Economic Development, Technological Change, and Growth

Determinants of Food Security in Nigeria

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Abstract: The aim of this study is to examine the determinants of food security in Nigeria. In this study, a multiple regression model was specified, which captured the effects of labour input (measured using employment in the agricultural sector), domestic capital investment (measured using gross fixed capital), bank inclusion (measured using bank lending to agriculture), environmental quality (measured using percentage of carbon dioxide emission to gross national income, and oil revenue. The autoregressive distributed lag (ARDL) method was adopted for analyzing the model, while pairwise granger causality was used to provide robust results. The results from the regression estimates found that only domestic capital had significant positive impact on food security in Nigeria; whereas bank lending only had significant positive impact on food security in Nigeria during the short run period. Based on the results the study recommends that: the Nigerian government should provide a conducive environment in the agricultural sector, for private participation; the CBN needs to look into bank

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lending policies and iron out gray areas that inhibit bank lending to the agricultural sector; the CBN, the Federal Ministry for Agriculture, the Ministry of Finance and the private sector should convey and design a short-long term plan for the growth and development of the agricultural sector in Nigeria; it is important to make agricultural subject a compulsory one in secondary schools; and the Nigerian government should reduce dependence on non-renewable energy.

Keywords: Food Security; Bank Inclusion; Environmental Quality

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1. Introduction

Food security is a measure of food availability, accessibility, acceptability and affordability. The Rome Declaration on World Food Security defines it as food that is available at all times, to which all persons have means of access; which is nutritionally adequate in terms of quantity, quality and variety, and is acceptable within the given culture (Clover, 2003). It is when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO, 2007). It plays an important role in the existence of man, needed for healthy living, labour and economic productivity (Clover, 2003; Agboola, 2014). Lack of ensuring food security is tantamount to political instability, hunger, malnourishment, and reliance of food importation and its adverse effects on trade deficits (Havas & Salman, 2011). Food security can be used to measure development of a country's agricultural sector. It is expected that every country should be able to feed itself. Thus, when an agricultural sector is able to provide quality food at affordable price, it is said to have developed.

Unfortunately, food security is not a feature of all economies. This is because it is a common problem among several developing countries. These countries lack of affordable and quality food (Fawole, Ilbasmis & Ozkan, 2015). Such countries are not always able to meet the 2250 kcal calorie intake per adult per day, as recommend by the World Health Organization. Report from the United Nations shows that about 805 million people are undernourished as of 2014 (Cargill, 2014); and many of these persons are from developing countries (Fawole, Ilbasmis & Ozkan, 2015). Between 1996 and 2000, an estimate of 840 million persons were undernourished: 11 million of them were from developed countries, 30 million are from emerging countries, and 799 million are from developing world (Food and Agricultural Organization, 2002). In Nigeria, the situation is escalating. The average daily per capita of calorie intake in Nigeria has been on the decline, dropping from 140 in 1992 to 37 in 2013, and was 42 in 2016 (World Development Indicators, 2019). Fawole, Ilbasmis and Ozkan (2015) noted that prevalence of food insecurity in Nigeria increased from 9% in 2009 to 11% by the end of 2014. These statistics suggest that there has been low agricultural productivity in the country. Metu, Okeyika and Maduka (2016) note that

the expected productions from crops, forests and livestock have been lower than their agricultural potentials. There is growing population, whereas source of sustenance is diminishing. This shows that worst times are ahead.

A number of empirical studies in the literature have tried explain agricultural performance in Nigeria. In this paper, two factors have been identified. A major issue discussed is poor financial inclusion. The agricultural sector was abandoned by the Nigerian government after the country became a member of the Organization of Petroleum Exporting Countries (OPEC) in 1971. There was the Agricultural Credit Guarantee Funds Scheme (ACGFS) setup by the Federal Military Government under the Agricultural Credit Guarantee Scheme Fund Decree 1977 (Decree No. 20). Yet, this framework was not effective, as productivity from the sector was abysmal. It took the intervention of the Goodluck Jonathan, whose Transformation Agenda (2011-2015) revamped the sector and made it the driver the Nigerian economy in 2014 (IMF, 2014). Also, environmental quality is considered an important factor that determines food security and agricultural development in Nigeria. Uzoechi (2009); Nwogwugwu and Nwogwugwu, (2013); and Osuafor and Nnorom (2014) have identified acidic rain to be harmful to agricultural productivity in Nigeria. Agbo (2012) discloses that there has been remarkable climate change in Nigeria, mostly caused by emission of poisonous gases to the atmosphere in Nigeria, which are harmful for plant growth and food production. These factors are explored in this paper using econometric analysis. The paper comprises five sections, which are: an introductory part, a literature review part, a methodology part, data analysis part, and concluding part.

2. Literature Review

2.1. Conceptual Review

2.1.1. Concept of Environmental Pollution

The environment is the natural habitat that comprises biophysical components and processes of natural environment of land, water and air (Bayode, Emmanuel & Sogbon, 2011). The environment can be said to be the natural habitat of man with several components within which various kinds of activities and processes occur. It provides all life support systems with air, water and land as well as the materials for fulfilling all developmental aspirations of man (Isife, 2012). It provides mankind with several opportunities such as shelter, agricultural resources, petroleum resources and clothing. Hence, the environment is the key existence of life on the earth. It that acts upon the organism for its survival (Toman, 2003). However, due drastic changes in the environment, mostly caused by man's activities, reduce environmental quality. Therefore, the quality of an environment determines the level of economic productivity.

Several studies (see Nduka, 2004; Bulama, 2005; Agukoronye, 2004) have identified many of the environmental problems, globally. These problems include the high rate of urbanization, psychological orientation of urban residents on the environment as well as poor environmental management practices. The true cost to an economy arising from environmental degradation and the depletion of natural resources is unknown.

The irrational use of the environment contributes to its degradation, which occur in the form of soil erosion, high population pressure and increasing congestion in urban centres. Human related activities since 1980s, especially in the development projects of the oil and gas sector, have led to the acceleration in the loss of the topsoil and deforestation; loss of habitat, species and biodiversity; and degradation of wetlands. Environmental degradation has resulted in the deterioration of urban and rural environmental quality, which is characterized by water shortages and floods that play a major role in the transmission of communicable diseases. These worsen the condition of the poor. Also, drought and desertification threaten food security and nation's ecological integrity, and are drivers of population displacements (Nwafor, 2006).

Aribigbola (2008) suggests that the prevailing global environmental degradation poses serious threat to sustenance of capacity of the ecosystem. Therefore, environmental sustainability has taken priority position in housing, infrastructure provision, planning, land use and urban development among others (Ogboru & Anga, 2015). Urban areas are centres of arts, culture, education, entertainment, technological innovations, specialized services and "economic engines" (Kadir, 2006; Kjellstrom & Mercado, 2008). The products of urbanization however, come with far reaching economic, and socio-spatial and health implications. The ecological and sociological "footprint" of cities has spread over wider areas and fewer places on the planet earth are unaffected by this phenomenon. Changes in the ecology of urban environment occasioned by increasing population, overcrowded habitations and uncontrolled exploitation of natural resources may have accounted for this wide ecological footprint of urban areas which is not peculiar to developing countries (Hales, 2000).

The pollution of the environment can be categorized into three groups. These are air or atmospheric pollution, aquatic or water pollution and land or surface area pollution. Air pollution relates to the limitation of outer ambient. This is often caused by household and industrial activities. The emission of carbon monoxide from households and industrial places is harmful to the health. This is because it reacts with the blood vessel and prevents it from taking up oxygen and the people are suffocated (Obajimi, 1998). Water pollution is the discharge of unwanted biological, chemical and physical materials into water bodies from man's environment. The pollutants are usually chemical, physical and biological substances that affect the

natural condition of water. This incidence is responsible for the wide spread water contamination in most cities. Also, solid wastes have equally flooded the water ways in these urban centres. Land surface pollution is the occurrence of unwanted materials or waste on land. The commonest pollutant on land is the waste products that are often scattered on land area in the cities. According to Kjellstrom and Mercado (2008), most environmental problems are due to the production or consumption of goods whose waste products translate easily into pollutant. It is believed that the emergence of urbanization is responsible for the rapid accumulation of solid waste.

2.1.2. Concept of Financial Inclusion

Financial inclusion refers to a process that guarantees the ease of access, accessibility and usage of the formal financial system by all members of an economy. Mbutor and Uba (2013) that it is an important policy tool employed by government in fighting and stimulating growth given its ability to facilitate efficient allocation of productive resources. The principle of financial inclusion has assumed greater level of importance in recent times due to its perceived importance as a driver of economic growth. Giving access to the hundreds of millions of men and women globally, who are presently excluded from financial services would provide the possibilities for the creation of a large depository of savings, investable funds, investment and therefore global wealth generation (Ukpai & Adigun, 2013). Countries with higher degrees of financial inclusion tend to post higher economic growth, as people who are financially included tend to be more productive, consume more and invest more (Mbutor & Uba, 2013).

The role of the financial market has been emphasized in the literature. The most important role it plays is intermediary function, whereby excess funds from an economy are pooled to deficit sector of the economy which need them. The intermediary function of the financial market is believed to help in achieving economic growth. This is because availability of credit promotes productivity, which has its multiplier effects through increase in employment, personal income and consumption pattern of households. It also assists in the reduction of risks faced by firms and businesses in their productive processes, improvement of portfolio diversification and the insulation of the economy from the vicissitudes of international economic changes (Nzotta & Okereke, 2009). Additionally, the market provides linkages for the different sectors of the economy and encourages a high level of specialization expertise and economies of scale. Nzotta (2004) reckons that the financial system provides the necessary environment for the implementation of various economic policies of the government which is intended to achieve non-inflationary growth, exchange rate stability, and balance of payments equilibrium foreign exchange. More so, economic literature provides basis to support the contributions of financial sector performance on economic growth.

2.2. Theoretical Review

The theory for this paper is the dual theory by Arthur Lewis. British Economist, Arthur Lewis (1915-1991) developed a dual sector theory in 1954 to explain the importance of developing the agricultural sector for economic prosperity. The theory applies mostly to developing countries like Nigeria, which have agriculturally-abundant resources that have not been optimally developed and a large underutilized population. Earlier in literature, an eighteenth-century school of thought known as the physiocrat ideology propounded that agriculture is the only sector that drives economic prosperity because it produces the net surplus that can promote growth and development. This school of thought comprises of scholars such as Francois Quesnay, Anne-Robert-Jacques Turgot, Marquis de Mirabeau, Marshal Vauban, and Richard Cantillon. The school of thought did not provide a concise explanation how the net surplus will be achieved. Arthur Lewis theory provided basis to understand how this net surplus can be achieved, when it recognized the need for introduction of surplus labour from an informal, less developed agricultural sector, to a well-developed but labour deficit agricultural sector (Jhingan, 2012). This would help increase marginal productivity of labour, raise their income level and standard of living, and bring about inclusive growth of the economy.

2.3. Empirical Review

Studies in the literature have examined the impacts of financial inclusion and environmental pollution on agricultural productivity / food security in Nigeria. For studies on environmental pollution and agricultural productivity, there is a strong consensus that environmental degradation is a threat to agricultural performance in the country. For instance, Edoja, Aye and Abu (2016) analyzed the dynamic impact of CO2 emission and agricultural productivity on food security in Nigeria, using time series data from 1961-2010. The study made use of econometric analysis, wherein unit root and co-integration tests were tested using Phillip and Perron and Augmented Dickey and Fuller, and the Johansen statistics. The study adopted a vector auto regressive regression framework to analyse the model of the study, and found that carbon dioxide emission has significant negative impact on food security in Nigeria. Using granger causality method to provide robust results, it was found that carbon emission granger causes agricultural productivity in Nigeria.

Similarly, Ayinde, Michie and Olatunji (2011) evaluated the impact of climate change on performance of the agricultural sector in Nigeria, using time series data. The study adopted similar econometric analysis as Edoa, Aye and Abu (2016), by testing for unit root and co-integration. Using the error correction methodology, it was found that excessive rainfall had negative significant impact on agricultural output in Nigeria.

Also, Izuogu (2015) examined the effects of environmental hazards on agricultural production in Nigeria, using a primary data. The study was based in Imo State. Based on regression results, it was found that environmental pollution caused by oil spillage significantly threatens food production within the State.

Using a time series data and the autoregressive distributed lag (ARDL) regression framework, Imoh and Ogbuagu (2015) determined the impact of climate change on agricultural productivity in Nigeria. The study covered periods of 1980 to 2014. Based on results obtained from regression analysis, it was found that climate change significantly affects agricultural productivity in Nigeria, during the long run period.

Studies on bank lending provide mixed results. However, many of these studies recognize the importance of bank lending on agricultural performance in Nigeria. Fowowe (2020) examined the impact of financial inclusion on agriculture sector performance in Nigeria. The study made use of secondary panel data comprising seven thousand, one hundred and eighty-three households. Data was obtained from general household surveys. The study employed regression analysis. Results showed that financial inclusion exerts significant positive impact on output from the agricultural sector in Nigeria.

Awotide, Abdoulaye, Alene and Manyong (2015) investigated the impact of bank credit on agricultural production in Nigeria, using primary data obtained from five South-West States in Nigeria: Oyo, Ondo, Ekiti, Osun and Ogun. The study made use of switching regression and found that bank credit has significant positive impact on farming and livestock production in the States examined.

3. Methodology

A research methodology was required to carry out an empirical investigation on the topic investigated. The methodology made use of a regression model draws from Arthur Lewis dual sector theory, which is a pro-agricultural theory that focuses on how to promote agricultural productivity. The theory can be traced to the works of the Physiocrats during the early eighteenth century, which asserted that agriculture produced the net surplus that spurred economic growth. The physiocrat school of thought could not explain how to achieve net surplus needed to economic prosperity. This was later explained by Lewis (1954) theory, which noted that through withdrawal of surplus labour from the informal sector of the economy to the formal/modern sector, marginal productivity of labour becomes enhanced by augmenting it using capital. With increase in productivity, earnings will increase, thereby leading to improved welfare and poverty reduction. Based on this theoretical framework, this study notes that capital injection and labour input are necessary to improve agricultural performance and ensure food security. This study adopts a Cobb–Douglas production function to capture the effects of capital and labour on

agricultural productivity. The Cobb–Douglas production function is stated mathematically as:

$$Y = A \, L^{\beta_1} K^{\beta_2} \tag{1}$$

Where: Y = total output

   L = labour input

   K = capital input

   A = total factor productivity

   β_1 and β_2 are the output elasticities of labor and capital respectively

Equation (1) is adjusted for the sake of this study. Food security is used to replace total output; whereas financial inclusion, environmental pollution and oil revenue are included as control variables that affect food security. This is stated as:

$$SEC = A \, L^{\beta_1} K^{\beta_2} INC^{\beta_3} ENV^{\beta_4} REV^{\beta_5} \tag{2}$$

Equation (2) is expressed in econometric form as we drew some insights from these recent studies Aderemi *et al.* (2020), Aderemi *et al.* (2021) Obiakor *et al.* (2021) and Obiakor *et al.* (2022)

$$SEC = \alpha + \beta_1 LAB + \beta_2 CAP + \beta_3 INC + \beta_4 ENV + \beta_5 REV + U \tag{3}$$

Where: SEC is food security (proxied using food production index)

   LAB = Labour input (employment rate in the agricultural sector)

   CAP = Capital input (measured by gross fixed capital formation)

   INC = Financial inclusion (proxied using bank lending to agriculture)

   ENV = Environmental pollution (measured using carbon dioxide emission)

   REV = Oil revenue

   α = Total Factor Productivity

   $\beta_1 - \beta_4$ = Parameter Estimates

   U = Stochastic Disturbance Error Term

The granger causality model for this study is stated as:

$$SEC = \delta_0 + \sum_{p=1}^{k} \delta_1 SEC_{t-j} + \sum_{p=1}^{k} \delta_2 LAB_{t-j} + \sum_{p=1}^{k} \delta_3 CAP_{t-j} + \sum_{p=1}^{k} \delta_4 INC_{t-j} + \sum_{p=1}^{k} \delta_5 ENV_{t-j} + \sum_{p=1}^{k} \delta_6 REV_{t-j} + \mu \tag{3}$$

Where: δ_0 is the intercept; δ_1 to δ_6; are parameter estimates of the granger causality model; μ_1 it the error term, whereas t-j represent the lag lengths; and k, p are periods.

Data for this study is secondarily sourced from the Central Bank of Nigeria Statistical Bulletin, Central Bank of Nigeria Annual reports; and World Development Indicators. The data spans from 1991-2019.

4. Discussion of Results

Table 1. Descriptive Statistics

Statistics	SEC	LAB	CAP	INC	ENV	REV
Mean	94.08	44.15	2.00	180.14	0.99	3261.48
Median	94.43	44.96	2.34	62.10	0.85	3191.94
Maximum	125.77	50.25	40.39	680.03	1.87	8878.97
Minimum	55.71	35.10	-23.75	5.01	0.51	82.67
Std. Dev.	22.15	5.36	12.48	206.71	0.43	2697.33
Skewness	-0.03	-0.35	0.44	1.09	0.92	0.38
Kurtosis	1.81	1.65	5.13	2.71	2.53	1.94
Jarque-Bera	1.71	2.81	6.44	5.80	4.34	2.05
Probability	0.43	0.25	0.04	0.06	0.11	0.36
Observations	29	29	29	29	29	29

Source: Author's Compilation (2021)

In table 1, the food security averaged 94.08, while labour, capital input, bank inclusion, environmental quality and oil revenue averaged 44.15, 2.0, 180.14, 0.99 and 3216.48. The standard deviation values show that the datasets used are not symmetric. With kurtosis values greater than 3.0, capital investment experienced extreme values during the periods under study. This implies that capital injection was not regular throughout the years, but experienced boom during some years. Likewise, the kurtosis values imply that food security did not witnessed rapid changes during the years, as growth was steady. The Jarque-bera probability values show that only capital investment is not normally distributed. Hence, the study can be analysed using parametric statistics as the datasets are not haphazardly distributed.
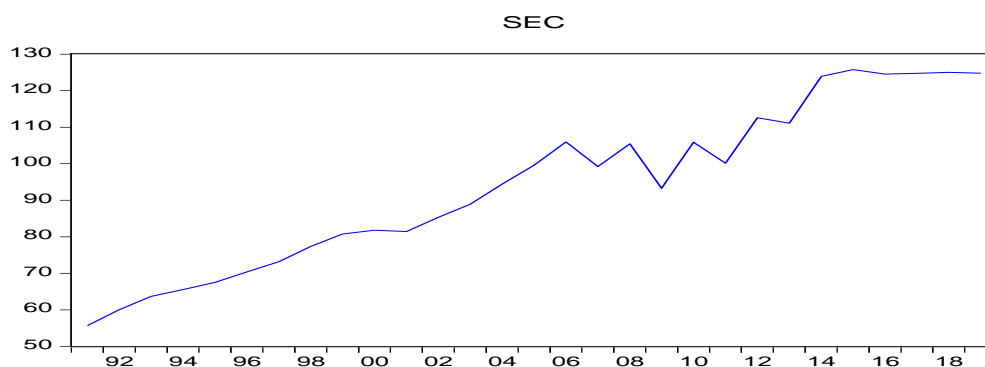
Figure 1. Trend in Food Security in Nigeria
Source: Author's Compilation (2021)

In figure 1, food security is shown to have increased in Nigeria during the years (1991-2019), with steady growth. However, there was decline in food security between 2006 and 2014, which was later improved upon, and trended upwards until 2019.

Table 2. Unit root Test Results

Variables	95% Critical values	ADF Test Stat	Order of Integration
SEC	-3.603202	-4.493422	I(0)
LAB	-3.580623	-3.609580	I(0)
CAP	-3.587527	-9.496005	I(0)
INC	-3.587527	-7.351654	I(1)
ENV	-3.587527	-4.898216	I(1)
REV	-3.587527	-5.317472	I(1)

Source: Author's Compilation (2021)

In table 2, the augmented dickey fuller test results for unit root shows that there are no unit roots in SEC, LAB and CAP variables. The rest of the variables (INC, ENV, and REV) were later differenced to remove presence of unit root in them. Differencing some of the data series warrants the adoption of co-integration method. Given that the stationarity statuses of the variables are not on the same order of integration, the bonds co-integration test will be used to co-integrate the variables and test them for long run relationship.

Table 3. Bonds Test Results

Test Statistic	Value	k
F-statistic	5.857355	5
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

Source: Author's Compilation (2021)

The variables were co-integrated and tested for existence of long run relationship. This test was conducted using the Bonds test. As shown in table 3, the f-statistic is greater than the upper and lower limit value at 5% level. This shows that the variables which have different stationarity levels, are co-integrated of order I(0), and that there is long-run relationship among the variables.

Table 4. ARDL Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Intercept	9.485983	63.84320	0.148583	0.8842
SEC(-1)	0.175230	0.127059	1.379120	0.1911
SEC(-2)	0.484970	0.124817	3.885448	0.0019*
LAB	-1.685257	3.689006	-0.456832	0.6553
LAB(-1)	-4.161741	6.481164	-0.642129	0.5320
LAB(-2)	6.111343	3.932685	1.553987	0.1442
CAP	0.289091	0.074985	3.855344	0.0020*
CAP(-1)	0.215910	0.066370	3.253116	0.0063*
CAP(-2)	0.260692	0.079984	3.259319	0.0062*
INC	-0.012254	0.015635	-0.783766	0.4472
INC(-1)	0.044340	0.020872	2.124407	0.0534**
ENV	-0.930484	2.378150	-0.391264	0.7019
ENV(-1)	2.418961	2.198219	1.100419	0.2911
REV	0.000597	0.000604	0.989058	0.3407
ECM	-0.339801	0.130520	-2.603444	0.0219*
Long run Estimates				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Intercept	27.916326	179.089762	0.155879	0.8785
LAB	0.777941	3.633510	0.214102	0.8338
CAP	2.253362	0.915937	2.460172	0.0287*
INC	0.094425	0.072586	1.300862	0.2159
ENV	4.380445	6.578303	0.665893	0.5171
REV	0.001758	0.002102	0.836280	0.4181
Summary Statistics				
R-squared	0.990866	Mean dependent var		96.75859

Adjusted R-squared	0.981732	S.D. dependent var	20.48991
S.E. of regression	2.769405	Akaike info criterion	5.181291
Sum squared resid	99.70483	Schwarz criterion	5.853207
Log likelihood	-55.94743	Hannan-Quinn criter.	5.381087
F-statistic	108.4806	LM test for serial correlation	0.0931
Prob(F-statistic)	0.000000	Breusch-Pagan test for heteroscedasticity	0.2812

Source: Author's Compilation (2021)

Hint: (*) (**) indicate significance at 5% and 10% levels, respectively

Table 4 presents short and long run estimates of the ARDL model. The model shows that adjusted r-squared and r-squared statistics are above 98%. This indicates that the exogenous variables accounted for more than 98% of the total variations in food security in Nigeria. The f-test is statistically significant at 1%. This shows that the model was rightly specified. Serial correlation was tested using the LM statistic because the model is an autoregressive one. Using the Durbin-Watson leads to spurious result when testing for serial correlation in an autoregressive model (Ojameruaye & Oaikhenan, 2001). The LM test value is 0.0931. Therefore, the null hypothesis that states no presence of serial correlation cannot be rejected. This shows that serial correlation is not a problem in the model. Breusch-Pagan statistic was used to test for heteroscedasticity. The p-value is not statistically significant. Therefore, the null hypothesis that states that the model is homoscedastic cannot be rejected. The ECM variable is negative and statistically significant. This shows that there is short run to long run convergence in the model. Based on these, the parameter estimates presented in the table above are significant to explain the phenomenon investigated.

Based on the parameter estimated, the impact of labour on food security is negative in the short run, but positive in the long run. The p-values are not statistically significant. This indicates that labour employed in agricultural production between 1991 and 2019 in Nigeria, has not been effective towards ensuring food security in the country. On the other hand, the parameter estimates reveal that domestic capital injection in agricultural in Nigeria significantly contributed positively to food security during the years. Bank inclusiveness had positive significant impact on food security in Nigeria during the short run, but did not contributed significantly to food security in the country during the long run period. Also, environmental pollution via carbon emission did not exert significant impact on food security in Nigeria during the short and long run periods. This shows that the amount of carbon emitted in the country during periods of 1991-2019 were not significant enough to influence food security. Oil revenue had positive impacts on food security both in the short and long run periods. Yet, the p-values reveal that the impacts are not significant. This shows that earnings from oil were not used to spur food security in Nigeria during the periods of 1991-2019.

Table 5. Pairwise Granger Causality Results

Null Hypothesis:	Obs	F-Statistic	Prob.
LAB does not Granger Cause SEC	27	5.06776	0.0155
SEC does not Granger Cause LAB		1.35039	0.2798
CAP does not Granger Cause SEC	27	0.19868	0.8213
SEC does not Granger Cause CAP		0.06110	0.9409
INC does not Granger Cause SEC	27	2.77101	0.0845
SEC does not Granger Cause INC		0.62328	0.5454
ENV does not Granger Cause SEC	27	0.13954	0.8705
SEC does not Granger Cause ENV		1.66840	0.2115
REV does not Granger Cause SEC	27	1.51824	0.2412
SEC does not Granger Cause REV		1.81823	0.1859

Source: Author's Compilation (2021)

Table 5 shows that only labour has causal relationship with food security. The relationship runs from labour to food security. Hence, factors like capital injections, bank inclusiveness, environmental quality, and oil revenue do not granger cause food security in Nigeria.

5. Conclusion

The results obtained from this study offer mixed findings on factors that determine food security in Nigeria. Based on the ARDL regression output, only domestic capital injections had significant impact on food security in Nigeria both in the long and short run. Bank inclusiveness only had positive significant impact on food security in Nigeria during the short run period. Labour and oil revenue both had positive insignificant impact on food security in the short and long run. Environmental quality impacted food security negatively and positively during the short run as time varied. In the long run, environmental quality impacted positively on food security in Nigeria. These impacts are not statistically significant. The granger causality result shows that only labour input granger causes food security in Nigeria. Contrasting this result with the regression results, it can be noted that the quality of labour currently, cannot be used to achieve food security in Nigeria. However, improving labour quality would suffice to grow food, make it available, nutritious and affordable in the country. On the other hand, the results from this study shows that bank operations have not been inclusive towards agricultural productivity and food security. The positive significant impact of bank lending to agriculture only occurred during the short run. This shows that the banking sector in Nigeria has not adopted a long term plan for agriculture. Most of these plans are short term, which

cannot be used to sustain food security in the long run. Further results on domestic capital show that domestic investments can be used to grow food in Nigeria both in the short and long run. However, the granger causality results reveal that the inability for domestic investments to sustain food security. This indicates there is need for supplement in investment towards agriculture in Nigeria. Based on these results, this study makes the following recommendations:

1. The Nigerian government should provide a conducive environment in the agricultural sector, for private participation. This support can come in the form of provision of quality infrastructure in the agricultural sector, capital and machinery import waiver, access to land for agricultural cultivation, and creating policies that are agro-friendly.

2. The CBN needs to look into bank lending policies and iron out gray areas that inhibit bank lending to the agricultural sector.

3. The CBN, the Federal Ministry for Agriculture, the Ministry of Finance and the private sector should convey and design a short-long term plan for the growth and development of the agricultural sector in Nigeria, so as to make food security achievable at all times in the country.

4. It is important to start training manpower exclusively for agricultural purposes in Nigeria. Already, the sector is unattractive owing to poor and insufficient farming and agricultural knowledge and skills. It is important that for a country that seeks to achieve food security, citizens should be knowledgeable and skilled in agricultural practices. This implies that every department of agriculture should be revamped to make graduates of agriculture effective farmers that would be confident of going into agriculture. More so, it is important to make agricultural subject a compulsory one in secondary schools just as mathematics and English language subjects are. Curriculum on agriculture in secondary school education should expose students to farming practices. This would help to promote agriculture in Nigeria and help foster food security in the country.

5. The Nigerian government should reduce dependence on non-renewable energy. Especially, most homes rely on generator and combustion of carbon gases as source of electricity. Continuous emission of carbon and other greenhouse gases are inimical to health and agricultural practices. Therefore, legislation on non-renewable energy should be introduced in Nigeria, so that the adverse effects of environmental pollution on food security can be mitigated.

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