Assessment of Agricultural Trade Flow and Food Security Status: Evidence from Nigeria

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Summary

Trade has substantial potentials to increase the diversity and quality of food consumed in a country. The main objective of this study is to assess the relationship between agricultural trade flow and food security status using Nigeria as a case study (WTO, 2002). The study mined secondary data from sources such as the National Bureau of Statistics, Central Bank of Nigeria, Economist Intelligence Unit, the World Bank, World Development Indicators and FAO Statistics. Data were analyzed with descriptive statistics. Findings revealed that although the share of food agricultural import and food bill was higher than that of export over the years, it consequentially increased food insecurity, brought about a deterioration in the state of food affordability, food quality and safety in Nigeria. Similarly, tariff rates in Nigeria have been low for most agricultural products with the average applied Most-Favoured-Nation (MFN) tariff pegged at 15.8 percent. Aggregate food production and *per capita* consumption is projected to increase more in Nigeria without climate change. Under the climate change scenario, cereals trade flows from Nigeria are higher relative to 2010 and the lowest net trade is experienced for pulses and oil seeds. Agricultural trade is extremely important for achieving food security. However, when trade in agricultural goods and inputs is opened, an important role for government is to ensure that these products are safe and of quality. The results from this study suggest that trade will become very important for food security in the future and if climate change is not properly checked, it will be an issue that will lead to higher levels of food insecurity.

Key words

comparative advantage, food affordability, food availability, food safety, Most-Favoured-Nation, WTO

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Introduction

Trade across borders (between countries) allows food to move from surplus areas to deficit areas. Agricultural trade is important in the global or regional food systems sustainability (Ash and Greenville, 2015) and is extremely important in achieving goal 2 of the Sustainable Development Goal of "Ending hunger, achieving food security and improved nutrition". Trade enables countries to take advantage of their potentially different factor endowment, allows land-abundant countries to provide export and land-poor countries benefit from more efficiently produced import (Martin, 2016). It is important to note that the benefits and drawbacks of increased trade are influenced not only by the country's resource endowment and comparative advantages but also based on the role of agriculture in the economy and the mix of production at its current stage of development.

International agricultural trade redistributes food production by positively increasing both quality and quantity of food globally in all regions and ensuring a global scale of food security. Expansion of international trade in agricultural commodities can have a growth-enhancing effect and improve their trade balance. Despite the prevalence of trade policy reform packages especially on agricultural trade flows in Nigeria over the last two decades, relatively little has been done to identify the importance and consequences on food security. Trade policy reforms from the World Trade Organization (WTO) negotiations, regional negotiations and/or bilateral agreements has resulted in lowering of tariff for instance in agricultural products and lead to an increase in import and a decline in the price of imported goods thereby enhancing food security (Chikhuri, 2013).

Various studies and statistics (such as EUI, 2021; NBS, 2021) however, have shown that the country is not yet food secure. The fact that trade permits the efficient transfer of food supplies from surplus to deficit regions fails to consider the wide differences in the purchasing power of different regions, and the fact that hunger and malnutrition are generally not the result of the lack of food availability, but rather of the inability for the poorest segments of the population to have access to food at an affordable price. This may be responsible for the status of Nigeria on food security and related concept such as hunger. Report of the 2021 Global Hunger Index score has shown Nigeria has a score of 28.3 and is ranked 103rd out of about 116 countries involved. This implies that Nigeria is still in a severe hunger situation. The prevalence of undernourishment and obesity are respectively14.6% and 11.5% in 2021, which is still very high. In trade, the country stood at 61st position in global imports with high import bills.

The main objective of this study is to assess agricultural trade flow and food security and how they are interrelated. The findings from the study are expected not only to contribute to the empirical literature on the linkages between agricultural trade and food security primarily in Nigeria, but they may have possible implications for regional integration dynamics and other developing countries.

Literature Review on Interlinkages between Agricultural Trade and Food Security

The connections between trade and food security are intrinsically complicated, with multiple routes of interaction affecting various dimensions of food security (availability, access utilization, and stability) at the same time. There are multiple routes through which trade interacts with the various dimensions of food security indicators. Trade has a direct influence on major domestic variables such as food production, prices, employment and government revenues, and is influenced by the economic background and sectoral composition of growth. In essence, these direct effects translate into changes in food security indicators through three primary intervening factors: total food supply, household income and government services (FAO, 2016).

The interaction between trade and food security has both positive and negative effects on the four pillars of food security in the short, medium and long terms (Table 1). The very first effects of trade on producers and consumers in the domestic market are through changes in the prices of goods produced and consumed (FAO 2016). Changes in imports and exports impact domestic food availability, demand and pricing almost immediately (Martin, 2016).

Trade Policy and Food Security

The impact of trade policy on food security heavily depends on the outcomes and nature of a country's trade policies (Martin, 2017). There are considerable number of studies (such as Posner, 2001; Charles et al., 2001; Madeley, 2000) that have concluded how agricultural trade reforms are harmful to food security in poor small-scale farm communities. The impacts of staple commodity price increases on food security for the poor depend on whether the poor are net producers or net consumers of those commodities (Gouel, 2014). Charles, Longrigg and Tugend (2001) in their study have found that in many poor countries, increased exposure to agricultural trade reforms weakens food security through increased dependence on food imports and reduced employment opportunities. Madeley (2000) reviews the experience of trade reforms in 27 developing and least-developed countries and reached a similar conclusion. Sebastein (2019) suggests that higher food trade openness leads to increased hunger in developing countries.

Laborde and Martin (2012) noted that, even though agricultural trade makes up only 10 percent of world trade, the potential income gains from agricultural trade reforms appear to make up around 70 percent of the total potential gains from trade. Valdés and Foster (2005) link improvements in food security to the presence of programmes targeted on the poor as well as trade reforms, concluding that "trade policy instruments alone are now seen as being inadequate to deal with the goal of increasing household income and food security". High transaction costs reduce trade and prevent countries from reaping the full benefits of trade liberalization and integration into global value chains (United Nations, 2016), but improvement in trade facilitation significantly reduces trade costs and increases trade flows (Anderson Arvis et al. 2016; Duval et al. 2018). To Bonuedi et al., (2020), merely opening borders to international trade may not necessarily lead to improved food security, unless trade is effectively facilitated.

Hawkes, Chopra and Friel (2009) raised concerns about the role of trade and globalization more generally, in creating nutritional problems, particularly those associated with obesity.

Table 1. The Interaction between Trade and Food Security

Food security Pillars	Short Term	Medium and Long term
Availability	❁ Imports rise as a result of trade, as does the quantity and diversity of food available	❁ Food production might rise as a result of increased specialization and productivity could rise as a result of increased competition
	* In net exporting countries, trade may reduce domestic crop supply/availability	* Domestic availability of staples may fall in net food exporting countries as production is diverted to exports; whereas, in net food importing countries, some farmers are likely to reduce production, foregoing the multiplier benefits of agricultural operations in rural areas
Access	❁ Food and input prices are expected to fall for net food importers	❁ Due to increased market access, income in competitive industries would rise and export growth and FDI inflows would promote growth and employment
	* For net food exporting countries, domestic prices of exportable products may rise	* In import-competing sectors, incomes may fall, and some farmers may leave the industry. In addition, unequal grain distribution may occur as a result of enclave developments in export crops, which would be detrimental to broad-based smallholder food crop cultivation
Utilization	❁ A wider variety of foods may encourage a more balanced (healthier) diet	❁ If international standards are applied more thoroughly, food safety and quality may increase
	* Food that is less expensive, heavy in calories and low in nutritious content may be consumed more in greater quantities	* Prioritizing commodity exports could drain land and resources away from traditional and indigenous crops, which are typically nutritionally superior
Stability	❁ Imports help to avoid shortages caused by local production hazards	❁ Global markets are less susceptible to policy or weather-related shocks
	* Export policy changes, such as export prohibitions/bans, may make countries more vulnerable	* Sectors in the early phases of development may be particularly vulnerable to price shocks and import surges

Note: Positive effects of trade on food security pillars/dimensions; * Negative effects of trade on food security pillars/dimensions

Source: FAO, 2016

Trade can generally increase food security and dietary diversity particularly in the higher income countries where consumers are able to afford more diverse diets (Martin, 2017). Bonuedi, Kamasaand Opoku (2020) in their study on the effects of easing trade across borders through reductions in documents, time and costs to export and import on food security outcomes in Africa found that that poor trade facilitation constituted a significant driver of food insecurity in Africa and ineffective trade facilitation was associated with significant increments in the prevalence of undernourishment and depth of food deficit, as well as reductions in dietary energy supply adequacy and access to sanitation facilities.

Materials and Methods

Study Area

Nigeria has 34 million hectares of arable land, with 6.5 million hectares dedicated to permanent crops and 28.6 million hectares dedicated to meadows and pastures. Agriculture accounts for around 24% of Nigeria's GDP. The country is a world leader in the production of a variety of agricultural products, including palm oil, cocoa beans, pineapple, and sorghum. It is the world's second-largest producer of sorghum, after only the United States, and ranks fifth in the production of palm oil and cocoa beans. Nigeria is a significant global exporter in this industry as well. Oil, fruits, nuts, and seeds are among the top 10 export categories.

Sources of Data

This study used historical data obtained from secondary sources such as FAOSTAT, the World Bank Global Food Security data by EIU, the World Bank, the World Development Indicators, the World Trade Organisation, World Integrated Trade Systems and the International Food Policy Research Institute (IFPRI) Impact Model Database.

The Global Food Security data produced by the Economist Intelligence Unit (EIU), measures the drivers of food security in developing and developed countries, based on the core factors of food affordability, availability, quality and safety, alongside natural resources and resilience, across 113 countries. The index is a dynamic quantitative and qualitative benchmarking model built from 58 distinct metrics that assess the determinants of food security in both emerging and developed nations.

Results and Discussion

Food Production in Nigeria

Nigeria's agriculture sector has been faced with challenges which impacted on its productivity and this has increased food import levels and decreased food sufficiency levels with Nigeria agricultural import standing at ₦3.35 trillion between 2016 and 2019, which is four-time higher than agricultural export (₦803 billion) within the same period (PwC, 2020).

Food crop production accounts for about 87.6% of total output in the agriculture sector and this has been the largest segment of the sector followed by livestock (8.1%), fishing (3.2%) and forestry (1.1%) (Oyaniran, 2020). Cassava output stood at about 59.5 million metrics tones compared to Thailand and Congo DR respectively at 31.7 million metric production and 30 million metrics (PwC, 2020). Nigeria's production of major staple crops – cereal, vegetables, maize, rice paddy, root and tuber stood at 28.87 million tons, 16.4 million tons, 10.42 million tons, 9.86 million tons and 115.98 million tons respectively (Agribusiness in Nigeria fact sheet, 2019). Results from the Nigerian food production index reveal a gradual increase in the index from 2000 through 2006, with fluctuations between 2007 and 2014 with a rise in production index of 101.9 in 2018 (Fig. 1).

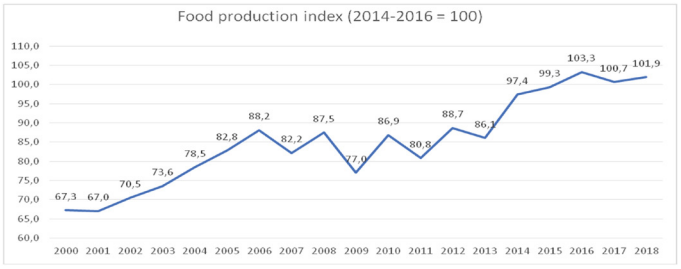

Figure 1. Food Production in Nigeria

Source: Data from the World Bank, World Development Indicators (2022)

Agricultural Land

Fig. 2 shows a steady increase (from 72.7 % in 2000 to 75.9% in 2018) in agricultural land cultivated in Nigeria. Despite the increase in agricultural land cultivated, the levels of both undernourishment and food insecurity have increased.

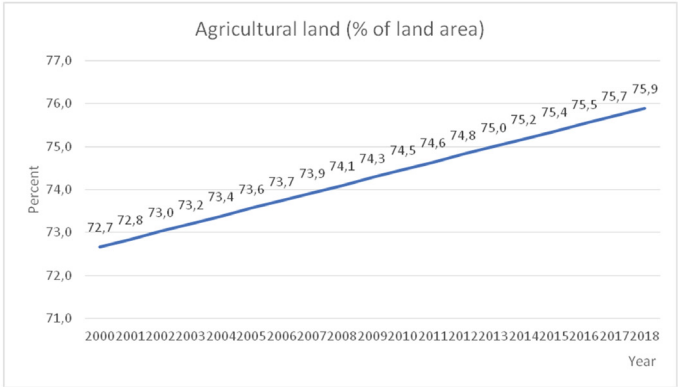

Figure 2. Agricultural Land (% of Land Area) in Nigeria

Source: Adapted from the World Bank, World Development Indicators (2022)

Between 2004 and 2006, and 2018 and 2020, the percentage of Nigeria's population experiencing moderate or severe food insecurity grew from 36.5% to 57.7%. In the same time, the proportion of the population that is undernourished doubled, rising from 7.1% to 14.6%; while the prevalence of severe food insecurity stood at 6.6% and 21.4% during the same period (Sasu, 2022).

Major Nigerian Agricultural Trading Partners

Increasing cross-border trade in agricultural products implies that the production of food is reoriented towards serving the foreign markets rather than the domestic markets. The Nigerian agriculture sector has been challenged by poor land tenure system, climate change and land degradation and poor level of irrigation farming and this has stifled agricultural productivity thereby causing an increase in food import. Between 2016 and 2019, Nigeria's agricultural imports totaled ₦3.35 trillion, four times more than the country's agricultural exports (₦803 billion) (PwC, 2020a). Nigeria's top trading partner (Table 2) regions are Europe, Asia, America and Africa (PwC 2019; Adesoji, 2019). The value of agricultural items imported from Europe in the fourth quarter of 2021 was approximately ₦394.2 billion (950.2 million US dollars); in the same period, Asia is the second most popular destination for Nigerian agricultural products, with exports totaling roughly ₦55.7 billion (134.2 million US dollars) (Statista Research Department, 2022).

Table 2. Nigeria's top 5 export and import partners

Market	Trade (US$ Mil)	Partner share (%)
India	8.263	15.41
Spain	5.319	9.92
Netherlands	4.868	9.08
Ghana	4.003	7.47
France	3.55	6.62
Exporter	**Trade (US$ Mil)**	**Partner share (%)**
China	12.06	25.46
India	5.703	12.04
United States of America	4.678	9.88
Netherland	3.493	7.37
Belgium	2.376	5.02

Source: The World Integrated Trade Solutions (2019)

Most-Favored-Nation Duty-Free and Tariff Rate on Nigerian Agricultural Products

In international trade, Most-Favoured-Nation (MFN) treatment is synonymous with non-discriminatory trade policy. It is a key principle underlying the multilateral trading system. MFN status is given to an international trade partner to ensure non-discriminatory trade between all partner countries of the

World Trade Organization. A country which provides MFN status to another country has to provide concessions, privileges and immunity in trade agreements. If a country belonging to the WTO reduces or eliminates a tariff on a particular product for one trading partner, the treaty's MFN clause obligates it to extend the same treatment to all members of the organization ((WTO, 2021). Tariff Rate on MFN for Nigeria's data reached an all-time high of 91.27 % in 1995 and a record low of 8.33 % in 2015. All Products data is updated yearly, 24.41 % from Dec. 1988 to 2016 with 23 observations and 11.36% in 2016 and 12.17 % in 2020. One thing observed is the fact that virtually all the agricultural products are duty free (Table 3).

Table 3. Summary and Duty Range of the Nigeria Tariffs and Imports by Most-Favored-Nation on Agricultural Products

Summary			Total	Ag	Non-Ag	WTO member since				1995
Simple average final bound			120.5	150.0		Binding coverage:			Total	19.7
MFN applied									Non-Ag	6.7
Simple average		2022	12.0	15.9		Ag: Tariff quotas (in %)				0
Trade weighted average		2022	8.7	8.9	8.7	Ag: Special safeguards (in %)				0
Imports in billion US$		2021	52.2	6.9	45.3					
Frequency distribution		Duty-free	0 ≤ 5	5 ≤ 10	10 ≤ 15	15 ≤ 25	25 ≤ 50	50 ≤ 100	> 100	NAV (%)
					Tariff lines and import values (in %)					
Agricultural products										
Final bound		0	0	0	0	0	0	0	99.9	0
MFN applied	2022	0	26.6	18.9	0	42.9	11.6	0	0	0
Imports	2021	0	56.9	33.1	0	9.3	0.7	0	0	0
Non-agricultural products										
Final bound		0	0	0	0	0	5.3	1.3	0.1	0
	2022	2.0	40.5	21.4	0	35.7	0.4	0	0	0
	2021	5.9	34.7	47.6	0	11.7	0.1	0	0	0

	Tariffs and imports by product groups								
	Final bound duties				MFN applied duties			Imports	
Product groups	AVG	Duty-free in %	Max	Binding in %	AVG	Duty-free in %	Max	Share in %	Duty-free in %
Animal products	150.0	0	150.0	100	24.5	0	35	0.0	0
Dairy products	150.0	0	150.0	100	17	0	35	1.0	0
Fruit, vegetables, plants	150.0	0	150.0	100	17.8	0	35	0.4	0
Coffee, tea	150.0	0	150.0	100	18.5	0	35	0.1	0
Cereals & preparations	150.0	0	150.0	100	13.6	0	35	7.3	0
Oilseeds, fats & oils	150.0	0	150.0	98.8	11.4	0	35	1.3	0
Sugars and confectionery	150.0	0	150.0	100	12.6	0	35	1.9	0
Beverages & tobacco	150.0	0	150.0	100	17.5	0	35	0.8	0
Cotton	150.0	0	150.0	100		0	5	0.0	0
Other agricultural products	150.0	0	150.0	100	9.6	0	20	0.5	0
Fish & fish products	150.0	0	150.0	3.8	16.0	0	20	1.7	0

Source: Data from the World Development indicators (2021)

However, a country may enter into a free trade agreement or customs union granting more favourable treatment to the participating states than to the other WTO members if it observes certain conditions stipulated in the relevant provisions of the WTO agreements, to ensure the complementarity of the ***free trade*** agreement (FTA) with the WTO system (notably Article XXIV of the General Agreement on Tariffs and Trade (GATT), for trade in goods, and Article V of the General Agreement on Trade in Services (GATS), for trade in services.

In December 2006, the WTO General Council established a new transparency mechanism for such agreements, which is currently being implemented on a provisional basis (Transparency Mechanism for RTAs). This mechanism provides for the early announcement and notification of any agreement to the WTO as well as notification of any subsequent changes affecting the implementation or the operation of an agreement. In addition, the WTO maintains an electronic database including relevant tariff and trade-related information on all notified FTAs. The European Free Trade Association (EFTA) Member States are committed to the rules and the implementation of this mechanism, in line with their overall priority given to the multilateral trading system.

Tariffs are the main trade policy instrument that the country has been aligning with through the ECOWAS common external tariff (CET). As a result, the average applied MFN tariff declined from 29% in 2003 to 12% in 2009. However, the average bound tariff was 118% in 2009 and only 20% of tariff lines are bound. The significant gap between the average applied MFN tariff rates and the average bound rates, and the low coverage of bindings makes the tariff quite unpredictable and acts as a significant disincentive to investment (WTO, 2011). In addition to tariffs, Nigeria charges a number of additional duties on imports, which vary from one product to another and this add considerably to the cost of business. There are also some inconsistencies in taxes charged on imported goods and domestically produced goods. For example, excise duties are not levied on imports, but on domestically produced goods. In addition to facing tariffs and other duties, imports entering Nigeria by road cannot be in containers, which places an additional obstacle to regional trade while doing nothing to reduce congestion in the sea ports.

Nigeria also has two import prohibition lists. These are: The Absolute Import Prohibition List, which is based on security, health and morality grounds; and the Import Prohibition List, which is used mostly to protect domestic industry and which has been reduced steadily over the past few years. Exports are also subject to some taxes and restrictions (WTO, 2011). Nigeria imposed a 0.5% levy on all goods imported from outside Africa in one of the key provisions contained in the country's 2022 Finance Bill. The 0.5% import levy is an addition to existing customs duties and other charges. Also, all exports of goods are subject to a levy of 0.5% to cover the cost of pre-shipment inspection, even exports to destinations that do not require pre-shipment inspection. Some goods are also subject to an export prohibition, and there are some inconsistencies between this list and the import prohibition list, with imports of some food products prohibited in order to reduce competition for domestic producers and exports of other food products prohibited on the grounds of food security.

Trends of Nigerian Agricultural Import and Exports

Nigeria relies on imports (about $10 billion) to meet its domestic food and agricultural production shortfalls. Most of these imports come in the form of wheat, rice, food services, poultry, fish and consumer-oriented foods) (ITA, 2021). Available statistics shows that there has been an increase in the volume of food imports in Nigeria (Fig. 3), indicating that Nigeria's import surged in 2011. However, this has gradually decreased in 2019. In 2019, Nigerians spent ₦22.8 trillion on food, accounting for more than a half of their entire household expenditure of ₦40.2 trillion (56.7%) (Oyaniran, 2020).

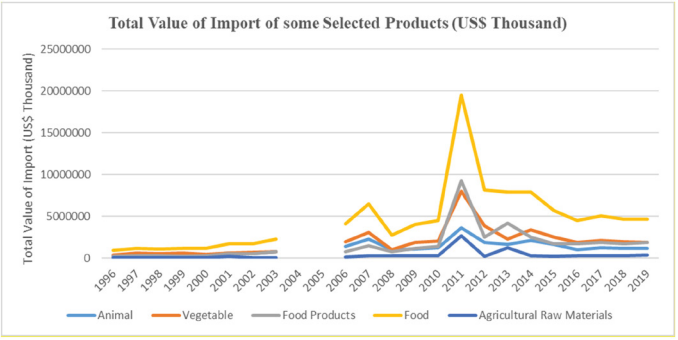

Figure 3. Trends in total values of importation of some selected agricultural products

Source: Data from the World Bank, World Integrated Trade Solution (2019) https://wits.worldbank.org/CountryProfile/en/Country/NGA/StartYear/1996/EndYear/2019/Indicator/NDX-XPRT-MKT-PNRTTN

Nigeria's total export earnings from agriculture remains small compared to crude oil exports. In 2019, agriculture accounted for less than 2% of total exports relative to crude oil (76.5%). Fig. 4 shows that since 2012, agricultural raw materials forming the bulk of export earnings, have progressively declined. Within the same period, the exports of food categories have gradually taken the lead since 2013 and 2019. The main food agricultural exports are sesame seeds and frozen shrimps. Within the period of 2019, Nigeria's agricultural export declined (by 11%) from €0.22 billion in 2018 to €0.26 billion in 2019 (Oyaniran, 2020).

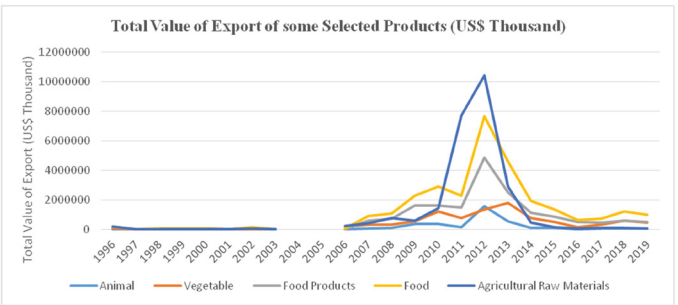

Figure 4. Trends in total values of exportation of some selected agricultural products

Source: Data from the World Bank, World Integrated Trade Solution

Net export is the measure of the difference between monetary value of export and import over a certain period. From Fig. 5, it is evident that Nigeria is a net importer of food, which has widened the country's agricultural trade deficit with import value exceeding exports. Oyaniran (2020) reported that Nigeria's agricultural trade deficit grew in 2019 (by €0.42 billion) compared to 2018 (€0.39 billion billion).

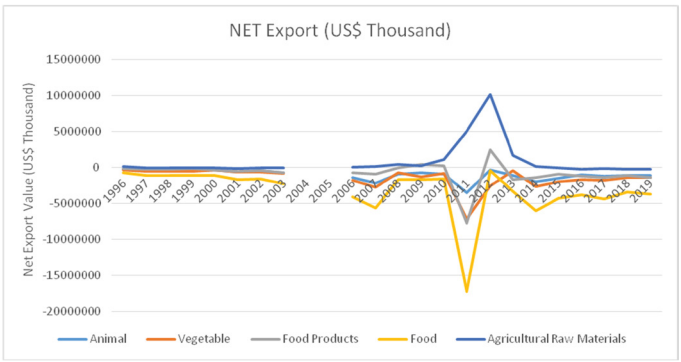

Figure 5. Trends in Net Export of some selected agricultural commodities

Source: Computed from the World Bank Data, World Integrated Trade Solution

The bulk of this deficit is arising from food and food products imports accounting for a total of 30.56% and 14.46%; and 9.91% and 3.99% share of imports respectively in 2011 and 2019 (Fig. 6), while food and food products accounted only for 5.34% and 3.40% of total share of export in 2012 and 1.79% and 0.91% total share of export in 2019 (Fig. 7).

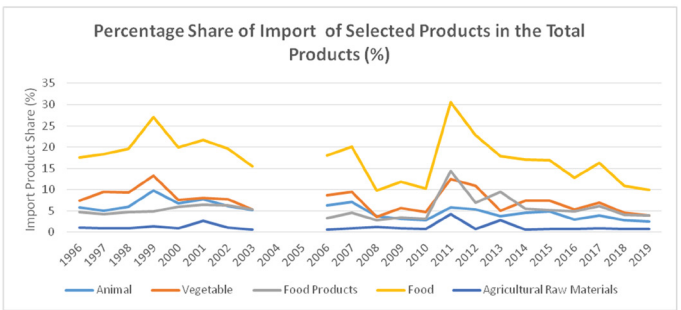

Figure 6. Trends in percentage share of import of some selected agricultural products in the total products

Source: Data from the World Bank, World Integrated Trade Solution

Nigeria has recorded a slight decline in its total import bill (Fig. 8) between 2017 and 2019 in food and food products which stood in thousands of US$ at 4370784.46 and 1448663.702 respectively in 2017 and 3732510.44 and 1402265.79 respectively in 2019. This perhaps was achieved due to certain initiatives and programmes implemented by the Nigerian government to address the situation in the agriculture sector.

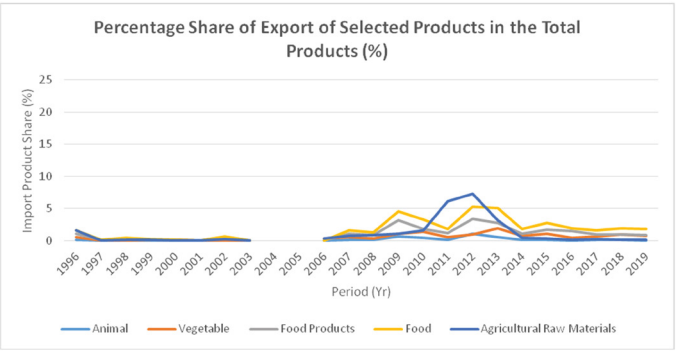

Figure 7. Trends of the Percentage Share of Export of Selected Products in the Total Products (%)

Source: Data from the World Bank, World Integrated Trade Solution

These programmes include Nigeria–Africa Trade and Investment Promotion Programme, the Presidential Economic Diversification Initiative, the Anchor Borrower Programme (ABP), Economic and Export Promotion Incentives and the Zero Reject Initiative, Reducing Emission from Deforestation and Forest Degradation (REDD+); Nigeria Erosion and Watershed Management Project (NEWMAP); Action Against Desertification (AAD) Programme, National Agricultural Technology and Innovation Plan (NATIP) – a four year scheme designed to aid Nigeria's COVID-19 economic recovery among others (FAO 2022, ITA, 2021).

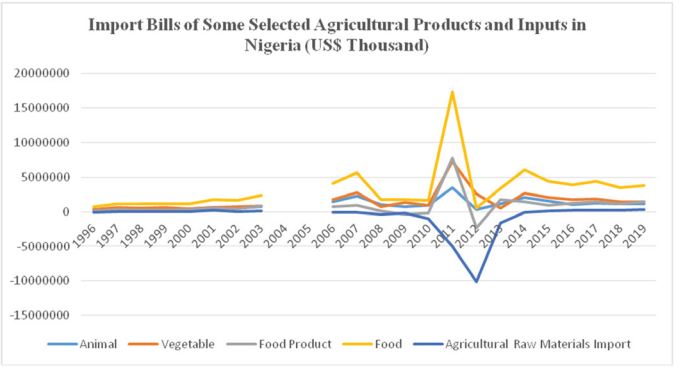

Figure 8. Import Bills of Some Selected Agricultural Products and Inputs in Nigeria

Source: Computed from data from the World Bank, World Integrated Trade Solution

Barriers to Trade: Tariffs and Nontariff Barriers

Globally, several countries utilize diverse instruments for the purpose of international trade either individually or as a combination to generate revenue and protect local industries from very competitive imports. Over time, Nigeria has made use of both tariffs and quotas to achieve these goals. Nigeria's tariffs are determined by the ECOWAS 2015-2019 Common External Tariff (CET) which has five bands. These include: a zero duty on essential drugs and capital goods, a 5 percent duty on raw materials, 10 percent on intermediate goods, 20 percent on finished goods and 35 percent on selected imports into strategic sectors.

The Nigerian government has continued to place bans or restrict certain imports especially on agriculture to protect and grow the local industries. Other measures include sanitary and phytosanitary measures, local content laws and some import substitution policies which seek to promote domestic production over import. An executive directive issued by the Nigerian government in May 2017, stipulated that at least 40 percent of the expenditure on procurement of uniforms and foot wears, motor vehicles, food and beverages, furniture and fittings, stationery and pharmaceuticals amongst others must be on locally manufactured products.

Because access to most country's domestic food markets is often constrained by tariffs and nontariff barriers, the 1995 World Trade Organisation (WTO) Agreement on Agriculture sought to address this issue by establishing a bound or maximum tariff for agricultural products to assure minimum import access through Tariff Rate Quotas (TRQs). According to the WTO (2018), numerous countries tend to apply lower tariff rates as compared to their bound rates (estimated at an average of 55 percent in 2015). In some cases, Groppo and Piermartini (2014) reported that the tariff overhang which is the difference between applied and bound rates may be large especially in developing countries, where the degree of this difference is reflected by the simple average of applied most-favored-nation (MFN) tariffs (less than 15%) for agricultural products in 2015 (WTO, 2018).

The applied MFN tariff rates were high (ranging from 16 - 24.5 percent) in Nigeria for products such as animal and dairy products, coffee and tea, beverages and tobacco and fish and fish products and the lowest (5 percent) for cotton. This collaborates the findings of Smith and Glauber (2019) who stated that average MFN are usually higher for dairy, meat and sugar products and lower for bulky products such as feed grains and wheat. The implication is that it will stimulate bulky products import to the detriment of processed products.

Domestic consumers benefit from lower tariffs through the lower prices they are faced with, while producer prices in exporting sector will raise. Caliendo, Feenstra, Romalis, and Taylor (2017) estimated that over 90 percent of welfare gains from trade from 1990 to 2010 occurred due to reduction in MFN tariff. Interestingly, Bureau, Guimbard, and Jean (2018) discovered that there has been an increase in the average tariff overhang thus implying that individual country's trade liberalization plays a crucial role in reducing applied tariff rates.

Food Security Situation in Nigeria

The results of the analysis of the data from the Economist Intelligence Unit (WIU) were used to compute the Global Food Security Index (GFSI). It revealed that Nigeria food security scores had been staggering over the years. Food security and the environment ranking compared with other countries has been on a steady increase (Fig. 9). Food affordability in Nigeria is still ranked 104th out of 113 countries and remains in deterioration zone with just a change from level of deterioration from -8.6% in 2012 to -2.2% in 2021. This may partly be due to food price inflation, unstable exchange rate and loss of income. This may be one of the reasons why Nigeria is still being food insecure as the majority of hungry people are living in rural areas and are highly dependent on agriculture either directly or indirectly for their livelihoods. The ones who are hungry are most often net food buyers who are poor (World Bank, 2008) and their incomes, which are on average is significantly lower than those of non-rural population (Aksoy, 2005), and is usually insufficient to buy the food which they do not produce themselves.

Food availability remains in the improvement zone and Nigeria is ranked 96th out of the 113 countries involved in GFSI ranking. The percentage fell from 11.8% in 2012 to 1.6% in 2020. This may partly be due to conflict between herders and farmers, climate change and the COVID-19 pandemic thereby affecting food production. This is in line with FAO et al., (2017, 2018, 2019) that observed that climate variability and extremes, conflicts, economic slowdowns and downturns are some of the drivers of the recent increases in global hunger rates.

Food quality and safety has moved from deteriorating zone (-8.6% in 2012) to improvement zone (0% in 2020) with Nigeria ranked 94th out of 113 countries. This improvement notwithstanding, a lot still needs to be done on this component for the country to be better off in terms of food quality and safety through keeping of good sanitary environment and enforcement of law against the law breakers.

Nigeria is ranked 100th out of 113 countries on natural resources and resilience with a change from a deteriorating state in 2012 (-8.6%) to improvement zone (1.7%). The country is endowed with a lot of natural resources and can do better with proper planning in terms of preservation and empowerment of her residents.

Climate Change and Agricultural Trade Trends Beyond 2020

Climate change remains of vital concern to policy makers and researchers across the world because of its debilitating effect on agricultural production, more so for subsistent farmers who often depend on agricultural incomes as the main source of livelihood. It is a threat that is facing about 570 million farms globally (Niyogi, 2016). These threats are mostly due to high temperatures, droughts, erratic rainfalls and floods amongst others which pose a huge problem to farmers, particularly those who rely solely on rain-fed agriculture.

Due to high dependence on rainfed agriculture and the inability of some countries to meet the food demands of their citizens, many countries use trade to meet this short fall. Globally, international trade has become a very important vehicle through which food is sourced for consumers in both developed and developing nations.

Annexes 1 and 2 present the result of the projections across countries and selected agricultural products using the IFPRI Impact model dataset which summarizes the latest projections to 2030 and 2050 on production, consumption, hunger and net trade with two baseline scenarios: one with the impact of climate change and one without climate change impact. Annexure 1 shows the projections of production, consumption and hunger in selected countries with and without climate change in 2010, 2030 and 2050. The result has shown that aggregate food production will increase in developing countries compared to developed countries in 2030 and 2050. It is interesting to note that aggregate food production would increase in Nigeria by 62 percent and 131 percent in 2030 and 2050 respectively without climate change while it would increase by 56 percent and 115 percent in 2030 and 2050 respectively with climate change.

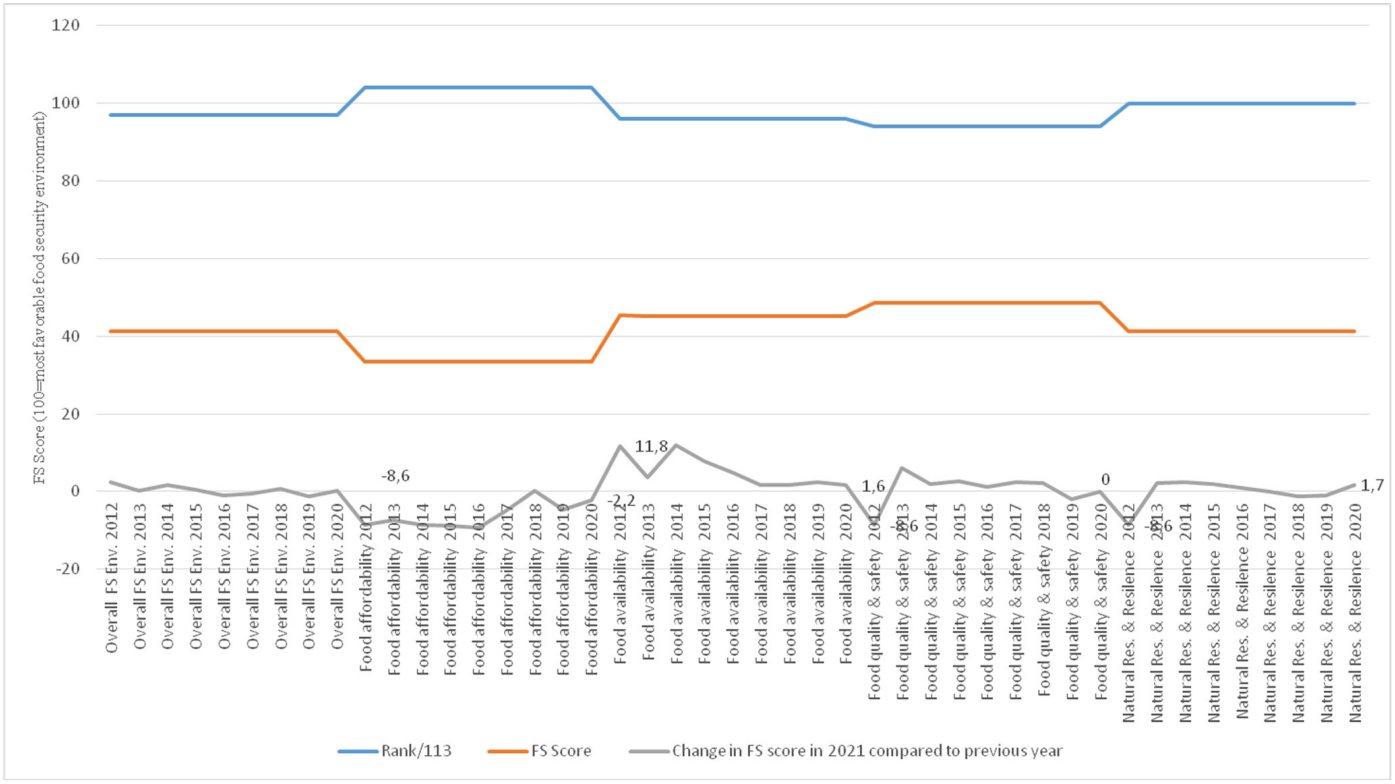

Figure 9. Trends of changes in the rank of food security (FS) environment and components of FS from 2012 to 2020 relative to 2021

Source: Extracted Nigeria data from Global Food Security data by EIU 2012-2021
https://impact.economist.com/sustainability/project/food-security-index/Index

The reverse is the case for *per capita* consumption in Annexure 1. *Per capita* is higher in developed countries than developing countries in 2030 and 2050. In Nigeria, *per capita* consumption would increase from 2751kcal in 2010 to 2943 kcal and 3136 kcal in 2030 and 2050 respectively without climate change and to 2857 kcal and 2964 kcal with climate change in 2030 and 2050 respectively.

There is huge disparity in the number of hungry people in developed nations compared to developing nations. The number of hungry persons in Nigeria is projected to increase under with and without climate change scenarios for all the years with just a slight decline from 9.7 million persons in 2010 to 8.5 million persons without climate change in 2030. Annexure 2 shows the projections of total production, consumption and net trade in selected agricultural products in Nigeria with and without climate change: 2010, 2030 and 2050. In Nigeria, cereals are found to be the largest source of food affected by the adverse effect of climate change and net trade flows compared to other commodities. Under the climate change scenario, cereals trade flows from Nigeria. The result from this projection suggests that trade will become very important for food security in the future and if climate change is not properly checked, it will be an issue that will lead to higher levels of food insecurity.

Challenges of Agricultural Trade in Nigeria

The bulk of Nigeria's agricultural trade involves time sensitive agricultural commodities. The cumbersome nature of documentation and customs formalities, numerous checkpoints and roadblocks hamper easy trade flow. Border delays (waiting times) poor trade-related infrastructure and inadequate post-harvest processing and storage facilities at the early and middle stages of the food supply chain are drawbacks. The delivery times for traders in most cases take more than a month to export and import even within some African countries, and inhibit the timely availability of dispatched agricultural products and worsen food insecurity situations.

Trade is an avenue through which those with plenty of food relate to those that have limited food. The WTO has played a significant role in achieving this through the Uruguay Round Agreement on Agriculture (AoA). The AoA is a restructuring process that is focused on promoting an impartial and effective agricultural trading system through the fulfillment of specific commitments aimed at reducing protection in areas such as export subsidies, domestic supports and market access through the creation of more efficient General Agreement on Tariffs and Trade (GATT) rules (WTO, 2001).

According to the WTO (2001), the objectives of the Nigerian agricultural policy are to increase food production, promote export diversification through cash crop production, increase the production of agricultural raw materials as further input in the economy and boost smallholder farmers and households' incomes to ultimately reduce poverty and promote rural employment and development. Under Article 20 of the AoA, Nigeria is to ensure impartiality and equality in agricultural trade by removing trade distorting practices while simultaneously tackling the development issues in developing countries. This study, however,

observes that Nigeria impedes free flow of trade through the use of trade distorting policies targeted at fixing short -term food shortages and protecting the local industries.

Conclusion and Recommendations

Trade is a crucial tool and a necessary part of any inclusive policy package that would achieve food security. Our study reveals that the total quantity and percentage of import of agricultural products and inputs is far higher than export, and food affordability was in deteriorating state with high food import bills and just slight improvement in food quality and safety between 2012 and 2020. There is no significant increase in export probably as a result of lack of incentives, partial implementation of reforms, geographical remoteness, high transaction cost, slow farmer's response to relative (crop) prices, limited access to inputs and fallacy of composition.

The WTO's agreement on agriculture basically is concerned with market access, domestic support and export subsidy; each of these has a link with food security. However, our results in the case of Nigeria have shown that the multilateral trade reform worsens the food security situation probably due to prevention of access to some imported agricultural products owing to unlawful restrictions contrary to ECOWAS free trade agreement.

Tariff rates in Nigeria have been low for most agricultural products with the average applied MFN tariff at 15.8 percent. This has led to an increase in aggregate food production in the country. Under the climate change scenario, cereals trade flows from Nigeria were higher in 2010, but the country imports are projected to be 36.7 million metric tons in 2050. The result from this study suggests that trade will become very important for food security in the future, and if climate change is not properly checked, it may lead to higher levels of food insecurity.

Nigeria's food security plan heavily relies on trade in food and agricultural products, as the country is dependent on imports to meet its food demands. Food security can be improved through several trade options. On the export side, market access can be increased for exports. This will ultimately enhance incomes and reduce food insecurity. Effort can also be made to reduce export tariffs substantially. On the import side, import costs can be made more predictable by introducing a financial rebate program or international import insurance. Some complementary policies such as nutrition policies, irrigation policies, access to agro-inputs (funds and fertilizers) and other related policies could assist in reducing food insecurity.

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CRediT authorship contribution statement

Abiodun Elijah Obayelu: conceptualization of the project, investigation, data validation, development of methodology, writing of original draft report of the project. **Sarah Edore Edewor:** reviewing, investigation, validation, analysis and contribution to the editing of the manuscript. **Agatha Osivweneta Ogbe:** reviewing, investigation and analysis and contribution to the editing of the manuscript. **Elizabeth Omolola Oyedepo:** Reviewing and editing of the manuscript.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Annex

Annexure 1. Projections of Production, Consumption and Hunger in Selected Countries with and without climate change: 2010, 2030 and 2050

	Aggregate food production (Index, 2010 = 1.00)					*Per capita* food consumption (kcal *per capita* per day)					Hunger (Millions of people at risk)				
		Without climate change		With climate change			Without climate change		With climate change			Without climate change		With climate change	
	2010	2030	2050	2030	2050	2010	2030	2050	2030	2050	2010	2030	2050	2030	2050
World	1	1.37	1.67	1.33	1.59	2795	3032	3191	2979	3070	838.1	528.2	405.8	598	482.6
Developing	1	1.42	1.77	1.4	1.71	2683	2961	3137	2904	3008	823.3	513.3	392.2	582.4	466.9
Developed	1	1.22	1.42	1.15	1.27	3384	3439	3513	3407	3441	14.8	14.9	13.6	15.6	15.7
Africa and Middle East	1	1.6	2.23	1.55	2.1	2623	2795	3002	2731	2866	238.7	229.8	185	260.2	229.9
Ethiopia	1	1.66	2.46	1.66	2.47	2066	2307	2614	2261	2519	32.7	32.3	22.5	35	27.3
Kenya	1	1.69	2.84	1.72	2.84	2133	2395	2708	2293	2504	10.2	8.9	5	11	8.7
Nigeria	1	1.62	2.31	1.56	2.15	2751	2943	3136	2857	2964	9.7	8.5	11.6	10.9	11.8
South Africa	1	1.49	1.84	1.48	1.78	2962	3229	3397	3155	3256	1.9	1.5	1.6	1.5	1.6

Source: The International Food Policy Research Institute Impact Project (2019)

Annexure 2. Projections of Total Production, Consumption and Net Trade in Selected Agricultural Products in Nigeria with and without climate change: 2010, 2030 and 2050

	Total production (Million metric tons)					*Per capita* food consumption (Kg *per capita* per year)					Net trade (Million metric tons)				
		Without climate change		With climate change			Without climate change		With climate change			Without climate change		With climate change	
	2010	2030	2050	2030	2050	2010	2030	2050	2030	2050	2010	2030	2050	2030	2050
Cereals	27	40	50	39	48	144.5	150.1	150.3	144.3	139.6	-6.4	-18	-42.8	-16.3	-36.7
Meats	1	3	5	3	5	8.5	13.1	19.7	12.9	18.9	-0.1	-0.6	-2.3	-0.6	-2.1
Fruits & Vegetables	24	44	67	41	59	135.5	166.8	196	162.9	187.2	0.1	-3.5	-15.7	-4.9	-19.5
Oilseeds	31	55	69	53	64	8.4	9.7	10.8	9.2	9.8	0	-1.1	-3.7	-1	-3.2
Pulses	3	6	10	6	9	8.8	9.8	10.9	9.5	10.2	0.2	0.4	0.4	0.4	0.5
Roots and Tubers	97	150	224	145	210	231.6	233.8	244.6	228.9	234.8	2	-2.8	-8.7	-2.8	-7.5

*A negative value for net imports indicates that the group of countries is a net exporter

Source: The International Food Policy Research Institute Impact Project (2019)