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ACHIEVING SUSTAINABLE DEVELOPMENT GOAL TWO: ESTABLISHING THE DETERMINANTS OF FOOD SECURITY IN NIGERIA

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Abstract

This paper sought to establish the social, economic and environmental factors that determine food security in Nigeria. It used time series data from 1981-2018 which were sourced from the Central Bank of Nigeria statistical bulletin for 2018 and from World Bank indicators. The study adopted the Autoregressive Distributed Lag (ARDL) model to estimate the relationship among the variables. The study established that no long run relationship exists among the variables. The findings from the study indicate that Agricultural Land area, Commercial Banks credit to agricultural sector, foreign direct investments, government expenditure on security and carbon emission are key factors determining food security in Nigeria. The study recommends government makes available more agricultural lands through appropriate agencies, and commercial banks increase their sectoral lending to agriculture at an affordable rate.

Keywords: ARDL model, Food Security, Sustainable Development Goal Two, Nigeria

INTRODUCTION

Food has been the key basic need of humans right from existence. This has reflected in the attention giving by governments to ensure that every human being has adequate food needed for sustenance. Different development efforts world over have always included food security as one of its keys targets. Some of these include the Millennium Development Goals (MDGs) and the Sustainable Development Goals. Despite the efforts made by various

governments and development agencies, the problem of food insecurity still persists. This problem is more pronounced in the under-developed countries of Asia and sub-Saharan Africa including Nigeria. African Food Security Briefs (AFSB) estimates that approximately one out of every three persons in sub-Saharan Africa is undernourished (Akerele, Momoh, Aromolaran, Oguntona and Shittu 2013)

Estimates from the United Nations indicate that in sub-Saharan Africa, the proportion of undernourished increased from 28% in 2004-2006 to 29% in 2008 (UN, 2009). This figure put to jeopardy the achievement of millennium development goal 1, which was to halve by 2015 both globally and in Africa the population in hunger as at 1990.

The sustainable development goal 2 of zero hunger further incorporates the need to achieve food security and improved nutrition, promote sustainable agriculture and ending rural hunger. Sustainable development of society thus is difficult to achieve without solving the prevalent challenges of malnutrition and hunger. Estimates from the Food and Agricultural Organization (FAO) indicate that about 792.5million people in 2015 continue to suffer from chronic hunger (FAO, 2015). In Nigeria food insecurity prevalence in the low income urban households and rural areas respectively stands at 79% and 71% (Akerele et.al, 2013)

Scholars believe that achieving human development is intricately linked to achieving food security and that meaningful progress on one cannot be sustained without progress on the other. Most social science and policy discussions, including the existing major early warning models of famine, assume that increased food supply is the key to reducing hunger and that the effects of economic growth will 'trickle down' to reduce hunger (FAO 1996a, Foster and Leathers 1999:67; Quinn and Kennedy 1994). This implies that a major component of ensuring food security is increased food production. In Nigeria, food shortages have been experienced in various parts with its attendant problems of malnutrition, hunger, diseases, etc. Since food security is related to socio-economic development vice-versa, it means that both may be affected by similar factors.

The 1996 World Food Summit in Rome agreed to support efforts aimed at achieving global food security and alleviation of hunger with the aim of halving the population of undernourished persons by the year 2015 (FAO, 2015).

Food security is determined by the conditions when all people, at all times have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active healthy life (FAO, 2015). Since the beginning of this millennium rising prices of food commodities have contributed to increasing the number of people facing food insecurity. This number has increased from 857million to 1.02billion in year

2009 and has reversed earlier progress in reducing the world's hungry population especially in the less developed countries (FAO-WFP 2009).

Food security issues are particularly acute in developing countries. Increasing food production will thus be a pre-requisite for achieving food security. Nigeria still faces food security crises as shown by food insecurity prevalence of 79% and 71% among low income urban house-holds and rural areas respectively (Akerele et.al, 2013)

It is believed that certain socio-economic factors affect food production hence food security. These may include demographic, financial, human capital, socio-political factors and environmental factors. In developing countries, lack of adequate infrastructure, use of primitive farming methods, massive market failures, difficulty in assessing credit and insurance facilities are believed to act as constraints to food production nay food security. This thus establishes the need to carry out an empirical research to establish the determinants of food security in Nigeria.

LITERATURE REVIEW

Food Security

According to FAO (1996), food security exists when all people at all times have physical, social and economic access to sufficient safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life. This definition implies that food security goes beyond availability of food items .It requires that people should have ready access to food. Thus, food production does not necessarily guarantee food security if people that need it do not possess the economic power to access it in their locality.

According to the Food and Agricultural Organization (FAO), food security involves four aspects entitled four dimensions. These dimensions arise from the definition of food security and are accompanied by a set of indicators. These dimensions are Availability, Access, Utilization, and Stability.

1. Availability: World food programme defines food availability as 'the amount of food that is present in a country or area through all forms of domestic production, imports, food stocks and food aid' (FAO/WFP, 2009)

2. Access: Access as a dimension of food security relates to the ability of households to purchase food and transport it. This concept was first presented by Amartya Sen in the early 1980's. It is defined as 'a household's ability to acquire adequate amount of food regularly through a combination of purchases, barter, borrowings, food assistance or gifts (FAO/WFP, 2009). This dimension is a logistical one. A simple illustration of this is where food is abundant

in one part of a country but unavailable in another part due to lack of information or transportation or households do not have the economic empowerment to purchase food.

3. Utilization: Food utilization borders on households being able to consume foods that provide their required nutritional standards.

4. Stability: Stability characterizes the situation where there is adequate food to satisfy the needs of the people in the country at all times.

Relevant Theories and Empirical Studies

Modernization theory

Modernization theory suggests that a development in education and domestic investments leads to industrialization and cultural transformation and ultimately economic development which can improve food security. This theory originated from the ideas of German sociologist Max Weber (1864-1920)

Economic Dependency Theory

This theory emphasizes that the economic development of a state is affected by external influences-political, economic, and cultural. This theory was developed in the late 1950s by Raul Prebisch and his colleagues at United Nations Economic Commission for Latin America.

Neo –Malthusian Population Pressure

Neo-Malthusians argue that rapid population growth results in over-cultivation of lands, excessive use of fertilizers and deforestation. These they argue may negatively affect food security. The term (Neo-Malthusianism) and their ideology were attributed to Samuel Van Houten in 1877.

Ecological- Evolutionary Theory

This theory was proposed by Gerhard Lenski in 2005 in collaboration with Jean Lenski and Patrick Nolan. It contends that traditional 'plow agriculture and resulting high levels of agrarian density facilitate rapid industrialization and lowers income inequality (Crenshaw and Ameen, 1993). Thus the development of agriculture is an important component of food security.

Human capital theory

This theory reveals that individuals and whole society gain economic benefits from investments in people (Nafukho, Hearston and Brooks, 2004).

Monetary Theories

The theories of money are central to macro-economics. The monetarists led by Milton Friedman believe that growth in money supply is the most important factor that determines economic growth. This implies that when more money is supplied to a sector of the economy it is expected to experience increase in output. Thus if more money is made available to the agricultural sector by applying favorable monetary policy instruments, increased food production is expected which will ultimately improve food security.

Empirical research on the problems of food security usually uses different indicators related to the dimensions of food security for measurement. These studies yielded various results which gives insight into the factors that may determine food security.

Wimberly (1991) studied the impact of transnational corporate investment (foreign investment stocks) on food consumption in 60 developing countries over a period of 1967-1985. He adopted a regression model. The result shows that countries that have less penetration by transnational corporations gained more calories and protein per capita per day than countries where the penetration of transnational corporations were higher. This suggests a negative relationship between foreign direct investment and food security. Mihalache-O'Keef and Li (2011) deepened the work of Wimberly (1991) in their study 'Modernization vs. Dependency' Effects of Foreign direct investment on food security in less developed countries. They adopted the framework of modernization and dependency framework to analyze a pooled sample of 56 developing countries from 1981 to 2001. Their result shows that FDI has a negative effect on food security. They recommended the diversification of local economy by developing countries as a way of increasing local production.

In other works, Jenkins and Scanlan (2001) studied food security in less developed countries from 1970-1990. They adopted a lagged panel model using child hunger as a predictor of food security. Their results shows that food supply has modest effects on child hunger rates and that food supply is structurally rooted in development processes (domestic investment, urban bias, foreign capital penetration). They further submit that internal violence, population pressure, tapped by increased age dependency, undermines both supply of food and population access to it. Their submissions support the modernization and population pressure theories. They recommended reduction in internal violence, political democratization, investment in human and physical capital and reducing fertility.

Studies by other scholars have shown varying results. In Ghana, Djokoto (2012) used auto-regressive distributed lag model to test the relationship between food security and agricultural FDI. He used daily energy consumption and daily protein consumption as a measure of hunger and nutrition respectively. The result indicate a negative relationship

between food security and agricultural foreign direct investment in both short and long-run periods He recommended that government support lower priced technologies for small holder farmers to adopt rather than depending on imported technology.

Urdal (2005) in 'People Vs Malthus: Population Pressure, Environmental Degradation and Armed Conflicts Revisited.' used cross-national time series covering the 1950-2000 periods in their analysis. The result did not support the neo-Malthusian view that high population rates put pressure on resources hence food security. It however, finds that in areas where there is land scarcity and high rates of population growth, the risk of armed conflicts increases. He recommended that the use of security for reducing global population growth is unwarranted.

Kopnova and Radionova (2017), in a study titled 'An Analysis of the Economic Determinants of Food Security in North Africa' did a statistical analysis of economic and financial factors in relation to the determinants of food security. They adopted a panel co-integrating model to study data from 1991-2014. The result of their study indicates that population growth and the intensification of agricultural production, foreign trade and foreign direct investment played a crucial role in food security. It further reveals that globalization of the financial system exacerbates food security problems. They recommended a strategy of long-term investment policy of World Bank and FAO be adapted to combat challenges of hunger and food insecurity.

In other studies, Okolo and Obidigbo (2015) in their study 'Food security in Nigeria: An Examination of Food Availability and Accessibility in Nigeria' employed multiple linear regression method to test the effect of commercial bank loans to agriculture and fishery, community and micro finance bank loans to agriculture and fishery, manufacturing and food processing, government recurrent expenditure on agriculture, agric credit guarantee scheme fund, food foreign exchange utilization on crop on food availability (livestock and fishery share of gross domestic product and import of food and life animals). They used data from 1992-2012. The result of their study indicates that the growth rate of population was higher than the growth rate of food availability in Nigeria. Also credit from commercial banks to agric sector, foreign exchange utilization for food and agricultural credit guarantee scheme fund significantly contributed to food availability in Nigeria. They recommended that microfinance banks should make sufficient credit available to smallholder farmers. Studying the impact of federal government agricultural expenditure on agricultural output in Nigeria, Iganiga and Unemhilin (2011) used Cobb-Douglas growth Model, descriptive statistics and econometrics model to analyze data from 1970-2008. The result of their analysis shows that federal government capital expenditure positively relates to agric output while population growth rate and credit to agriculture has a negative relationship with agric output. They recommend that government

should lay emphasis on capital expenditure to revive the agric sector and well monitored credit facilities to agric sector. In other studies, Ladan (2014) conducted an appraisal of climate change and agriculture in Nigeria. The study used secondary data to appraise climate change and found out that climate change has negative impact on agriculture in Nigeria. In a related study on 'carbon dioxide emissions and crop production: finding a sustainable balance', Ejemeyovwi, Obindah and Doyah (2018) used a ordinary least square method to measure the relationship between carbon dioxide emissions and crop production. The study revealed that a positive and significant relationship exists between the two.

MATERIALS AND METHODS

Data Sources

This study employed ordinary least square regression and used secondary time series data that spanned from 1981-2018 (37 years). The series was limited to the period due to data availability and to ensure completeness of data. The data represents the socio-economic, demographic and environmental factors of interest. Data was sourced from the Central Bank of Nigeria statistical bulletin, and World development indicators. Specifically, data on government expenditures on agriculture, security and human capital development, commercial bank credit to agric sector and bank lending rate were sourced from Central Bank of Nigeria statistical bulletin for 2018 while data on food production index, agricultural land area, population growth rate, foreign direct investment and carbon emission were sourced from world development indicators. The focus of this study is to discover the determinants of food security in Nigeria. Measuring food security involves adopting indicators that relate to the dimensions of food security earlier discussed. These may include cereal import dependency ratio (CIDR) which was used by Kopnova and Rodionova (2017) and ratio of food imports to total exports (Diaz-Bonilla et al 2000). Other studies also adopted other indicators for measure of food security like Gentilini and Webb (2008), which proposed a composite indicator labeled the poverty and hunger index. Each of these indicators is related to one of the four dimensions of food security discussed earlier.

Model Specification

This study adopts the food production index as an indicator of food security. This indicator relates to the availability dimension of food security. It tests the response of selected socio-economic variables on it in a bid to find out the determinants of food security.

The focus of this study is to discover the socio-economic, demographic and environmental variables that determine food security in Nigeria. From the literature reviewed the model is specified as follows

FPI =F (AGA, GEA, FDI, CBA, BLR, HCD, SEC, PGR, IMP, CAE)……1

Therefore,

FPI= $\beta_0 + \beta_1$AGA + β_2GEA + β_3FDI + β_4CBA+ β_5BLR + β_6HCD +β_7SEC+β_8PGR + β_9IMP+ β_{10}CAE + μ_t 2

Where,

FPI= food production index

AGA= agricultural land area

GEA= government expenditure on agriculture

PGR=population growth rate

FDI =foreign direct investment

CBA=commercial bank credit to agric sector

BLR= bank lending rate

HCD=human capital development (federal government expenditure on health and education)

SEC= security (represented by total of government expenditure on defence and internal security)

PGR=population growth rate

IMP= Imports as a percentage of GDP

CAE= Carbon emission (proxy for climate change)

u_t = error term

b_0 = constant term/intercept

b_1 –b_{10} = slope coefficients

Technique of Estimation

Analysis of levels and trends in the selected variables was done to provide an insight into their pattern of movement over time.

An Augmented Dickey-Fuller (ADF) unit root test was conducted to test the stationarity of the variables. Based on the order of stationarity, the appropriate cointegration test was carried out and subsequently the model was estimated .The study also used relevant test instruments such as the sign of expectation and parameter value to check if the results conform to theoretical expectation. The T-test was used to determine the statistical significance of the variables using the rule of the thumb that the absolute value of the t-statistics must not be less than (2).

RESULTS AND DISCUSSION

Unit Root Tests and Order of Integration

Table 1: ADF unit root test results (E-views output)

	At Levels		At 1st difference		
Variable	ADF Test	5% C.V	ADF Test	5% C.V	Order Of Integration
FPI	-3.040259	-3.544284	-3.778104	-2.954021	1(1)
AGA	-1.607889	-3.536601	-4.419192	-2.945842	1(1)
GEA	-5.324795	-3.536601	-	-	1(0)
FDI	-3.485852	-3.562882	-7.090051	-2.945842	1(1)
CBA	-1.011650	3.540328	-2.029334	-1.950687	1(1)
BLR	-5.083107	-3.557759	-	-	1(0)
HCD	-0.325018	-3.536601	-4.055197	-2.945842	1(1)
SEC	-1.058668	-3.536601	-5.314417	-2.945842	1(1)
PGR	-1.314944	-3.544284	-3.586441	-2.951125	1(1)
IMP	-2.953122	-3.536601	-7.605883	-2.945842	1(1)
CAE	-2.171490	-3.536601	-6.517909	-2.945842	1(1)

The ADF test was conducted on variables in order to determine their order of stationarity. The result as shown in Table 1 above indicates that all the variables are stationary at first difference except Government expenditure on agriculture (GEA) and Bank lending rate (BLR) that are stationary at levels. This condition warrants the use of Autoregressive Distributed Lag Model (ARDL).

Autoregressive Distributed Lag (ARDL) Bounds Test

Table 2: co-integration test result (ARDL bounds test) (E-views output)

Test Statistic	Value	k
F-statistic	0.823406	10
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	1.83	2.94
5%	2.06	3.24
2.5%	2.28	3.5
1%	2.54	3.86

To ascertain the existence of a long–run relationship between the variables, The ARDL bounds test is adopted. The result as shown in Table 2 above indicates that the F-statistic value is 0.823406. This is below the 5% lower bound value of 2.06 thus indicating the absence of cointegration among the variables. Thus only the short run form of the model was estimated.

ARDL Model Estimation and Diagnostic Tests

Table 3: ARDL model estimation result (E-views output)

Selected Model: ARDL(1, 0, 0, 1, 1, 0, 0, 0, 1, 0, 0)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
FPI(-1)	0.327857	0.131285	2.497295	0.0205
AGA	1.284561	0.293597	4.375248	0.0002
GEA	0.092350	0.052918	1.745142	0.0949
FDI	0.169556	0.648417	0.261492	0.7961
FDI(-1)	1.923838	0.666933	2.884607	0.0086
CBA	0.039062	0.020069	1.946421	0.0645
CBA(-1)	0.042095	0.019209	2.191389	0.0393
BLR	0.017829	0.166075	0.107353	0.9155
HCD	-0.057164	0.015901	-3.594947	0.0016
SEC	0.021156	0.009695	2.182054	0.0401
PGR	-109.1417	35.35079	-3.087392	0.0054
PGR(-1)	71.06743	30.23701	2.350346	0.0281
IMP	-0.066555	0.175790	-0.378605	0.7086
CAE	0.000174	4.38E-05	3.976662	0.0006
C	27.37766	50.99253	0.536896	0.5967
R-squared	0.991099			
Adjusted R-squared	0.985434			
S.E. of regression	2.985814			
Sum squared resid	196.1319			
Log likelihood	-83.35631			
F-statistic	174.9675			
Prob(F-statistic)	0.000000			

The result of the estimated model in Table 3 indicates that agricultural Land area, foreign direct investment, commercial bank loans to agriculture and government expenditure on security all have a positive and significant relationship with food production index. Specifically, the

coefficients indicate that a unit increase in agricultural land area will increase food production index (nay food security) by 1.28 units Also 1unit increases in foreign direct investment, commercial bank loans to agric sector and government expenditure on security will lead to 0.17, 0.04 and 0.02 unit increases respectively in food production index which translates to food security. The result further indicates a negative and significant relationship between human capital development and food security. Specifically a unit increase in human capital development will lead to 0.057 decreases in food security. From the results we can also infer that one lag period of population growth rate positively and significantly affected food security. During this period a 1unit increase in population growth rate led to a 71 unit increase in food security while a second lag period showed a negative relationship with food security. During this period a 1unit increase in population growth rate resulted in a 109 units decrease in food security. Finally, we notice that carbon emission which proxies for climate change has a positive and significant relationship with food security. Specifically, a 1unit change in carbon emission results in 0.00017unit increase in food security. This supports the results obtained in Ejemeyovwi, Obindah and Doyah (2018). The R-squared value of 0.99 and F-statistics probability of 0.0000 indicates that the goodness of fit of the variables and the joint significance of the model is reasonably realistic and reliable.

Diagnostic Tests

Table 4: Breusch-Godfrey serial correlation LM test (E-views output)

F-statistic	2.197237	Prob. F(1,21)	0.1531
Obs*R-squared	3.504631	Prob. Chi-Square(1)	0.0612

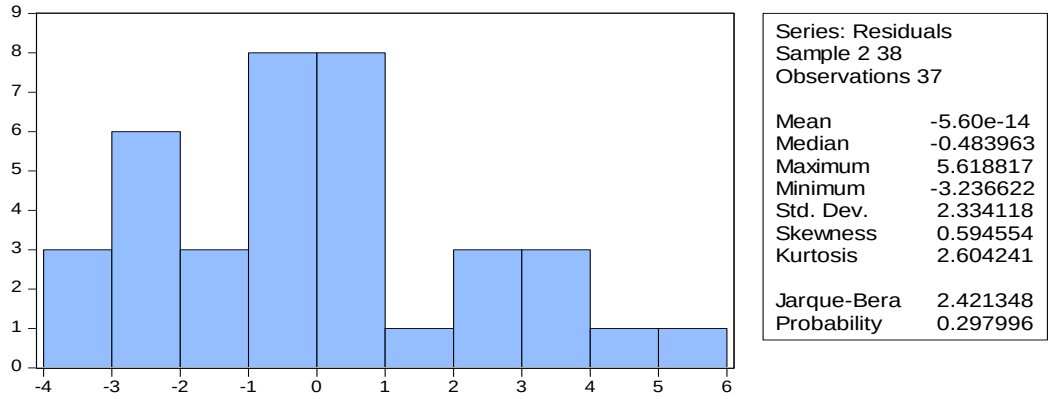
The Breusch-Godfrey Serial Correlation LM test, tests for presence of serial correlation within the variables. The result shown in table 4 indicates the absence of serial correlation given the probability value is above 0.05.

Table 5: Ramsey reset test (E-views output)

Test	Value	df	Probability
t-statistic	0.600977	21	0.5543
F-statistic	0.361173	(1, 21)	0.5543

The Ramsey Reset Test checks for possible model misspecification and omitted variables. The result in table 5 shows that the Probability value of the F-statistic (0.15543) is above 0.05 indicating the model was well specified and no variables omitted.

Figure 1: Histogram normality test (E-views output)



The histogram normality test (Figure 1) tests if the residuals are normally distributed. The Jarque –Bera probability value (0.2979) is significantly higher than 5% critical value which implies that the residuals are normally distributed.

Table 6: Heteroskedasticity test: Breusch-Pagan-Godfrey (E-views output)

F-statistic	1.093470	Prob. F(14,22)	0.4134
Obs*R-squared	15.18196	Prob. Chi-Square(14)	0.9933

Finally, the Breusch-Pagan-Godfrey Heteroskedasticity test (see Table 6 above) shows that there is absence of Heteroskedascity in the dataset.

CONCLUSION AND RECOMMENDATIONS

This study sought to establish the determinants of food security in Nigeria between the period 1981 and 2018. The results revealed that Agricultural Land area, foreign direct investment, commercial bank credit to agricultural sector, government expenditure on security and carbon emission positively and significantly affects food production index and hence positive determinants of food security in Nigeria while human capital development and population growth rate negatively affects food production index and hence food security in Nigeria. The study further established that a long run relationship does not exist between the regressors and food security. It thus recommends that government should make available lands for agricultural purposes through appropriate agencies like the River Basin development

authorities and the Nigeria agricultural land development agency. Furthermore, commercial banks and other lending institutions should increase credit to agricultural sector at cheap rate so as to ensure food security in Nigeria. Also, government should provide adequate security for people to engage in agricultural production activities and also provide favourable business environment to attract foreign direct investments into the agricultural sector. Having established the determinants of food security in Nigeria based on the food availability concept, it is suggested that going forward, further researches focus on how to improve on the other dimensions of food security especially access to food which is key to achieving stability in food security.

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