

# Nexus among Macroeconomic Indicators and Sustainable Food Security in Nigeria (1981 to 2020)

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## Abstract

This paper investigates the Nexus among macro-economic indicators and sustainable food security in Nigeria using annual time series data covering the period from 1981 to 2020. The long-run fully modified OLS methods were used for this study while, dynamics OLS and canonical cointegration regression are estimated which shows the existence of a positive relationship between agricultural value added production and food security at a significant level of 1%. Accordingly, negative relationships exist among internally displaced persons and food security. This suggest that factors such as domestic violence, population growth, food inflation, and exchange rates volatility can lead Nigerian economy into long term food insecurity while, increase in agricultural value added production activities and per capita growth can induce a positive and sustainable food security in the long-run in Nigeria. This study strongly recommend active economic and political stability that will help to achieve a sustainable food security dominated which is determined by negative shock from population growth, food inflation and persistent insecurity should be established.

**Key Words:** Food security, Internally Displaced Persons, Conflict

## I. INTRODUCTION

A definition of the term food security, describing the issue as “availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption,” first appeared at the 1974 World Food Summit, [2] but it has since evolved. In 1983, the Food and Agriculture Organization (FAO) of the United Nations defined food security as “ensuring that all people at all times have both physical and economic access to the basic food that they need.” And by the 1996 World Food Summit, food security’s definition had grown even more specific: “Food security, at the individual, household, national, regional and global levels [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.”

Five years later, the FAO’s 2001 report “[The State of Food Insecurity in the World](#)” included social access to food, and not just physical and economic access, in its definition of food security. Social access to food describes one’s ability to obtain nourishment in socially acceptable ways, such as going to a supermarket to buy groceries rather than stealing food, scavenging for it, or relying on emergency food supplies for nourishment.

Food insecurity exists on a spectrum, [1] with households experiencing high food security, marginal food security, low food security, and very low food security, according to the United States Department of Agriculture (USDA). Food security and hunger may not always intersect, but they are related; if people are food insecure for months at a time, they may very well experience a substantial drop in food intake that leads to hunger.

People in food insecure households have [common characteristics](#). The USDA found that 98% [2] of people in these households worried that food would run out before they could afford to buy more; 96% [2] reported lacking money for balanced meals; and 47% [2] reported weight loss because they couldn't afford food. Food insecurity differs from hunger, the physiological process that occurs when a person is unable to eat a sufficient amount of food to meet their basic nutritional needs for a prolonged period of time. Nigeria not an exception, is Africa's largest economy, a major oil producer with population of over 200 million people, with an average growth rate of about 3% per year. The country's Gross Domestic Product (GDP) is estimated at \$500 billion. Earnings from crude oil and gas exports constitute approximately 80% of the country's total revenue (Federal Ministry of Agriculture and Rural Development (FMARD), 2018). In spite of the oil, agriculture remains the base of the Nigerian economy, providing the main source of livelihood for most Nigerians. The sector faces many challenges, notably an outdated land tenure system that constrains access to land (1.8 ha/farming household), a very low level of irrigation development (less than 1% of cropped land under irrigation), limited adoption of research findings and technologies, high cost of farm inputs, poor access to credit, inefficient fertilizer procurement and distribution, inadequate storage facilities and poor access to markets have all combined to keep agricultural productivity low (average of 1.2 metric tons of cereals/ha) with high postharvest losses and waste [3].

The Anchor Borrowers Program (ABP) for example, was created by the Central Bank of Nigeria and works in partnership with state governments and several private sector groups to provide farm inputs in kind and cash to small holder farmers to boost production of agricultural commodities. At harvest, the farmers supply their produce to the agro-processors (anchor) which pays the cash equivalent to the farmers' account. According to government reports, under the ABP initiative, a cumulative amount of over 150 million dollars has been

disbursed to more than 250,000 small farmers who cultivated almost 300,000 ha of farmland for rice, wheat, maize, cotton, soybeans, and cassava. This growing trend of agricultural activity is expected to continue, thus creating demand for agricultural inputs (FMARD, 2018).

The survival of the citizens who heavily depend on these agricultural commodities is also shaky due to the volatile nature of these commodities, thus, the financial stability of the citizens becomes a paramount need if the matters regarding theft, social unrest and terrorism would be avoided [39]. The United States Department of Agriculture Economic Research Service (USDA-ERS) put the average population share that are food insecure in Nigeria at about 19.9 million, more than the entire population of seven West African countries combined [22]. This was also corroborated by the FAO Cadre Harmonized analysis report in November 2018 that 1.7 million people currently face food insecurity in three different states in the country (Adamawa, Borno and Yobe) with about 2.7 million people projected to be severely food-insecure in June–October 2019 [11].

More importantly, the effect of any macroeconomic policy especially the policies targeted at stabilizing the Nigerian economy is dependent on both the volatility and persistence occurring in the agricultural commodity market. A neglect of the return and volatility transmission occurring in the market leads to a neglect in the effect of the stated policies.

## **II. LITERATURE REVIEW**

This section presents empirically the work done by various experts on related topics and it is categorized into three (3) perspectives these are: Economic; politics and the society; environment, natural resources and food production.

### ***A. Economic perspectives of food security***

Many countries, developed as well as underdeveloped ones, have undertaken substantial policy reforms in the last three decades, including trade policy reforms aimed at reducing tariff and non-tariff barriers. These trade policy reforms have contributed to growth in international trade

worldwide [4]. Trade reforms have been justified by expected increases in efficiency, particularly in resource allocation, and output growth by improving transparency in incentives, thereby promoting economic growth and poverty alleviation and improving food availability for local consumption [13-10-2]. With respect to the issue of ensuring national availability of food, the world market can function as an essential source of food supplies, especially for those countries where domestic food production is constrained by agro-climatic and other factors [29]. Trade openness allows access to larger markets, opens up opportunities for specialization in production as well as the realization of dynamic efficiency gains from factors such as economies of scale, technology transfers and knowledge spillovers and thus enhances the possibilities for generating export revenues [34].

A considerable body of empirical research has focused on the impact of globalization and trade liberalization on specific dimensions of economic development, such as economic growth and poverty, yielding inconclusive results [3]. Given that poverty is a broad indicator of the well-being of a country's population, the issue of food insecurity, which is more about basic needs, has attracted the attention of researchers over the past decade [31]. The importance of trade policies for food security was recognized by the World Food Summit in 1996, speaking in favor of a fair and market-oriented world trade system (Rome Declaration, 1996). At the global level, international trade can link production and consumption of food and may thus play an important role in securing enhanced food security, as it permits global production to take place in those regions most suited to it and enables food to flow from countries with abundant food supplies to ones with insufficient supplies [29]. A country's increasing openness to trade may then lead to an increase in the total amount of food available to the national population and make available a greater variety of foods, contributing to increased food security. However, food security both in terms of research and policy- has received much less attention than poverty, with only few studies explicitly exploring the impact of trade liberalization on food security [21 – 38].

#### ***B. Political and the societal conflict perspectives***

In many developing countries, armed conflict is perhaps the most damaging shock to land under cultivation [12]. Previous studies suggest that

conflicts drive land-use changes in many ways, including the abandonment of agricultural land by internally displaced persons (IDPs) and refugees [20]; reduced utilization of land due to safety concerns [12]; lower agricultural intensity resulting from a dearth of labor and other inputs [7], reduced investments in irrigation infrastructure due to fears about capital loss in areas affected by conflict [4]; and increased forest loss due to inhabitation by non-state actors [23-28]. Since 2009, the Northeastern Nigerian states of Borno, Adamawa and Yobe (BAY States) have struggled with continuous terrorist attacks from BH as it aimed to disrupt the country's democracy.

The other northeastern states of Bauchi, Gombe and Taraba (BGT) have also been occasionally hit, but have had to deal with major problems associated with the high population of Internally Displaced Persons (IDPs) who stress their resources, infrastructure and budgets. In the Northeastern Nigeria, agriculture is the predominant land use, agriculture is highly dependent on land, and many attacks have been in rural areas. These factors make it a region to test the impact of conflict on household land use decisions. It is widely believed that the BH insurgency compromised agriculture [2-25]. Anecdotal claims made about how the BH insurgency led to the destruction of the agricultural sector include claims about the complete and partial abandonment of fields, uncertainty about how much area is to be cultivated, shifts in cropping patterns, and constraints to acquiring land for agricultural purposes. For example, [25] specifically reports that vast areas of land in Northeast Nigeria were under-cultivated or under harvested as a result of attacks and conflict-related fears. Other anecdotal claims about the influence of conflict include increased prices of major commodities [6].

In northeastern Nigeria, the center of the Boko Haram insurgency, at least 70 percent of all displaced people are farmers [22]. Farmers are forced to flee their communities and fields, even during the cropping season, in the fear of imminent attacks. For example, in 2013, 19,000 rice farmers were forced to abandon their fertile fields near the Sahel region, leaving behind around 24,700 acres of rice paddies unharvested [5]. Moreover, because the migrating population includes not only farmers, but also food sellers and transporters, the effects of conflict through abandonment is exacerbated.

### C. Environment, natural resources and food production

From an agronomic perspective, poor soil fertility is the primary factor that limits agricultural productivity in sub-Saharan Africa. Even in the dry savannas of the Sahel, agricultural productivity is nutrient limited [29]. The critical shortages of nutrients within African farming systems indicate that mineral fertilizers are needed [8 – 19]. Equally, it is recognized that management of soils solely using mineral fertilizers without attention to maintenance of soil organic matter cannot sustain crop production. This has led to the paradigm of integrated soil fertility management (ISFM) [34] that recognizes the need for efficient nutrient recycling and use of crop residues and organic manures together with judicious use of mineral fertilizers. ISFM further recognizes that good crop varieties and agronomic management are essential to achieving efficient use of nutrients and increased productivity. Intercropping and rotations with grain legumes are a key component within ISFM, enabling capture of atmospheric nitrogen through their symbiosis with rhizobia [20 – 34]. Legumes also offer the potential for both diversification of cropping systems and intensification, giving extra benefits in terms of human nutrition, suppression of pests and diseases and enhancing yields of other crops in rotations [15]. Smallholder farms predominate throughout sub-Saharan Africa and produce the vast majority of the food [9]. Farming systems are highly diverse reflecting climate, soils and cultural preferences. In many places high population density, with concomitant pressure on land leads to small farms, and low capital availability [25 – 27]. Using data from 13,000 rural households across 93 locations in 17 countries of sub-Saharan Africa we found that a staggering 37% of the households were food insecure – unable to achieve household food security even if all forms of income were converted into calories [17]. Food insecurity is an important dimension of poverty, and across these 13,000 households it was associated with more household members, limited livestock and land holdings, which together explained 72% of the variability in food availability. Market access and off-farm employment were also important [17].

### III. MATERIAL AND METHODS

The study employed the quantitative method to investigate the nexus among macroeconomic

indicators and sustainable food security in Nigeria using Fully Modified OLS technique, Dynamic OLS and Canonical co integration regression proposed by Phillips and Bruce (1990) and Stock and Mark (1993) respectively. These methods are efficient at resolving autocorrelation omitted variable bias, endogeneity issues and measurement inaccuracies that exist in a model and are capable of avoiding probable endogeneity issues that might arise among the Regressors. This is possible because it possesses an efficient mixture –normal asymptotic distribution [35].

### D. Estimation Techniques

To carry out this investigation, the study performed unit root test to determine the order and long run relationship of the variables in the model using Levin, Lin & Chu and Johansen Co-integration test respectively. The possibility of generating spurious results is inherent when making use of non stationary variables in a traditional time series model unless the variables share a common trend (i.e., are co integrated) which describes their long-run relationship. This study employed co integration in the multivariate form to determining the rank of  $\Pi$  and to determine if the variables share one or more co integrating relationships since the stationary property has been ascertained at the same order of 1 (1). We describe two test statistics: namely, the trace statistic and the maximum eigenvalue statistic in order to determine the estimate for the appropriate rank.

The null hypothesis (i.e.,  $H_0$ ) specified by trace statistic for  $r$  co integration relations can be computed as follows:

$$\lambda_{\text{trace}} = -T \sum_{i=r+1}^n \log(1 - \hat{\lambda}_i) \quad r = 0, 1, 2, \dots, n-1$$

Where: the alternative hypothesis is that there are more than  $r$  cointegration relationships among the variable of interest.

The null hypothesis (i.e.,  $H_0$ ) of at most  $r$  cointegration relationships specified by maximum eigenvalue statistic can be estimated as follows:

$$\lambda_{\text{max}} = T \log(1 - \hat{\lambda}_{i+1}) \quad r = 0, 1, 2, \dots, n-1$$

Where: the alternative hypothesis is that there are  $r + 1$  cointegration relationships among the variable of interest.

In view of that, it is possible to have up to  $r$  linearly independent cointegration relationships (where  $r \leq k - 1$ ) in every system of variables. For both trace and maximum eigenvalue tests and just as in the case of the univariate Dickey-Fuller test for unit roots, the asymptotic distribution is non-standard and depends upon the deterministic components included (constant and trend).

Following (Adom and Kwakwa, 2014; kwakwa et al, 2018), the Fully Modified Ordinary Least Square, Dynamic OLS and Canonical Cointegration Regression Models are specified as follows:

$$\phi FME = \left( \sum_{t=1}^T Z_t Z_t' \right)^{-1} \left( \sum_{t=1}^T Z_t Y_t^+ - T j^+ \right)$$

(1)

Where  $Y_t^+ = y_t - \hat{\lambda}_{0x} \hat{\lambda}_{xx}^{-1} \Delta x_t$  is the correction term for endogeneity, and  $\hat{\lambda}_{0x}$  and  $\hat{\lambda}_{xx}$  are the kernel estimates of the long run covariances,  $j = \hat{\Delta}_{0x} - \hat{\lambda}_{0x} \hat{\lambda}_{xx}^{-1} \hat{\Delta}_{xx}$  is the correction of term serial correlation, and  $\hat{\lambda}_{0x}$  and  $\hat{\Delta}_{xx}$  are the kernel estimates of the one sided long run covariances.

The canonical cointegration regression estimator employed by.... is similar to FMOLS as specified below:

$$\phi CCR = \left( \sum_{t=1}^T Z_t^* Z_t^{*'} \right)^{-1} \sum_{t=1}^T Z_t^* Y_t^*$$

(2)

Where  $Y_t^* = (X_t^{*1}, D_t^*)$ ,  $X_t^* = X_t - \left( \hat{\Sigma}^{-1} \hat{\Lambda}_2 \right) \hat{v}_t$

and  $Y_t^* - \hat{\Sigma}^{-1} \hat{\Lambda}_2 \hat{\beta} + \left[ \hat{\eta}_{22} \hat{\omega}_{21} \right]^{-1} \hat{v}_t$  denotes the transformed data,  $\hat{\beta}$  is an estimate of the cointegrating equation coefficients,  $\hat{\Lambda}_2$  is the second column of  $\hat{\Lambda}$  and  $\hat{\Sigma}$  denotes estimated contemporaneous covariance matrix of the residual. Accordingly, to check the robustness of the result dynamic OLS is further estimated

$$y_t = X_t' \beta + D_{1t}' \gamma_1 + \sum_{j=-q}^r \Delta X_{t+j}' \delta + v_{1t}$$

(3)

Where  $\Delta X_t$  as the lag and leads that augments the cointegrating regression and equation error term is orthogonal to the whole history of the stochastic regressor innovations. Addition of  $q$  lags and  $r$  leads of the long run correlation between  $v_{1t}$  and  $v_{2t}$ , least squares estimates of  $\theta = (\beta', \gamma_1)$ . Have the same asymptotic distribution as those obtained from FMOLS CCR.

### E. Model Specification and Data Description

The study employed annual time series data covering 1981 to 2019 obtained from world development indicators data base and the long run econometric model of this study is specified as below:

$$LFPI = \alpha + \beta_1 LAFVA_{it} + \beta_2 LIDP_{it} + \beta_3 LGDPpc_{it} + \beta_4 LPOPTl_{it} + \beta_5 LREER_{it} + \beta_6 LINFCp_{it} + \epsilon_{it}$$

(4)

Where LFPI is the food production index (2004-2006=100) which includes nutritional edible food crops as proxy for sustainable food security in Nigeria. LAFVA is the agricultural value added including hunting, fishing and forestry that correspond to division 1-5 of International Standard Industrial Classification (ISIC) measured as a percentage of GDP. *LIDP is the new internally displaced persons associated with violence and conflict measured based on number of cases and a dummy variable has been applied to it*<sup>1</sup>. LGDPpc is gross domestic product divided by midyear population measured in constant local currency unit. POPTl is the population total regardless of citizenship or legal status measured as a midyear estimates. REER is the real effective exchange rate index (2010=100) measured by the national currency value against several weighted average foreign currencies. INFcp is the inflation rate based on consumer prices measured based on annual percentage.

The  $i$  and  $t$  subscripts represent economy specific and ant time horizon respectively. To directly interpret elasticities, minimize the effects of serial correlation, heteroscedasticity amongst other spurious regression issues in the data; all the variables have been logged

linearized. Accordingly, the  $\alpha$  represents the intercept parameter while  $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5,$  and  $\beta_6$  will provide us the long run elasticities of LFPI with respect to LAFVA, LIDP, LGDPpc, LPOptl, LREER, and LINFcp respectively. The  $\epsilon_t$  is the error term which should be normally, identically and independently distributed around zero mean and constant variance (i.e., NIID  $\sim (0, 1)$ ).

**IV. DATA PRESENTATION**

**F. Descriptive statistic**

To fully understand the dynamics of the overall LFPI in the economy, a descriptive statistics is conducted and presented in Table 1. By observing the historical tendency of LFPI the Nigerian economy, average growth rate of the LFPI is about 4.43% with maximum and minimum values at 4.83% and 3.51%, respectively. The maximum growth rate could arguably be regarded as the initial effect of the structural adjustment program (SAP) in 1987 and a more domestic violence free economy. This is further ascertained by the long run positive impact of GDPpc in table ... The economy moved from the lowest negative growth to the highest growth in 2002, perhaps due to the positive impact of private sector-led development pursued by the democratic

government after the collapse of military regime as well as phenomenal rise in oil prices that tends to have significant consequences on the growth.

The annual fluctuation rate from 2.99% to 3.28% (LAFVA), 8.51% to 13.79% (LIDP), 12.69% to 12.86% (LGDPpc), 18.85% to 19.11% (LPOptl), 4.52% to 4.82% (LREER) and 2.08% to 2.80% (LINFcp) established a fairly symmetrical data set across all observations with skewness of zero were, realized with exception of LFPI, LAFVA and LIDP that have a decline skewness of -1.12%, 1.58% and -1.27% respectively. This could be attributed to internally displaced persons resulted from domestic political crises and terrorist activities which affect the agricultural value added and food security in Nigeria. Considering the value of standard deviation that stood at 1.56%, it could be said that there is a considerable dispersion in the series, which is supported by the average value of measure of kurtosis 2.54, indicating that real LFPI growth is platykurtic. Note that Nigeria is ranked 94th economy in the global food security index ranking. In addition, it is the leading economy in Africa with the highest population growth.

**Table F:** Descriptive statistic

Variables	LFPI	LAFVA	LIDP	LGDPpc	LPOPTL	LREER	LINFcp
Mean	4.426683	3.074025	12.17709	12.80228	18.99544	4.701990	2.463950
Median	4.645671	3.053477	12.82339	12.79993	19.00051	4.712227	2.480672
Maximum	4.834455	3.286492	13.79019	12.86190	19.11863	4.824283	2.804786
Minimum	3.517218	2.995245	8.517193	12.69970	18.85457	4.528870	2.087222
Std. Dev.	0.486170	0.063864	1.565232	0.038476	0.078595	0.078445	0.208197
Skewness	-1.121142	1.586425	-1.272903	-0.415657	-0.154306	-0.279365	-0.326597
Kurtosis	2.540817	5.107561	3.451182	3.015775	1.755932	1.958957	2.178911
Observation	132	132	132	132	132	132	132

**Figure:** FMOLS

**Source:** Computed by the author, 2020

**Note:** FMOLS= Fully Modified Ordinary Least Squares

**G. Levin Lin and Chu unit root Test**

Table 2 shows that, the null hypothesis of the presence of unit root has not been rejected at level with both intercept -0.33119 (0.6298) and intercept and trend 1.04860 (0.8528) because they are greater than 5% significance level. However, after taking first difference of the variables, the null hypothesis indicating the presence of unit root test is rejected with both intercept -1.65305 (0.0492), and intercept and trend -1.84514 (0.0325). The implication shows that a cointegration analysis is applicable for the determination of the long-run relationship among the variable of interest.

**Table G:** Levin, Lin & Chu Unit Root Test

Level		First difference	
Intercept	Intercept & trend	Intercept	Intercept & Trend
0.33119 (0.6298)	1.04860 (0.8528)	-1.65305 (0.0492)	-1.84514 (0.0325)

The parentheses denotes the p value and the other figures represent the t-statistics

**H. Johansen Cointegration Test**

Table 3 shows that, the trace as well as the Eigenvalue revealed 3 cointegration equations at 5% (0.05) significance level. The (\*) represent rejection of the null hypothesis of no cointegration at the 5% significance level. The implication for this is that, the null hypothesis of no cointegration is rejected. This shows the implication for the presence of long-rung association among the variables up to third null hypothesis.

**Table H:** Johansen Cointegration Test

H0: No. of CE (s)	Eigen-value	Trace Stat.	Prob*	Max-Stat.	Prob*
None *	0.767845	178.2687	0.0000*	54.0296	0.0061*
At most 1*	0.708472	124.2357	0.0002*	45.60691	0.0108*
At most 2*	0.621576	78.62882	0.0084*	35.95436	0.0279*
At most 3*	0.417460	42.67446	0.1407	19.99320	0.3416
At most 4	0.322289	22.68126	0.2621	14.39427	0.3335
At most 5	0.197222	8.286988	0.4352	8.128060	0.3658
At most 6	0.004286	0.158928	0.6901	0.158928	0.6901

**I. FMOLS, DOLS AND CCR**

Table 4 shows the long rung results of FMOL, DOLS and CCR. The results show a positive

relationship between the LAFVA and LFPI at significant level of one percent. This indicates that, one percent increase in LAFVA activities induces an increase in LFPI in Nigeria by 1.29%, and 1.92% and 2.80% respectively. Accordingly, a negative relationship exists among LIDP and LFPI. This reveals that, a one percent increase in LIDP resulting from domestic violence activities induces -0.33% decrease in LFPI with a 0.13% and 0.12% change in LFPI in Nigeria. The positive relationship could be attributed to inter regional displacements that led to improved knowledge sharing as well as other people benefiting from the social unrest in the economy. However, a positive increase in per capita GDP from 1% to 5% can automatically offset effects LIDP of on LFPI in Nigeria by 1.32%, 1.20% respectively. LREER shows a negative relationship with LFPI. This could be attributed the external trade competitive resulting from devaluation of domestic currency. LPOptl and LINFcp show negative responses to change in LFPI in Nigeria. This means that a 1% to 5% increase in LPOptl and LINFcp will decrease LFPI by 0.98% and 0.48% respectively.

**Table I:** Long Run Coefficient of FMOLS, DOLS, and CCR

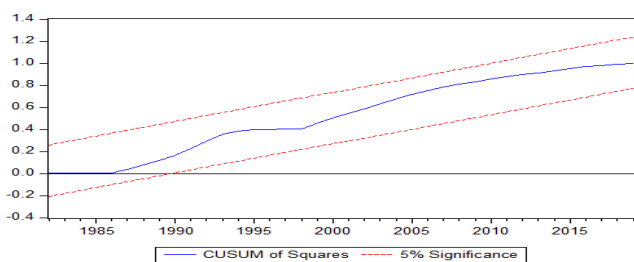
Variables	FMOLS	DOLS	CCR
LAFVA	1.298069 (0.0024)	1.921085 (0.0373)	2.805554 (0.0000)
LIDP	-0.334479 (0.1798)	0.136196 (0.5080)	0.125304 (0.0308)
LGDPpc	1.323619 (0.0415)	0.402858 (0.7627)	1.207023 (0.0001)
LPOptl	-0.146844 (0.7921)	-0.524969 (0.5664)	-0.989721 (0.0000)
LREER	-0.072217 (0.4955)	-0.181451 (0.0452)	0.060945 (0.1186)
LINFcp	-12.98795 (0.3433)	-0.275143 (0.0275)	-0.482647 (0.0000)
R- square	0.508968	0.607043	0.219355
S.E. of regression	0.354828	0.346601	0.550344
Long run variance	0.03432	0.0246	0.013416

The normality hypothesis of residuals confirmed that residuals are distributed normally. Also, the Breusch–Godfrey Serial Correlation test of

autocorrelation shows that there is no problem of serial correlation in the equation residuals. Similarly, Breusch–Pagan–Godfrey Heteroskedasticity test confirms that variance is homoskedastic in the long run. Similarly, Ramsey RESET is implemented to further illuminate our analysis. The outcome of the test showed that there is no specification error in the model as the coefficient on the power of fitted dependent variable is greater than all the levels of significance (.01, .05, and .10). Therefore, it is concluded that the estimated equation does not suffer specification error. This is further supported by the residual stability tests, CUSUM and CUSUMSQ, in Figures 2 and 3. The decision regarding these tests is that when the statistics fall within a .05 level of significance represented by two direct lines whose functional form is specified in Brown, Durbin, and Evans (1975), it is concluded that the estimated elasticity coefficients of the variables are stable over time. Given that the statistics of the two tests are inside the .05 level of significance, it is concluded that the estimated model is stable.

**Table I:** Diagnostics checks

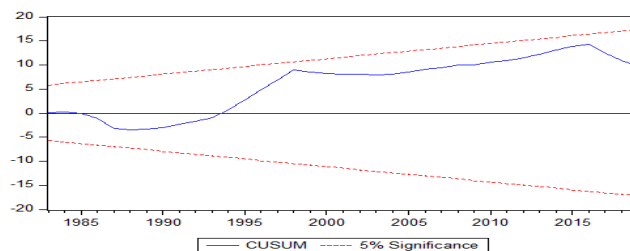
Normality	2.3332(0.3114)
Breusch –Godfrey Serial Correlation LM Test	38.999(0.1258)
Breusch –Pagan–Godfrey Heteroskedasticity Test	21.904(0.1103)
Ramsey Reset Test	1.9150(0.1763)



**Figure CUSUM Plot**

**Source:** Obtained on the basis of the underlying data

**Note.** CUSUM = Cumulative Sum.



**Figure. CUSUMSQ Plot**

**Source.** Obtained on the basis of the underlying data

**Note.** CUSUMSQ = Cumulative Sum of Squares.

## V. CONCLUSION

The view that food security has long been associated with making more food available for a population, continue to be an important means for accomplishing the sustainable Millennium Development Goal of reducing poverty and hunger, especially when directed at small producers. However, physical, political, economic, and social environments in which a household lives condition the riskiness of a particular social unrest. Rural economies in agrarian regions in Nigeria are more prone to shocks because of conflicts and overall insecurity and this has been imposing a binding restriction on long run growth of agricultural production and domestic income ever since the emergence of an unprecedented insecurity in Nigeria. Agriculture plays a key role in rural economies, and economic growth and poverty reduction are not likely to be achieved without improvements in agricultural production. Obviously this will only work in situations where households have access to their land because of the central role that livelihoods play in food security outcomes. The strength and diversity of its livelihood certainly conditions how well it will respond to a particular hazard. Against this background, **the objective of this paper is to investigate the nexus among macroeconomic indicators and sustainable food security in Nigeria** using annual time series data covering 1981 to 2019 on the Fully Modified OLS for the long run estimation. To further ascertain the robustness of the results, Dynamic OLS and Canonical cointegration



Regression are estimated. The long run results revealed positive relationships exist between agricultural value added production and food security at a significance level of 1%. This indicates that, one percent increase in value added production activities induces an increase in food security in Nigeria by 1.29%, and 1.92% and 2.80% respectively. Accordingly, a negative relationship exists among internally displace persons and food security where a one percent increase in displacement resulting from domestic violence activities induces -0.33% decrease in food security with a 0.13% and 0.12% positive and insignificant change in food security in Nigeria. The positive relationship could be attributed to inter regional displacements that led to transfer of skills and knowledge sharing as well as other people illegally benefiting in certain ways from the social unrest in the economy. However, positive increases in per capita GDP from 1% to 5% can automatically offset the negative effects of internally displace persons on food security in Nigeria by 1.32%, 1.20% respectively. External trade competitive resulting can induce agricultural production and food security via commercial agriculture. Finally, the paper concludes that internally displace persons, real effective exchange rate, population increase and food inflation have negative impact on food security sustainability in Nigeria while agricultural value added production and per capita GDP have positive impact on sustainable food security in the long run in Nigeria.

#### **Policy Implication and Recommendation**

The results of FMOLS, DOLS and CCR provide new evidence on the long-run prospects of food security in Nigeria. By implication, this indicates that factors such as domestic violence, population growth, food inflation and exchange rate volatility can lead the Nigerian economy into long term food insecurity while increase in agricultural value added production activities and per capita growth can induce a positive and sustainable food security in the long run in Nigeria. Since the influence of domestic violence, population growth, food inflation and exchange rate volatility can lead the Nigerian economy into long term food insecurity, the economic aspect of the

sustainability of their impacts remains at the forefront. The fact is that minimizing their negative effects on food security will cause a momentum in domestic agricultural value added production activities. In addition, favorable economic conjuncture affects the agricultural and enabling business environment that can compete in both domestic and global markets. This can induce an increase the domestic output as well as encourage private sector investments participation. The study argues that the Nigeria's geography is largely favorable for commercial agricultural investments and projects for the reason that agricultural value added production activities and per capita growth revealed some gains and added value for sustainable food security in Nigeria.

The implications of our findings on sustainable food security is that on average, domestic violence and insecurity, population growth, food inflation and exchange rate volatility can lead the Nigerian economy into long term food insecurity remains the key factors in determining a persistent food insecurity in Nigeria. **Therefore, any divergence from these factors can assist the economy to meet its current food needs without compromising the ability of the economy's future generation to meet their own food needs among other things.**

The study strongly recommends that active economic and political stability that will help achieve a sustainable food security dominated which is dominated by negative shock from population growth, food inflation, and persistent insecurity should be established. The government should recognize the elements of vulnerability that many households face and to develop responses such as food security interventions to address the needs of the people affected by crises which are seldom considered. This will improve their livelihood situation so that they are better able to confront the next emergency.

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