AGRICULTURE FINANCING AND FOOD SECURITY IN NIGERIA

ABDUL MARY YUSUF
Department of Social Sciences and Humanity, Kogi State Polytechnic, Lokoja
E-mail: abmary7878@gmail.com
Tel. : 08036296043

SAHEED ZAKARI
Professor, Economics Department, Nigerian Defense Academy, Kaduna
E-mail: zakss_1@yahoo.co.uk
Tel. : 08039370901

ABRAHAM ALEXANDER
Professor, Economics Department, Nigerian Defense Academy, Kaduna
E-mail: abrahamlex2@gmail.com
Tel. : 08057371739

BERNARD OJONUGWA ANTHONY
Department of Economics, Air Force Institute of Technology
E-mail: bernarddecobros@gmail.com
Tel. : 08065499711

YAKUBU ALFA
Economics Department, Nigerian Defense Academy, Kaduna
E-mail: yakubualfa@nda.edu.ng
Tel.: 08036857217

ABSTRACT
This study examined the impact of public agriculture financing on food security in Nigeria spanning the period of 1981 to 2020. The data for the study were analyzed using the Autoregressive Distributed Lag (ARDL) model. The study used calorie supply per capita as the dependent variable, while the Agricultural Credit Guarantee Scheme Fund, bank credit to the agricultural sector and interest rate were the independent variables. Findings from the study revealed that agriculture financing has a positive impact on food security in Nigeria, with the Agricultural Credit Guarantee Scheme Fund and bank credit to the agricultural sector having positive coefficients in the long-run and in the short-run. The result also shows that interest rate has a negative impact on food security in the long-run and in the short-run. Based on the findings of the study, it recommends that credit facilities through the Agricultural Credit Guarantee Scheme Fund and bank credit should be made available to farmers in order to enhance food security in Nigeria. Equally, the study also recommended that while encouraging farmers to take agricultural credit, the cost of credit to the agricultural sector should be reduced to encourage more farm investment.
Keywords: Agricultural Financing, Food security, Agricultural Credit, Fund, Bank Credit.
JEL: G21, Q14, Q18.

1. INTRODUCTION
Food Security remains a major concern across the world as one in nine people on earth is suffering from hunger (Oluwasanmi et al. 2021; Osabuohien, 2016). Theorists argued that

food insecurity is attributed to the increasing population without a commensurate increase in food production. It could be rightly said that population and food production crises is in tandem with Malthus' theory of population growth. Malthus in his theory argued that population grows in geometric progression while food production grows in an arithmetic progression.

Irrespective of the growing population, every human being needs food not just for energy but to sustain life in general. Hence, the issue of food security cannot be over emphasized because of its necessity to life. Agriculture was once the major source of the country's economy and source of foreign exchange prior to oil discovery. However, the economy post discovery of oil witnessed agricultural production gradually drop, due to less attention by the government, this led to the challenge of food insecurity, unemployment and youth restiveness. The neglect of agriculture as the mainstay of the economy by the federal government over the years also contributed to poverty and some social vices in the society. However, combating food insecurity continues to be a major public policy challenge in developing countries. As such, according to the Food and Agricultural Organization (FAO), over one billion people worldwide are undernourished, many more suffer from micronutrient deficiencies, and the absolute numbers tend to increase further, especially in Sub-Sahara Africa (FAO, 2008). Hence both the developed and developing countries make considerable efforts to increase their food production capacity.

Attainment of food security in any country is usually an insurance against hunger, malnutrition, poverty and unemployment which slow down economic development (Davies, 2009). Generally, a country is food-secure when a majority of its population have access to food in sufficient quantity and quality consistent with decent existence at all times (Idachaba, 2004). It has been documented since the 1980s, that the achievement of food security requires paying attention to the supply-side, which can be secured through agricultural production, commercial imports or food aid, and on the demand-side food, has to be safe, nutritious, and appropriate to meet food preferences (Devereux, Vaitla & Haunstein, 2008).

Undoubtedly, there are immense potentials in Nigeria's agricultural sector, which if properly managed would unleash income growth for farmers, food and nutritional security, and employment opportunities as well as elevate the country to the ranks of leading players in global food markets (Oluwasanmi et al., 2021). However, there are various barriers to repositioning Nigeria's agricultural sector. These include among others, uncompetitive environment for agribusiness, underinvestment, corruption, and lack of access to credits as well as quality agricultural inputs, weak implementation of policies, poor market access and national insecurity (Key, 2022; Downie, 2017).

The major threat to the agricultural sector is insecurity from both the Boko Haram and Fulani herdsmen. In the northeast of Nigeria, the sustained terrorist activities of the Boko Haram have had negative impact on agricultural activities. Not only are farming activities incapable of being carried out under an insecure environment, domestic agricultural production is stifled, farming communities are displaced and access to regional market is blocked (Eigege & Cooke, 2016). In addition to the Boko Haram group, the Fulani herdsmen have become a major threat to farming communities due to incessant attacks on these communities with attendant fatalities (Tunji, 2022).

Besides the issue of insecurity, other important factors affecting food security are Credit facilities and infrastructure (Mubaraq, 2021; Nakazi & Nathan, 2020; Osabohien et al. (2020). Similarly, Adejoh (2021), Bello et al. (2021), and Okhankhuele (2021) emphasized the importance of adequate credit in any investment. It is in this regards that

successive governments in Nigeria came up with different programmes and policies over the years. Specific among these programmes include; the National Accelerated Food Production project (NAFPP), set up in 1972; National Cereals Research Institute (NCRI) in 1974, the Agricultural Credit Guarantee Scheme Fund in 1978; Abakaliki Rice Project in 1978; Green Rice Project in 1986; Agricultural Development Project (ADP) in 1987; Nigeria Agricultural Cooperative Bank (NACB) in 1988.

In addition to the National Special Food Security Programme aimed at offering a practical vehicle for piloting and eventually extending the application of innovative low cost approaches both technical and institutional to improving the productivity and sustainability of agricultural system with the ultimate objective of contributing to better livelihoods for poor farmers on a sustainable basis; the National Fadama Development Project (Fadama I, II, and III) aimed at addressing some of the factors that militate against the full realization of the potential benefit of agricultural production activities. According to Blench and Ingawa (2003), the Fadama projects were aimed at increasing the incomes of Fadama users who depend directly or indirectly on Fadama resources through empowering communities to take charge of their own development schedule. Most recent among this programme and policies are the NIRSAL Anchor Borrower's Programme of the Central bank of Nigeria; Multinational New Rice for Africa in 2000; the Ibom Rice Project in 2001 and the Anchor Borrowers' Programme (ABP) in 2016 (Ayinde et al., 2018).

Over the years, funding for the agricultural sector has increased. Data from the Central Bank of Nigeria (CBN) showed that commercial bank credit to the agricultural sector grew from ₦4.22 billion in 1990, ₦41.03 billion in 2000, ₦128.41 billion in 2010, and ₦1,457.82 billion in 2021 (CBN, 2022). Similarly, the value of loans guaranteed under the Agricultural Credit Guaranty Scheme Fund (ACGSF) grew from ₦98,494. 40 in 1990 to ₦361,450.40 in 2000, ₦ 4,425,861. 84 in 2007, and ₦5,786,729.88 in 2021 (CBN, 2022). But, despite these growing financial commitments to the agricultural sector, food insecurity has been on the rise in the country. Data from the World Development Indicators (WDI) as reported by the Census and Economic Information Center (CEIC) data showed that the prevalence of food insecurity increased from 14% of the population in 1992 to 35% in 2009, and rose to 57% in 2019 (CEIC, 2022). Consequently, the central problem of this study is the rising case of food insecurity in the country despite funding from both government and the private sector.

In addition to government efforts in ameliorating the growing food insecurity, many scholars such Osabohien et al. (2018), Akinriola and Okunola (2017), Bidisha et al. (2017), Chude and Chude (2013), Sers and Mughal (2019), and Agaptus et al. (2019) have carried out researches on the effect of agricultural financing on food security with no consensus on the determinants of food security in Nigeria. It is against this back drop that this study contributes to existing knowledge on the contribution of agricultural financing via commercial bank credit, ACGSF and government expenditure on food security in Nigeria.

2. LITERATURE REVIEW

2.1 Conceptual Review

Key (2021) defined food security simply as the availability at all times of adequate world supplies of basic food-stuffs. The World Bank proposed a definition of food security which remains current today, broadening the emphasis from food availability to include access to food, and narrowing the focus from the global and national to households and individuals: "access by all people at all times to enough food for an active, healthy life" (World Bank, 1986). Food security entails producing food that will go round every citizen

both in quantity and quality (World Bank, 2007). Food security according to FAO (1984) is all people at all times having the physical, social and economic access to sufficient safe and nutritious food in order to meet their dietary needs and food preferences for an active and healthy life. Contrary to FAO's definition Igba (2003), also reported that food security, is the relationship between the total numbers of people as against food available at a particular people on a time. It can as well be seen as a slate of affairs where all people at all times have access to adequate supply of food.

In a similar contest, Oriola (2009), sees food security to entail producing food that will go round every citizen both in quality and quantity. To achieve this, agricultural production needs to be enhanced with adequate knowledge of the environment, climatic condition, the market and its operation, and be aware of price and price mechanism, good transportation system, storage, fashion modality to check glut and be well prepared in case of disasters.

Going by the above definition, the working definition of food security according to this study is the sustained availability of food and the ability of the people to have access to sufficient food to meet their daily needs.

ClassHall (2022) describes agricultural credit as the instruments used to finance agricultural transactions. These instruments include loans, notes, bills of exchange, and banker's acceptances. This type of financing is specially adapted to specific financial needs of farmers and allows them to secure equipment, plant, harvest, marketing, and do other things that are necessary to keep their farms running. Credits are always available on competitive terms to allow farmers who operate in a free market economy to compete with farms that receive subsidies. Similarly, Hassan (2022) argues that agricultural credit is one of the most basic inputs for conducting all agricultural development programmes. Sources of agricultural credit can be broadly classified into institutional and non-institutional sources. Non-Institutional sources include moneylenders, traders and commission agents, relatives and landlords, but institutional sources include co-operatives, commercial banks. However, apart from the moneylenders, cooperative credit sources and the government, nowadays, the long term and short term credit needs of institutions are also being met by Bank of Agriculture and Rural Development. Agricultural credit can also be seen as a type of credit designed purposely for agricultural development of a country with the aim of enhancing food supply and raw materials to manufacturing industry (Braginsii 2015).

Narrowing down from these general definition, this study gives its working definition of agricultural financing as the acquisition and application of capital for the production, processing, and marketing of agricultural products

2.2Theoretical Literature

2.2.1 Sustainability theory

Theories of sustainability make an effort to organize and prioritize social responses to issues with the environment and culture. A political model relates to social systems that uphold human dignity; an ecological model relates to biological diversity and ecological integrity; and an economic model relates to the sustainability of natural and financial capital. Economic theories advocate for the preservation of opportunity, typically in the form of capital.

"We should think of sustainability as an investment problem, in which we would use returns from the use of natural resources to create great opportunities of equal or greater value," wrote economist Robert Solow in his classic definition published in 1991.

According to Shahan (2009), the theoretical underpinnings of sustainability theory are forms of progress that address the needs of the present without endangering the capacity of future generations to address their needs. Following Ukpe (2016), sustainability refers to food security within the context of this study.

2.2.2 Financial Intermediation Theory

The financial intermediation theory of bank credit emanates from the writings of Sealey and Lindley (1977), and much later popularized by great economists such as Keynes (1936). The financial intermediation theory considers banks as financial intermediaries both individually and collectively, rendering them indistinguishable from other non-bank financial institutions in their behaviour, especially concerning the deposit and lending businesses, being unable to create money individually or collectively. The theory holds that banks are merely financial intermediaries, not different from other non-bank financial institutions as they gather deposits and lend them out. In other word, banks create liquidity by borrowing on short term basis and lending in long term long basis, meaning that banks borrow from depositors with short maturities and lend to borrowers at longer maturities (Lyonnet & Werner, 2012).

While Sealey and Lindley (1977) argues that financial intermediation was only one of the functions of banks, Keynes (1936) states that for investments to take place, savings first need to be gathered. This view has also been reflected in the Keynesian growth models by Harrod (1939) and Domar (1947), which are based on the financial intermediation theory of banking, although not explicitly modelling banks. Indeed, this theory provides the justification for failing to incorporate banks and the way they operate in economic models. Harrod and Domar's conclusions have had a significant influence on economic policy in the post-war era, as their work has been interpreted to the effect that developing countries could be helped by international banks who could provide missing domestic savings through their lending from abroad in order to fund economic growth. This logic has resulted in a significant increase in foreign borrowing and indebtedness by developing countries since the World War II.

2.3 Empirical Review

The relevance of credit facility to Nigeria's agricultural sector is not in doubt. Its provision is an effective policy thrust that drives agricultural commercialization and food self-sufficiency. Empirical literature revealed that access to credit facilities enables farmers to satisfy their cash desires encouraged by the agricultural production cycle and consumption requirements (Osabohien et al., 2018). In addition, one of the most challenging factors to agricultural productivity is the inability of farmers to gain access to credit due to the perceived risk and volatility of the sector (Osabohien et al., 2018). Most important one being that banks and other financial institutions are still very reluctant to fund agricultural projects which is evident by stringent credit conditions. Also, it is on record that, food security is a function of adequate food production as well as income to meet the households' nutritional level (Abdul-Jalil, 2015). Agricultural credit facility to farmers could be in the form of funds for the purchase of resources (input and capital) that will propel increased in food production.

Mubaraq (2021) posited that credit financing is one of the problems militating against the performance of agriculture in Nigeria. Against this background, he employed the threshold regression to analyze the impact of Agricultural credit guarantee scheme fund (ACGSF) on agricultural performance in Nigeria between 1981 and 2019. The performance of agriculture was captured using real agricultural Gross Domestic Product (GDP). Annual time series data were obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin and the World Development Indicators (WDI). The results revealed a

U-shaped relationship between real agricultural GDP and ACGSF. In addition, ACGSF has significant positive effects on real agricultural GDP at 1060389 (₦' thousand) and 5951809 (₦' thousand) thresholds. Similarly, Reuben et al. (2020) assessed the impact of ACGSF on agricultural output in Nigeria from 1998 to 2017 using OLS technique. The results showed that ACGSF has significant positive effect on agricultural output. Similarly, Eyo et al. (2020) analyzed the effect of agricultural credit guarantee scheme (ACGSF) on agricultural output in Nigeria using OLS technique. The findings showed significant positive impact of ACGSF on agricultural output. Okafor (2020) examined the effect of commercial banks credit and ACGSF on agricultural development in Nigeria using Augmented Dickey Fuller test, Phillip-Perron test and OLS technique. The results revealed that banks credit to agriculture and ACGSF have no significant effects on agricultural output.

In Vietnam, et al (2020) examined the impact of bank credit on agriculture performance from 2004Q4 to 2016Q4 using Indicator Saturation (IS) break test, ARDL bounds test and Toda-Yamamoto Granger causality test. Their findings revealed that agricultural credit has significant positive influence on agricultural output in both short-run and long-run. Also, a unidirectional causality exists running from agricultural credit to agricultural output. Employing Panel Autoregressive Distributed Lag Model (PARDL) and Vector Error Correction Model (VECM)

Ngong et al. (2020), examined banking sector development and agricultural productivity in Central African Economic and Monetary Community (CEMAC) from 1990 to 2018 using Panel Autoregressive Distributed Lag Model (PARDL) and Vector Error Correction Model (VECM). The findings revealed long-run relationship between banking sector and agricultural productivity. Also, bi-directional causality exists between banking sector and agricultural productivity in the CEMAC region. Contrary to the Vietnam, et al (2020), the PARDL result revealed no significant contribution of bank credits to agricultural productivity in CEMAC. Study in Turkey with time series data from 1998 to 2016 using the Ordinary Least Squares (OLS) technique. The results showed significant positive impact of agricultural credit on agricultural output (Bahsi & Cetin, 2020). Similar study in Nigeria using the Autoregressive Distributed Lag (ARDL) approach reported that credit have significant positive impact on agricultural output in the long run.; while in the short run, bank credit does not have an on agricultural output (Nakazi & Nathan, 2020). Using ARDL technique to analyze quarterly time series data of commercial banks' credit on agricultural growth in Uganda from 2008Q3 to 2018Q4, the findings has no consensus with Nazaki and Nathan (2020). It was concluded banks' credit have no significant impact on agricultural output in both long-run and in the short-run.

Using an Error Correction Model, Emenuga (2019) investigated the effect of commercial bank on real sector development in Nigeria for 37 years (1981-2017). The result showed that there exists a long-run relationship between bank credit and Agricultural development in Nigeria. The study found that the ECM is negative and statistically significant at 5% level of significance. Furthermore, commercial banks' credit to Agriculture and ACGSF were positively related to Agricultural development while the interest rate was found to be negatively related to Agricultural development in Nigeria. In a supporting study, Osabohien et al. (2018) employed the ARDL technique to examine the potential of agricultural credit facilities in terms of commercial bank credit to agriculture and agricultural credit guarantee scheme fund (ACGSF) and their corresponding interest rates to farmers towards increasing agricultural production. It was revealed that the contribution of commercial banks credits and ACGSF was not significant but contribute positively to increasing food security in Nigeria. Similar study was carried out by Anyanwu et al. (2017) used Ordinary Least Squares (OLS) techniques to analyze the impact of commercial banks' credit on agricultural productivity in Nigeria

the study concluded that there is no positive relationship between commercial banks credit and ACGSF on agricultural productivity.

Using a nonlinear autoregressive distributed lag (NARDL) model to investigate the relationship between credit to agriculture and agricultural output in Nigeria from 1992 to 2015. Results show no evidence of asymmetry in the impact of credit on output growth in the agricultural sector (positive and negative changes) in the short-run, but different equilibrium relationships exist in the long-run. The dynamic adjustments show that the cumulative agricultural output growth is mostly attracted by the impact of the positive changes in credit to agriculture with a lag of four quarters of the prediction horizon (Olowofeso et al., 2017).

Given the above review, this study shall improve on existing research by contributing to reconciling the varying opinions on the impact of agricultural credit on food security with emphasis in Nigeria. Contrary to previous studies, this study shall recognize the role of government in providing agricultural credit, infrastructure with the aim of enhancing food security in Nigeria. Periods covered by previous researches in this area may not be applicable to current period as Nigeria is currently faced with various economic challenges raging from floods, revenue falls due global oil price, global health issues caused by viruses to insecurity threatening the lives of farmers. This study therefore expand is scope to a more recent period of 2020. Also, given the dynamic nature of monetary variables, this study employs a more robust pre-estimation technique to test the stochastic behavior of financial time series variables that may be employed in this study.

3. METHODOLOGY

3.1 Theoretical framework

This study is anchored on financial intermediation theory of credit because the theory confers two important benefits that makes it relevant to agricultural farmers. First, it supports the idea that borrowers undertake to borrow fund simply because they do not have sufficient fund for investment. Thus, farmers need more fund to invest in agriculture. As famers' income are augmented by credit, it will raise the level of investment in agricultural sector as well as farmers' savings thereby increasing the efficiency in the allocation of financial funds in the system. Secondly, this theory expresses a proportional relationship between agricultural financing and agricultural output. As such, when there is sustainable increase in agricultural output, there will be a relative increase in food security. Consequently, it models food security as a function of credit.

3.2 Types and Sources of Data

This study makes use of secondary data sourced from the 2021 Central Bank of Nigeria (CBN) statistical bulletin and the Food and Agriculture Organization Corporate Statistical Database (FAOSTAT).

3.3 Model specification

This study adopted the model of Nakazi and Nathan (2020) who applied the Autoregressive Distributed Lag (ARDL) model approach to examine the short run and long run impact of commercial banks' credit on agricultural sector growth. The functional form of their model was stated as:

$$Q_t = f(BC_t, INT_t, INF_t) \qquad (1)$$

Where: Q_t = Agricultural output over time, BC_t = Commercial bank credit to agricultural sector in Nigeria over time, INT_t = interest rate, and INF_t = inflation rate over time.

The ARDL specification of their model was presented as:

$$\Delta \ln Q_t = a_0 + a_1 \ln Q_{t-1} + a_2 \ln BC_{t-1} + a_3 INT_{t-1} + a_4 INF_{t-1} + \sum_{i=1}^{k} b_1 \Delta Q_{t-1} + \sum_{i=1}^{k} b_2 \Delta \ln C_{t-I} + \sum_{i=1}^{k} b_3 \Delta \ln INT_{t-1} + \sum_{i=1}^{k} \alpha_4 \Delta \ln INF_{t-i} + \mu_t \quad (2)$$

The model of Nakazi and Nathan (2020) does not include food security. However, this study identified food security in terms of calorie supply per capita. Calorie supply per capita is amount of secured food available for consumption, measured in kilocalories per capita per day. Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life. Given the above, the model for this study is stated as:

$$CALR = f(AGRC, BCAGR, INTR) \quad (3)$$

where, CALR represents calorie supply per capita, AGRC is the Agricultural Credit Guarantee Scheme Fund, BCAGR represents bank credit to the agricultural, while, INTR stands for interest rate.

The ARDL specification of equation 3 is given as:

$$CALRt = c + \delta_1 CALR_{t-1} + \delta_2 AGRC_{t-1} + \delta_3 BCAGR_{t-1} + \delta_4 INTR_{t-1} + \sum_{j=0}^{p} \propto_j \Delta CALR_{t-j} + \sum_{j=0}^{p} \varphi_j \Delta AGRC_{t-j} + \sum_{j=0}^{p} \omega_j \Delta BCAGR_{t-j} + \sum_{j=0}^{p} \theta_j \Delta \mathrm{INTR}_{t-j} + \varepsilon_t \quad (4)$$

The first part of the equation with the parameters $\delta_1,\ \delta_2,\ \delta_3\ and \delta_4$ represents the long-run ARDL equation while second part of the equation with $\propto_j$, φ_j, ω_j, and θ_j, represents the short-run ARDL model. The null hypothesis of the model is:

$H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$ (There is no long-run relationship)
$H_1: \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq 0$ (There is long-run relationship)

The process start with conducting a bounds test for the null hypothesis of no co-integration. The calculated F-statistic is compared with the critical value tabulated by Pesaran (1997) and Pesaran et al. (2001). If the test statistics exceeds the upper critical value, the null hypothesis of no long-run relationship can be rejected while it is accepted if otherwise.

4. RESULTS AND DISCUSSION OF FINDINGS

Pre-Estimation Statistics

Table 1: *Result of PP and KPSS Unit Root Tests*

Variables	PP Levels	PP First Difference	Order of Integration (PP)	KPSS Levels	KPSS First Difference	Order of Integration (KPSS)
CALR	-1.446	-3.262*	I (1)	0.695	0.323*	I (1)
AGRC	-1.284	-4.728*	I (1)	0.548	0.121*	I (1)
BCAGR	-2.019	-3.500*	I (1)	0.617	0.420*	I (1)
INTR	-3.636*	--------	I (0)		-------	I (0)
				0.347*		
$H_{0\ (PP)}$: Variables are NOT stationary				*$H_{0\ (KPSS)}$: Variables are stationary*		
PP Critical Value at 5% = - 2.938				KPSS Critical Value at 5% = 0.463		

** denotes stationary at 5%*

Source: Computed by the Researchers using E-views 10

Table 1 shows the results of the unit root test. The test was conducted using two unit test options (the Phillips-perron (PP) and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS). The choice of PP and KPSS was informed by their ability to resolve the problem of size distortion suffered by the ADF unit root test. The test was conducted with intercept but no trend. This was because when intercept and trend components were included in the test, the intercept was statistically significant while the trend component was insignificant. Therefore, trend was excluded from the test while intercept was retained in it.

The PP results show that calorie supply per capita (CALR), agricultural credit scheme fund (AGRC) and bank credit to agriculture (BCAGR) are not stationary at levels because their calculated PP values, at levels, were less than their critical values at 5% level of significant. However, at first difference, CALR, AGRC, BCAGR becomes stationary. However, interest rate (INTR) was stationary at levels since its calculated value, at level, is greater than its critical value at 5%.

Like the PP results the KPSS results show that CALR, AGRC and BCAGR are not stationary at levels because their calculated KPSS values, at levels, were greater than their critical values at 5% level of significant. At first difference however, CALR, AGRC, BCAGR becomes stationary. However, interest rate (INTR) like the PP result shows, was stationary at levels because its calculated KPSS value is less than its critical value at 5%.

What could be inferred from Table 1 is that the result of both unit root test options, in terms of the stationarity status of the individual variables, did not disagreed. This further confirmed the reliability of the results of unit root status of the individual variables. Hence, it could be said that the variables of the study are integrated of different orders, with *CALR*, *AGRC*, *BCAGR* being integrated of order one (I(1)) while *INTR* is integrated of order zero (I(0)). The different orders of co-integration of the variables satisfy the condition necessary for the use of the ARDL model in this study.

Table 2: *Result of Lag selection for Co-integration Test*

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1266.542	NA	7.88e+24	68.67797	68.85212	68.73937
1	-1142.179	215.1151	2.27e+22	62.82049*	63.69125*	63.12747*
2	-1122.782	29.35777	1.95e+22	62.63686	64.20424	63.18944
3	-1090.465	41.92423*	8.79e+21*	61.75488	64.01888	62.55305

* indicates lag order selected by the criterion
Source: Computed by the Researchers using E-views 10

LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

The optimal length of lag selection for the co-integration test, based on the six information criteria, is reported in Table 2. From the table, three of the five information criteria, the AIC, SC and HQ suggest that a lag length of one is optimal for the test. Only FPE and LR suggested a lag length of three. Consequently, this study used a lag length of one for the ARDL test of co-integration and for the subsequent diagnostic tests.

Table 3: *F-Bound Test of Co-Integration*

F-Bounds Test			Null Hypothesis: No levels relationship	
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	9.176620	10%	2.37	3.2
K	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Source*: Computed by the Researchers using E-views 10*

The result of F-bound co-integration in table 3 reveals that the F-statistics is 9.177 is greater than 1%, 2.5%, 5% and 10% asymptotic critical values. Therefore, the null hypothesis of no co-integration is rejected in favour of the alternative hypothesis of the presence of co-integration among the variables. Based on the result in table 3, it can be concluded that the variables of the study bear a long-run equilibrium relationship. Specifically, it could be inferred from the result that CALR in current year had equilibrium relationship with AGRC, BCAGR and INTR which keep them in proportion to each other in the long-run for the period under study.

Table 4: *Result of Long-run ARDL Model*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGRC	0.010100	0.004169	2.422643	0.0395
BCAGR	0.292028	0.105809	2.759954	0.3573
INTR	-0.625833	0.322237	-1.942151	0.0847
C	2928.829	3914.746	0.748153	0.4597

Source: *Computed by the Researchers using E-views 10*

Table 4 shows the result of long-run ARDL model. The result shows that agricultural credit guarantees scheme (AGRC) is positive at 0.0101. This implies that, all other things being equal, a 1 per cent increase in agricultural credit guarantee scheme lead to about 0.01 per cent increase in food security in Nigeria over the period of the study. The estimate is statistically significant and conform to the apriori expectation. This finding is in line with Mubaraq (2021) who notes that the ACGSF was formed in order to encourage financial institutions to lend funds to those engaged in agricultural production as well as agro-processing activities in order to enhance the safety of food for local consumption.

Similarly, bank credit to agriculture (BCAGR) is positive and is 0.292. This implies that, all other things being equal, 1 per cent increase in BCAGR lead to about 0.29 per cent increase in food security in Nigeria over the period of the study. The estimate is statistically significant and conform to the apriori expectation. This is because credit is one of the critical inputs for agricultural development. It capitalizes farmers to undertake new investments and/or adopt new technologies thereby demonstrating the importance of agricultural credit in fostering agricultural growth and development. This result supports the outcome of Nazaki and Nathan (2020). However, interest rate (INTR) has negative impact on food security. The result shows that one per cent increase in INTR decreases food security by about 0.626 per cent. This is as expected. INTR is the cost of borrowing capital for investment in agriculture. Therefore, an increase in the cost of borrowing will discourage the farmers to take loan from financial institutions for investment in agriculture. The result agrees with Emenuga (2019).

Table 5: *Result of Short-run ARDL Model*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGRC(-1)	0.000172	5.09E-05	3.381502	0.0019
BCAGR(-1)	0.456477	0.074523	6.125287	0.0000
INTR(-1)	-0.978257	0.332437	-2.942690	0.0370
ECM_{t-1}	-0.156313	0.021793	-7.172495	0.0000

Source: Computed by the Researcher using E-views 10

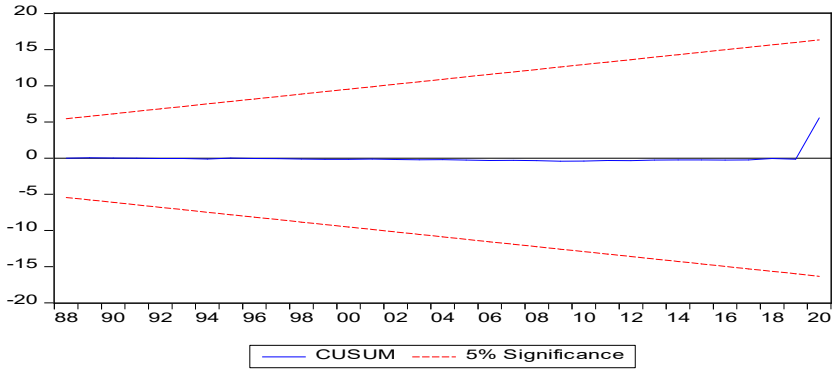
Table 5 shows the result of short-run ARDL model. The results were estimated at first difference which is in line with optimal lag selected by the lag selection criteria. The result reveals a negative error correction term (ECM_{t-1}), as anticipated, and statistically significant at 5 per cent. The negative sign implies that there is adjustment from short-run to long-run equilibrium among the variables of the study. That is, the economy is responsive to deviations from equilibrium such that if the short run variables (AGRC, BCAGR, INTR and CALR) deviate from equilibrium, in the long run they have the tendency to re-adjust back to equilibrium. The coefficient of ECM_t indicates an annual level of adjustment from long-run disequilibrium of about 0.156 per cent per annum. This means that in the current year, about 16 per cent of the disequilibrium errors, which occurred the previous years, are corrected.

Furthermore, all the short-run estimated coefficients are statistically significant. The result shows that Agricultural Credit Guarantee Scheme Fund is positive and significant with a coefficient value of 0.0002, supporting the finding of Eyo et al. (2020). Similarly, bank credit to agriculture (BCAGR) is equally positive at 0.456. This implies that, all other things being equal, 1 per cent increase in BCAGR lead to about 0.46 per cent increase in food security in Nigeria over the period of the study. The estimate is statistically significant and conform to the apriori expectation. However, interest rate (INTR) has negative impact on food security. The result shows that a one per cent increase in INTR decreases food security by about 0.979 per cent. This is as expected. This implies that, all other things being equal, 1 per cent increase in INTR lead to about 0.46 per cent decrease in food security in Nigeria over the period of the study. This finding supports the finding that the cost of borrowing is adversely affects food security.

Table 6: *Result of the Residual Diagnostic Test.*

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	1.686067	Prob. F(3,30)	0.1084
Obs*R-squared	1.044422	Prob. Chi-Square(3)	0.1060
Heteroskedasticity Test: ARCH			
F-statistic	0.151594	Prob. F(10,18)	0.2160
Obs*R-squared	2.865970	Prob. Chi-Square(10)	0.1114

Source: *Computed by the Researchers using e-views 10*



Source: *Computed by the Researchers using E-views 10*
Figure 1: *Stability Test Result*

Table 6 shows the post estimations statistics for the variables of the study. The serial correlation LM test has a probability value of 0.1084 which is greater than 0.05. This suggests the absence of autocorrelation in the model. Similarly, the probability value for the test of heteroskedasticity is 0.2160, implying the absence of heteroskedasticity in the model. Furthermore, the result passed the test of stability. This is because the CUSUM plot reported in figure 1 does not cross either of the 5% critical lines. Therefore, it could be concluded that the estimated parameters for the study are stable for the period under investigation. However, the result failed the test of normality reported on Figure 1.

5. CONCLUSION AND POLICY RECOMMENDATIONS

This study uses the ARDL model to examine the impact of agriculture financing on food security in Nigeria. Food security was proxied by calorie supply per capita while agriculture financing was represented by agricultural credit scheme fund and bank credit to agriculture, the interest rate variable represents the cost of capital in the model. Findings from the study revealed that, both in the short-run and in the long-run, agriculture financing has positive impact on food security in Nigeria over the period of the study. This supports the findings by Osabohien et al. (2018), Mubaraq (2021), Reuben et al. (2020), Eyo et al. (2020), and Nakazi & Nathan, 2020) that appropriate finance for the agricultural sector is vital for agricultural productivity and food security. The study equally concluded that bank credit to the agricultural sector had a higher positive impact on food security in both short and long-run when compared to the Agricultural Credit Guarantee Scheme Fund. This is in support of the finding by Nakazi & Nathan (2020) that concluded that the Agricultural Credit Guarantee Scheme Fund is not well utilized. Emenuga (2019) contends that the cost of borrowing is killing the agricultural sector, and the conclusion of an adverse effect of interest proves this.

Based on the findings of the study, the study recommended that credit facilities through ACGSF and commercial banks should be made available to farmers in order to enhance the security of food in Nigeria. This can be achieved by strengthening the financial capacity ACGSF and increasing the liquidity position of commercial banks. Finally, given that continuous increase in interest rate will lead to fall in agricultural output, there is need to charge a fair price as cost of borrowing for investment in the agricultural sector.

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