Acta Universitatis Danubius
ŒCONOMICA

# Agriculture, Food Security and Poverty Reduction in Nigeria: Cointegration and Granger Causality Approach

**Obiakor Rowland Tochukwu[1], Wahid Damilola Olanipekun[2], Olufemi Samuel Omoyele[3], Timothy Ayomitunde Aderemi[4]**

**Abstract**: Provision of sufficient food and elimination of abject poverty have usually been the conventional benefits of agriculture to any society. Meanwhile, despite the fact that Nigeria is an agrarian society, food insecurity and poverty have become the issues of concern among both scholars and policymakers in the recent times. Against this backdrop, this study examined the nexus among agriculture, food security and poverty reduction in Nigeria from 1990 to 2019 within the framework of Cointegration and Granger Causality approach. Data was collected from the Statistical Bulletin of the Central Bank of Nigeria and the World Development Indicators respectively. The following are the major results that emanated from the study. A long run equilibrium convergence exists among agricultural valued added, food production index and GDP per capita in Nigeria. Similarly, there is a unidirectional causality which flows from food production index to poverty reduction in Nigeria. In the same vein, one way causality flows from poverty reduction to agricultural value added in the country. Consequently, this study makes the following recommendation for the policymakers in Nigeria, and other African countries by extension, that agricultural value added and food production are the important variables that cannot be undermined when poverty reduction occupies the central focus of the policymakers. Therefore, any time these policymakers want to reduce poverty, policies that will drive agricultural value added and food production should be embarked upon.

**Keywords**: Agricultural value Added; Food Production Index; GDP per Capita; Nigeria

**JEL Classification:** Q18

[1] Department of Economics, Babcock University, Ogun State, Nigeria, Address: 121103, Ilishan-Remo, Nigeria E-mail: tochukwurowland@gmal.com
[2] College of Management and Information Technology, American International University, West Africa, Address: F87G+JJM, Serrekunda, Gambia, E-mail: W.olanipekun@aiu.edu.gm.
[3] Department of Business Administration and Marketing, Redeemer's University, Ede, Osun State, Nigeria, Address: Gbongan - Oshogbo Rd, 232101, Ede, Nigeria, E-mail: olufemi5n@gmail.com.
[4] Department of Economics, Accounting and Finance, Bells University of Technology, km. 8, Idiroko Road, Benja Village, P.M.B. 1015, Ota, Nigeria, Corresponding author aderemi.timothy@gmail.com.

## 1. Introduction

Agriculture is defined as the cultivation of land for subsistence and commercial output, as well as fishing, forestry, hunting, and all other activities that involve extracting natural resources from the earth (Osabohien *et al.,* 2019). Every human being needs food not just to provide energy but also to preserve life in general. Food security should not be overstated because it is essential to life through sustainable agricultural growth. Prior to the discovery of oil in Nigeria, agriculture was the primary source of the country's economy and a source of foreign cash (Central Bank of Nigeria, 1970). Following the finding of oil, agricultural production rapidly declined and the federal government paid less attention to it, resulting in the difficulty of food insecurity, unemployment, young restiveness in Niger Delta towns where oil is discovered and agricultural farms destroyed and poverty. Agriculture growth in Nigeria has been identified as the most important economic approach for eradicating poverty, ensuring food security, enhancing human welfare, and giving the nation with a sustainable long-term prosperity (Kilima *et al.,* 2013). Agriculture has the potential to assist a nation greatly, according to Kilima *et al*. (2013). Agriculture decreases the cost of food consumption and lessens the frequency with which people migrate from rural to urban areas. It also boosts nonfarm economic growth, allows local residents to participate in economic activities, and make nutritional goods available for human consumption. The federal government's neglect of agriculture has become one of the critical issues motivating poverty and other social evils in Nigeria. A Look into the Brookings Institute report shows that about 86.9 million Nigerians are ravaged by abject poverty, which has been established to be the highest among the economies of the world (Adebayo, 2018; Aderemi *et al*. 2020). Consequently, one of the most critical debate around the globe in the recent times is the exploration of means of providing sufficient food for the global population of over seven billion. This is one the reasons why the United Nations (UN) Sustainable Development goal two (2) was centered towards food security. Meanwhile, food insecurity in Nigeria calls for urgent attention because of the alarming rate at which it is rising in the country (EIU, 2019).

In spite of the fact that Nigeria is an agrarian society, the continuous rise in the levels of poverty and food insecurity has become the issues of concern to all the relevant stakeholders such as decision makers as well as scholars in the country. As a result of this, various empirical works have been carried out to investigate the nexus between agriculture, food insecurity and poverty reduction in Nigeria. However, these past studies have failed to examine the direction of causality among these important economic variables. Against this backdrop, this study examined how linkage exists among agriculture, food security and reduction of poverty in Nigeria. The novelty of this study lies in the application of Granger causality approach, to the best of our knowledge, in which majority of the past studies have undermined in the recent times.

## 2. Literature Review

Oriola (2009) examined a study that focuses on how food security affected poverty reduction in Nigeria. This study offers a framework for comprehending the link between irrigation systems, food production, and poverty. It acknowledges the nation's natural endowment; land and water resources for profitable agriculture, as well as irrigation technology as a cure to the vagaries of weather as a militating factor against appropriate food production. The report examined prior administrations' attempts to achieve food sufficiency and prevent hunger. Current developments in food security and the prevalence of poverty were also highlighted. According to some, a reform of the irrigation agricultural system will encourage development in food production, which will in turn stimulate wider expansion in both farm and non-farm rural economies, so contributing to poverty reduction in the economy. Kilima *et al.* (2013) used surveyed data generated from on-farm research works in the Tanzanian economy to investigate if government investments in agriculture assist farmers, who potentially have a significant influence on the economy. Questionnaires were used to collect data on effect, while coefficients of variation, alongside Gini coefficients, and Theil's t-statistic were employed to examine the distribution of income. According to the findings, agriculture programs increased farm revenue by improving agricultural performance and product sales.

Etim *et al* (2017) conducted a research about if food insecurity, poverty and hunger have implications Nigeria’s National Security. The goal of this study is to see how food insecurity, poverty, and hunger affect Nigeria's national security. People's behavior is explained by the relative deprivation hypothesis when they sense a gap between the 'ought' and the 'is' of collective value satisfaction. Data was gathered from secondary sources. According to the study, the only way to restore peace and security in Nigeria is to thoroughly identify and address the root causes. The study recommends that agricultural production be boosted by stimulating the study and use of new technology, among other things. Ayodeji and Oladokun (2018) investigated the impact of output generated from agriculture and reduction of poverty in Nigeria using the co-integration test and the tool of regression analysis. The study found reported an evidence to argue that the allocation of government resources and commercial bank loans to agricultural sector were insufficient to improve agriculture to the point where it could alleviate the menace of poverty in Nigeria from 2000 to 2016. The findings, on the other hand, showed that the index from food production and credit from microfinance bank disbursed to agriculture had a positive impact on the reduction of poverty and hunger in Nigeria.

John and Dankawu (2018) analyzed the influence of the activities from agriculture on poverty alleviation in Nigeria with the aid of principal component analysis and a vector error correction model from 1981 to 2014. Through the breakdown of variance, the study affirmed that shocks to all the components of agriculture in

Nigeria had a significant impact on poverty alleviation. Amaechi (2018) studied security of food and its effect on sustainability of agricultural in Nigeria. The report explored the notion of food security, as well as several methods, policies, and strategies that the government may use to achieve appropriate food security through sustainable agricultural growth. The necessity for agricultural sustainability was investigated, as well as the socioeconomic implications and limitations of sustainable agriculture. The study suggests that the Federal Government enhance policy implementation, monitoring/evaluation, and agricultural support as steps for long-term agricultural growth in Nigeria. Gassner *et al* (2019) looks at how poverty could be eradicated via food security in Africa as result of agriculture rethinking and accessibility. While technologies exist to increase smallholder farmers' yields by three or four ways, despite the fact that it was during raining conditions, the limited amount of the available space brought limitation to the growth of farming, and eventually caused agriculture's per capita income not to be sufficient enough to move people out of the current World Bank`s benchmark of poverty line of US$1.90 per day, according to the findings. Cordelia (2020) investigated Nigeria's food availability, agricultural sustainability and poverty reduction. The impact of agricultural productivity and food production on poverty reduction in Nigeria is investigated in this research. This study's data spans the years 2009 to 2019 with the application of regression analysis to arrive at the findings presented in this work. Thus, the statistics demonstrate that the index of food security has a significant and beneficial impact on elimination of poverty, whereas agricultural output has a negligible negative impact. According to the research, Nigeria's poverty reduction and food security would be contingent on the government's complete commitment to agriculture and an increase in its agricultural budget.

Obiakor *et al.* (2021) utilized pairwise Granger causality and Fully Modified Ordinary Least Squares to investigate the contribution of agriculture to employment generation in Nigeria between 1990 and 2019. It was discovered from the study that the impact of agriculture was significant in contributing to job availability in Nigeria. Also, Granger causality analysis revealed that there was no feedback relationship between agriculture and the rate of unemployment in the country.

Ebere *et al*. (2021) used DOLS and Granger Causality techniques to explore the linkage that exists between agricultural output and agricultural credit in Nigeria from 1981 to 2017. The authors submitted that agricultural output was significantly facilitated by agricultural credit in Nigeria. The study also estabilished that a unidirectional causality flows from agricultural credit to agricultural expenditure.

Aderemi *et al*. (2021) explored the relationship between and poverty reduction in Nigeria from 1981 to 2016 using ARDL technique. It was discovered from the paper that employment in agriculture and poverty level have a significant relationship in the short run.

## 3. Methodology

### 3.1 Data Collection

The focus of this study required the application of data from secondary sources which span from 1990 to 2019. All the data for this paper were sourced from World Development Indicators (WDI).

### Model Specification

A granger causality model is specified below to examine the causal relationship that exits among the variables of interest, which are agricultural value added, food production index and GDP per capita in the study.

$$GCA_t = \beta_0 + \sum_{i=1}^{m} \beta_1 GCA_{t-i} + \sum_{j=1}^{n} \beta_2 FPI_{t-j} + \sum_{k=1}^{O} \beta_3 AVA_{t-k} + \mu_{1t}$$

$$FPI_t = \alpha_o + \sum_{i=1}^{m} \alpha_1 FPI_{t-i} + \sum_{j=1}^{n} \alpha_2 AVA_{t-j} + \sum_{k=1}^{O} \alpha_3 GCAP_{t-k} + \mu_{2t}$$

$$AVA_t = \gamma_0 + \sum_{i=1}^{m} \gamma_1 AVA_{t-i} + \sum_{j=1}^{n} \gamma_2 FPI_{t-j} + \sum_{k=1}^{O} \gamma_3 GCA_{t-k} + \mu_{3t}$$

Where: GCA is GDP per capita used to proxy poverty reduction

FPI is Food Production Index used to proxy food security

AVA is Agricultural, Forestry and Fishing Value Added used to represent agriculture.

U captures error term. t is 1990-2019

However, in addressing the objective, Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) unit roots test were used to verify the possibility of the unit root presence in the the data series, and Johansen Cointegration test was used to check if the convergence exists in the long run equilibrium within the studied variables. Also, the stationarity or otherwise of the data set is a strategic factor to put in consideration in an empirical research so as to check the validity of the result to avoid a spurious result from emanating from the study. Meanwhile, if the data set variables possess unit root, this means they only have a short run relationship hence the need for the cointegration test to check for the long run relationship. The study also checked for the causal relationship among the variables in the data set using the Pairwise Granger Causality

### 3.3 Result and Discussion

**Table 1. Descriptive Statistics**

| | GDP | FPI | AVA |
|---|---|---|---|
| Mean | 1363.816 | 74.57483 | 24.42207 |
| Median | 1007.874 | 77.01000 | 24.47535 |
| Maximum | 3098.986 | 103.2900 | 36.96508 |
| Minimum | 270.2240 | 40.28000 | 19.99025 |
| Std. Dev. | 940.5894 | 18.18406 | 3.933087 |
| Skewness | 0.394996 | -0.128782 | 1.446763 |
| Kurtosis | 1.628945 | 1.979798 | 5.374166 |
| Jarque-Bera | 3.025521 | 1.337808 | 16.92774 |
| Probability | 0.220301 | 0.512270 | 0.000211 |
| Sum | 39550.65 | 2162.670 | 708.2401 |
| Sum Sq. Dev. | 24771835 | 9258.481 | 433.1369 |
| Observations | 29 | 29 | 29 |

*Source: Authors` Computation (2022)*

The table above shows the result of the statistics used to describe the data set in this research. This is pertinent due to the fact that it helps to determine whether the data set agrees with the normal distribution assumption. The table above indicates that the both mean value and the value of median in the variables food production index (FPI) and agricultural value added (AVA) are almost equal except from that of GDP per capita which is different. This indicates that the way in the data series was distributed is moving symmetrical direction, due to the argument that perfectly symmetry occurs when t the mean value and the value of median of such data set are moving toward convergence (Karmel & Polasek, 1980)

### 4.2. Unit Root Tests

**Table 2. Augmented Dickey-fuller Test and Phillips PerronTest**

| Variables | Augmented Dickey-Fuller Test | | | | |
|---|---|---|---|---|---|
| | Level | Probability | 1st Diff | Probability | Remark |
| GDP | -2.967767 | 0.8527 | -2.971853 | 0.0149 | I(1) |
| FPI | -2.991878 | 0.7383 | -2.991878 | 0.0112 | I(1) |
| AVA | -2.976263 | 0.4284 | -2.976263 | 0.0000 | I(1) |
| Variables | Phillips Perron Test | | | | |
| | Level | Probability | 1st Diff | Probability | |
| GDP | -2.967767 | 0.8262 | -2.971853 | 0.0155 | I(1) |
| FPI | -2.971853 | 0.4699 | -2.976263 | 0.0000 | I(1) |
| AVA | -2.967767 | 0.1884 | -2.971853 | 0.0001 | I(1) |

*Source: Author`s Computation (2022)*

Table 2 confirms the estimated results of the unit roots tests using the Augmented Dickey-Fuller (ADF) and the Phillips Perron (PP) Test. The result signifies that all the variables in the data set were not stationary when verified at level but became stationary after they were first differenced. This is an indication that all these data applied in this study are I (1).

**Table 3. Johansen Cointegration test**

| Hypothesized No. of CE(s) | Eigen value | Trace Statistic | Prob. | Max-Eigen Statistic | Prob.** |
|---|---|---|---|---|---|
| None * | 0.545058 | 30.46344 | 0.0419 | 21.26479 | 0.0479 |
| At most 1 | 0.204927 | 9.198659 | 0.3473 | 6.191682 | 0.5887 |
| At most 2 | 0.105392 | 3.006976 | 0.0829 | 3.006976 | 0.0829 |

Source: Authors` Computation (2022)

The report showed in table 3, is a multivariate cointegration test by Johansen and Juselius (1990) which was used to confirm the existence of a long run relationship among the variables. The reports from the above shows the existence of at most 2 cointegrating vector among the variables. Therefore, it can be confirmed that a long run relationship exists among the variables.

**Table 4. Direction of Causality among Agriculture, Food Security and Poverty Reduction in Nigeria**

| Null Hypothesis | F-Statistic | Prob. | Decision | Causality |
|---|---|---|---|---|
| AVA does not Granger Cause FPI | 0.08364 | 0.9201 | Accept | No |
| FPI does not Granger Cause AVA | 0.85578 | 0.4386 | Accept | No |
| GDP does not Granger Cause FPI | 0.78694 | 0.4676 | Accept | No |
| FPI does not Granger Cause GDP | 6.54039 | 0.0059 | Reject | Yes |
| GDP does not Granger Cause AVA | 3.39890 | 0.0509 | Reject | Yes |
| AVA does not Granger Cause GDP | 1.17853 | 0.3256 | Accept | No |

*Source: Authors` Computation (2022)*

The result above shows that there is no causal relationship between agricultural value added and food production index. However, there is a unidirectional causality which flows from food production index (food security) to poverty reduction in Nigeria. This implies that food security is a paramount factor for poverty reduction in Nigeria. In the same vein, one way causality flows from poverty reduction to value addition in agriculture in the country. This implies that reduction of poverty stimulates agricultural value added in the country.

## 4. Conclusion and Policy Recommendation

This study has examined the nexus among agriculture, food security and poverty reduction in Nigeria from 1990 to 2019 within the framework of Cointegration and Granger Causality approach. The following are the major results that emanated from the study. A long run equilibrium relationship exists among agricultural valued added, food production index and GDP per capita in Nigeria. Similarly, there is a unidirectional causality which flows from food production index (food security) to poverty reduction in Nigeria. This implies that food security is a paramount factor for poverty reduction in Nigeria. In the same vein, one way causality flows from poverty reduction to agricultural value added in the country. This implies that reduction of poverty propels value addition in agriculture in the country. Against this

backdrop, this study makes the following recommendation for the policymakers in Nigeria, and other African countries by extension that agricultural value added and food production are the important variables that cannot be undermined when poverty reduction occupies the central focus of the policymakers. Therefore, any time these policymakers want to reduce poverty, policies that will drive agricultural value added and food production should be embarked upon.

## References

Adebayo, B. (2018). *Nigeria overtakes India in extreme poverty ranking*. https://edition.cnn.com/2018/06/26/africa/nigeria-overtakes indiaextreme-poverty-intl/index.html.

Aderemi, T. A.; Wahid D. O.; Ayodeji, G. B.; Christiana Onyohu Hassan, C. O.; Osabohien., R. & Azuh, D. E. (2021). Role of Agriculture in Poverty Reduction in Nigeria: An Implication for Sustainable Development Goals (SDGs). *African Journal of Business and Economic Research* (AJBER),

Aderemi, T.A.; Amusa, B.O.; Elufisian, O. O. & Abalaba, B.P. (2020). Does Capital Flight Move Nigeria to the World`s Poverty Headquarters? An Implication for Sustainable Development. *Journal of Academic Research in Economics*, 12(1), pp. 31-44.

Amaechi L. N. (2018). Food security and sustainable agricultural development in Nigeria. *The International Journal of Social Sciences and Humanities Invention*, 5(6), pp. 4765-4768.

Ayodeji E.A. & Oladokun, B. S. (2018). Agricultural productivity and poverty reduction in Nigeria (2000- 2016). *International Journal of Innovative Research & Development*, 7(9): pp. 330-338. https://doi.org/10.24940/ijird/2018/v7/i9/SEP18080.

Central Bank of Nigeria (1999). Nigeria's development prospects: poverty assessment and alleviation study. *Research Department*, Abuja.

Ebere, E. E.; Oresanwo, A. M.; Omogboye, M. A. & Aderemi, T. A. (2021). Would Agricultural Credit Sustain Agricultural Output in Nigeria? An Empirical Perspective. *The Journal of Accounting and Management*, 11(3), pp. 76-83.

EIU (2019). *Global food security index (2019)*. Strengthening the food systems and the environment through innovation and investment. A report from The Economist Intelligence Unit.

Etim, E. E.; Duke, O. O. & Ogbinyi, O. J. (2017). The implications of food insecurity, poverty and hunger on Nigeria's national security. *Asian Research Journal of Arts & Social Sciences*, pp. 1-10.

Gassner, A.; Harris, D.; Mausch, K.; Terheggen, A.; Lopes, C.; Finlayson, R. F. & Dobie, P. (2019). Poverty eradication and food security through agriculture in Africa: Rethinking objectives and entry points. *Outlook on Agriculture*, *48*(4), pp. 309-315.

John, M. A. & Dankawu, M. U. (2018). Effect of Agriculture on poverty reduction in Nigeria: A multifaceted approach using principal component analysis. *IOSR Journal of Humanities and Social Science (IOSR-JHSS)*, *23*(6), pp. 35-43.

Kilima, F. T. M.; Tarimo, A. J. P.; Johnsen, F. H.; Nchimbi-Msolla, S.; Mbaga, S.; Sesabo, J. & Iranga, G. (2013). The impact of agricultural research on poverty and income distribution: A case study of selected on-farm research projects at Sokoine University of Agriculture, Morogoro, Tanzania. *Tanzania Journal of Agricultural Sciences*, 12(1).

Obiakor, R. T.; Omoyele, O. S.; Olanipekun, W. D. & Aderemi, T. A. (2021). Is Agriculture still a Strong Force in Employment Generation in Nigeria? An Empirical Investigation. *Euro Economica*, 40(2), pp. 90-100.

Omodero, C. O. Sustainable Agriculture, Food Production and Poverty Lessening in Nigeria. *Transport*, *3*, p. 6.

Oriola, E. O. (2009). A framework for food security and poverty reduction in Nigeria. *European Journal of Social Sciences*, *8*(1), pp. 132-139.

Osabohien, R.; Matthew, O.; Gershon, O.; Ogunbiyi, T.; Nwosu, E. (2019). Agriculture development, employment generation and poverty reduction in West Africa. *The Open Agriculture Journal*, 13, pp. 82-89. https://doi.org/10.2174/1874331501913010082.

World Bank (1998). Income Expressed As GDP per Capita PPP US.

World Bank (2000). *World Bank development report. Oxford University Press*, New York.

Worsld Bank (2016). *Poverty and shared prosperity: taking on inequality*. World Bank, Washington, DC.