African Journal of Housing and Sustainable Development (AJHSD)
Volume 3, Number 1
http://ujh.unilag.edu.ng/index.php/ajhsd

# Food Security in Africa: The Role of Agricultural Import and Export

**Enilolobo, O. S.; Babalola, B. A.; Nnoli, I. T.; Ajibola, A. A. and Okere, W.**

Economics, Accounting and Finance Department, Bells University of Technology, Ota

**To cite this article:** Enilolobo, et al. (2022). Food Security in Africa: The Role of Agricultural Import and Export. *African Journal of Housing and Sustainable Development*, 3(1), pp. 68-82.

## Abstract

The study investigates food security in Africa and utilises secondary data sourced from the World Data Banks from 1980 to 2019 on ten African countries; Angola, Central African Republic, Cote D'Ivoire, Cameroon, Egypt, the Gambia, Ghana, Kenya, Nigeria, and South Africa selected using the convenience sampling technique. The objectives of the study were to examine the impact of agricultural export/import on food security and establish the direction of causality among agricultural export/import and food security in the selected African countries. The autoregressive distributed lag (ARDL) model and Dumitrescu Hurlin panel causality test were adopted in the evaluation of the study hypotheses. Food security was measured in terms of availability and accessibility was proxied by food production index (FPI) and GDP per capita respectively. The result reveals that agricultural exports (AGREXP) has a negative and insignificant impact on food security in the selected African countries while agricultural imports (AGRIMP) has a positive and significant impact on food security. We also found evidence of unidirectional causality between agricultural export and food security and between agricultural import and food security, at a 5% level of significance. We conclude that agricultural import has a positive effect on food security while agricultural export has a negative insignificant effect on food security. It is therefore recommended that, in view of the rapid urbanization in Africa, agricultural imports and trade liberalization should be further used to boost food security in order to achieve the sustainable goal of zero hunger in African cities.

**Keywords:** Africa; Agricultural export; Agricultural imports; Exchange rate; Food security

## 1. Introduction

Food security is a measure of food availability, acceptability and affordability (Enilolobo et al, 2022). Food security occurs when all people have physical and economic access to adequate nutritious and balanced food to fulfil their nutritional needs and food preferences for an active and healthy life at all times (Astou, 2015; Wisdom, Apollos, Samuel, and Lawrence, 2022). Food

✉ itnnoli@bellsuniversity.edu.ng*

supply, accessibility, consumption, and stability are the four factors that drive food security. Regardless of the dimensions of food security, it plays an important role in human health and welfare; it contributes to economic and political stability; and thus, serves as a focal topic in several academic fields (Havas & Salman, 2011; Candel, 2014). Also, it is associated with political instability. In most countries in the world where political instabilities are experienced, food security is an inevitable problem (Fawole, IIbasmis & Ozkan, 2015).

Despite the international community's best efforts to address global food insecurity, the number of malnourished people started to increase again in 2015, after a period of steady decrease in the 1990s and 2000s. This increases vulnerability of city systems and welfare. For example, chronic hunger and malnutrition are responsible for roughly 60% of all childhood deaths in developing countries (World Health Organization, 2018). In addition, chronic malnutrition makes children susceptible to common childhood illnesses such as diarrhoea, acute respiratory infections, malaria, and measles (Fawole, IIbasmis & Ozkan, 2015).

Inadvertently, macro-economic conditions such as exchange rates drive food security. Exchange rates, as an important index of trade fluctuations continuously contribute to a major setback in Africa's socio-economic development. The overvaluation of the domestic currencies is associated the balance of payments deficits emanating mainly from exchange rate disincentives to the various exporters and farmers that produce food crops for domestic consumption. Killick, and Commander, (1988) argues that avoiding a severe balance of payments crisis and rapid rates of inflation could be regarded as a necessary condition for satisfactory progress in the domestic agricultural sector and reducing food imports. Food imports compete with capital goods for the available foreign exchange so that domestic investment for the development of the agricultural sector is crowded out. Without the proper macroeconomic framework, policies aimed at agricultural producers at the farm level are unlikely to achieve the desired effects.

According to FAO (2019), 52 countries depend heavily on agricultural imports out of 65 developed economies and low developing countries. The circumstances have put pressure on available foods, and such circumstances are extremely worrisome for those countries' food security, especially when export restrictions are enforced by the world's leading suppliers, such as Russia, Vietnam, and Ukraine.

Agriculture exports and imports continue to play a crucial role in maintaining food security, based on different trade policies around the world. Furthermore, a study of agricultural production over the last 50 years reveals that Africa has lagged far behind unlike what is obtainable in other parts of the world (Fowowe, 2020). Africa's yields have only increased by about 72 per cent since the 1960s, while yields in other regions have increased by more than 150 per cent (NEPAD, 2015). This study, however, investigates the impact of agricultural imports and export on food security in Africa from 1980 to 2019 vis-à-vis the experience in ten African countries using a convenient sampling technique.

## 2. Literature Review

### 2.1 Concept and Measures of Food Security

Food security refers to the supply of food as well as people's ability to purchase it. Food security, according to the Rome Declaration on World Food Security, means food is available at all times, that all people have access to it, that it is nutritionally adequate in terms of quantity, consistency, and variety, and that it is suitable within the given community (Clover, 2003). Food security is

when all individuals have physical, social, and economic access to sufficient, hygienic, and nutritious food that meets their nutritional needs and food preferences for an active and balanced life at all times (FAO, 2007).

Food protection encompasses a number of requirements, including food availability, access to food, and culturally acceptable food (Havas & Salman, 2011). Food security has three dimensions, according to Fawole, IIbasmis, and Ozkan (2015). They are food supply, food access, and food adequacy. The key determinants of food security, according to FAO (2013), are availability, accessibility, usage, and stability. Food availability is a significant factor in food security. Having enough food in a country is important, but it is insufficient to ensure that everyone has enough access to food. The population has grown faster than the supply of food in recent years, resulting in food scarcity per human. The ability to obtain food is contingent on two major factors: economic and physical access.

Economic access is determined by one's wealth, food prices, and people's purchasing power. The availability and quality of infrastructure necessary for food production and distribution define physical access. The rise in the rate of poverty has resulted in a lack of economic access to food. Two outcome measures that illustrate the effect of insufficient food intake and consumption are used to assess food utilisation. The first result is the nutrition level of children under the age of five. The second is the standard of food, health, and hygiene. The FAO claims that calculating the nutritional status of children under the age of five is a good estimate for the entire population. Wasting (too thin for height), underweight (too thin for age), and stunting (too short for age) are markers for measuring children under the age of five (Metu, Okeyika & Maduka, 2016).

According to the United Nations, nearly 805 million people (roughly one in every eight people) were undernourished in 2014. (FAO, 2012). Human suffering would be devastating as a result of food insecurity. According to scientific evidence, inadequate nutrition has an effect on health through the immune system, raising the frequency and severity of diseases (FAO, 2012). Between 1996 and 2000, an estimated 840 million people were malnourished: 11 million in developed countries, 30 million in emerging countries, and 799 million in developing countries (FAO, 2012). About 868 million people are chronically malnourished around the world, with 84 per cent of them living in developing countries. Hence, while food insecurity is a global problem, it is most frequently associated with developing countries.

It is becoming more widely acknowledged that both rural and urban communities experience food insecurity. However, the urban poor are more susceptible and at a higher peril of experiencing food insecurity than the rural poor (Enilolobo & Aromolaran, 2004; Dake, 2021). Moreover, amid the urban poor, nutrition insecurity a closely related aspect of food insecurity is widespread and causes malnutrition. The potential impact of food security in African urban areas has received less attention than other elements that have been explored in efforts to address the food crisis (Dake, 2021).

The system of food and nutrition security is made up of four elements: availability, access, usage and utilisation, and stability. The term "access" means all households have constant and adequate opportunities to acquire food in sufficient quantities, consistency, and in variety for a healthy diet. Another considerable factor is biological utilisation, this refers to the human body's ability to digest and convert food. Stability is the period within which food and nutrition security is accomplished. It becomes achievable when the availability of goods and services at the household level remains stable over the year and over time.

Based on the availability of the household budget, daily calorie consumption per person may be used to assess food security (Webb et al, 2006). Food security indicators and measures are designed to capture some or all of the key components of food security, such as food availability, access, and use, as well as adequacy. While availability (production and supply) and utilisation/adequacy (nutritional status/anthropometric measures) appeared easier to estimate and thus more common, access (ability to obtain adequate quantity and quality) remains elusive.

## 2.2 Empirical Review

Aragie, Pauw, and Pernechele, (2018) look at the consequences of Malawi's long-term maize export ban, which was lifted on March 15, 2021, and a new oilseed export tax, all of which are meant to boost food security and fund local processing industries. The author's discovery shows that maize export bans favour only the wealthy in cities, while poor farmers' incomes and maize consumption levels decline over time. And as tax receipts are used to further subsidise food processors, their value-added benefits are outweighed by falling agricultural value-added. These findings suggest that, while export controls can produce the desired effects in the short term, development responses can make the policies counterproductive in the medium to long term. In the end, such restrictive policies perpetuate a subsistence approach to agriculture and contradict the reported economic development goals in Sub-Saharan African countries.

Magdalena (2018) conducted research on food imports and food security among the major global industry participants. This research covers 1995 to 2015. The results were focused on knowledge collected by the global market's major players. Digital files and publications were the primary sources of information. Quantitative and qualitative analysis approaches were used to analyse the results. The researchers used a variety of statistical techniques, structure and dynamics indices, economic transparency measures, and indicators relevant to the three dimensions of security (availability, connectivity, and stability). Food imports observed a global growth pattern, with overlapping cycles of contrasting trends, according to the results. The transparency of food trade in the countries surveyed was higher than that of global imports, and it was on the rise. The peculiarities of the agri-food sectors' progress were expressed in decreasing values of the exports-to-imports ratio, which were crucial for the positive growth rate of agri-food production per capita. Imports were positively associated with physical and economic supply and negatively correlated with stability, according to a study of relationships between improvements in trade levels and selected food security indicators.

There are several empirical studies that used the Autoregressive distributed lag (ARDL) in food security research. In South Africa, Malefa and Odhiambo (2018) examined the effect of trade liberalisation on the economic growth over the period between 1975 to 2014. The study utilised the autoregressive distributed lag (ARDL) method. The long-run estimates revealed that trade openness had a positive impact on economic growth. This thus suggests that deregulation policies in the South African economy have been useful.

Also, Adesola, Ewa, Edem, Oka and Eneg (2018) carry out an empirical study on the impact of trade liberalisation on economic growth (measured using real GDP) in Nigeria. The study utilised time series data from 1986 to 2014. Real GDP emerged as a regression on total imports, total export, trade openness, the balance of trade, and exchange rate. The study adopted the autoregressive distributed lag (ARDL) method, while the pairwise granger causality method was used to provide robust results. The unit root was tested with Augmented Dickey Fuller and Phillip-Peron statistics. Results from the ARDL estimates showed that total imports and exports

had significant positive impacts on real GDP in Nigeria during the short-run period. The trade openness indicator had no significant impact on real GDP. Further results showed that there was no causal relationship between trade liberalisation and economic growth in Nigeria. Also, none of the trade liberalisation indicators (total imports, total exports and trade liberalisation) had a significant impact on economic growth in Nigeria during the long-run period. Hence, trade liberalisation only improved economic performance in Nigeria in the short run.

Also using ARDL econometric technique, Osabohien, Akinpelumi, Mattew, Okafor, and Oluwande (2019) examined the effect of agricultural exports (agricultural export, foreign direct investment, inflation rate, and labour force) on economic growth (real gross domestic product) in Nigeria. Agricultural exports have a major impact on economic development, according to their research. The researchers affirmed that agricultural export should be supported by extending the agricultural production base.

Other studies were based on other techniques of empirical analysis. Ajayi and Araoye (2019) examined the contributions of trade liberalisation (measured using trade openness) on economic performance in Nigeria. Their study covered the period of 1970 to 2016. Like Adesola et al (2018), they used the Augmented Dicker Fuller and Phillip- Peron statistics to test for unit root. Co-integration was examined using the Engel and Granger statistic. The study made use of both the error correction methodology and vector error correction methodology regression techniques. Based on the parameter estimates obtained, the effort discovers that the consequence of trade openness on the economic growth of Nigeria is a significant negative.

Using panel regression, Shobande (2019) investigated the effects of economic liberation and integration on agricultural exports among West African countries, covering periods from 1970 to 2016. Using the pooled and fixed effect panel regression methods, the study discovers that trade openness strongly predicts economic growth among West African countries.

Mbogela (2019) analyses the impact of trade openness on the economic performance of 40 countries. The study adopts the two-stage least squares to mitigate the problems of endogeneity in the regression model to evaluate a timeframe of 1989 to 2008. The results obtained from the regression analysis reveal that a positive significant impact on the economic performance of the countries investigated is traceable to trade openness. In their research, Pawlak and Kołodziejczak (2020) look at the role of agriculture in maintaining food security in developed countries from 2016 to 2018. They used regression analysis and Ward's system. The findings showed that low GDP has a negative influence on agricultural development and that infrastructure is inadequate.

Duru, Okafor, Adikwu, and Njoku (2020) investigate the relationship between trade liberalisation and economic development in Nigeria from 1981 to 2018. The autoregressive distributed lag bounds technique was used to cointegrate the data. Findings showed that trade liberalisation does not contribute to the economic development of Nigeria. Consequently, the validity of the comprehensive trade liberalisation campaign in developed countries in the late 1980s and early 1990s, which was based on the brilliant concept of international organisations, was questioned. Furthermore, the findings reveal that in Nigeria, unidirectional causality occurs between actual GDP and trade liberalisation.

## 3. Methodology

This section discusses the theoretical framework, variable description and data source, model specification, and data analysis technique.

### 3.1 Theoretical Framework

The model is based on the Heckscher-Ohlin Theorem. The Heckscher-Ohlin theorem (H-O theory) is a tenet of classical trade theory that suggests that international trade liberalisation leads to economic development. According to the hypothesis, countries with a lot of capital will export capital-intensive products, and countries with a lot of labour will export labour-intensive goods. The H-O theory also recognizes the economic implications of not being efficient in production. Therefore, a country that has a relatively cheap cost of capital to labour, but chooses to engage in labour-intensive would be inefficient in productivity. Therefore, the liberalisation of agricultural foreign trade is an essential factor to promote food security in Africa.

The relevance of the theory hinges on the fact that each country is endowed with one form of resources or the other as postulated. Further, the theory emphasizes that the basis of trade is the difference in natural resources. The postulation is adequately relevant to the selected countries because they are endowed with different resources. For instance, Nigeria is endowed with cocoa; Ghana is endowed with rich timber, gold, diamonds, and bauxite. Also, Cameroon is a nation with a natural endowment in oil, timber, coffee, tea, crude oil, and cocoa beans. Further, the Gambia is endowed with fish, silicon sand and zircon, cashew nuts and machinery. Also, Angola is perceived as one of the richest African country due to its immense natural resource endowment. Similarly, East African countries are endowed with diamonds, iron ore, phosphates, copper, gold and manganese.

From the aforementioned different natural resources' endowments of the selected countries, there is a basis for trade as explained by the H-O theory of international trade. The evidence of trade indicates that there is a tendency for food security among the selected countries based on different natural resources.

### 3.2 Model Specification

The model for this study was adapted from the work of Duru, Okafor, Adikwu, and Njoku (2020) in their study on "Trade Liberalization and Economic Growth". Their model is given as follows;

$$Log(RGDPPC_t) = \beta_0 + \beta_1 TOPEN_t + \beta_2 GFCF_t + \beta_3 INFL_i + \beta_4 GOVFCEXP_t + e_{it} \quad \text{.....(1)}$$

The model equation (1) was modified to meet the objective of the current study by using food security as the dependent variable. Food security will be proxied by availability and accessibility. Thus, the model of the current study is specified as follows;

$$FS_{it} = \beta_0 + \beta_1 AGREXP_{it} + \beta_2 AGRIMP_{it} + \beta_3 EXCHR_{it} + e_{it} \quad \text{.....(2)}$$

$$FS_{it} = \beta_0 + \beta_1 AGREXP_{it} + \beta_2 AGRIMP_{it} + \beta_3 EXCHR_{it} + e_{it} \quad \text{.....(3)}$$

Where: $FS_{it}$ = Food Security, $(_{it\ =\ 1,2})$ 1 for food availability proxied by FPI, and 2 for food accessibility proxied by GDP per capita.

$GDPPC_{it}$ = Gross domestic product per capita; $AGREXP_{it}$ = Agricultural Export; $AGRIMP_{it}$ = Agricultural Import; $EXCHR_{it}$ = Exchange Rate; $\alpha_0$, $\alpha_1$, $\alpha_2$, $\alpha_3$, $\beta_0$ , $\beta_1$ , $\beta_2$ , $\beta_3$ = parameters in the models ($\alpha_0$, $\alpha_1$, $\alpha_2$,> 0; $\alpha_3 < 0$; $\beta_0$ , $\beta_1$ , $\beta_2 > 0$; $\beta_3 < 0$); = $e_{it}$ = Error term; $i$ = Entity (Countries); $t$ = Time.

### 3.3 Justifications of the Variables in the Model

***Food Production Index (FPI):*** The food production index covers food crops that are considered edible and contain nutrients. The amount of food potentially available for human consumption is derived after considering the sources of supply, and their utilisation.

***Gross Domestic Product Per Capital (GDPPC):*** GDP per capita is gross domestic product divided by midyear population and gives a clear indication of the economic mean of the individual and therefore his effective possibility to buy food (Napoli, De Muro, & Mazziotta, 2011).

***Agricultural Export (AGREXP):*** Agricultural export is the selling of agricultural produce across the national boundaries of other countries (Gilani, 2015; Adesola, et.al.,2018; Osabohien, et.al., 2019). Thereby, the inclusion of the variable is important in the current study due to the export activities of the countries.

***Agricultural Import (AGRIMP):*** Agricultural import is the selling of agricultural produce across the national boundaries of other countries (Magdalena, 2018; Adesola, et.al.,2018). Like agricultural export, the import activities of the countries also matter in the current study**.**

***Exchange (EXCHR):*** The price of one currency in favour of another currency is known as the exchange rate. The exchange rate is a crucial macroeconomic indicator and it is usable for the assessment of a country's international competitiveness and signals the economy's global position.

### 3.4. Data Analysis Techniques

The data analysis technique comprises three sub-sections namely; pre-test analysis, estimation and post-test. Each sub-section is explained herein.

#### 3.4.1. Pre-Test Analysis

Descriptive statistics and unit root tests and panel co-integration tests would be conducted before the estimation. The descriptive statistics would show the statistical distribution of the variables used in the model in terms of the mean, median, standard deviation, covariance and number of observations. The unit root test would reveal the stationary status of the variables used in the model to avoid the problem of spurious regression analysis. The unit root was tested with the Levin, Lin and Chu (LLC) test, and Johansen Fisher Panel Cointegration was used to ascertain the level of long-run relationship among the variables.

#### 3.4.2. Estimation Techniques

The autoregressive distributed lag (ARDL) model and Granger causality test were employed as the data analysis technique.

#### 3.4.3. ARDL Model Specification

Equations (2) and (3) are formulated into the ARDL model as follows;

When FPI is a Dependent variable:

$$FPI = \propto_0 + \sum_{i=1}^{p} \propto_{1,} i\,\Delta\,(FPI_{t=i}) + \sum_{i}^{p} = \propto_{2,i} \Delta\,(AGEXPP_{t-i}) + \sum_{i=1}^{p} \propto_{3,i} \Delta\,(AGRIMP_{t-i}) + + \sum_{i=1}^{p} \propto_{4,i} \Delta\,(EXCHR_{t=i}) + \beta_1\,AGREXP_{t-i} + \beta_2\,AGRIMP_{t-i} + \beta_3\,EXCHR_{t-i} + \mu_{it} \quad (4)$$

When GDPPC is a dependent variable:

$$GDPPC_{it} = \propto_0 + \sum_{i=1}^{p} \propto_{1,} i\,\Delta\,(GDPPC_{t=i}) + \sum_{i=1}^{p} \propto_{2,i} \Delta\,(AGEXPP_{t-i}) + \sum_{i=1}^{p} \propto_{3,i} \Delta(AGRIMP_{t-i}) + \sum_{i=1}^{p} \propto_{4,i} \Delta\,(EXCHR_{t=i}) + \beta_1\,AGREXP_{t-i} + \beta_2\,AGRIMP_{t-i} + \beta_3\,EXCHR_{t-i} + \mu_{it} \quad (5)$$

### 3.4.4. Granger Causality Model

The granger causality model is specified as follows:

$$FPI = \sum_{i=1}^{n} \alpha_1\,FPI_{t-1} + \sum_{j=1}^{n} \beta_j\,AGREXP_{i-j} + U_{it} \quad (6)$$

$$AGREXP_{it} = \sum_{i=1}^{n} \Lambda\,FPI_{t-1} + \sum_{j=1}^{n} \sigma_j\,AGREXP_{i-j} + U_{it} \quad (7)$$

The above equations depict the causality between FPI and AGRIEXP, by extension, the principle applied to AGRIMP and AGREXP.

**Table 1:** Variable Description, Measurement and Data Source(s)

| Variables | Types of Variables | Measurement | Units | Sources |
|---|---|---|---|---|
| Food Security | Dependent | Food Production Index | 1999 -2001 = 100 | WDI * |
| | | GDP Per capita | Current US $ | WDI |
| Agricultural Imports | Independent | Agricultural Import | US$ thousands | WDI |
| Agricultural Exports | Independent | Agricultural Export | US$ thousands | WDI |
| Exchange Rate | Independent | Exchange Rate | US$ | WDI |

*WDI is World Development Indicators.

**Source:** Researchers' computation (2021)

## 4. Analysis and Findings

This section presents the data analysis and interpretation of the results obtained from the panel data regression analysis. This section of this chapter includes; the presentation of results, descriptive statistics, trend analysis and model estimation.

### 4.1. Pre –Estimation

In econometrics, a pre-test condition happens when the effect of a statistical test defines which estimator should be used for the parameter(s) of interest. Thereby, the preliminary tests carried out in the study are; descriptive statistics and unit-roots tests.

### 4.2.1 Descriptive Statistics

**Table 2:** Descriptive Analysis

| | FPI | GDPPC | AGREXP | AGREXP | EXCHR |
|---|---|---|---|---|---|
| **Mean** | 77.31191 | 6837.473 | 120.5913 | 106.0658 | 200.2329 |
| **Median** | 69.68000 | 792.3030 | 34.40805 | 32.35100 | 69.17583 |
| **Maximum** | 206.9600 | 2176002. | 897.5290 | 940.1400 | 733.0390 |
| **Minimum** | 25.81000 | 220.0697 | 1.500709 | 0.444918 | 0.001000 |
| **Std. Dev.** | 35.40874 | 109428.2 | 194.6399 | 172.6836 | 229.2260 |
| **Skewness** | 1.095891 | 19.79432 | 2.281145 | 2.218250 | 0.720050 |
| **Kurtosis** | 4.146750 | 392.8779 | 7.628325 | 7.687130 | 2.011090 |
| **Jarque-Bera** | 100.7076 | 2527539. | 695.1321 | 685.5179 | 50.22802 |
| **Probability** | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| **Sum** | 30538.21 | 2700802. | 47633.55 | 41895.98 | 79091.99 |
| **Sum Sq. Dev.** | 493989.0 | 4.72E+12 | 14926571 | 11748933 | 20702552 |
| **Observations** | 395 | 395 | 395 | 395 | 395 |

**Source:** Researchers' computation (2021)

Table 2 reports summary statistics for the variables used in the study. Critical analysis of the descriptive statistics (mean, median, minimum, maximum, Std. Dev., Skewness and Kurtosis) for the dependent and independent variables details the behaviours of the variables. The dependent variable (FPI) has a mean value of 77.31191 for the whole sample, while the GDPPC has a mean value of 6837.473. The first measure of food security shows that the mean value of FPI for all the selected countries falls within the minimum and maximum values. Also, the mean value of the second dependent variable fell within the minimum value and the maximum value of the selected countries. The behaviour of the two dependent variables is similar to the value of the mean, minimum value and maximum values reported by Ojo and Adebayo (2012). Similarly, the mean values of all the independent variables had a mean value that falls within their respective minimum and maximum values.

Further, the result, on the one hand, indicates that FPI, GDPPC, AGREXP and AGRIMP were leptokurtic since their respective Kurtosis values of 4.147, 392.88, 7.628 and 7.687 were greater than 3. On the other hand, EXCHR is platykurtic since their respective value of 2.011 is less than 3. Furthermore, the Jarque-Bera statistics reveal that all the variables are not normally distributed, since the p-values associated with their Jarque-Bera statistics are statistically significant at a 5% level.

### 4.2.2. Unit Root Test

Levin, Lin and Chu's Panel unit root test was employed to assess the unit root properties of the variables and the emanated results are shown in Table 3.

**Table 3:** Panel Unit root test

| Variables | Statistic | Prob. | Order of Integration |
|---|---|---|---|
| FPI | -6.2256 | < 0.001 | I (1) |
| GDPPC | -7.50 41 | < 0.001 | I (1) |
| AGREXP | -11.1522 | < 0.001 | I (1) |
| AGRIMP | -12.1432 | < 0.001 | I (1) |
| EXCHR | -10.0732 | < 0.001 | I (1) |

**Source:** Researchers' computation (2021)

Using Levin, Lin and Chu unit root test, the test results show the same evidence on the order of integration of the variables, that is, I(1). FPI and GDPPC are not stationary at level but became stationary after differencing which means that the order of integration of the variable is order one, I(1). Also, AGREXP and AGRIMP are stationary after differencing. Further, EXCHR became stationary at first difference.

### 4.3 Panel Cointegration Tests

**Table 4:** Johansen Fisher Panel Cointegration Result

| Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue) | | | | |
|---|---|---|---|---|
| Hypothesized | Fisher Stat.* | | Fisher Stat.* | |
| No. of CE(s) | (from trace test) | Prob. | (from max -eigen test) | Prob. |
| None | 59.95 | 0.0000 | 50.41 | 0.0002 |
| At most 1 | 25.50 | 0.1831 | 22.43 | 0.3178 |
| At most 2 | 17.46 | 0.6230 | 9.370 | 0.9782 |
| At most 3 | 33.53 | 0.0295 | 33.53 | 0.0295 |

**Source:** Researchers' computation (2021)

Table 4 depicts the Johansen Fisher Panel Cointegration results and the results indicated both trace test and Max-eigen test statistics, which signal that there is one cointegrating equation. This implies that there is evidence of a long-run relationship. Thus, the long-run and short-run ARDL model is the most appropriate model since there is evidence of cointegration among the variables.

### 4.4. ARDL Regression Results

**Food Production Index (FPI) as a Dependent Variable**

The first research objective of the study was to analyse the impact of agricultural export/Import on food security in the selected African countries during the study period. To achieve the objective of the study and to test the corresponding research hypotheses, panel ARDL long-run and short-run models were estimated since there is cointegration among the variables.

**Table 5:** ARDL Panel Data Results (Long-Run and Short-Run)

| Variable | Coefficient | Std. Error | t-Statistic | Prob.* |
|---|---|---|---|---|
| **Long Run Equation** | | | | |
| AGREXP | -0.017437 | 0.02 1808 | -0.799548 | 0.4245 |
| AGRIMP | 0.260594 | 0.036701 | 7.100485 | 0.0000 |
| EXCHR | 0.134364 | 0.052970 | 2.536587 | 0.0116 |
| **Short Run Equation** | | | | |
| COINTEQ01 | -0.089641 | 0.049235 | -1.820658 | 0.0695 |
| D(AGREXP) | -0.177156 | 0.153607 | -1.153309 | 0.2496 |
| D(AGRIMP) | -1.143093 | 0.973805 | -1.1738 42 | 0.2413 |
| D(EXCHR) | 0.161813 | 0.135716 | 1.192289 | 0.2340 |
| C | 3.803089 | 2.623522 | 1.449612 | 0.1481 |

**Source:** Researchers' computation (2021)

### 4.5 Interpretations of the Result

Table 5 contains the ARDL long-run and short-run coefficients of AGREXP, AGRIMP, and exchange rate (the control variable). The evaluation in this section is based on the coefficients of the variables and the error correction term.

#### 4.5.1 ARDL Long-Run

The result indicates that the long-run coefficient of AGRIEXP has a value of -0.0174 and a corresponding t-statistic value of -0.7995. The result implies that agricultural export has a negative and insignificant impact on food security in the selected African countries during the study period. The coefficient of AGRIMP has a value of 0.2606 and a corresponding t-value of less than 0.001. This implies that agricultural import has a positive and significant impact on food security in the selected African countries during the study period. By implication, a unit increase in agricultural imports leads to an increase in food security by 0.26 during the study period.

The exchange rate has a value of 0.1344 and the t-statistic is 2.5366 and the p-value (0.012) less than the 5% level of significance. By implication, the exchange rate has a positive and significant impact on food security in the selected African countries. Thereby, a unit change in the exchange rate leads to an increase in food security by 0.1344 in the selected African countries.

#### 4.5.2. ARDL Short–Run

In the short run, the error correction term has a coefficient of -0.08934 and a corresponding probability value of 0.0695. By implication, the error correction term has the expected negative coefficient and is also significant at a 10% level. Thereby, a deviation of the variables from the long -run will be adjusted at the rate of 8.9%. This rate of adjustment back to the equilibrium after displacement is 8.9%.

### Gross Domestic Product Per Capital as Dependent Variable

**Table 6:** ARDL Outputs When GDP Per Capita is the Dependent Variable

| **Fixed regressors: C** | | | | |
|---|---|---|---|---|
| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.*** |
| **Long Run Equation** | | | | |
| AGREXP | 102.5301 | 55.74130 | 1.839392 | 0.0668 |
| AGRIMP | 230.4360 | 136.4620 | 1.688646 | 0.0923 |
| EXCHR | -15.66690 | 7.904655 | -1.981983 | 0.0483 |
| **Short Run Equation** | | | | |
| COINTEQ01 | -0.121892 | 0.138068 | -0.882842 | 0.3780 |
| D(AGREXP) | -22.85991 | 16.28588 | -1.403664 | 0.1614 |
| D(AGREXP (-1)) | -306.3316 | 275.8685 | -1.110426 | 0.2677 |
| D(AGRIMP) | 4.734190 | 89.27254 | 0.053031 | 0.9577 |
| D(AGRIMP(-1)) | 8.826442 | 22.82275 | 0.386739 | 0.6992 |
| D(EXCHR) | 574.9174 | 652.3052 | 0.881363 | 0.3788 |
| D(EXCHR(-1)) | 330.9800 | 323.9930 | 1.021565 | 0.3078 |
| C | -8341.774 | 8388.027 | -0.994486 | 0.3207 |
| Mean dependent var | 37.73141 | S.D. dependent var | | 1579003.0 |
| S.E. of regression | 78079.21 | Akaike info criterion | | 13.17852 |
| Sum squared resid | 1.93E+12 | Schwarz criterion | | 14.00675 |
| Log-likelihood | -2552.704 | Hannan-Quinn criter. | | 13.50651 |

**Source:** Researchers' computation (2021)

### 4.6. Discussion of Findings.

Table 6 indicates the ARDL output when gross domestic product per capita (GDPPC) is the dependent variable. From the output in the long-run, agricultural export (AGREXP) has a positive and significant effect on gross domestic product per capita (102.43; p-value = 0.07) at a 10% level of significance. By implication, a unit increase in the value of agricultural export leads to an increase in the GDPPC of the selected countries. The findings do not corroborate existing results by Ajayi and Araoye (2019) and Duru, et.al., (2020). However, Duru, et.al., (2020) ascertain that trade liberalisation does not support economic growth in Nigeria.

Further, the coefficient and the p-value of AGRIMP (230.44; p-value = 0.09) reveal that agricultural import has a positive and significant effect on GDPPC at a 10% level of significance. This implies that a unit increase in agricultural imports leads to an increase in GDPPC by 230.44 in the selected countries. The finding aligns with some previous studies (Magdalena, 2018; Adesola, et. al., 2018; and Osabohien, et. al., 2019). Magdalena (2018) reveals that changes in trade levels and selected food security indicators, (imports) have a positive correlation with physical and economic availability. Further, the results of Adesola, et. al., (2018) show that total imports have a positive impact on real GDP in Nigeria during the short-run period.

The exchange rate has a negative and significant effect on GDPPC. This shows that a unit decrease in the value of the exchange rate leads to an increase in GDPPC.

From the short-run output, the error correction term (ECT) has a coefficient of -0.121892 and a corresponding p-value of 0.378. The results indicated that the ECT has the expected negative but insignificant value.

### 4.7. Causality Result

The last objective of the study was to ascertain the causal relationship between agricultural export, agricultural import and food security in the selected African countries during the study period. To achieve the objective, Dumitrescu Hurlin Panel Causality Tests were adopted and the result is shown in Table 7.

**Table 7:** Dumitrescu Hurlin Panel Causality Tests

| **Pairwise Dumitrescu Hurlin Panel Causality Tests** | | | |
|---|---|---|---|
| **Lags: 2** | | | |
| **Null Hypothesis:** | **W-Stat.** | **Zbar -Stat.** | **Prob.** |
| | | | |
| AGREXP does not homogeneously cause FPI | 5.34797 | 4.46965 | 8.E-06 |
| FPI does not homogeneously cause AGREXP | 6.15990 | 5.59781 | 2.E-08 |
| | | | |
| AGRIMP does not homogeneously cause FPI | 2.89411 | 1.06007 | 0.2891 |
| FPI does not homogeneously cause AGRIMP | 6.58862 | 6.19349 | 6.E-10 |
| | | | |
| AGRIMP does not homogeneously cause AGREXP | 2.97158 | 1.17315 | 0.2407 |
| AGREXP does not homogeneously cause AGRIMP | 11.6 785 | 13.2966 | 0.0000 |

**Source:** Researchers' computation (2021)

The Dumitrescu Hurlin panel causality tests result in Table 7 reveal that AGREXP granger cause FPI at a 5% level of significance and food security (FPI) granger cause AGREXP at a 5% level of significance. This implies that there is bi-directional causality between AGREXP and FPI.

The result reveals that the AGRIMP does not granger cause FPI but FPI granger cause AGRIMP. There is evidence of unidirectional causality between AGRIMP and FPI with causality running from food security to agricultural import.

Lastly, AGRIMP does not granger cause AGREXP as the null hypothesis of no granger causality cannot be rejected at a 5% level of significance. However, AGREXP granger causes AGRIMP. Thus, there is unidirectional causality between AGRIMP and AGREXP with causality running from agricultural export to agricultural import.

As a result of urbanization, there is competing demand for the available lands that ordinarily would be used for cultivation of land but due to urbanization are been used for residential building hence limiting the available land for agriculture resulting in the need to import agricultural produces, which will have a positive and significant impact on food security(availability) in the long-run.

Also, from the findings of the study, both agricultural imports and export have a positive and significant impact on food security (accessibility), in the long run. This is due to the large population of households in urban areas demanding diverse agricultural products which will inform the need for the importation of agricultural products. The economic contribution of exports to the national economies will also demand that exports continue in these countries.

## 5. Conclusion

The objectives of the study are to evaluate the impact of agricultural export and import on food security and establish the direction of causality among agricultural export/Import and food security in the selected African countries during the study period from 1980 to 2019. Ten selected African countries (Nigeria, Ghana, Cameroon, Gambia Angola, Egypt, Kenya, Central African Republic, South Africa and Cote D'Ivoire). The research hypotheses formulated were tested using the panel autoregressive distributed lag (ARDL) model and panel granger causality tests.

The findings reveal that agricultural export has a negative and insignificant impact on food security in the selected African countries during the study period. Further, the findings indicate that agricultural import has a positive and significant impact on food security in the selected African countries during the study period. The exchange rate has a positive and significant impact on food security when proxied in terms of availability. The exchange rate has a negative and significant impact on food security when proxied in terms of accessibility. Besides, the findings of the research, the hypothesis indicates that there is evidence of unidirectional causality between AGRIMP and FPI and there is unidirectional causality between AGRIMP and AGREXP in the study at a 5% level of significance.

The following recommendations are the outcomes of the findings of the study:

Policies aimed at stabilising exchange rate fluctuations should be enacted as this will help improve food security in Africa. Also, due to the negative contribution of agricultural export to food security in African countries, it is recommended that African countries should revisit their export policies in order to control and restrict the exportation of agricultural produce that should be consumed locally as this will enhance food security in the region. Similarly, because agricultural import has a positive and significant effect on food security, it is recommended that the selected countries in the study should intensify efforts on the importation of agricultural machinery to enhance food security. Lastly, arising from the unilateral causality between agricultural import and food security as well as agricultural import and agricultural export, African countries should liberalise trade mechanisms to boost healthy trade relations among trading partners.

## References

Adesola, W. A., Ewa, U. E., Edem, E. N., Oka, F. A., & Eleng, D. M. (2018). Influence of trade liberalization on the growth of Nigerian economy: Autoregressive distributed lag approach. *European Journal of Accounting, Auditing and Finance Research, 6*(7), 87-106.

Ajayi, E. O., & Araoye, F. E. (2019). Trade openness and economic growth in Nigeria. *International Journal of Economics and Financial Management, 4* (2), 50-63.

Aragie, E., Pauw, K., & Pernechele, V. (2018). Achieving food security and industrial development in Malawi: Are export restrictions the solution? *World development*, *108*, 1-15.

Astou, D. (2015). Food Imports as a Hindrance to Food Security and Sustainable development: The Cases of Nigeria and Senegal.

Candel, J. J. (2014). Food security governance: a systematic literature review. *Food Security*, 6(4), 585-601.

Clover (2003) Food security in sub-Saharan Africa, *Africa Security Review 12*(1), 5-15

Dake, F. A. (2021). Foodscapes in urban spaces of Africa: implications for food and nutrition security among the urban poor. *Open Research Africa*, *4*(44), 44.

Duru, I. U., Okafor, B. O., Adikwu, F. O., & Njoku, F. C. (2020). Trade liberalization and economic growth: An assessment of Nigerian experience. *Asian Development Policy Review*, *8*(3), 194-213.

Enilolobo O.S. and Aromolaran A.B. (2004): "Food Security Problem and Coping Strategies in Ogun State, Nigeria". West African Journal of Foods and Nutrition, Vol. 7: Number 1, pp 24-33

Enilolobo, O. S., Nnoli, T. I., Olowo, S. O., Aderemi, T. A., Adewole, A. O., Olapade, V. O., & Esedeke, J. F. (2022). Determinants of Food Security in Nigeria. *Acta Universitatis Danubius: Oeconomica*, *18*(3).

FAO, 2007, "Food and Agriculture Organization of the UN" Retrieved June 25

FAO (2012). The state of food and agriculture: Investing in agriculture for a better future. Rome: United Nations Food and Agriculture Organization. Available at: http://www.fao.org/docrep/017/i3028e/i3028e.pdf.FAO (2013) Climate-smart agriculture sourcebook. Food and Agriculture Organization, Rome.

FAO (2019) The situation of food security and nutrition in the world. *Journal on Nutritional Science Vitaminol*,65, S4-S8.

Fawole, W. O., IIbasmis, E., & Ozkan, B. (2015). *Food insecurity in Africa in terms of causes, effects and solutions, a case study of Nigeria.* A paper presentation at the 2nd International Conference on Sustainable Agriculture and Environment held at the Selcuk University and Bahri.

Fowowe, B. (2020). The effects of financial inclusion on agricultural productivity in Nigeria. *Journal of Economics and Development*, *22*(1), 61-79.

Gilani, S. W. (2015). The impact of agricultural imports and exports on agricultural productivity. Journal of economics and sustainable development, 6(11). http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.879.3983&rep=rep1&type=pdf

Havas, K, & Salman, M. (2011). Food security, its components and challenges. *Int. J. Food Safety, Nutrition and Public Health, 4* (1).

Killick, T., & Commander, S. (1988). State divestiture as a policy instrument in developing countries. *World Development*, *16*(12), 1465-1479.

Magdalena (2018) Exploring the Role of Individual Food Security in assessment of Population Food Security. *Amfiteatru* 21(51):347-360

Malefa M.R & Odhiambo (2018) Impact of Trade Openness on Economic Growth: Empherical Evidence from South Africa. *Econmia Internazionale/International Economics,* 2018 (71) 4,387-416.

Mbogela, C. (2019). An empirical examination on trade openness and economic growth nexus in Africa. *Asian Journal of Economics and Empirical Research*, *6*(1), 1-15.

Metu, A.G. Okeyika, K.O. & Maduka, O.D. (2016) Achieving Sustainable Food Security in Nigeria: Challenges and Way Forward. In Proceedings of the 3rd International Conference on African Development Issues (CU-ICADI 2016), Covenant University, Ota, Nigeria, 9-11 May 2016; 182–187, ISSN 2449-075X.

Napoli, M., De Muro, P., & Mazziotta, M. (2011). Towards a food insecurity multidimensional Index (FIMI). *Master in human development and food security*, 1-72.

NEPAD (2015). Documents and Speeches background in the new partnership for Africa's development (NEPAD).

Ojo, E. O., & Adebayo, P. F. (2012). Food Security in Nigeria: An Overview. *European Journal of Sustainable Development, 1*(2), 199-220.

Osabohien, R., Akinpelumi, D., Matthew, O., Okafor, V., Iku, E., Olawande, T., & Okorie, U. (2019, September). Agricultural exports and economic growth in Nigeria: An econometric analysis. In *IOP Conference Series: Earth and Environmental Science 331*(1), 012002. IOP Publishing.

Pawlak, K., & Kołodziejczak, M. (2020). The role of agriculture in ensuring food security in developing countries: Considerations in the context of the problem of sustainable food production. *Sustainability*, *12*(13), 5488.

Shobande (2019) Effect of Economic Integration on Agricultural Export, Performance in West African Countries. Economies, 7(3): https://doi.org/10.3390/economies 7030079

Webb, P., Coates, J., Frongillo, E. A., Rogers, B. L., Swindale, A., & Bilinsky, P. (2006). Measuring household food insecurity: why it's so important and yet so difficult to do. *The Journal of nutrition, 136*(5), 1404S-1408S.

Wisdom, O., Apollos, N., Samuel, O., & Lawrence, I. (2022). Environmental Taxation and Food Security in Sub-Saharan Africa. *Current Journal of Applied Science and Technology, 41*(18), 6-14.

World Health Organization (2018). Global nutrition policy review 2016-2017: country progress in creating enabling policy environment for promoting healthy diets and nutrition. Geneva, Switzerland.