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Investigating the impact of agricultural development on food security in Nigeria: An econometric synthesis

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Abstract

Achieving sustainable economic growth and food security remains the central focus of most developing economies of the world. The study examined the impact of economic growth and agricultural development on food security in Nigeria. Using the Autoregressive Distributed Lag (ARDL) model and data covering 27 years period (1990- 2018). The study found that in both the long and short run periods, economic growth and agricultural development have a significant positive impact in reduction of food insecurity in Nigeria. It can be inferred from the findings of the study that an increase in economic growth and agricultural development will invariably translate into improvement of food security outcomes and by extension reduce poverty in Nigeria. The study recommends, among others, investment in rural agriculture in Nigeria.

Keywords: *Agricultural productivity; economic growth; food security; food security outcomes; agricultural development*

Introduction

Achieving sustainable economic growth and food security remains the central focus of most developing economies of the world. Access to food is considered the most important basic need of man. In acknowledgement of this fact, the United Nations General Assembly through its Resolution (2030 Agenda) in 2015 included eradication of poverty and ensuring food security as its first and second sustainable development goals that should be achieved by 2030. Various policy makers have instituted laws, programmes and schemes to help ensure that food security and poverty are eradicated. An economy is said to be food secured if it can guarantee physical and socio-economic access to safe, sufficient daily-recommended food and dietary preferences for healthy living.

The world's population has been projected to exceed 9 billion by 2050 (United Nations, 2019). A huge portion of this growth is expected to come from developing economies in Africa, Asia and Latin America. Unfortunately, the sub-Saharan Africa plays host to the highest amount of food unsecured populace. One out of every three persons suffers from food insecurity and hunger related conditions (Food and Agricultural Organisation, FAO, 2008). There are four cardinal dimensions to food security. These are: availability, access, utilization and stability. For food security to be achieved, food should be available in the right quality and quantity and consumers should have unfettered

access while ensuring optimum utilization and stability in cost. The amount of food available is the food remainder after food spoilt or destroyed during distribution and food exported is subtracted from food produced and imported. To achieve food security, there is the need for a vibrant agricultural sector that produces enough food to meet up with the increasing nutritional needs of the growing population.

The world at various points in time has experienced food crisis of unimaginable proportions. In 1973 and 1974 the world experienced what was later termed "world food crisis" which saw the prices of food product like maize and wheat rise by approximately 57% and 105% respectively (FAO,1999). Similarly, between 1994 and 1996 the global wheat price surged by approximately 35%. During the periods of 1960-1996, the world witnessed increase in food availability from less than 2000Kcal per day to above 2500Kcal per day, however per capita growth of food slowed in the late 1990s (FAO,1999). The World Food Summit's (WFS) goal of halving the number of the worlds undernourished by 2015 remains unmet. The recent COVID-19 pandemic has been projected to cause very severe food insecurity globally and Nigeria is in no way insulated from this pending food crisis which the UN has termed virus-linked hunger. The UN has estimated and linked up to 10,000 child deaths each month to the outbreak of the novel Corona Virus (Abay, et al 2020; Adjognon, et al 2020;Akter, 2020; Aggarwal, 2020; Mahler, Lakner, Aguilar & Wu, 2020; Zurayk, 2020;World Bank, 2020;World Food Programme WFP, 2020a; WFP, 2020b; Amare et al, 2021 and Abay et al., 2021).

Nigeria with a population of over 200 million people has been projected to hit 250 million by 2030 (Worldometer, 2021).This projected increase in population if unaccompanied by increase in agricultural productivity will spell doom for the fight against food insecurity and poverty eradication (Malthus, 1798). In Nigeria the measured averages fall short of the conventional increase. The level of food availability still remains greatly unequal as more than 40% of its population still live on less than $2 per day making it extremely difficult for the country to gain economic access to the recommended daily calories (World Bank, 2020). The year on year Consumer Price Index as at April 2021 stood at 18.12% while the composite food index rose by 22.72% with states like Kogi, Bauchi and Sokoto recording the highest 24.33%, 22.93% and 20.96% respectively (National Bureau of Statistics, 2021).

To solve the problem of food security and poverty, the Nigerian government has developed various schemes and agricultural extension programmes. Schemes such as

Operation Feed the Nation (OFN 1976), National Accelerated Food Production Project (NAFPP 1973), Green Revolution Programme (GRP 1980), The Directorate of Food, Roads and Rural Infrastructure (DFRRI 1986), National Food Security Programme (NFSP 2008), Agricultural Promotion Policy (APP 2016), FarmerMoni, School Feeding Programme and many more have been instituted. Various national food production and management companies were also instituted such as The National Grains Production Company,National Root Crops Production Companies, North-east; Western and National Livestock Production Companies, Nigerian National Fish Company, and Nigerian National Shrimp Company, among others. These programmes were floated to help increase agricultural productivity by subsidizing agricultural inputs (fertilizer, seeds and machinery), revise the land tenure system, provide unfettered access to credit facilities for both small and big farm holders, increase food quality and quantity, regulate food price and food inflation, and improve agricultural product value chain. Others include guaranteeing food security, reduce food import and encourage export of agro based products, diversifythe economy from its over reliance on crude oil, reduce unemployment and poverty (Onunka, et al. 2018).

However, despite the above listed schemes introduced by successive Nigerian governments, Nigeria still ranks 94th out of 113 nations on the Global Food Security Index 2019. Its Food Insecurity Multidimensional Index (FIMI) values leave much to be desired. With an alarming score of 29.2, the 2020 Global Hunger Index ranks Nigeria 98th out of 107 countries - a significant decrease from its 40th position out of 79 countries in 2012. In the year 2020, the UNICEF officially declared Nigeria the under-five death capital of the world after it overtook India. It presently has an under-five mortality ratio of 201 deaths per 1000 live birth (Global Hunger Index, 2020). Nigeria's sudden overtaking of India as the global poverty headquarters has been mainly attributed to malnutrition and food insecurity. Diagram 1 below highlights the position of Nigeria on various key food security indices, while diagram 2 shows the ranking of Nigeria on three out of the four main dimensions of food security.

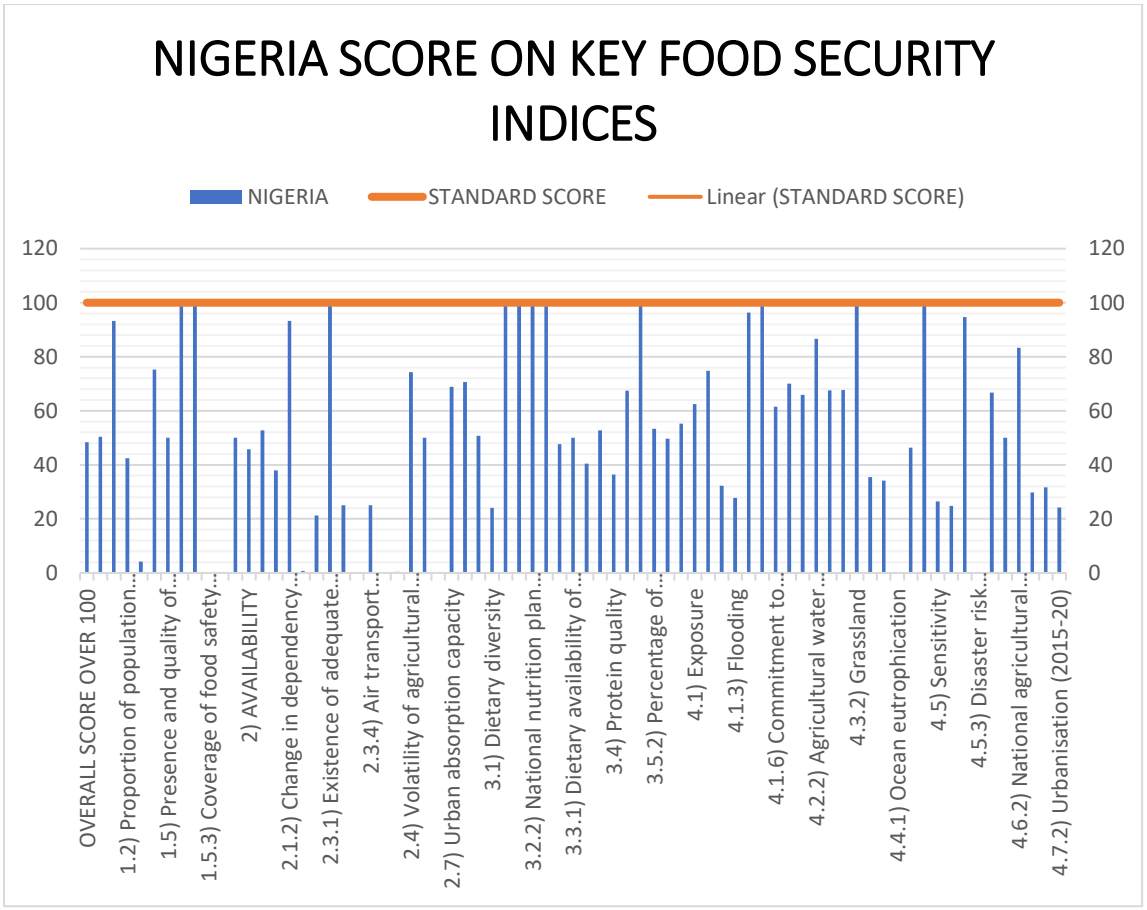


Figure1: Nigeria's score on selected key food security indices

Source: Author's adaptation from FAO data 2019

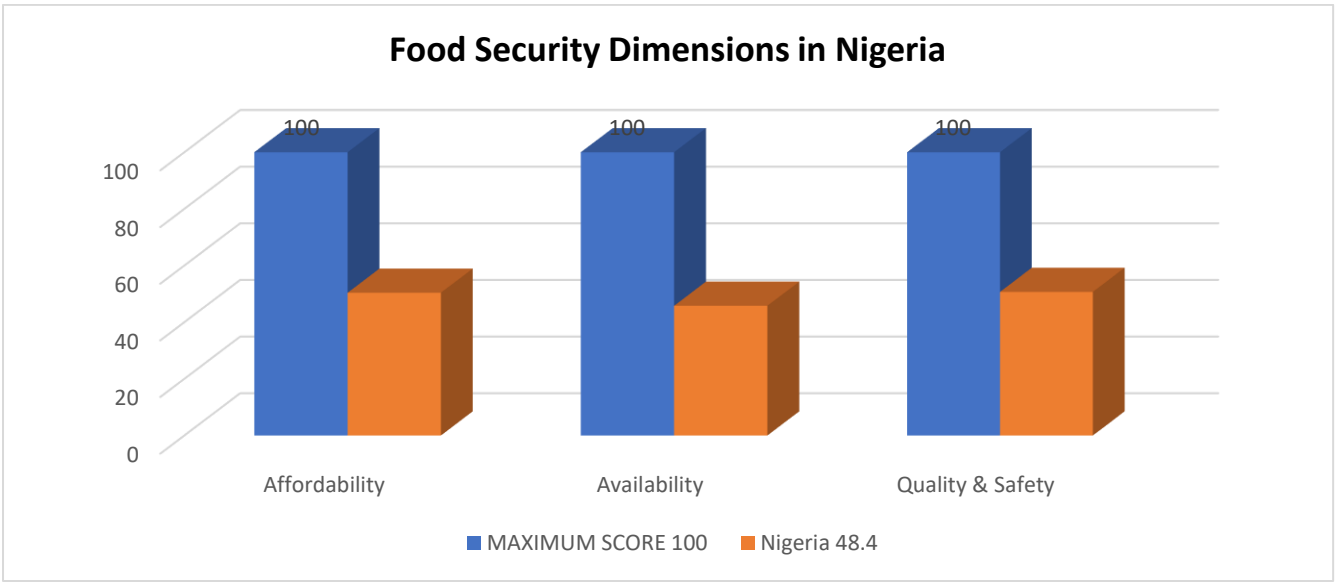
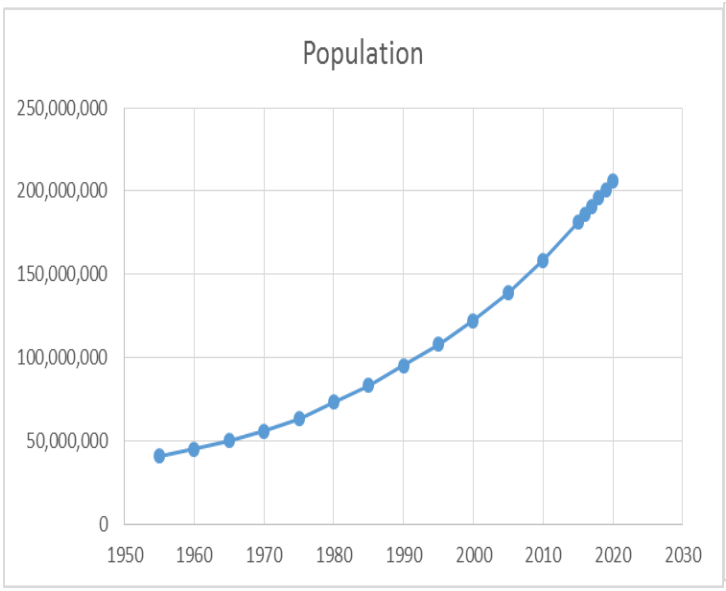


Figure2: Nigeria performance on selected food security dimensions.

Source: Author's adaptation from FAO data 2019

Many factors have been attributed to be responsible for food insecurity in Nigeria. These factors range from drought, flood, erosion, poor soil type and fertility, monsoon failure, poor farming system, lack of access to credit, onerous land tenure system, use of old agricultural method of farming, poor initiation and execution of various agricultural extension programmes and policies etc. Another cause of food insecurity is population explosion and mass drive towards urbanization in most developing economies including Nigeria. Nigeria's general food production still needs to improve from its present position if food security must be achieved for the teaming population (Armanda et al, 2019).

Figure 3 clearly highlights the growth rate of population and level of food production. The diagram shows the geometric growth rate of population while food production lags behind. Figure 4 further highlights the level of deficits in food supply of selected agricultural products. Hence there is a need for an increase in agricultural productivity so as to meet up with the growing population dietary needs. In light of the numerous challenges against food security in Nigeria, there is an increasing need to examine the role of economic growth and agricultural development in determining food security outcomes. Hence, this study examines the role played by both economic growth and agricultural development on food security in Nigeria.



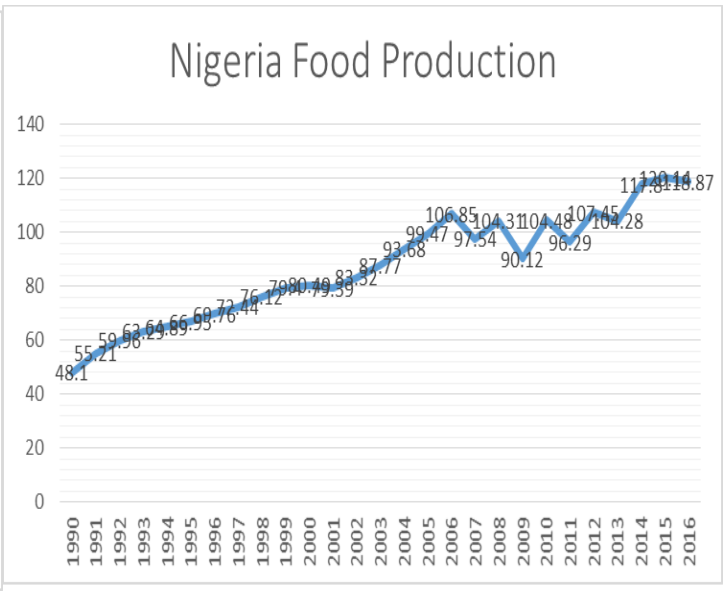


Figure3: Nigeria population growth rate and level of food production. Author's computation using WDI data (Food Production), World meter data (Population)

Figure 4

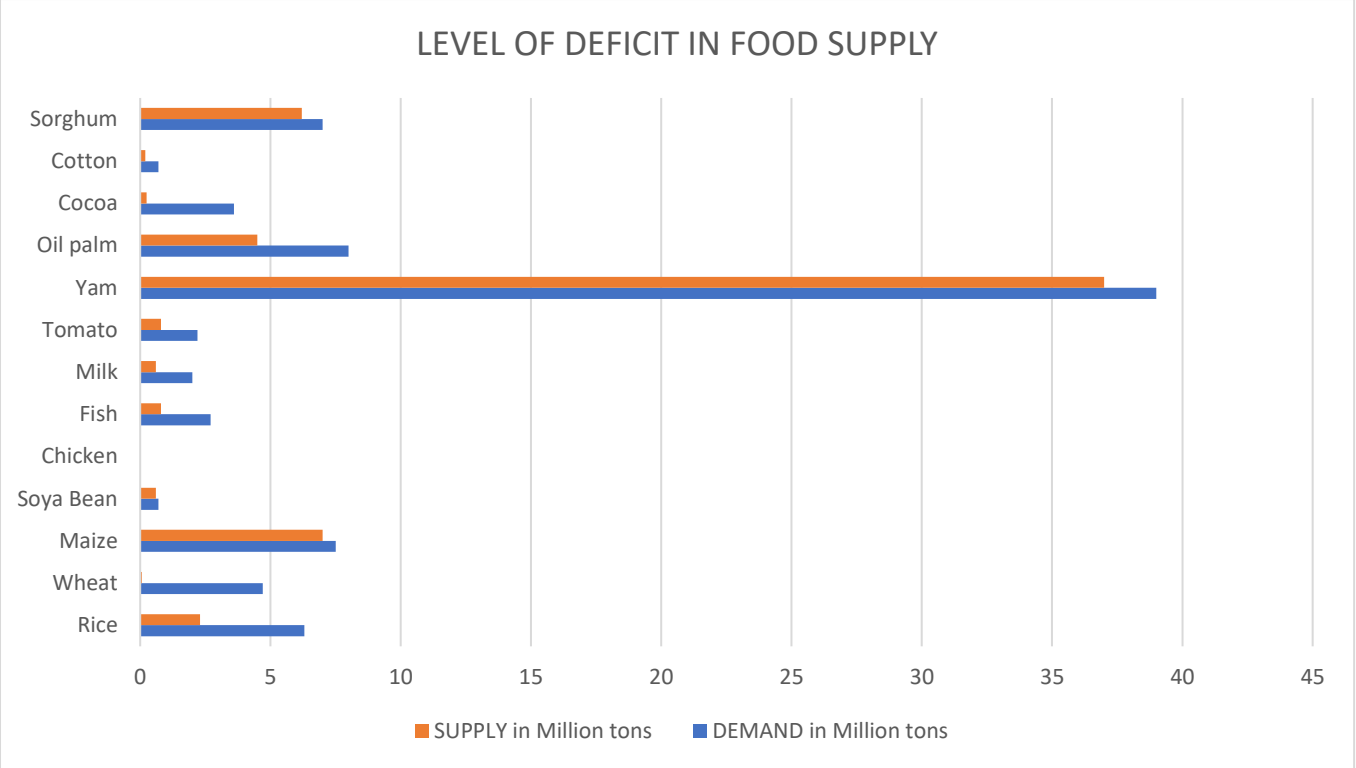


Figure4: Nigeria food supply deficit. Author's computation using Federal Ministry of Agriculture & Rural Development Data

2.0 Review of Literature

Agriculture remains the main stay of rural Nigeria. Agriculture in Nigeria encompasses the various subsectors of the primary economy such as farming, fishing and forestry. The per capita relative level of agricultural productivity in contemporary times has been on the decrease as the contribution of agriculture to the GDP and generation of employment opportunities in rural areas has continued to decline. As evident from figure 3, the level of food production slowed down in the mid-1990s while tipping down in the late 2000s.Over the years, a paradox that has continued to puzzle food security experts is the fact that rural areas produce the highest amount of food but have the lowest access to these foods when produced. Nigeria is one of the most ecologically diversified nations on earth, blessed with over 60million hectares of cultivatable land for agriculture, a coastline spanning into thousands of kilometres for fisheries and aqua culture.

Several studies have examined the relationship between agricultural development and economic development (Johnston and Mellor, 1961; Thorbecke and Jung, 1996; World Bank, 2007; Wiggins, 2009; and Igbinedion and Aihie, 2015).The UN committee on World Food Security 1975 addressed the issue of food security from three dimensions: availability, access and stability. This was adopted by the Organization for Economic

Cooperation and Development OECD with an addition of utilization in place of stability. Deriving a universally acceptable indicator that captures all the trends associated with food security still remains elusive to food security experts. Some indicia have focused strictly on capturing the underperformances in consumption necessities while others focus on bridging these underperformance gaps. Rosen and Shapouri (1999) focuses on availability and distribution of food. Various other indicators acknowledge the major role played by finance in bridging the gap between import and national deficit, production and distribution.

Martin and Warr (1993) observed in their seminal work that agricultural productivity increases with the growth of the economy, however this is at a lower growth rate when compared with economic growth. Nigeria has continued to experience food price volatility and inflation which makes it difficult to maintain stable and guaranteed availability, access, cost effective daily recommended dietary intake. Many factors have been attributed to account for low food productivity and inability to achieve food sufficiency and in extension food security in Nigeria. The classical economist, Malthus (year), first drew the world's attention to the challenge a geometric growing population poses towards achieving food security especially when food production grows at a lower rate.

Incessant food price inflation has also been a major impediment towards achieving food security. Presently Nigeria's food price inflation is 18.12% year on year while the composite food index rose by 22.72% (NBS, 2021). This is usually triggered by volatility in international and domestic markets, food import price and availability of foreign exchange, integration of the world market for cereals etc. Sudden surge in the price of food products is easily transmitted to other markets both within and outside the economy. It is also worth pointing out that food importation posits great economic burden on the health of such economies' foreign exchange and reserve, hence, the need for a vibrant agricultural sector is *sine qua non*. Achieving food security is heavily centered on being able to identify susceptible individuals or households. Their susceptibility to food insecurity could be as a result of their inability to find and keep gainful employment which helps them generate real income. Another pivotal factor in winning the war against food insecurity is a successful identification of the various stratification of societies based on location (Urban or rural), household head (male or

female), and socio- economic status (age, income level, employment, transfer payment and remittance).However to effectively do this, unbiased data are greatly needed.

Dreze and Sen (1991) propounded the concept of "entitlement to food" which examines how households gain access food. This could be in the forms of subsistence farming, households seeking gainful employment, trading, utilization of assets and resources, transfers as well as remittances.

Recently, agricultural productivity, food security and poverty have been greatly affected by the impact of human activities on the environment. In more recent times, the climate has been warmer causing alterations in seasons and monsoon. It is also intriguing to observe that agricultural activities are one of the major contributors to global warming through emission of greenhouse gas (see Organisation for Economic Co-operation and Development OECD, 2016). Cattles and agricultural products such as cereal release methane into the environment. The act of falling down trees and converting forest to farming further contributes to global warming (FAO, 2016, and Whitmee et al 2015). This has further led to incessant flood, drought, erosion, cyclone, tsunamis, and other forms of natural disasters in some areas hence reducing and destroying agricultural productivity.

Food insecurity is not majorly a problem of supply (inability to produce enough food) or active demand (socio-economic purchasing power).Instead, food insecurity mainly stems from inability to effectively distribute food from where they are excessively produced to where they are needed. A critical component of the food insecurity phenomenon is food wastage. More than one-third of food produced goes to waste and close to 40% of food losses occur prior to food reaching the market (WFP, 2020b**).** The problem of food distribution remains a global challenge and in Nigeria it is even worse. Northern Nigeria remains the major food production hub. The ability to effectively distribute these foods produced in excess from the north to the south, east and western part of Nigeria where they are mostly needed remains a major challenge. Poor infrastructure such as bad road network and inadequate power supply for preservation remain elusive thereby contributing to food wastage. The effect of this on food security is disturbing. The World Food Programme (2020b) estimated that more than 680 million people worldwide still go to bed without food even though the volume of food production globally is enough to go round.

Agriculture possesses the potentials of lifting millions of Nigeria's population out of poverty. Agriculture and its allied sectors employ more than 50% of the Nigerian

population and contribute close to 40% of its Gross Domestic Product (Federal Ministry of Agriculture & Rural Development, 2016). Against this backdrop, immediately after independence in 1960 the government of Nigeria and key stakeholders took concerted efforts towards improving agricultural productivity. Programmes such as the Operation Feed the Nation (OFN), Green Revolution Programme (GRP), National Accelerated Food Production Project (NAFPP), Agricultural Credit Guarantee Scheme), Agricultural Transformation Agenda (ATA, 2011), FADAMA programme, FarmerMoni, School Feeding Programme and many more were introduced to help increase agricultural productivity, ensure food security while also providing lasting solutions to some of the problems associated with the sector. Initially some positive points were scored. Before and immediately after independence productivity soared as Nigeria became a self-sufficient economy in the production of certain agricultural products such as cocoa, yam, palm oil, rubber, groundnut, cassava etc. However, due to misappropriation of funds, embezzlement, corruption and diversion of funds, poor implementation strategy and many more, these schemes have yielded little or no dividend. A good example of this is the School Feeding Programme which has been embroiled in large scale corruption allegation, poor food quality, over bloated figures of those who have benefitted, irregular supply of the food to the schools, lack of payment to the cooks etc. During the pandemic induced lock down, the scheme was mildly revised to provide uncooked food items to school pupils at home. This too has been seen as one of the scandalous government policies by the public.

Food security is also inextricably linked to health. Food contains the needed nutritional requirements to keep the body in good health. Poor nutritional patterns have been linked to various conditions such as obesity, wasting, kwashiokor, anaemia, stunted growth, diarrhea, cholera, diabetes, weak immune system, underage death and poor formation of various parts of the body (Leung et al 2012, Rivera, et al 2014; Zhang et al, 2016). Food insecurity has been observed to cause mental strain on the vulnerable especially when they are the family head. An important effect of food insecurity that is usually overlooked is the psycho-social and pscho- emotional effects of being food insecured in a household. These could take the form of low self-esteem and self-worth, depression, inferiority complex feeling of exclusion anxiety in cases where children and dependents are involved (Phojanakong et al. 2020). Other effects include: poor sleeping patterns, social unrest, poaching of wildlife and endangered species as supplement for

protein and environmental degradation. All these could be termed the "real effect of food insecurity" (Phojanakong et al. 2020). Hence, there is always the need for a healthy and nutritious food supply. Since food is the most important basic need of man, households without the ability to secure the daily nutritional requirements would find it very much difficult to meet their medical needs and as such may end up not seeking medical aid or purchasing other health interventions.

Another factor that has continued to pose threat to achieving food security in Nigeria is the degree of insecurity especially in the northern region of the country, which serves mainly as the food basket of the nation. The last two decades have been bedeviled with incessant community clashes, farmers and herder clashes, spasmodic terrorist attacks by the much-dreaded Boko-Haram group which often leave both farmers and their livestock dead. In some cases, this usually forces the surviving farmers to relocate from their ancestral homes and farmlands thereby abandoning their crops and exacerbating food insecurity. States such as Borno, Kaduna, Yobe and Adamawa are currently facing serious cases of insurgency induced hunger for internally displace persons (IDPs) making it more difficult to achieve food security in these parts of Nigeria. This study hopes to fill the gap in literature on the effect of economic growth and agricultural development on food security in Nigeriaas previous studies mainly focused on the impact of poverty, land tenure system, climate change and other factors on food security. This study hopes to achieve this using the Autoregressive distributive lag (ARDL) econometric model.

METHODOLOGY

Theoretical Framework

The study is hinged on the Solow growth model first published in 1956. The Solow model which adopted the Cobb-Douglas production assumes a closed economy and that in the short run technology is exogenous. The Solow model gives insight into the role of technology in determining the overall output of the agricultural sector. This study on the other hand attempts to explain food security by change in the overall level of food production hence challenging the long-held assumption that food security is determined by household savings and capital accumulation. There are numerous factors that determines agricultural productivity such as technological changes, security, economic

efficiency, innovation system, climate change and many more (Osabohien et al, 2017; Matemilola, et al 2017).

Model Specification

The study adopts a blend of descriptive, empirical and econometric techniques for analysis. Descriptively, the study uses various charts and graphs to pictorially depict comparison of the various food security indicators in Nigeria. Empirically, the study reviewed relevant literature and econometric analysis using Pesaran et al., 2001Autoregressive distributive lag (ARDL) was adopted. The model attempts to explain a functional relationship between food security and its supposed determinants while establishing a long run relationship between these variables.

The functional, mathematical and stochastic forms of the model are presented in the equations below.

FST=*f*(RGDP, FPI,TECH, CPI)……..3.1

Where:

FST= is food security which is captured by the average value of the prevalence of food inadequacy (*Pfi*) and average value of food production (*Avfp*).

RGDP=Real Gross Domestic Product (*RGDP*) growth rate as proxy for economic growth.

FPI=the food production index (*FPI*) is adopted as a proxy for agricultural development. It covers all food items considered nutritious and edible with the exclusion of coffee and tea.

TECH= indicates the use of technology in agriculture to help increase agricultural productivity and development. It is proxied by two indicators namely Agricultural Machinery and tractor (amtr) Agricultural Machinery per 100 square of arable land (Amtpa).

CPI= Consumer Price Index

The model is mathematically represented linearly as showed in Equation 3.2

$\ln FST = \beta_0 + \beta_1 \ln RGDP + \beta_2 \ln FPI + \beta_3 \ln TECH + \beta_4 \ln CPI$……..3.3

The model is econometrically represented as showed in Equation 3.4

$\ln FST = \beta_0 + \beta_1 \ln RGDP + \beta_2 \ln FPI + \beta_3 \ln TECH + \beta_4 \ln CPI + \mu$……..3.4

The ARDL model will be used to examine the impact of economic growth and agricultural development on food security in Nigeria.The ARDL model remains one of the most widely used econometric technique of estimation as it enables both the long term and short parameter estimates while simultaneously taking care of the problems usually

associated with integration order of the variables. The ARDL model based on the linear model specification in Equation 3.2, 3.3 and 3.4 is showed in equation 3.5

$$\Delta LRFST_t = \alpha_0 + \sum_{i=1}^{p} \Psi_n \, \Delta InLRFST_{t-1} + \sum_{i=0}^{q} \delta_i \, \Delta LRGDP_{t-n} + \sum_{i=0}^{q} \beta_k \, \Delta LFPI_{t-k} + \sum_{k=0}^{q} \in_k \Delta LTECH_{t-k} + \sum_{l=0}^{pq} \gamma_l \, \Delta LCPI_{t-l} + \lambda_1 LFST_{t-1} + \lambda_2 LRGDP_{t-1} + \lambda_3 LFPI_{t-1} + \lambda_4 GEA_{t-1} + \lambda_5 TECH_{t-1} + \mu_t \quad ---------3.5$$

Where α_0 is the autonomous component of the model and μ_t is the white noise component of the model. The expressions with the signs of summation in the equation are the short run components. The parameter coefficient signifies the short run effects while lambda (λ) is the analogous relationship in the long run. The study used EViews software (version 10) and times series data spanning between 1990 and 2018 from World Development Indicator (WDI), FAO database and Central Bank of Nigeria (CBN) Statistical Bulletin 2019 edition.

Table 4.1: Bound Co-integration Test

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	4.56311	10%	1.42	2.54
K	6	5%	2.83	3.84
		1%	2.49	3.29

Source: Author's Computation

Since the calculated F-statistic (4.56) is greater than the lower bound and upper bound critical values at 1%, 5% and 10% level of significance, it indicates that the variables have a long run relationship (co-integrated) hence the null hypothesis is rejected. This implies that economic growth and agricultural development have long run relationship.

Table 4.2: Estimated ARDL Model

Dependent Variable (LNFST)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.734553	1.642864	0.418458	0.824187
Short Run Model				
D(LNFST(-1))	0.309841	0.164223	3.061958	0.0225
D(LNRGDP(-2))	0.502844	0.124673	3.058441	0.0102
D(LNFPI(-1))	0.647814	0.154882	4.087518	0.0002
D(LNCPI (-1))	0.401348	0.192245	-3.976998	0.0001
D(LNTECH(-1))	4.087518	0.202468	-2.695137	0.0402
ECT (-1)	0.647814	0.326516	-1.984019	0.0030
Long Run Model				
LNFST	0.308938	0.210684	1.164665	0.0200
LNRGDP	0.466296	0.064665	5.341466	0.0042
LNFPI	0.560192	0.006878	7.23162	0.0152
LNCPI	0.471645	0.024239	9.01893	0.0061
LNTECH	0.579973	0.015308	7.856225	0.0004
R-squared	**0.805104**	Durbin-Watson stat		**1.608424**
Adjusted R-squared	**0.785335**			
F-statistic	17.3**7979**			
Prob(F-statistic)	0.000002			

Source: Researcher's Computation using Eviews 10, 2020

The result of the short run and the long run models in table 4.3 revealed that the independent variables Real Gross Domestic Product (RGDP), the Food Production Index (FPI), use of technology in agriculture (TECH) andConsumer Price Index (CPI) explained about 73% of the total variations in food security which is captured by the average value of the prevalence of food inadequacy (Pfi) and average value of food production (Avfp)

while the remaining 27% unexplained is captured by the error term. Considering the prob (F-statistic) of 0.000002 the entire model is robust and is devoid of the presence of autocorrelation problem.

The short run model accounts for the speed of adjustment to long run equilibrium of the variables employed. Hence, the speed of adjustment of the model to long run equilibrium is measured by the coefficient of the first lag of the error correction term (ECT (-1)). The error correction term (-0.67) has the right a priori sign and it is statistically significant. Hence, the result of the ECT (-1) showed that 67% of the deviation of the variables in the short run will be restored in a year.

Based on the long run model, Real Gross Domestic Product (R*GDP*) has an estimated coefficient value of 0.46 meaning that a 1% increase in Real Gross Domestic Product (R*GDP*) growth rate led to 0.46% increase in food security (FST). This revealed that Real Gross Domestic Product (R*GDP*) has positive impact on food security (FST) in Nigeria. Hence, Real Gross Domestic Product had significant positive impact on food security in Nigeria within the study period.

Food production index (FPI) has an estimated coefficient of 0.56 meaning that a 1% increase in food production led to 0.56% increase in food security (FST) in Nigeria. This implied that improvement in food production has significant positive impact on food security (FST) in Nigeria. Hence, improvement in food production had significant positive effect on food security in Nigeria within the study period.

On the other hand, an increase in the change in the price of consumer goods (CPI) led to a 47% decrease in food security while 1% increase in use of technology in agriculture (TECH) led to 57% increase in food security within the study period.

4.3 Diagnostic Test for the Short Run and Long Run Models

Table 4.4: Ramsey RESET Test

	Value	Df	Probability
t-statistic	5.705121	30	0.6458
F-statistic	32.54840	(1, 30)	0.3456
Likelihood ratio	27.92025	1	0.2001

Source: Researcher's Computation

From table 4.3With a F probability value of (0.6458) which is greater than 0.05, we accept the null hypothesis and reject the alternative hypothesis and conclude that there is no specification error in the short run and long run models.

Table 4.4: Serial Correlation Test

F-statistic	8.727240	Prob. F(2,29)	0.3011
Obs*R-squared	14.27785	Prob. Chi-Square(2)	0.2008

Source: Researcher's Computation

From table 4.4, since the probability value of the chi-square (0.2008) is greater than 0.05, we accept the null hypothesis and reject the alternative hypothesis and conclude that there is no serial correlation in the short run and long run models.

Table 4.5: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.508019	Prob. F(6,31)	0.7975
Obs*R-squared	3.401899	Prob. Chi-Square(6)	0.7570
Scaled explained SS	2.185251	Prob. Chi-Square(6)	0.9019

Source: Researcher's Computation

From table 4.5, since the probability value of the chisquare (0.7570) is greater than 0.05, we accept the null hypothesis and reject the alternative hypothesis and conclude that there is no heteroskedasticity in the short run and long run models.

Table 4.6: Granger Causality Test Result

Null Hypothesis:	Obs	F-Statistic	Prob.
RGDP does not Granger Cause FST	36	8.33706	0.0134
FST does not Granger Cause RGDP		7.26109	0.0219
TECH does not Granger Cause FST	36	8.33587	0.0073
FST does not Granger Cause TECH		9.26129	0.0001

Source: Researcher's Computation using Eviews 10, 2020

From table 4.6, the results of the granger causality test revealed that since the probability values of the F-Statistic (0.0134) and (0.0219) is less than 0.05, we conclude that there is

a bi-directional causality between food security and economic growth in Nigeria. Finally, since the probability value of the F-Statistic (0.0073) and (0.0001) are less than 0.05, we conclude that there is bi-directional causality between technology used in agriculture and food security in Nigeria. Hence, both variables granger causes each other in Nigeria.

Fig 5: Stability Test: CUSUM and CUSUMSQ test of the Short and Long Run Models

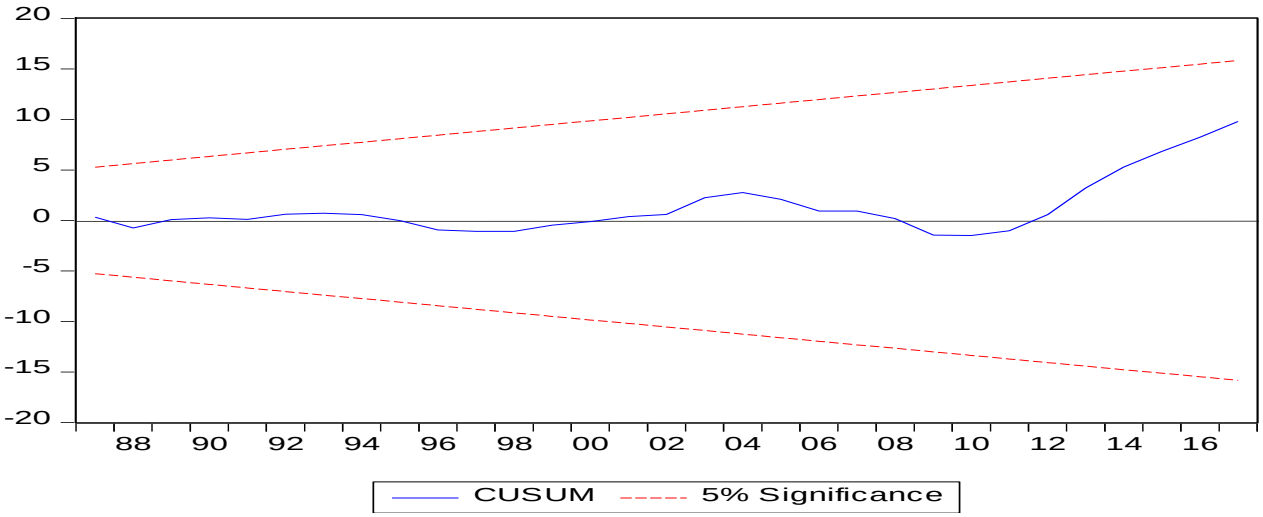
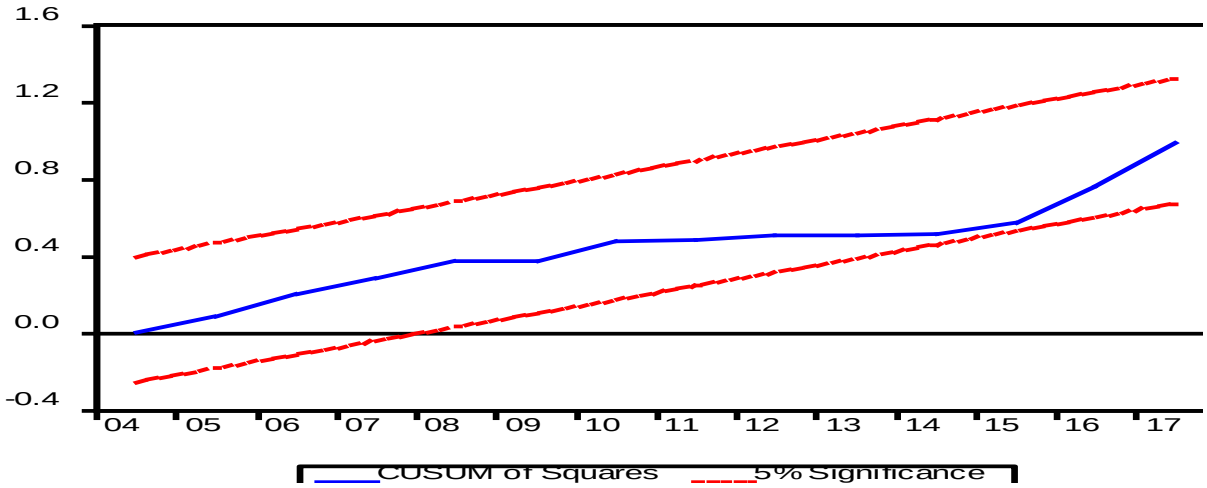


Fig 6: Stability Test: CUSUM of Squares test of the Short and Long Run Models.



The result of the CUSUM test in fig.5 which is the necessary condition for stability of a model indicates that the model is dynamically stable at 5% level of significance. The result of the CUSUM of squares test in fig. 6 which is the sufficient condition for stability of a model indicates that the model is dynamically stable at 5% level of significance.

Conclusion and Policy Recommendations

The study examined the relationship between economic growth and agricultural development on food Security in Nigeria using the Autoregressive distributive lag (ARDL)

model. The study found a strong positive relationship between economic growth, agricultural development and food security status of Nigerians. It can be inferred from the findings of this study that an increase in economic growth and agricultural development will invariably translate into improvement of food security outcomes and in extension reduce poverty in Nigeria. The study further found that an increase in the price of food items negatively impacted on food security. It was also found that when technology was used in agricultural cultivation, there was a proportionate improvement in agricultural productivity and food security.

As a result of these findings, the study makes the following recommendations:

- Government and private sectors should make concerted efforts to improve agricultural productivity in Nigeria. This could be in the form of access to agricultural inputs (high yielding varieties seeds, fertilizers, irrigations facilities, farm machines, storage facilities) for farmers especially subsistent farmers, revision of the current land tenure system in Nigeria, encouraging cutting-edge agricultural research and development.
- Government needs to strengthen and execute well planned agricultural extension programmes especially in rural areas where majority of smallholder farmers dwell.
- The federal government and stakeholders should also improve the Nigerian agricultural value chain which has been centered on export of agricultural raw materials and import of processed agro products.
- Effective and efficient strategies should be adopted to help mitigate food shortages and control food price inflation. A national grain and other food item reserve bank and public distribution systems which ensure that these reserved food items get to parts of Nigeria where they are needed is a must if the incessant food insecurity must be effectively curtailed.
- Finally, ensuring access to credit facilities; curtailing food wastage, making agriculture more attractive and a choice employment destination for graduates, improving risk management strategies for farmers and their farms, and education of the consumers on good dietary practices should be encouraged.

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