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# AFRICAN CONTINENTAL FREE TRADE AREA AGREEMENT AND THE AGRICULTURAL PERFORMANCE IN NIGERIA IN THE POST-COVID-19 ERA: A SIMULATION FOCUS ON AGRICULTURAL OUTPUT, TRADE, AND EMPLOYMENT

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## *ABSTRACT*

*The COVID-19 pandemic has unleashed negative economic consequences on the global economies and Nigeria inclusive. In response, Nigeria has launched the Economic Sustainability Plan (ESP) to leverage the potential gains of the African Continental Free Trade Area Agreement (AfCFTA) to accelerate agricultural performance in the post-COVID-19 era. Thus, this paper investigated the potential impact of AfCFTA on the performance of the agricultural sector in Nigeria in the post-COVID-19 era focusing on Agricultural output, trade and employment within the framework of a small macro-econometric model. The study used secondary data from 1970 to 2018 for a within-sample forecast and a twelve-year out-of-sample forecast spanning from 2019 to 2030. Two simulation experiments based on AfCFTA tariff reduction lines were conducted. Findings revealed that with tariff reduction under the AfCFTA, there is an increase in agricultural output, exports, employment, and the share of agriculture to GDP growth, as well as actual private consumption in Nigeria. The study concludes that if the AfCFTA is implemented, it will boost agricultural sector performance in Nigeria during the post-COVID-19 era. Based on these findings, the study recommended that the country implement mechanisms to overcome the challenges militating against agricultural production and exports in the economy to maximize the potential gains that AfCFTA provides. The government should also streamline its expenditures and invest hugely in infrastructural facilities such as roads, electricity, and expansion of sea-port facilities, communication networks and earth-dams to encourage dry-season farming activities.*

***Keywords:*** *AfCFTA, Agriculture, Employment, Macro Econometric Model, Trade, Simulation*

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## Introduction

The COVID-19 pandemic took a severe toll on the global economy. Before the pandemic outbreak in Africa, the continent was on the path of impressive economic progress. The continental growth was projected to increase from 2.9 per cent in 2019 to 3.5 per cent in 2021. This expected expansion was predicated upon member countries signing the African Continental Free Trade Area (AfCFTA). The implementation of AfCFTA can stimulate trade in the continent by as high as 25 per cent by 2040 (United Nations, 2020).

This promising economic outlook was, however, dampened following the outbreak of the COVID-19 pandemic in the continent on 14 February 2020. In response, member countries took proactive measures to contain the pandemic and defend their economies from collapse. The lockdowns crippled economic activities leading to massive job losses and supply chain disruptions. For Nigeria, the economy's over-dependence on oil for foreign exchange earnings and revenue made the country vulnerable in this precarious situation. In the quest to salvage the economy from a recession, the Nigerian government launched the Economic Sustainability Plan (ESP) to use the real sector and monetary policy measures to create jobs in areas. Such as agriculture and agro-processing, housing construction, renewable energy, infrastructure, manufacturing and the digital economy (Nigeria's National Development Plan (NDP), 2020).

The Economic Recovery and Growth Plan (ERGP) (2017-2020), an economic sustainability plan that sought to achieve its objectives in the face of COVID-19, had already projected that by 2020, Nigeria would become a net exporter of essential agricultural products. Such as rice, cashew nuts, groundnuts, cassava and vegetable oil. Also, the ERGP projected that using agriculture, manufacturing and services, unemployment will reduce from 13.9 per cent as of the second quarter of 2016 to 10.23 per cent by 2020 (Ministry of Budget and National Planning, 2017).

Given the enormous agricultural potential of the Nigerian economy, which has remained untapped over the years, the Economic Sustainability Plan has identified the agricultural sector as a gateway to Nigeria's inclusive, sustainable development. The ESP intends to leverage the potential gains of the AfCFTA, which emphasizes eliminating tariff and non-tariff barriers to boost the production and trade of agricultural commodities in the country. It is predicated upon the premise that the United Nations Economic Commission for Africa's (ECA) model projected that intra-African trade in agricultural products would increase. An increase between 20 per cent and 30 per cent higher in 2040 with the AfCFTA in place with particular gains in sugar, vegetable, fruits, nuts, beverages and dairy products. It is based on the expectation that the AfCFTA would provide access to the market at the regional and international levels, which would generate State revenue, increase farmers' income and expand both farmer and country capacity to invest in modernizing the agricultural sector through processing and mechanization (United Nations Economic Commission for Africa (UNECA), 2018).

The Nigerian agricultural sector has backward and forward linkages that have the potential to usher the economy into sustainable development. Thus, Nigeria being a signatory to the AfCFTA and the largest economy in the continent, the question that arises is: Can her membership of the AfCFTA help to boost the agricultural sector performance in the post-COVID-19 era? Answering this question requires an empirical investigation with policy simulations using the AfCFTA tariff reduction lines. However, studies such as Akighir et al. (2020) and the Nigerian Economic Summit Group (2019) have investigated the impact of the AfCFTA on the Nigerian economy. These studies focused on the generic performance of the Nigerian economy without detailed attention to the agricultural sector, which is one of the leading sectors of the economy that has the sheered prosperity of the country.

Therefore, this study aims to simulate the impact of the AfCFTA tariff reduction lines on agricultural sector performance in Nigeria, focusing on agricultural output, trade and employment in the post-COVID-19 era. The paper is structured as follows after the introduction. Section two is on literature review, section three deals with the methodology; the stylized facts are contained in section four; section five dwells on results presentation and discussion, and section six concludes the paper and makes policy recommendations.

## Literature Review

The literature review for this study is divided into conceptual, theoretical review and empirical literature.

### *Conceptual Literature*

*African Continental Free Trade Area Agreement*

AfCFTA is an African continental trade policy that seeks to liberalize intra-African trade by eliminating tariff and non-tariff barriers. The primary goal of the AfCFTA is to boost intra-African trade with the view to helping member countries achieve trade expansion, economic growth, and economic transformation and, consequently, achieve Sustainable Development Goals (SDGs) and Agenda 2063 (International Trade Centre, 2018). According to Kituyi (2016), the AfCFTA allows African countries to transform their economies and achieve economic development. AfCFTA is a medium for African countries to achieve economic integration for African products to reap the advantage of economies of scale and importing raw materials and intermediate inputs at a lower cost. AfCFTA can help member countries integrate into the Global Value Chain (GVC) and access raw materials from other African countries at a cheaper rate. These cheap imported raw materials and intermediate goods would help member countries produce finished goods that will be competitive internationally (Saygili et al., 2018).

*Agricultural Sector Performance*

According to Olomola & Nwafor (2018), agricultural sector performance refers to the level of growth in vital agricultural variables such as agricultural productivity (i.e. labour productivity, land productivity), agricultural trade volumes in terms of agricultural imports and exports, and agricultural product prices (i.e. the level of food inflation and retail prices of agricultural commodities). Similarly, Akighir et al. (2020) defined agricultural sector performance as the rate of increase in agricultural production and employment, the volume of agricultural exports and imports, and the share of agriculture to the Gross Domestic Product (GDP) in an economy during a given period. Furthermore, The World Bank (2008) conceptualized agriculture's performance as the capacity of the agricultural sector to meet the demand for food and other uses. It is concerned with increasing per capita production, rising agricultural productivity and declining commodity prices.

### *Theoretical Review*

The study is anchored on the theoretical expositions of the optimal tariffs theory. The classical and neo-classical roots of the theory of optimum tariffs theory beginning from Torrens, Mill, Marshall, Sidgwick, Edgeworth and Bickerdike to Kaldor, have explained that tariff imposition by the levying country tends to benefit the imposing country at the expense of the general trading partners (Sidgwick, 1887). The proponents of the optimal tariff theory also worried about a tariff rate ideal for trade between countries. They argued that, initially, tariff imposition increases the terms of trade of the imposing country and reduces the terms of trade of the paying countries; since the gain of one country constitutes a loss to another

country, and as such, the global loss exceeds the levying country's gain (Kaldor, 1940). They argued further that in the event of retaliation in tariff imposition by other countries, the terms of trade of both countries would reduce. Based on this, it was concluded that tariff imposition is detrimental to global welfare since it brings a costly reduction in the volume of global trade. The consensus is that tariff impositions as a protectionist approach to trade have more costs than benefits and, thus, are unacceptable from a cosmopolitan point of view. As such, free trade has been widely accepted as the best policy from a practical and moral standpoint.

In the spirit of free trade practice, the African countries have agreed under the auspices of AfCFTA to liberalize trade by tariff and non-tariff eliminations with a view to boosting intra-African trade. Against this background, the optimal tariff theory is found suitable as a theoretical anchorage of this study.

***Empirical Literature Review***

Only some studies have attempted to quantify member countries' gains in implementing the AfCFTA. It began with Akighir et al. (2020), who used a macro-econometric model to quantify the impact of AfCFTA tariff reduction on non-oil exports and macroeconomic trajectories in Nigeria. Their study employed the AfCFTA tariff reduction lines to simulate the effect. The study found significant increases in non-oil output such as agriculture, manufacturing and services. Also, it was found that there are increases in exports and employment as well as in welfare gains and other macroeconomic trajectories (Susetyo, 2017). The study concluded that AfCFTA holds enormous potential benefits for the Nigerian economy, especially in the agriculture and manufacturing sectors.

Similarly, Gumede (2020) investigated the impact of the AfCFTA in the context of a political federation for the African continent. The study employed a descriptive analysis and concluded that the AfCFTA and AEC are potential steps towards the United African States and member nations would have influence and power in the global economy. Furthermore, World Bank's study (2020) focused on the economic and distributional effects of the AfCFTA within a global Computable General Equilibrium (CGE) framework and a microsimulation, quantified the impact of AfCFTA. Findings indicated that the agreement has the potential to take 30 million people out of extreme poverty and enhance the GDP growth of member countries.

Another study by Abrego et al. (2021) estimated the agreement's welfare gains within the framework of the general computable equilibrium model. It found that reducing trade barriers under the AfCFTA would increase welfare gains for member countries, with most of the gains coming from non-tariff barriers. Also, the study found that trade openness and the initial level of trade barriers are the major determinants of the allocative efficiency of member countries. Furthermore, the study found that agriculture and manufacturing would be the highest contributors to these member countries' welfare gains. This study has made commendable efforts to provide helpful insight into the benefits of AfCFTA. However, it used a static model that did not unravel the intertemporal dynamics in the countries surveyed.

Again, Saygili et al. (2018) employed a multi-country general computable equilibrium model and estimated the costs and benefits of tariff reduction under the African continental free trade area. Findings indicated significant welfare gains, output and employment expansion, and intra-African trade growth in the long run. Gains were found to vary among countries. In the short run, the estimates suggested that member countries would experience losses in revenue as a result of adjustments in tariffs. Also, these revenue losses will likely vary from country to country. It was further found that the gains and losses will reduce if sensitive products are exempted from eliminating tariff and non-tariff barriers.

Furthermore, it was found that uneven distribution of gains and losses may affect smooth tariff negotiation among member countries. Just like the previous study, the static nature of the model could not allow for the robust exposition of the dynamics of the Af-CFTA among member countries. Also, country-specific findings, especially for Nigeria, were not done, which is the focus of this current study, with particular emphasis on the agricultural sector.

In Nigeria, the Nigerian Economic Summit Group (2019) investigated the macroeconomic effects of the African Continental Free Trade Area Agreement (AfCFTA) on the Nigerian economy using the GCE modelling. The study found that the AfCFTA has no significant effect on macroeconomic variables such as GDP, government revenue, private investment and inflation in Nigeria. This study, though on the Nigerian economy, should have paid more detailed attention to the agricultural sector for which AfCFTA provides enormous prospects.

From the previous empirical works, it is clear that all the reviewed empirical works are based on a cross-section of African countries. The studies have employed static GCE models that cannot unravel the intertemporal dynamics of tariff reduction in Africa. The current study is unique from existing studies in that Nigeria. It is the first to employ a dynamic macro-econometric model using a dynamic-stochastic solution. This simulation technique can conveniently capture the intertemporal dynamics of tariff reduction on the Nigerian agricultural sector performance in the post-COVID-19 era.

**Methodology**

The study employs a small macro-econometric model based on the theoretical foundations of the Keynesian theory and its extension, the Mundell-Fleming IS-LM framework focusing on the agricultural sector. In doing this, the Nigerian economy is divided into three interrelated blocks, namely: the agricultural block, the absorption block, and the external block, to capture the dynamics of agricultural sector performance. The specifications in these blocks are based on theories and eclectic incorporation of specific features of the Nigerian economy. The following schema model presents the dynamics of the Nigerian agricultural sector.

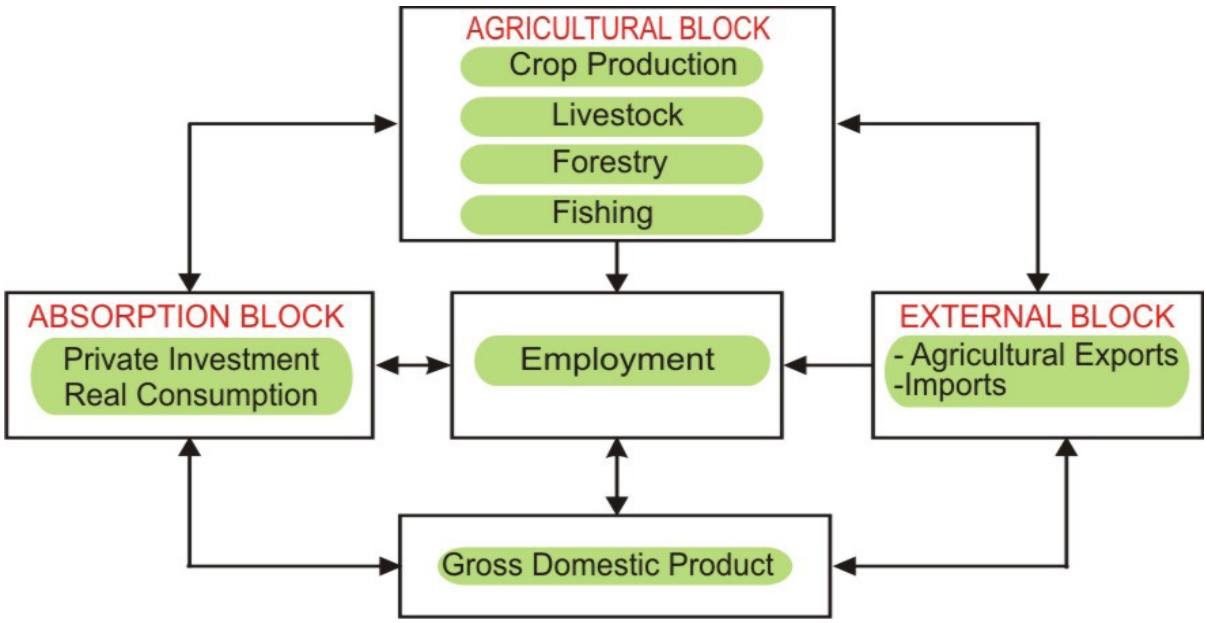


**Figure 1: Macro-econometric Schema Model**

Source: Akighir et al. (2020)

**Models Specification**

The equations of the macro-econometric model are specified block by block based on theoretical postulations, empirical findings and institutional knowledge of the Nigerian economy.

***Agricultural Block***

The agricultural production activities in Nigeria are broadly divided into crop production, livestock, forestry and fishing sub-sectors. Thus, Akighir et al. (2020) considered the inputs or factors determining agricultural production in Nigeria to explain the agricultural output. Agricultural production in Nigeria is seasonal and depends mainly on the amount of rainfall and government support. Therefore, government expenditure is a critical factor in agricultural production. Hence, agricultural output in Nigeria is determined by the amount of rainfall (RNF), credit to the agricultural sector (CREA), prime lending rate (PLR), government expenditure (GEX), agriculture capacity utilization (CUA), import of capital goods (MK) and foreign direct investment (FDI). The equations for the agricultural sector are specified based on the sub-divisions, namely, crop production (CRP), livestock production (LSK), forestry production (FTR) and fishery production (FHI). The agricultural output specifications are presented in equations 1 to 4 as follows:

$$CRP = f(RNF, CREA, PLR, GEX, CUA, MK, FDI) \quad (1)$$

$$LSK = f(RNF, CREA, PLR, GEX, CUA, MK, FDI) \quad (2)$$

$$FTR = f(RNF, CREA, PLR, GEX, CUA, MK, FDI) \quad (3)$$

$$FHI = f(RNF, CREA, PLR, GEX, CUA, MK, FDI) \quad (4)$$

***Absorption Block***

The absorption block comprises private consumption and private investment. This block attempts to capture the backward and forward linkages associated with the agricultural sector. Thus, from the Keynesian psychological law of consumption, private consumption is specified as:

$$C = f(YD) \quad (5)$$

Where C is consumption and YD is disposable income. Equation 5 is expanded to incorporate other relevant variables that affect consumption, such as inflation (INF), tariff (TAR), interest rate (INTR), and remittances (REM). The inclusion of tariff into equation 5 is to measure the impact of AfCFTA on agricultural performance in Nigeria. Therefore, the private consumption (PC) model is specified as follows:

$$PC = f(YD, INF, TAR, INTR, REM) \quad (6)$$

Private consumption is expressed as actual consumption to measure the welfare gains of tariff reduction under the AfCFTA.

Again, private investment is modelled following the accelerator and Keynesian theory. The accelerator theory considers the central role of output growth in investment, and the Keynesian theory, on the other hand, emphasizes the cost of capital (interest rate) as a sig-

nificant determinant of private investments. Based on these theoretical postulations, private investment is expressed as a function of gross domestic product (Y), interest rate (INTR), credit to the private sector (CPS), government expenditure (GEX), inflation rate (INF), and tariff rate (TAR) (Akighir & Kpoghul, 2020). The incorporation of the tariff rate captures the effect of tariff reduction under the AfCFTA on private investment in Nigeria, especially in the agricultural sector. Therefore, the private investment equation is specified as follows:

$$PI = f(Y, INTR, CPS, GEX, INF, TAR) \tag{7}$$

***External Block***

The external block of the model considers Nigeria's trade with the rest of the world, including African countries, especially as it relates to agricultural exports and imports. In international trade, the exchange rate is an important mediating variable. Also, tariffs influence the volume of exports and imports between countries. Again, foreign reserves are used to finance imports (Akighir et al., 2020). Thus, agricultural trade is subdivided into agricultural exports and imports.

***Agricultural Exports***

This study models exports of agriculture (XA) as a share of total exports and is functionally determined by the exchange rate (EXR), tariffs (TAR), credit to the private sector (CPS), domestic cost of funds captured by prime lending rate (PLR), and terms of trade (TOT) (Akighir et al., 2020; Akighir & Kpoghul, 2020), the specification of agricultural exports is stated as follows:

$$\frac{XA}{X} = f(EXR, TAR, CREA, PLR, TOT) \tag{8}$$

***Agricultural Imports***

In line with Agu (2015) and following the modelling approach of Akighir et al. (2020), agricultural imports are influenced by gross domestic product (Y), an exchange rate (EXR), tariff (TAR), foreign reserves (RES), cost of finance proxy by prime lending rate (PLR), and terms of trade (TOT). Therefore, the model for imports is specified as follows:

$$M = f(Y, EXR, TAR, RES, PLR, TOT) \tag{9}$$

***Share of Agriculture to Gross Domestic Product***

The share of agriculture to gross domestic product is modelled to ascertain the effects that tariff reduction under AfCFTA will exert on the GDP of the Nigerian economy in terms of the agricultural sector's contribution. Functionally, the share of agriculture to GDP in Nigeria is influenced by critical variables such as interest rate (INTR), government expenditure (GEX), tariff (TAR), an exchange rate (EXR), infrastructure proxy by the index of electricity production (IEP), and private investment (PI) (Akighir et al., 2020). The specification for the share agriculture to gross domestic product is expressed as follows:

$$\frac{YA}{GDP} = f(INT, GEX, TAR, EXR, IEP, PI) \tag{10}$$

***Agricultural Employment***

The specification of the agricultural employment equation follows Okun's Law (OL), which postulates a negative relationship between an increase in the unemployment rate and the growth rate of real gross domestic product (Okun, 1962, 1970).

$$EMP = f(GDP) \tag{11}$$

Employment in this study is proxy by the agricultural sector employment to ascertain the contribution of agriculture to employment creation in Nigeria given tariff reduction under the AfCFTA. Accordingly, the agricultural employment model is further expanded to incorporate other essential variables such as agricultural output (YA), government expenditure (GEX), private investment (PI), credit to the private sector (CPS), and infrastructure proxy by the index of electricity production (IEP) (Akighir et al., 2020). Therefore, the agricultural employment equation is specified as follows:

$$AEMP = f(YA, GEX, PI, CPS, IEP) \tag{12}$$

***Infrastructure***

The infrastructural equation is modelled following Akighir & Kpoghul (2020) and Akighir et al. (2020) Infrastructure is a critical variable in agricultural production in a typical rural economy like Nigeria. Functionally, infrastructure (IEP) is determined by government expenditure (GEX), foreign direct investment (FDI), the exchange rate (EXR), inflation (INF) and import of capital goods (MK). The specification is expressed as follows:

$$IEP = f(GEP, FDI, EXR, INF, MK) \tag{13}$$

The stochastic equations of the model were estimated using the Two-Stage Least Squares technique, given that all the equations in the system were over-identified and the quest to circumvent the simultaneity problems inherent in macro-econometric models. The study used annual time series data collected from the Central Bank of Nigeria (CBN) statistical bulletins, National Bureau of statistics bulletins, the direction of trade, and the world trade indicators.

***Policy Scenarios***

The simulation experiments here are based on the AfCFTA tariff elimination lines. Thus, the study simulated the full and partial tariff liberalization of AfCFTA. The AfCFTA provides for the gradual elimination of tariffs by member countries based on their categories. For the Less Developed Countries (LDCs), 90% full liberalization will have a 10-year phase down; for non-LDCs, a 5-year phase down; for the G6 countries, a 15-year phase down. For sensitive products, AfCFTA provides 7% of tariff lines. For LDCs, 13-year phase down and non-LDCs 10-year phase down, while excluded products have 3% of tariff lines for both the LDCs and non-LDCs countries.

This study developed two scenarios based on the AfCFTA tariff reduction lines and Nigeria being a non-LDC in the continent. First, linear tariff cuts were simulated, where an annual tariff reduction of 20% over 5-year. Secondly, two-phased down linear tariff cuts were simulated, eliminating an immediate large share of 90% of tariffs and the rest over several years. A simple average of tariff rates was computed using the various tariff schedules used in the simulation. The within-sample forecast used data from 1970 to 2018; the out-of-sample forecast used 2019 to 2030. It enables us to examine the performance of the agricultural sector under AfCFTA tariff reduction lines in Nigeria during the post-COVID-19 era. The simulation solution for the model was the stochastic-dynamic procedure since it is the best for the multi-step ahead forecast.

### *Stylized Facts*

The stylized facts cover the overview of the agricultural sector in Nigeria, agricultural exports and imports in Nigeria, agricultural employment in Nigeria, and AfCFTA and the prospects of agriculture in Africa.

### *Overview of the Agricultural Sector in Nigeria*

According to the World Bank (2020), the agricultural sector is the largest sector of the Nigerian economy and a significant contributor to real GDP growth and employment. The Nigerian agricultural sector is divided into four significant sub-divisions: crop production, livestock, fishing, and forestry. Crop production is the largest sub-sector that, accounts for about 87.6% of the sector's total output, followed by the livestock sub-sector at 8.1% and fishery at 3.2%, with the forestry sub-sector accounting for 1.1%. The agricultural sector is the largest sector of the Nigerian economy, contributing an average of 24% to the nation's GDP over the past seven years (2013 to 2019). Furthermore, the sector employs more than 36% of the country's labour force, making it the largest employer of the labour force (National Bureau of Statistics, 2021). Figure 2 depicts the agricultural sector's contribution to Nigeria's GDP from 2013 to 2021.

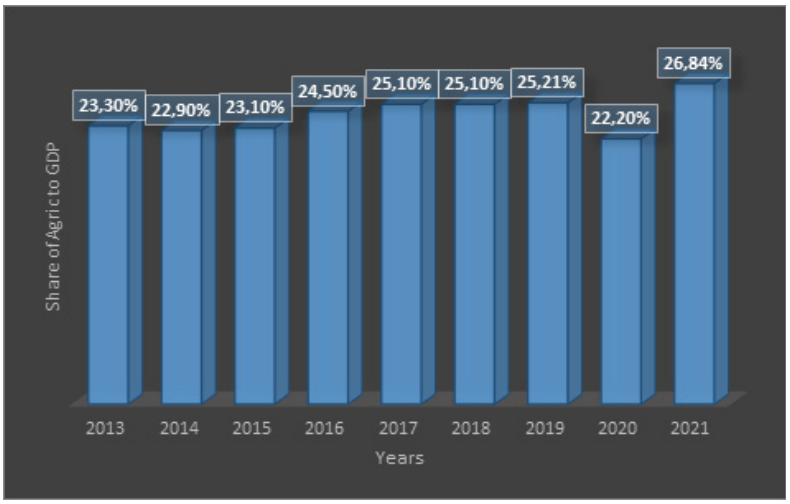


**Figure 2: Contribution of Agriculture to GDP (%) from 2013 to 2021**

Source: National Bureau of Statistics (2021)

The trend of the contribution of agriculture to Nigeria's GDP has exhibited consistent increases over the years. These increases may be attributed to the current agricultural policies in the country, such as the Anchor Borrower's Programme (ABP), Presidential Fertilizer Initiative (PFI), Youth Farm Lab (YFL), Presidential Economic Diversification Initiative (PEDI), the Food Security Council (FSC) and Farmers' money among others. However, the share of agriculture to GDP dropped in 2020 due to the COVID-19 pandemic. In 2021, the sector's contribution to GDP increased by 4.64%. This increase can be ascribed to government policies that boost the country's agricultural production, such as the Economic Sustainability Plan.

### *Agricultural Imports and Exports in Nigeria*

Main Nigeria's agricultural imports include wheat, sugar, fish and milk. Wheat is imported from Russia and the United States, fish from the Netherlands, and wheat importation dominates Nigeria's agricultural imports. On the other hand, central Nigeria's agricultural export commodities include the following crops: cashew nuts, cocoa, soya beans, beans, frozen shrimps and prawns, cocoa, ginger, sesame seeds, cotton and agro-foods. According to the

Price Waterhouse and Coopers (PWC) (2019) Nigeria's major agricultural export destinations include the Netherlands, Germany, Indonesia, Malaysia and Belgium. The National Bureau of Statistics (2019) states that Nigeria is ranked the third highest producer of sesame in the world, and about 95 per cent of sesame output in Nigeria is exported. Again, Nigeria is the world's sixth-highest producer of cashew nuts, producing about 120 000 metric tons per annum. Figure 3 shows agricultural imports and exports in Nigeria.

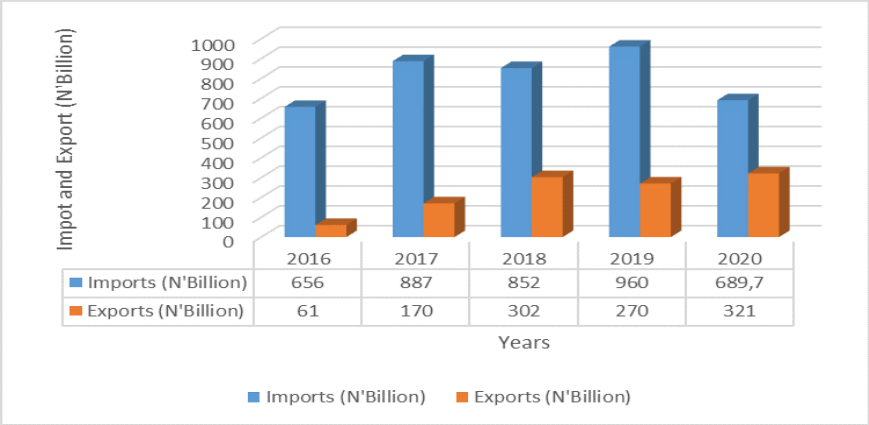


**Figure 3: Nigeria's Agricultural Imports and Exports from 2016 to 2020**

Source: National Bureau of Statistics (2021)

It is evident from Figure 3 that Nigeria is a net food importer, as agricultural trade reveals that food imports exceed exports. The agricultural trade deficit continues to widen as imports have exceeded exports to the tune of N690 billion in 2019 compared to N550 billion in 2018. According to Price Waterhouse and Coopers (PWC) (2019), the challenges militating against the exports of agricultural commodities in Nigeria include but are not limited to: logistic challenges at the ports, inadequate facilities and poor distribution network, poor quality of agricultural products for exports and low-value addition to agricultural products. Despite these challenges, the Price Waterhouse and Coopers (PWC) (2019) asserts that AfCFTA offers prospects and opportunities for agricultural exports in Nigeria.

***Agricultural Employment in Nigeria***

Nigeria's agricultural sector is considered the country's highest employer of labour in the country since the sector engages more people than any other sector. The agricultural sector's contribution to employment in the country is depicted in the following figure.

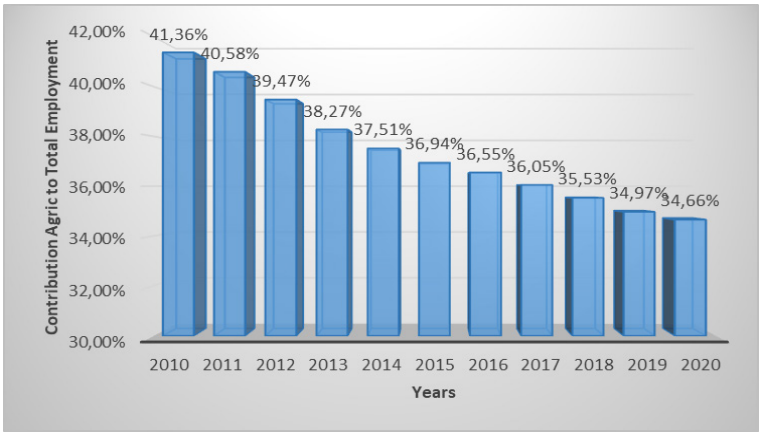


**Figure 4: Contribution of the Agricultural Sector to Employment in Nigeria from 2010 to 2020**

Source: National Bureau of Statistics (2021)

The figure reveals that the agricultural sector's contribution to employment in Nigeria from 2010 to 2020 has consistently exhibited a declining trend. The Price Waterhouse and Coopers (PWC) (2019) has attributed this declining employment in the sector to some militating factors such as shortage/poor supply of farm inputs, insecurity, outdated system of agriculture practices, lack/absence of agricultural value addition and supply linkages, lack of access to finance by farmers amongst other challenges.

***AfCFTA and the Prospects of Agriculture in Africa***

According to the Price Waterhouse and Coopers (PWC) (2019), AfCFTA will unlock opportunities in the agricultural sector and expand trade for agricultural commodities in member countries. The prospects of agriculture in Africa, given the establishment of the AfCFTA, are predicated upon the following. First, Africa's food import bill averaged US$35 billion in 2016, projected to surge to US$110 billion by 2025. Furthermore, Africa's Agro-business is estimated to hit US$1 trillion by 2025. This surge is predicated on the rapid increase in the continent's middle class.

Secondly, a weak value chain beset the continent's agricultural sector. About 90% of Africa's agricultural export to non-African countries are predominantly primary or semi-processed products, and about half of intra-regional trade has to do with processed products (Price Waterhouse and Coopers (PWC), 2019). According to the Price Waterhouse and Coopers (PWC) (2019), out of the US$62 billion in agricultural products exported from Africa to other countries in 2017, only US$12 billion were classified as processed products.

Thus, with the AfCFTA in place, it is expected to strengthen agro-business gains in Africa to create new regional markets for farmers. It is expected that AfCFTA will unlock the agro-value chain, enhance agro-exports, and significantly reduce agricultural imports into the continent.

**Presentation of Results and Discussion**

The unit root test was conducted on the series to avoid spurious estimates using the Augmented Dickey-Fuller (ADF) test. The results are presented in the following table.

**Table 1: Unit Root Test**

| Variable | Level | 1st Difference | Remarks | Variable | Level | 1st Difference | Remarks |
|---|---|---|---|---|---|---|---|
| YA | -1.728793 | -6.262088** | I(1) | LSK | 1.274562 | -6.427288** | I(1) |
| RNF | -5.866586** | -8.251614** | I(0) | FTR | 0.731415 | -7.454838** | I(1) |
| CREA | -0.680470 | -4.216973** | I(1) | FHI | -0.505256 | -5.028335** | I(1) |
| PLR | -1.703513 | -10.94232** | I(1) | PC | -1.051681 | -7.202201** | I(1) |
| GEX | 0.169744 | -6.198006** | I(1) | YD | -2.430266 | -14.33610** | I(1) |
| CUA | 3.867989** | -5.033172** | I(0) | INF | -3.535993** | -6.591703** | I(0) |
| MK | -1.789308 | -7.445928** | I(1) | TAR | -2.868561 | -6.285933** | I(1) |
| FDI | -0.539064 | -10.63768** | I(1) | INTR | -2.063613 | -7.183555** | I(1) |
| CRP | 1.066228 | -6.151169** | I(1) | REM | -1.195913 | -8.146858** | I(1) |
| PI | 0.685273 | -6.246036** | I(1) | XA | -0.380064 | -7.077088** | I(1) |
| Y | -1.828390 | -8.146316** | I(1) | NX | -1.281632 | -7.308181** | I(1) |
| CPS | 3.819821** | -5.520577** | I(0) | M | -0.774577 | -7.377566** | I(1) |
| EXR | 2.470875 | -4.666779** | I(1) | RES | -1.343615 | -7.518698** | I(1) |
| TOT | -1.510050 | -6.773571** | I(1) | IEP | -1.801359 | -2.306225** | I(1) |
| EMP | -1.601055 | -8.923622** | I(1) | AEMP | -0.876201 | -3.758456** | I(1) |
| YAG | -1.314518 | -8.774103** | I(1) | | | | |

**Denotes 5% level of significance

Source: Authors' Computations using Eviews

The results of the ADF test, as presented in Table 1, reveal that some of the variables were stationary at levels, and most of the series only became stationary after the first differencing. It suggests that the variables have a mean-reverting ability. The implication is that any shock to the series will fade with time.

The estimated results of the macro-econometric model using the two-stage least square method are presented in the following table.

**Table 2: The Estimated Result of the Two-Stage Least Square**

| Independent Variable | Dependent Variable | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **CRP** | **LSK** | **FTR** | **FHI** | **PC** | **PI** | **XA** | **M** | **YAG** | **AEMP** | **IEP** |
| Constant | 7.95 | 3.65 | 1.54 | 11.9 | 20.8 | 1.85 | 1.45 | 5.69 | -0.12 | 27.8 | 144.3 |
| | (2.48) | (2.36( | (1.54) | (1.57) | (4.31) | (4.36) | (-3.07) | (-2.33) | (-1.68) | (0.97) | (5.57) |
| RNF | - 1.21 | -0.29 | 0.08 | -2.42 | - | - | - | - | - | - | - |
| | (-1.82) | (-1.01) | (-0.34) | (-1.51) | | | | | | | |
| CREA | 0.16 | 0.07 | 0.05 | 0.09 | - | - | 0.86 | - | - | - | - |
| | (3.35) | (3.18) | (1.78) | (1.08) | | | (9.34) | | | | |
| PLR | 0.04 | 0.01 | -0.01 | 0.07 | - | - | 0.03 | 0.06 | - | - | - |
| | (1.12) | (1.22) | (-1.01) | (0.93) | | | (3.93) | (2.98) | | | |
| GEX | 0.01 | 0.08 | 0.07 | 0.19 | - | 0.53 | - | - | 0.12 | 17.9 | 36.3 |
| | (-0.25) | (0.44) | (4.08) | (2.86) | | (2.23) | | | (3.12) | (4.50) | (4.53) |
| CUA | 0.13 | 0.13 | 0.15 | 0.12 | - | - | - | - | - | - | - |
| | (2.63) | (4.77) | (6.04) | (1.04) | | | | | | | |
| MK | -0.01 | -0.01 | -0.02 | -0.03 | - | - | - | - | - | - | -1.79 |
| | (-1.67) | (-3.22) | (-3.91) | (-1.65) | | | | | | | (-0.76) |
| FDI | 0.03 | -0.03 | -0.03 | -0.04 | - | - | - | - | - | - | 28.4 |
| | (0.93) | (-1.23) | (-0.57) | (-0.53) | | | | | | | (5.48) |
| YD | - | - | - | - | 5.35 | - | - | - | - | - | - |
| | | | | | (2.88) | | | | | | |
| INF | - | - | - | - | -0.05 | -0.02 | - | - | - | - | -0.17 |
| | | | | | (-0.41) | (-1.01) | | | | | (-1.50) |
| TAR | - | - | - | - | -0.01 | -0.02 | -0.05 | -0.02 | -8.66 | - | - |
| | | | | | (0.85) | (0.80) | (2.25) | (-0.34) | (-0.27) | | |
| INTR | - | - | - | - | -0.02 | 0.02 | - | - | 0.09 | - | - |
| | | | | | (-0.86) | (1.86) | | | (0.94) | | |
| REM | - | - | - | - | -0.19 | - | - | - | - | - | - |
| | | | | | (-1.18) | | | | | | |
| EXR | - | - | - | - | - | - | 0.01 | 0.04 | 0.02 | - | 0.07 |
| | | | | | | | (1.35) | (1.79) | (1.44) | | (1.36) |
| YA | - | - | - | - | - | - | - | - | - | 12.5 | - |
| | | | | | | | | | | (2.63) | |
| Y | - | - | - | - | - | 0.62 | - | 0.71 | - | - | - |
| | | | | | | (2.12) | | (1.74) | | | |
| CPS | - | - | - | - | - | 1.25 | - | - | - | -12.8 | - |
| | | | | | | (8.20) | | | | (-2.78) | |
| TOT | - | - | - | - | - | - | -0.13 | 0.02 | - | - | - |
| | | | | | | | (-1.06) | (0.07) | | | |

| Independent Variable | Dependent Variable | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | CRP | LSK | FTR | FHI | PC | PI | XA | M | YAG | AEMP | IEP |
| RES | - | - | - | - | - | - | - | 0.71 | - | - | - |
| | | | | | | | | (3.86) | | | |
| IEP | - | - | - | - | - | - | - | - | 0.03 | 0.11 | - |
| | | | | | | | | | (4.20) | (-1.59) | |
| PI | - | - | - | - | - | - | - | - | -0.11 | 0.94 | |
| | | | | | | | | | (-2.79) | (0.81) | |
| Adjusted R-Square | 0.97 | 0.97 | 0.97 | 0.84 | 0.95 | 0.97 | 0.94 | 0.85 | 0.72 | 0.77 | 0,61 |
| D.W | 1.84 | 0.87 | 1.84 | 0.75 | 1.84 | 1.96 | 1.70 | 1.53 | 1.58 | 0.52 | 1,72 |

The results showed that government expenditure has a positive and statistically significant relationship with agricultural output in crop production, livestock, fishery, and forestry, respectively as well as agricultural employment and infrastructural development. The implication is that increase in government expenditure on agriculture, and critical infrastructure will boost total agricultural output and increase employment in Nigeria. Also, the results revealed inverse relationships between tariff and private consumption, private investment, agricultural exports, the share of agriculture to GDP and imports of goods and services. It suggests that a reduction in import tariff will increase private consumption, private investment, agricultural exports, the share of agriculture to GDP and imports of goods and services in Nigeria.

**Simulation Results**

Before the simulation experiments were conducted, the model was evaluated using the validation statistics. The validation results of the estimated model are reported in Table 3. Information is provided on the Root Mean Squared Percentage Errors (RMSPE), Theil's mean statistics, Bias Proportion, Variance Proportion and Covariance Proportion evaluating the forecasting ability of the model. These measures are computed for the 11 endogenous variables in the model.

**Table 3: Summary Statistics of Model Validation**

| Variables | RMSPE | Theil's Inequality | Bias Proportion | Variance Proportion | Covariance Proportion |
|---|---|---|---|---|---|
| CRP | 0.0377 | 0.0052 | 0.0000 | 0.0032 | 0.9968 |
| LSK | 0.0224 | 0.0041 | 0.0000 | 0.0043 | 0.9957 |
| FTR | 0.0251 | 0.0064 | 0.0000 | 0.0089 | 0.9911 |
| FHI | 0.0856 | 0.0203 | 0.0000 | 0.0296 | 0.9704 |
| PC | 0.0641 | 0.0629 | 0.0000 | 0.3709 | 0.6291 |
| PI | 0.1371 | 0.0129 | 0.0000 | 0.0033 | 0.9967 |
| XA | 0.2293 | 0.0302 | 0.0000 | 0.0131 | 0.9869 |
| M | 0.4667 | 0.0893 | 0.0000 | 0.0326 | 0.9674 |
| YAG | 0.0266 | 0.0674 | 0.0000 | 0.0543 | 0.9456 |
| AEMP | 0.0554 | 0.0293 | 0.0000 | 0.0737 | 0.9263 |
| IEP | 0.0247 | 0.0800 | 0.0000 | 0.0148 | 0.8952 |

Source: Authors' Computation

Table 3 indicates that the coefficients of RMSPE, Theil's Bias proportion, and Variance proportion are pretty low. It implies that the causes of discrepancies between the actual and simulated values of most variables are not precipitated by the differences between their

mean and variances except for imports which showed a relatively high value of RMSPE. That does not, however, affect the performance of the model. The Covariance is generally high as expected, meaning that the actual and simulated values co-move. The implication is that the model is suitable for forecasting and policy simulation in the Nigerian economy. Furthermore, the actual and the simulated paths of the 11 endogenous variables were plotted together and presented in the following figure to examine their turning points in detail.

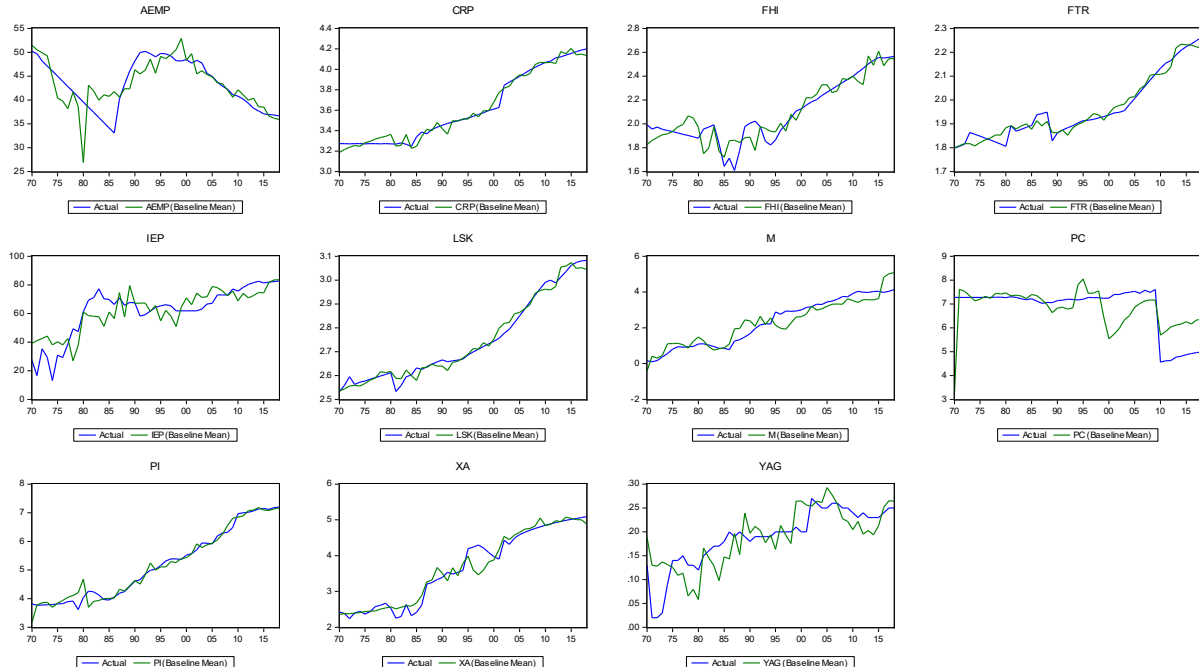


**Figure 5: Baseline Simulation of the Endogenous Variables**

Source: Extract from Eviews 10.

A cursory look at the figure shows that the simulated values could replicate the critical turning points of the historical data, meaning that the model is appropriate for policy analysis and projections of the macroeconomic variables of the Nigerian economy.

### Analysis of the Simulation Results

Two simulation experiments were conducted to examine the impact of AfCFTA on the agricultural sector in the post-COVID-19 era.

### Scenario 1: Linear annual tariff reduction of 20%

The first scenario used for the simulation was a linear annual tariff reduction of 20% over five years, and the results of the scenario are reported in the following table.

**Table 4: Simulated results for linear annual tariff cut of 20% over the period of five years**

| Variable | 20% Tariff Cut | | 40% Tariff Cut | | 60% Tariff Cut | |
|---|---|---|---|---|---|---|
| | Within Sample | Out-of-sample | Within Sample | Out-of-sample | Within Sample | Out-of-sample |
| CRP | 0.75 | 0.78 | 0.78 | 0.81 | 0.84 | 0.87 |
| FHI | 0.84 | 0.85 | 0.86 | 0.87 | 0.89 | 0.92 |
| FTR | 0.81 | 0.85 | 0.86 | 0.88 | 0.89 | 0.93 |
| LSK | 0.69 | 0.71 | 0.73 | 0.75 | 0.81 | 0.89 |
| XA | 0.82 | 0.83 | 0.83 | 0.85 | 0.93 | 0.95 |
| AEMP | 0.69 | 0.71 | 0.71 | 0.73 | 0.89 | 0.90 |

| Variable | 20% Tariff Cut | | 40% Tariff Cut | | 60% Tariff Cut | |
|---|---|---|---|---|---|---|
| | Within Sample | Out-of-sample | Within Sample | Out-of-sample | Within Sample | Out-of-sample |
| YAG | 0.71 | 0.74 | 0.74 | 0.75 | 0.77 | 0.79 |
| PC | 0.84 | 0.86 | 0.86 | 0.87 | 0.89 | 0.92 |
| PI | 0.75 | 0.78 | 0.78 | 0.79 | 0.82 | 0.85 |
| M | 0.69 | 0.73 | 0.72 | 0.75 | 0.76 | 0.78 |
| IEP | 0.81 | 0.82 | 0.83 | 0.84 | 0.84 | 0.86 |

*Note: simulated further 20% annual reductions for the 4th and 5th years, and the results showed the same outcomes*

Source: Authors' Computation

The simulated results in Table 4 showed that a 20 per cent reduction in import tariff under the AfCFTA would lead to an increase in agricultural crop production by 0.75 per cent within the sample forecast and 0.78 per cent in the out-of-sample forecast. Further reduction in the import tariff by 40 and 60 per cent revealed that agricultural crop production would increase by 0.78 and 0.84 per cent for the within-sample forecast and 0.81 and 0.87 per cent for the out-of-sample forecast, respectively. These increases may be attributed to the fact that farmers would expect an increase in the export of their products, and as such, they will be encouraged to cultivate more cash crops for exports. Similarly, a 20 per cent reduction in import tariff would increase fish production by 0.84 per cent for the within-sample forecast and 0.85 per cent for the out-of-sample forecast. Further simulation of 40 and 60 per cent tariff reduction showed that fish production would increase for the within-sample forecast by 0.86 and 0.89 per cent. The out-of-sample forecast would increase by 0.87 and 0.97 per cent, respectively. These increases may be ascribed to the fact that fish farmers would expect an increase in the export of their products to other African countries, and as such, they will be encouraged to increase fish production for exports.

For forestry production, a 20 per cent reduction in import tariff would increase forestry production by 0.81 per cent for the within-sample forecast and 0.85 per cent for the out-of-sample forecast. When import tariff is further reduced by 40 and 60 per cent, forestry production will increase for the within-sample forecast by 0.86 and 0.89 per cent. The out-of-sample forecast will increase by 0.88 and 0.93 per cent, respectively. These increases may be ascribed to the fact that forestry farmers would expect an increase in the export of their products to other African countries. As such, they will be encouraged to increase forestry production for exports.

Reducing the import tariff for livestock production by 20 per cent would increase livestock production by 0.69 per cent for the within-sample forecast and 0.71 per cent for the out-of-sample forecast. Conversely, reducing import tariffs further by 40 and 60 per cent showed that livestock production would increase for the within-sample forecast by 0.73 and 0.81 per cent. The out-of-sample forecast would increase by 0.75 and 0.89 per cent, respectively. These increases may also be attributed to the fact that livestock farmers would expect an increase in the export of their products to other African countries. As such, they will be encouraged to increase livestock production for exports.

The simulation results have also shown that reducing import tariffs by 20 per cent, 40 per cent and 60 per cent, respectively, have increased the out-of-sample forecast of the exports of agricultural products from 0.83 per cent to 0.95 per cent. These increases may be because of an increase in private investment in the agricultural sector and the demand for Nigerian agricultural products in other African countries under the AfCFTA. These findings align with that of Price Waterhouse and Coopers (PWC) (2019) that AfCFTA will provide a market

advantage for the Nigerian economy to unlock her agricultural potentials that have remained untapped over a long period. Price Waterhouse and Coopers (PWC) (2019) further stressed that with the AfCFTA in place, it is a golden opportunity for Nigeria to develop her agricultural sector to increase the country's agricultural output for increased exportation of the same to other African countries. The findings also corroborate the findings of Abrego et al. (2021) representatives of member countries of the African Union signed the African Continental Free Trade Area (AfCFTA). They found that with AfCFTA tariff reduction, agriculture will be one of the highest contributors to the income gains of most African countries. Similarly, the findings conform to Mevel et al. (2015).They found that tariff liberalization in Africa will increase the contribution of intra-Africa trade from 10.2 per cent in 2011 to 15.5 per cent in 2020, especially in the agricultural sector.

Furthermore, by reducing import tariffs by 20 per cent, 40 per cent and 60 per cent, respectively, agricultural employment for out-of-sample forecast would increase from 0.71 per cent to 0.90 per cent. These increases may be attributed to the value chain in the agricultural sector. This increase may be because of the exports of Nigerian agricultural products to other African countries under the AfCFTA.

The simulated results have shown that reducing import tariffs by 20 per cent, 40 per cent and 60 per cent. Respectively, it has increased the out-of-sample forecast of the share of agricultural production to the GDP from 0.74 per cent to 0.79 per cent. These increases may be ascribed to increases in private investment in agriculture and the corresponding increases in the exports of agricultural products to other African countries. Also, these findings are in tandem with that of Saygili et al. (2018). They found that tariff reduction under the AfCFTA is estimated to increase GDP and employment by 0.97 per cent and 1.17 per cent, respectively, in Africa.

The simulation results reveal that reducing import tariffs by 20 per cent, 40 per cent and 60 per cent, respectively, would increase real private consumption of the out-of-sample forecast from 0.86 per cent to 0.92 per cent. The increase in real private consumption is taken as welfare gains associated with the AfCFTA. These increases may be attributed to agricultural employment increase occasioned by agricultural production and exports.

It is also evident from Table 4 that tariff reduction by 20 per cent, 40 per cent and 60 per cent would increase the out-of-sample forecast for imports from 0.73 per cent to 0.78 per cent. It is because trade liberalization under AfCFTA is expected to offer African countries the opportunity to import relatively cheap and affordable inputs and intermediate goods among African countries. Consequently, an increase in imports would increase infrastructural development in the economy.

**Scenario 2: Two-phased linear large share of 90% tariff cut**

The second scenario used for the simulation was the two-phased linear tariff cut of 90%, where an immediate large share of tariffs is eliminated, and the rest is gradually eliminated over several years. The results of the scenario are presented in the following table.

**Table 5: Two-Phased Linear large share of 90% Tariff cut**

| Variable | 90% Tariff Cut | |
|---|---|---|
| | Within Sample | Out-of-Sample |
| CRP | 0.98 | 0.99 |
| FHI | 0.94 | 0.95 |
| FTR | 0.98 | 0.99 |

| Variable | 90% Tariff Cut | |
|---|---|---|
| | Within Sample | Out-of-Sample |
| LSK | 0.92 | 0.99 |
| XA | 0.95 | 0.98 |
| AEMP | 0.91 | 0.92 |
| YAG | 0.80 | 0.87 |
| PC | 0.92 | 0.94 |
| PI | 0.95 | 0.96 |
| M | 0.79 | 0.83 |
| IEP | 0.86 | 0.88 |

Source: Authors' Computation

The simulation results of the immediate 90 per cent import tariff reduction showed a significant increase in crop production, fishery production, forestry production, and livestock production. In addition, agricultural exports, agricultural employment, and the share of agriculture to GDP, real private consumption, private investment, imports and infrastructure. Comparatively, the two-phased down scenario of 90 per cent tariff reduction has yielded more impact than the linear annual tariff reduction of 20 per cent, 40 per cent and 60 per cent for both the within and out-of-sample forecast horizons.

**Conclusion and Policy Recommendations**

The study has found that tariff reduction under the AfCFTA offers the Nigerian economy the opportunity to use the agricultural sector as the gateway to achieving inclusive, sustainable development, especially in the post-COVID-19 era. It is so because of the inclusive nature of the agricultural sector. Findings from the two scenarios have revealed that AfCFTA can potentially increase agricultural output, agricultural exports, agricultural employment, and the share of agriculture to GDP growth, as well as private investment in agriculture and real private consumption in Nigeria.

From these findings, the study concludes that tariff reduction under the AfCFTA offers prospects for Nigeria to use her enormous agricultural potential to achieve inclusion. Sustainable development in the post-COVID-19 era in employment creation, unlocking the agricultural value-chain and investment in infrastructure and poverty reduction, respectively.

Based on this conclusion, the study provides the following recommendations. First, African countries should expedite actions by laying the technical grounds for the quick implementation of the AfCFTA because its full implementation holds enormous benefits for member countries' economic advancement, especially in the post-COVID-19 era.

Secondly, for Nigeria to maximize the gains associated with the AfCFTA, the country needs to put in place mechanisms to mitigate the challenges of agricultural production, processing and export growth in the short to medium term to maximize the market potentials that AfCFTA provides fully. It can do by providing good distribution networks and adequate storage facilities to prevent post-harvest losses. It ensures high-value addition to agricultural products and provides adequate infrastructural logistics at the seaports for processing bulk trading activities for agricultural commodities.

Thirdly, the government should collaborate with the private sector to tackle all the issues affecting the agricultural value chain, such as production, harvesting, storage, transporting, processing and marketing. These can be achieved by giving invention funds to the

agricultural sector so that smallholder farmers and agro-processors can access interest-free loans with minimal administrative charges. Also, the government can involve individual farmers and agricultural cooperatives in all agricultural programmes to increase agricultural labour capacity utilization. The government should enter into a public-private partnership to execute pragmatic approaches to increase yield per hectare, including the out-grower scheme and knowledge transfer protocols and greater access to energy for production and refrigeration. Furthermore, the government can arrange to provide ready markets for agricultural products to mitigate post-harvest product losses. It can achieve by using the private sector off-takers, commodity exchanges, government buy-back schemes, and strategic reserve purchases.

Fourthly, the government should streamline its expenditures and invest hugely in infrastructural facilities such as roads, electricity, and expansion of seaport facilities, communication networks and the provision of earth dams to encourage dry-season farming activities. These will boost agricultural production and employment creation in the economy.

Specifying that this study was constrained by data availability on individual agricultural products such as crop types, fishery types, livestock types, and forestry types is essential. It prevented the study from investigating the individual agricultural products with a comparative advantage under the AfCFTA. However, to overcome this limitation and maintain the internal and external validity of the study, used aggregate data on crops, livestock, fishery and forestry. Thus, future research should investigate individual agricultural products to ascertain the comparative advantages of the various agricultural products under AfCFTA.

**References**

Abrego, L., Amado, M. A., Gursoy, T., Peron Nicholls, G., & Perez-Saiz, H. (2021). The African Continental Free Trade Agreement: Welfare Gains Estimates from a General Equilibrium Model. *SSRN Electronic Journal*, *124*. https://doi.org/10.2139/ssrn.3417719

Agu, C. (2015). Resources inflows, import leakages and growth linkages: Why remittance flows are not optimized in Nigeria. *Economic and Financial Review*, *53*, 91–133. https://www.scirp.org/(S(czeh2tfqyw2orz553k1w0r45))/reference/referencespapers.aspx?referenceid=3204562

Akighir, D. T., Ikwue, R., & Kpoghul, E. T. (2020). Nigeria's economic sustainability plan and the performance of the agricultural sector amid the COVID-19 pandemic: A simulation focus on food security. *Nigerian Journal of Social Sciences (Special Edition)*, *14*(2), 99–127. https://www.researchgate.net/publication/359258423_Nigeria's_economic_sustainability_plan_and_the_performance_of_the_agricultural_sector_amid_the_COVID-19_pandemic_a_Simulation_focus_on_food_security

Akighir, D. T., & Kpoghul, E. T. (2020). Quantifying the impact of the African continental free trade area tariff reduction on non-oil exports and macroeconomic trajectories in Nigeria. *Proceeding of the 61th Annual Conference of the Nigerian Economic Society Held in Abuja, Nigeria from 8th-12th September*.

Akighir, D. T., & Kpoghul, E. T. (2020). Oil exports, foreign reserves and economic growth in Nigeria: A Structural VAR approach. *Journal of Economics and Allied Research*, *4*(4), 16–37.

Gumede, V. (2020). Examining the African continental trade area in the context of the political federation for Africa-towards a United African States. Retrieved at https://www.researchgate.net/publication/342960874.

International Trade Centre. (2018). *A Business Guide to the African Continental Free Trade Area Agreement*. https://intracen.org/resources/publications/a-business-guide-to-the-african-continental-free-trade-area-agreement

Kaldor, N. (1940). A Note on Tariffs and the Terms of Trade. *Economica*, *7*(28). https://doi.org/10.2307/2550231

Kituyi, M. (2016). *This African trade deal could improve lives across the whole continent*. https://www.weforum.org/agenda/2016/05/this-african-trade-deal-could-improve-lives-across-the-whole-continent/

Mevel, S., Valensisi, G., & Karingi, S. (2015). The Economic Partnership Agreements and Africa's integration and transformation agenda: the cases of West Africa and Eastern and Southern Africa regions. *Selected Paper for 18th Annual Conference on Global Economic Analysis*.

Ministry of Budget and National Planning. (2017). *Nigeria Economic Recovery and Growth Plan 2017 – 2020*. https://www.nipc.gov.ng/ViewerJS/?#../wp-content/uploads/2019/01/Economic-Recovery-Growth-Plan-2017-2020.pdf

National Bureau of Statistics. (2019). *Statistical Bulletin*.

National Bureau of Statistics. (2021). *Statistical Bulletin*. https://www.statista.com/statistics/1288871/agriculture-sector-share-in-employment-in-nigeria/

Nigeria's National Development Plan (NDP). (2020). Bouncing Back: Nigeria Economic Sustainability Plan-NDP. In *Economic Sustainability Committee (ESC)* (Issue 2).

Okun, A. (1962). Potential GNP: Its measurement and Significance. *Proceedings of Business and Economic Statistics Section of American Statistical Association*.

Okun, A. (1970). *The Political Economy of prosperity*. Norton.

Olomola, A. S., & Nwafor, M. (2018). *Nigeria's Agricultural sector performance review*. https://fscluster.org/nigeria/document/nigeria-agriculture-sector-performance

Price Waterhouse and Coopers (PWC). (2019). *Unlocking Nigeria's Agricultural Exports*. https://www.pwc.com/ng/en/assets/pdf/unlocking-ngr-agric-export.pdf

Saygili, M., Peters, R., & Knebel, C. (2018). African Continental Free Trade Area: Challenges and Opportunities of Tariff Reductions. *United Nations Conference on Trade and Development*, *15*.

Sidgwick, H. (1887). *The Principles of Political Economy* (2nd ed.). Macmillan and Company Ltd. https://doi.org/https://doi.org/10.1017/CBO9781139095358

Susetyo, F. (2017). The Effect of Trade Facilitation on Trade Margin of 8 ASEAN-China Free Trade Area Countries (ACFTA): A Gravity Model Approach. *Journal of Developing Economies*, 1(2), 122–133. https://doi.org/10.20473/jde.v1i2.3297

The Nigerian Economic Summit Group. (2019). *Macroeconomic Effects of the African Continental Free Trade Area Agreement (AfCFTA) on the Nigerian Economy*.

The World Bank. (2008). *World Development Report 2008 : Agriculture for Development*. https://openknowledge.worldbank.org/handle/10986/5990

United Nations. (2020). *Impact of COVID-19 in Africa*. https://archive.uneca.org/publications/policy-brief-impact-covid-19-africa

United Nations Economic Commission for Africa (UNECA). (2018). *An Empirical assessment of the African Continental Free Trade Area Modalities on Goods*.

World Bank. (2020). *The African Continental Free Trade Area: economic and distributional effects*. https://www.worldbank.org/en/topic/trade/publication/the-african-continental-free-trade-area

**Appendix**

**The Stochastic Equations of the Model**

$$\log CRP = \alpha_0 + \alpha_1 \log RNF + \alpha_2 \log CREA + \alpha_3 \log PLR + \alpha_4 \log GEX + \alpha_5 \log CUA + \alpha_6 \log MK + \alpha_7 \log FDI + \mu_t \quad (14)$$

$$\log LSK = \alpha_0 + \alpha_1 \log RNF + \alpha_2 \log CREA + \alpha_3 \log PLR + \alpha_4 \log GEX + \alpha_5 \log CUA + \alpha_6 \log MK + \alpha_7 \log FDI + \mu_t \quad (15)$$

$$\log FTR = \alpha_0 + \alpha_1 \log RNF + \alpha_2 \log CREA + \alpha_3 \log PLR + \alpha_4 \log GEX + \alpha_5 \log CUA + \alpha_6 \log MK + \alpha_7 \log FDI + \mu_t \quad (16)$$

$$\log FHI = \alpha_0 + \alpha_1 \log RNF + \alpha_2 \log CREA + \alpha_3 \log PLR + \alpha_4 \log GEX + \alpha_5 \log CUA + \alpha_6 \log MK + \alpha_7 \log FDI + \mu_t \quad (17)$$

$$PC = \alpha_0 + \alpha_1 YD + \alpha_2 INF + \alpha_3 TAR + \alpha_4 INTR + \alpha_5 REM + \mu_t \quad (18)$$

$$PI = \alpha_0 + \alpha_1 Y + \alpha_2 INTR + \alpha_3 CPS + \alpha_4 GEX + \alpha_5 INF + \alpha_6 TAR + \mu_t \quad (19)$$

$$XA = \alpha_0 + \alpha_1 EXR + \alpha_2 TAR + \alpha_3 CREA + \alpha_4 PLR + \alpha_5 TOT + \mu_t \quad (20)$$

$$M = \alpha_0 + \alpha_1 Y + \alpha_2 EXR + \alpha_3 TAR + \alpha_4 RES + \alpha_5 PLR + \alpha_6 TOT + \mu_t \quad (21)$$

$$YAG = \alpha_0 + \alpha_1 INTR + \alpha_2 GEX + \alpha_3 TAR + \alpha_4 EXR + \alpha_5 IEP + \alpha_6 PI + \mu_t \quad (22)$$

$$AEMP = \alpha_0 + \alpha_1 YA + \alpha_2 GEX + \alpha_3 PI + \alpha_4 CPS + \alpha_5 IEP + \mu_t \quad (23)$$

$$IEP = \alpha_0 + \alpha_1 GEX + \alpha_2 FDI + \alpha_3 EXR + \alpha_4 INF + \alpha_5 MK + \mu_t \quad (24)$$