null hypothesis (ρ = 1) that the series are non-stationary after the first difference is rejected for all the series. We therefore concluded that the series are of order one I(1). This implies that a long rum equilibrium exist between the dependent variable (LOGAGP) and the included independent variables.

Single-Equation Cointegration Test

In this study, we carry co-integration test for the variables in the models using Engle-Granger cointegration test for a single-equation test. The result of co-integration for the variables is shown in table 2 below. The result shows that there exists one co-integrating equation at 1%, and 5% level of significance. This result indicates that there is a long run relationship between the dependent and all the independent variables used in both models.

Table 2: Engle-Granger Cointegration Test Results

Series: LOGAGP LOGMBCA LOGCBCA LOGGFAA LOGACGS					
Null hypothesis: Series are not cointegrated					
Cointegrating equation deterministics: C					
Fixed lag specification (lag=1)					
Dependent	tau-statistic	Prob.*	z-statistic	Prob.*	Long-run residual variance
LOGAGP	-3.858037	0.2727	-27.00572	0.0211	0.055298
LOGMBCA	-3.971793	0.2368	-34.91183	0.0003	0.994473
LOGCBCA	-1.873931	0.9591	-7.624863	0.9419	0.075283
LOGGFAA	-3.485414	0.4132	-26.39732	0.0270	0.536340
LOGACGS	-3.028674	0.6147	-20.05323	0.1960	0.209646

Authors' Computation

The Engle-Granger tau-statistic (t-statistic) and normalized auto-correlation coefficient (which we term the z-statistic) both do not reject the null hypothesis of no cointegration at the 5% significance level. The probability values are derived from the MacKinnon response surface simulation results. Given the small sample size of the probabilities and critical values there is evidence of no cointegrating equations at the 5% level of significance using the tau-statistic (t-statistic). While there is evidence of three cointegrating equations at the 5% level of significance using the z-statistic. They are the variables LOGAGP, LOGMBCA and LOGGFAA. This implies that z-statistic did not rejected the null hypothesis of no cointegration among the variables at the 5% level of significance.

Long-run residual variance" is the estimate of the long-run variance of the residual based on the estimated parametric model. The estimator is obtained by taking the residual variance and dividing it by the square of 1 minus the sum of the lag difference coefficients. These residual variance and long-run variances are used to obtain the denominator of the z-statistic. On balance, using the z-statistic of the Engle-Granger test, evidence clearly suggests that there is three cointegration equation between the variables at 5% significance level, and the null hypothesis of no cointegration rejected. This implies that there exists a long-run relationship or cointegration between AGP and MBCA and GFAA.

Interpretation of Estimated Coefficients

Table 3: Coefficients impacts Estimate

Dependent Variable: LOGAGP					
Method: Generalized Linear Model (Newton-Raphson / Marquardt steps)					
Family: Normal					
Link: Identity					
Dispersion computed using Pearson Chi-Square					
Coefficient covariance computed using outer product of gradients					
Variable	Coefficient		Std. Error	z-Statistic	Prob.
C	b_0	3.729076	0.519137	7.183225	0.0000
LOGMBCA	b_1	0.094492	0.046745	2.021443	0.0432
LOGCBCA	b_2	0.391259	0.080268	4.874409	0.0000
LOGGFAA	b_3	0.115720	0.076199	1.518648	0.1289
LOGACGS	b_4	0.372005	0.055109	6.750324	0.0000
a-priori assumptions: $b_0 > 0$, $b_1 > 0$, $b_2 > 0$, $b_3 > 0$ and $b_4 > 0$					

Akaike info criterion	0.116524	Schwarz criterion		0.358466
Hannan-Quinn criter.	0.186195	Deviance		1.139810
Deviance statistic	0.054277	Restr. deviance		51.52340
LR statistic	9.201731	Prob(LR statistic)		0.013438
Pearson SSR	1.139810	Pearson statistic		0.054277
Dispersion	0.054277			

Source: Authors' Computation

The result in Table 3, shows that the coefficients of are fully in line with our apriori expectation.

The result find support for all the hypotheses and overall the empirical results displayed total conformation to the previous researches. In this study the z-statistic is computed as the ratio of an estimated coefficient to its standard error, is used to test the hypothesis that a coefficient is equal to zero. To test our hypothesis we used both the probability (p-value) of observing the z-statistic given that the coefficient is equal to zero. For this study we are performing the test at the 5% significance level, that is, a p-value of 5% are taken as evidence to reject the null hypothesis of a zero coefficient (H_0: $\beta_1 = \beta_1 = 0$) and accept the alternative (H_1) (H_1: $\beta_1 \neq \beta_1 \neq 0$). The low probabilities values strongly rejected the null hypotheses and indicate that these variables are significantly in explaining the dependent variable in the model. In other words their parameters are significantly different from zero (H_1: $\beta_1 \neq \beta_1 \neq 0$). While high probabilities values strongly accept the null hypotheses and indicate that these variables are not significantly in explaining the dependent variable in the model. In other words, their parameters are not significant different from zero (H_0: $\beta_1 = \beta_1 = 0$).

In the estimated regression line above, the value of b_0 (the constant term) is 3.73 which means that holding the value of all the explanatory variables (MBCA, CBCA, GFAA and ACGS) used constant or with no contribution of these variables to agricultural productivity (AGP), the value of AGP will increase by 3.73% in Nigeria annually. The implication of this is that agricultural sector autonomous behaviour is highly significant (z-stat =7.183 and p- values = 0.00) in explaining agricultural productivity.

The results in Table 3 show that estimated coefficient of microfinance banks' credit to agricultural sector (MBCA) is 0.0945(9.45%), commercial banks' credit to agricultural sector (CBCA) is 0.3913 (39.13%), government financial allocation to agricultural sector (GFAA)is 0.1157 (11.57%) and agricultural credit guarantee scheme fund (ACGS) is 0.3720 (37.22%), have no expected signs. The variables did conform to a prior expectation.

The result shows that a 1% increase in MBCA will increase AGP by 9.45% in the short run, while a 1% increase in CBCA will increase AGP by 39.13% in the short run. Also, the result shows that 1% increase in GFAA will increase AGP by 11.57% in the short run and 1% increase in ACGS will increase AGP by 37.22 % in the short run. The result also shows that all the explanatory variables has a positive impact in explaining agricultural productivity in the short-run.

The calculated t-statistics for current values of MBCA, CBCA and ACGS are 2.0214, 4.8744, and 6.750 with their probabilities distribution values of 0.0432, 0.0035 and 0.0020 respectively. These results however show that MBCA, CBCA and ACGS are positively and statistically significant in explaining agricultural productivity in Nigeria at annual levels, but MBCA was less significant in explaining agricultural productivity in Nigeria.

The result also show that the calculated t-statistics for current values of GFAA is 1.519 and with a probability distribution value of 0.1289. The result however shows that even though the relationship between GFAA and AGP is positive, but the current level of GFAA relationship is not statistically significant in explaining the current level of agricultural productivity in Nigeria for the period under review.

The result also shows the corresponding LR test statistic and probability. The test indicates that the MBCA, CBCA, GFAA and ACGS variables are jointly significant at roughly the 1% level. We see that the dispersion estimator is based on the Pearson χ^2 statistic and the coefficient covariance is computed using the product of gradients.

Regression Specification Error Test (RESET).

Table 4: Ramsey Reset Test Result

Ramsey RESET Test				
Specification: LOGAGP LOGMBCA LOGCBCA LOGGFAA LOGACGS C				
Omitted Variables: Squares of fitted values				
	Value	Df	Probability	
t-statistic	4.271293	20	0.0004	
F-statistic	18.24394	(1, 20)	0.0004	
Likelihood ratio	18.24394	1	0.0000	
F-test summary:				
	Sum of Sq.	Df	Mean Squares	
Test Deviance	0.543737	1	0.543737	
Restricted Deviance	1.139810	21	0.054277	
Unrestricted Deviance	0.596074	20	0.029804	
Dispersion SSR	0.596074	20	0.029804	
LR test summary:				
	Value			
Restricted Deviance	1.139810			
Unrestricted Deviance	0.596074			
Dispersion	0.029804			

Source: Authors' Computation

The intuition behind the test is that if non-linear combinations of the explanatory variables have any power in explaining the response variable, the model is mis-specified. The following types of specification errors are test with RESET: (1) Omitted variables; the explanatory (LOGMBCA, LOGCBCA, LOGGFAA and LOGACGS) do not include all relevant variables. (2) Incorrect functional form; some or all of the variables in model should be transformed to logs, powers, reciprocals, or in some other way. (3) Correlation between explanatory variables and the error term, which may be caused, among other things, by measurement error in explanatory variables, simultaneity.

The result in Table 4 shows that the Ramsey RESET test used the powers of the fitted values of agricultural productivity (AGP) as we assumed that all explanatory variables are exogenous and the test are likelihood ratio based tests. The top portion of the output shows the test settings, and the test summaries. Looking at the F-statistic, likelihood and probability value, the results show evidence of linearity with no case of omitted variables, incorrect functional form and correlation between explanatory variables and the error term.

Conclusion

Agricultural credit is believed to be a very important ingredient in farming activities as adequate provision of funds to famers makes all activities in the farm possible and leads to increase in output. Based on this perception, the core objective of the present research was to examine and assess the role of access to agricultural credit on agricultural productivity.

The main focus and purpose of this study is to examine credits effect on agricultural productivity in Nigeria. The findings in this study confirm that the joint action of microfinance banks, commercial banks credit to the agricultural sector, government financial allocation to agricultural sector and agricultural credit guarantee loan by purpose in Nigeria contribute greatly and play vital role towards increasing agricultural productivity.

Arising from the findings in this study, it is concluded that, access to credit brings about higher productivity and profit in agricultural production. Credit investments in the agriculture sector enhance the crop production and seasonal income. The results found in this study support the interpretation that credits to the agricultural sector has created the opportunities which were important for the agricultural productivity decline and increase. Hence, the positive relationship between agricultural finances and agricultural productivity also confirms theoretical postulation. This is because an increase in credits given to farmers will encourage many farmers to produce and hence high agricultural investment.

To this end, the study established that even though microfinance bank loans have a positive and a significant impact on agricultural productivity in Nigeria, microfinance bank played less important role in increasing agricultural productivity looking at the coefficient. The result shows that the commercial banks is the major contributor to agricultural productivity in nigeria. Be conventional financial institutions, it implies that it have kin interest in agricultural finance. Further investigation of the result revealed that there existed a significant relationship between agricultural credit guarantee scheme fund and agricultural in Nigeria. This means that increased guarantee of credit by the government via agricultural credit guarantee scheme fund spurred more farmers to collect more loans for agricultural investment and hence increase in agricultural productivity. However, result shown government financial allocation to agricultural sector less significant relationship in the determination of agricultural productivity. The available literatures provide a comprehensive view of different scholars about the relationship between government expenditure on agriculture and agricultural output, but, most of the research findings are not in consensus.

Policy Recommendations

In the light of the above findings, the following recommendations were suggested.

i. The less significant effect of microfinance banks on agricultural output calls for policies that will encourage the microfinance banks to give loans to farmers without much risk. Hence, the Federal Government should ensure the implementation of its microfinance policy, as well as the mandate given to state and local governments to set aside one percent of their annual budgets for on lending through microfinance banks. This is to ensure smooth microfinance delivery in the country.

ii. The positive effect of commercial banks' credit to agriculture on agricultural productivity calls for more allocation of credit to the agricultural sector in Nigeria. This can be achieved by the central bank of Nigeria (CBN) lowering the interest rate charged on farmers for money borrowed for the purpose of agricultural production.

iii. The positive impact and less significant of government finance allocation on agriculture and agricultural productivity also calls for more government spending in the sector as such spending provides the needed fund for the farmers for increased agricultural production.

iv. The positive effect of agricultural credit guarantee scheme fund on agricultural productivity calls for the proper funding of the scheme by the government. Government should to continue to guarantee loans given to farmers as this will encourage the banks to lend more to farmers. The Agricultural Credit Guarantee Scheme (ACGS) should improve on their conditions for credit guarantee in order to make agricultural financing attractive to commercial banks. Also, the government should strengthen the agricultural credit guarantee scheme by meaningful budgetary allocation in order to enhance its capital base significantly.

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