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Impact of a free trade agreement on unemployment and productivity growth in Nigeria

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Abstract: This research investigates the impact of a free trade agreement on unemployment and productivity growth in Nigeria over the period 1981–2019. Data was collected from the World Bank Development Indicators (WDI) online database as of 2020. The study employed various analytical methods, including unit root tests, autoregressive distributed lag (ARDL) bound tests, error correction models (ECM), and cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests to assess data stability. The ARDL bound test statistics (F-statistics) of 4.26914 and 7.680624 exceeded the critical values for both I(0) and I(1) bounds, indicating a meaningful relationship between the variables. In the long run, physical capital, human capital development, and economic growth were found to have a negative impact on unemployment, with statistical significance. Additionally, sectoral productivity growth negatively influenced aggregate productivity growth. The error correction model (ECM) indicated a weak speed of adjustment, suggesting that the disequilibrium takes around 13% of the time to return to equilibrium annually. Based on these findings, the study recommends the implementation of safeguards to protect vulnerable industries, particularly in manufacturing and agriculture. Additionally, the government should focus on fostering human capital development by ensuring the availability of suitable support measures.

Keywords: *Agreement, Free trade, Growth, Productivity, Unemployment.*
JEL Classification: *E24; F10; F18; O4.*

1. Introduction

Free Trade Agreements (FTAs), which is multinational convention among two or more countries to facilitate trade and remove trade barriers in exports and imports, is generally seen as a central driver for economic growth, sustainability and industrialization both in the developed and developing nations. With just little or no quotas, goods and services can be obtained and trade across the national boundaries of affiliated countries (Barone & Scott, 2020). High profits from free trade and access to low but quality goods and services can lead to improved competency, raise innovations and increase economic expansions. FTAs can free up resources and create works in competent industries; enhance earnings and standard of living. It can reduce unemployment; promote political support and trading. Reduction in unemployment can occur as a result of growth in the market, technical dispersion and investment across boundaries. Political cooperation between member nations leads to better and stronger economic knots which give way for nonviolent conflict resolution and better economic steadiness. Promotion of trade among country members lead to economies of scale, increase competitiveness, increase market development, improve

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productivity growth and lower the cost of goods and services which can increase purchasing power (Kenton, 2020).

Unemployment occurs when a person who is eligible and sincerely seeking for work could not find one. The issue of unemployment is a global reality that has become a hindrance to societal growth. Some costs in the country like personal cost, national cost, and societal cost could be linked to unemployment. An unemployed person can suffer from poverty, debts and financial hardship, as they are unable to earn money to meet some financial responsibilities, increase not only their purchasing power but that of the nation's purchasing power. While at the societal level, it can lead to political instability and social problems such as an increase in sabotage, dishonesty, crime, gambling and immorality. Unemployment can reduce economic growth because of the underutilization of the labor force and increase government borrowing. An increase in government debt is a result of low tax revenue and fewer people paying income tax and spending less. This can increase government expenditure on unemployment benefits which the end product could be low Gross Domestic Product (GDP) (Pettinger, 2019).

Unemployment described as persons (aged 15 – 64) who are available and vigorously searching for a job but are without a job during the reference period, has risen very high nationally (National Bureau of Statistics, 2020). For example, Figure 1 shows the trend of unemployment in Nigeria from 2010 to 2020. As indicated in the chart, the unemployment rate in 2010 was 5.09 per cent, which increased to 5.96per cent in 2011, in 2012 it rises to 10.57per cent, and further increased 9.96per cent in 2013, but in 2014 there was a reduction of 7.84per cent, and later increased to 9per cent in 2015, 13.38 in 2016, 23.48 and 34.9 in 2019 and 2020 respectively.

Figure 1.
Unemployment rate.
Source: World Development Indicators (2020).

Productivity growth is an increase in the rate of goods and services produced from a certain level of inputs over time. A high productivity growth rate can guarantee a lower cost of production, make efficient use of available resources and increase output, thereby, enabling a country to gain vast attractiveness among other nations. The ability of a nation to increase its output per worker will determine its standard of living. It can increase exports thereby, causing the country to have a comparative advantage over other countries and this can give a country an edge to compete with other nations of the world. Productivity growth can go a long way in achieving the overall affluence and growth of an economy. Productivity growth can allow a firm to stay competitive within the industry by disbursing higher salaries or incomes

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to shareholders or make funds available for investment. Higher productivity growth can generate larger tax reimbursement for the government thus, letting them spend more on social services and infrastructures. It can disclose the nation's capacity to harness its human and physical resources to generate income and output. World specialization and production are at an increase because of the share of traded agriculture products (Productivity Commission, 2009).

The problem associated with Free Trade Agreement in the past decades, Nigeria has signed several trade agreements and several measures have also been put in place to ensure that the benefits of FTAs are fully actualized, which include employment generation, and productivity growth. FTAs signed by Nigeria within the African region include the Economic Community of West African States (ECOWAS) Trade Liberalization Scheme (ETLS) - implemented in 1990, the ECOWAS Common External Tariff (CET) – implemented in April 2015, and the African Continental Free Trade Area (AfCFTA) – signed in 2018 and launched on 7th July 2019among others (Onwuka & Udegbunam, 2019). Although many advantages of trade agreements have been suggested by theory and evidence, but not every member country does benefit from FTAs.

The signing of different FTAs within the past decades raised a lot of concerns on the ability of Nigeria to fully derive the benefits of FTAs. This is because, among the key factors for beneficial trade agreements are productivity, institutions and competitiveness, which Nigeria has a poor record. Nigeria's institutions are weak, among the poorest in the world's institutional quality ranking. This, in addition to the inability to compete with foreign counterpart FTAs member countries, has worsened the already high taste for foreign goods. The demand for foreign products is on the increase while domestic productivity growth has been low with a frequent recession in recent years.

The main objective of this study is to examine the impact of free trade agreements (FTAs) on unemployment and productivity growth in Nigeria. The specific objectives are: to examine the impact of FTAs on unemployment (1981-2020) and to examine the effect of FTAs on aggregated productivity growth (1981-2020).

The remaining sections of the paper are organized as follow: section 2 provides review of empirical literature; section 3 deals with data and methodology; section 4 discusses the empirical results and section 5 gives conclusions and recommendations.

2. Literature Review

There are three basic underlying theoretical links between free trade agreements, unemployment and productivity growth. These are: Hecksher-Ohlin Theory of Trade,Keynesian Theory of Unemployment and Neoclassical Theory of Growth.

The Hecksher-Ohlin theory of trade was propounded in the 1900s by two Swedish economists, Eli Heckscher and Ohlin. The model assumes that trade is essential since; there are variations in labour output in different countries. It assumed that different nations have fixed labour productivity for diverse goods. By this model, inbuilt technological variation in labour output for different goods among diverse nations is not just a good reason for trade; those nations are naturally blessed with different factor supplies. To factor endowments, factor costs will vary (hence, labour will be cheap in countries with abundant labour) and similarly domestic goods of trade cost proportion and factor combinations. Because of the comparative price and cost-benefit improved by global specialization, Less Developed Countries (LDCs) that are into manufacturing will import capital-intensive commodities in exchange for exports of labour-intensive goods. This theory proposes free trade because it provides an avenue for a country to take advantage of its rich wealth through additional intensive production which is similarly confirmed in the Hecksher-Ohlin-Samuelson model.

The Keynesian theory of unemployment in his work titled, "The General Theory of Employment, Interest and Money". Keynesian theory of unemployment states that economic productivity is significantly subjective to total demand (the aggregated costs in the country) in the short-run, especially in recessions. It also postulates that the productive competence of a country is not necessarily equivalent to total demand. That a lot of features and stimuli could attribute to total demand such as a change in

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total demand affects inflation, employment and production in the country. A decrease in demand leads to unemployment and recession. That reducing wages is not a cure to a recession but rather raising the level of government investment and reducing the interest rate. Unemployment in a country is a result of higher savings than investment. The Keynesian theory consists of three main assumptions which are rigid price, effective demand and savings-investment determinant (Keynes, 1936).

The neoclassical growth model; they illustrate how a combination of three motivating forces (technology, labor, and capital) can lead to stable economic growth. It explains that long-term equilibrium is not the same as short-term equilibrium. The theory states that production function, in the short-term equilibrium is a result of varying quantities of capital and labor. Furthermore, it argues that growth in the economy cannot persist without technical advances, which a technology change has a major control in the economy. The neoclassical theory postulates that how citizens use accumulated assets in the economy is vital for economic growth (Solow, 1956).

3. Empirical Review

The study by Sunge and Ngepah (2020a) examined trade liberalization, output growth, the function of regional trade agreements (RTAs), and organizations in decreasing agricultural incompetence in Africa. Its studies covered 10 countries with data of 120 observations for maize between, 2005 to 2016. Single-stage maximum likelihood estimation of a true fixed effects panel data model and a stochastic frontier approach was employed. Findings proved that RTAs grant a good technological efficiency effect that differs across goods and membership. Egypt and Jordan, the relationship between sector productivity growth and employment intensity and whether economic expansion cause unemployment or generated more works in two Middle Eastern countries; Egypt and Jordan was carried out by Zaki, Alshyab, and Seleem (2020). The study covered 10 sectors over the period 1983-2010. The methodology employed was random coefficient estimation technique panel data. The result pointed out that in Egypt, manufacturing is the main sector that generates employment while, in Jordan service sector is more vital.

Khalid et al. (2020) investigates the relationship between regional trade of South Asian Association for Regional Cooperation (SAARC) countries and the food security challenges faced by the region. The data covers the periods of 1990–2018 for Sri Lanka, Pakistan, Bangladesh, and India. Johansen's co-integration test was used to carry out the analysis. The results show an absence of a long-run correction between the volume of trade and food security.

Edeme, Nkalu, Idenyi, and Arazu (2020) investigates the potential impact of free trade areas and common currency in fostering agricultural export, in 45 countries in Africa. Covariance matrix that adjusts both heteroscedasticity and autocorrelation was used. The data period covers from 1996 - 2018. The result shows that there is evidence that membership becoming membership to free trade area has a positive marginal impact on agricultural export, its influence is not immediate.

Oladipupo and Adedoyin (2019) assessed Nigeria's bilateral trade flows and its correlation among the dimension of Nigerian economy and space with trading collaborators (16 trading partners of Nigeria) from 2000 to 2016. The gravity model and fixed effects estimation technique were used. It was found that domestic, distance and partner's GDPs as significant.

Titus and Abiodun (2017) assessed the effect of trade liberalization on the economic performance of Nigeria with exceptional concern in the manufacturing and agricultural sectors. Generalized Method of Moment (GMM) technique and Simultaneous models were employed. The study indicated a negative but significant link among measures of trade liberalization and manufacturing output in Nigeria while there is a significant positive effect of trade liberalization on the production of the agricultural sector.

Huijskens (2017) observed how free trade agreements (FTAs) affect bilateral trade flows and whether the impact varies among developing and developed nations. It covered 31 developing and 31 developed nation's from1995-2014 sample period. A finding shows a 6per cent rise in trade because of FTA among nations. And the result also revealed that the more the impact of FTAs on trade flows rises, the more developed the concerned nations become.

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Rijesh (2019) applied a growth accounting technique to evaluate 62 industries. With the sample periods of 1980 to 2007. The study found a clear shift of manufacturing composition to technology and skill-intensive creation activities.

Funlayo and Olanipekun (2015) examined Okun's law to verify the relationship between economic growth and unemployment in Nigeria. The Error Correction Model (ECM) and Johansen co integration test were carried out. Findings proved that there is a short and long-run relationship between output growth and the unemployment rate in Nigeria.

Although there are studies on FTAs, the majority of the studies investigated the impact of either free trade on unemployment or regional trade agreement on agriculture. While few studies examined the impact of sector productivity growth on employment intensity, the impact of free trade on agriculture, and some examined the impact of trade liberalization and Intra trade e.g., Shuaibu (2015), Sunge and Ngepah (2020b) and Okebie (2017). To the best of the researcher's knowledge, no known direct study has been done on the impact of free trade agreements (FTAs) on unemployment and productivity growth in Nigeria. The study identify the gap in respect of nature on the subject matter and general perspective from empirical and theoretical perspective, therefore, the study adds value to past studies and has a policy implication because it virtually shows not just the effect of FTAs on the productivity growth of the manufacturing and agricultural sub-sectors but, also will determine to know the complementary effect of FTAs and productivity growth on unemployment in Nigeria. Therefore, by focusing on these areas to close the existing gap, this study adds value to the literature on FTAs, unemployment, and productivity growth in Nigeria. The gap covered in this study will help in the implementation of policy and as well tackle some underperformances in the Nigerian economy in particular and other Africa nations in general.

4. Methodology

4.1. Model for Objective One: Model for Unemployment

Objective one is to examine the effect of FTAs on unemployment. The functional form of the model is specified as:

$$UNEMP = f(FTAs, PHYSC, HKD, ECOG)$$

$$UNEMP = \beta_0 + \beta_1 FTAs_t + \beta_2 PHYSC_t + \beta_3 HKD_t + \beta_4 ECOG_t + \mu_t \quad (1)$$

Where:
UNEMP = unemployment rate.
FTAs = free trade agreements signed by Nigeria within the African continent.
$PHYSC$= physical capita is a measure of physical capital.
HKD = human capital development index, a measure of the human capital stock.
ECOG = economic growth (annual per cent), an indicator for economic growth.

We rewrite Equation 3 in an autoregressive distributed lag (ARDL) form as:

$$UNEMP = \varphi_0 + \varphi_1 UNEMP_{t-1} + \varphi_2 FTA + \varphi_3 physc + \varphi_4 HKD + \varphi_5 ECOG + \sum_{j=1}^{p} \phi_j \Delta UNEM_{t-j} + \sum_{s=0}^{q} \rho_s \Delta FTA_{t-s} + \sum_{m=0}^{q} \delta_m \Delta physc_{t-m} + \sum_{z=0}^{q} \psi_z \Delta HKD_{t-z} + \sum_{z=0}^{q} \vartheta_z \Delta ECOG_{t-z} + \mu_{1t} \quad (2)$$

The Granger representation theorem proffers that in the presence of cointegration among variables, there is a mechanism (which is an error correction model) that describes the adjustment of the

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cointegrated variables towards equilibrium. On this basis, the error correction model for equation is specified as:

$$\Delta UNEMP = \varphi_0 + \sum_{j=1}^{p} \phi_j \Delta UNEMP_{t-j} + \sum_{s=0}^{q} \rho_s \Delta FTA_{t-s} + \sum_{m=0}^{q} \delta_m \Delta physc_{t-m} + \sum_{z=0}^{q} \psi_z \Delta HKD_{t-z} + \sum_{z=0}^{q} \vartheta_z \Delta ECOG_{t-z} + aECM1_{t-1} + \mu_{1t} \quad (3)$$

Where $ECM1_{t-1}$ is the error correction term.

4.2. Model for Objective Two: The Aggregated Productivity Growth Model

Objective two is to examine the effect of FTAs on aggregated productivity growth. The functional form of the model is specified as:

$$APGR = f(FTAs, PHYSC, HKD, MSPS) \quad (4)$$

$$APGR = \beta_0 + \beta_1 FTAs_t + \beta_2 PHYSC_t + \beta_3 HKD_t + \beta_4 MSPS_t + \mu_t \quad (5)$$

Where:

APGR = aggregated productivity growth, measured bytotal growth rate of manufacturing and agricultural sectors' output per worker.

FTAs = free trade agreements signed by Nigeria within the African continent

PHYSC= physical capita is a measure of physical capital

HKD = human capital development index, a measure of the human capital stock

GFCF = gross fixed capital formation, a measure for domestic investment

From 1990 to 2019. Equation 7 can be rewritten in an autoregressive distributed lag (ARDL) form as:

$$APGR = \varphi_0 + \varphi_1 APGR_{t-1} + \varphi_2 FTA + \varphi_3 physc + \varphi_4 HKD + \varphi_5 GFCF + \sum_{m=1}^{p} b_1 \Delta APGR_{t-j} + \sum_{m=1}^{q} b_2 \Delta FTA_{t-s} + \sum_{m=1}^{q} b_3 \Delta physc_{t-m} + \sum_{m=1}^{q} b_4 \Delta HKD_{t-z} + \sum_{m=1}^{q} b_5 \Delta GFCF_{t-z} + \mu_{2t} \quad (6)$$

The Granger representation theorem proffers that in the presence of cointegration among variables, there is a mechanism (which is an error correction model) that describes the adjustment of the cointegrated variables towards equilibrium. On this basis, the error correction model for Equation 8 is specified as:

$$APGR = \varphi_0 + \sum_{m=1}^{p} b_1 \Delta APGR_{t-j} + \sum_{m=1}^{q} b_2 \Delta FTA_{t-s} + \sum_{m=1}^{q} b_3 \Delta physc_{t-m} + \sum_{m=1}^{q} b_4 \Delta HKD_{t-z} + \sum_{m=1}^{q} b_5 \Delta GFCF_{t-z} + aECM2_{t-1} + \mu_{2t} \quad (7)$$

Where $ECM2_{t-1}$ is the error correction term.

The verification of the variables stationarity was conducted by means of testing the existence of a unit root in order to prevent the occurrence of spurious regressions. This was done using both the Augmented Dickey-Fuller (ADF) and Phillips-Perron tests. The data used for this study consists of an annual time series covering the sample periods from 1981 to 2019. The data was obtained from the statistical bulletins of the Central Bank of Nigeria (CBN) as well as the World Bank Development Indicators (WDI). The Index of Human Capital Development, unemployment rate, and labor force data will be sourced from the

World Bank Development Indicators database, while the remaining variables will be sourced from the CBN statistical bulletins.

5. Result and Presentation

5.1. Stationarity Tests

In order to mitigate the issue of spurious regression outcomes that are characteristic of non-stationary time series data, the authors, Gujarati, Porter, and Gunasekar (2009) proposed subjecting the data to a test for stationarity. Hence, this investigation conducted an analysis of the stationarity properties of all the variables. The stationarity tests utilized were the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, which were employed to enhance accuracy, facilitate comparison, and bolster confidence in the regression findings. The summarized outcomes can be found in Tables 1 and 2.

Table 1.
Unit root test (Model 1: Unemployment).

Variable	PP				ADF			
	At level	Prob.	1st diff.	Prob.	At level	Prob.	1st diff	Prob.
UNEMP	6.75	1.00	-3.40	0.02**	4.49	1.00	1.84	0.99
FTAs	-2.22	0.20	-8.09	0.00***	-2.31	0.17	-7.47	0.00***
PYHSC	5.22	1.00	-4.41	0.00***	-3.46	0.01**	-2.06	0.03**
HCD	-2.66	0.09	-5.89	0.00***	-2.66	0.08*	-5.42	0.00***
ECOG	-4.17	0.00***	-10.41	0.00***	-4.16	0.00***	-10.07	0.00***

Note: (*) indicates significant at the 10%, (**) significant at the 5% and (***) significant at the 1%.

Table 2.
Unit root test (Model 2: Aggregated productivity growth).

Variable	PP				ADF			
	At level	Prob.	1st diff.	Prob.	At level	Prob.	1st diff.	Prob.
APG	-4.11	0.00***	-10.45	0.00***	-4.10	0.00	-10.09	0.00***
FTAs	-2.22	0.20	-8.04	0.00***	-2.30	0.17	-7.47	0.00***
HCD	-2.66	0.09*	-5.89	0.00***	-2.66	0.08*	-5.42	0.00***
MSPG	0.76	0.99	-3.31	0.02**	0.16	0.96	-3.30	0.02**
PHYSC	5.22	1.00	-4.41	0.00***	-3.46	0.02	-2.06	0.03**

Note: (*) indicates significant at the 10%, (**) significant at the 5% and (***) significant at the 1%.

The findings of the unit root analysis, as shown in Tables 1 and 2, indicate that all variables, except for Human Capital Development (HCD), Economic Growth (ECOG), and Aggregate Productivity Growth (APG), become stationary after the first difference. HCD remains stationary at the levels of significance of 1, 5, and 10 percent in both Tables 1 and 2. This suggests that the variables are integrated of order I(0) and I(1) according to the ADF and PP tests, respectively. The test statistics of the variables after the first difference exceed their critical values at the 5 and 10 percent levels of significance. Similarly, the test statistic of the price level (PL) at that level exceeds its critical value at the 10 percent level of significance. This is further supported by the probability values, which are all less than or equal to 0.05. As a result, the ARDL bounds test for co-integration is deemed appropriate to examine the long-term relationship among the variables in the models employed in this study.

5.2. Lag Selection

Before testing for the long-run relationship among the variables in the two equations (Unemployment and aggregate productivity growth), the study tested for the optimum lags to be used in the ARDL bounds test and its short and long-run estimates using the VAR lag order selection criteria. The result obtained is presented in Tables 3 and 4.

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Table 3.
VAR lag order selection criteria for unemployment.

Lag	*LogL*	*LR*	*FPE*	*AIC*	*SC*	*HQ*
0	-45.4	NA	1.14	2.80	3.02	2.88
1	167	354	3.43	-7.61	-6.29*	-7.15*
2	195	39.7*	3.06	-7.81	-5.40	-6.97
3	229	36.9	2.44*	-8.27*	-4.75	-7.05

Note: * indicates lag order selected by the criterion.
LR: Sequential modified LR test statistic (Each test at 5% level).
FPE: Final prediction error.
AIC: Akaike information criterion.
SC: Schwarz information criterion.
HQ: Hannan-Quinn information criterion.

Table 4.
VAR lag order selection criteria for aggregated productivity growth.

Lag	*LogL*	*LR*	*FPE*	*AIC*	*SC*	*HQ*
0	-14.9	NA	2.09	1.11	1.32	1.18
1	166	301	3.61	-7.56	-6.24*	-7.10*
2	190	33.9	4.05	-7.54	-5.11	-6.69
3	225	38.5*	2.98*	-8.07*	-4.55	-6.85

Note: * indicates lag order selected by the criterion.
LR: sequential modified LR test statistic (each test at 5% level).
FPE: Final prediction error.
AIC: Akaike information criterion.
SIC: Schwarz information criterion.
HQ: Hannan-Quinn information criterion.

From Table 4, the various criteria suggest different optimal time lags that can be employed for the specified output equation. The Sequential Modified LR test statistic (TS) opted for 3 lags, while the Final Prediction Error (FPE) and Akaike Information Criterion (AIC) selected 3 lags from a maximum of 3 lags. On the other hand, the Schwarz Information Criterion (SIC) and Hanna-Quinn Information Criterion chose 1 lag from a maximum of 3 lags. In instances where there are limited observations in an ARDL model, it is often recommended to utilize the Schwarz Information Criterion (SIC) to determine the optimal lag length. Consequently, this study utilized one lag to establish the long-term relationship among the variables in the unemployment equation.

In Table 3, from the perspective of lag selection, various criteria have been proposed for different optimal lags for the specified output equation. Sequential Modified LR Test Statistic (TS) has suggested the use of 3 lags, while Final Prediction Error (FPE) and Akaike Information Criterion (AIC) have both opted for 3 lags out of a maximum of 3 lags. On the other hand, Schwarz Information Criterion (SIC) and Hanna-Quinn Information Criterion have recommended the use of 1 lag out of a maximum of 3 lags. In situations where there are limited observations in an ARDL model, it is often advisable to employ the Schwarz Information Criterion (SIC) for selecting the optimal lag length. Consequently, this study has utilized one lag to determine the long-run relationship among the variables in the unemployment equation.

5.3. ARDL Bounds Test for Co Integration

After determining the order of integration and the maximum lags for the two equations used in this study, the analysis proceeded to examine the presence of a long-run relationship among the variables using the autoregressive distributed lag (ARDL) bounds testing approach. The findings for the two equations are outlined separately in Tables 5 and 6.

Table 5.
ARDL bounds test.

Test statistic	Value	K
F-statistic	4.27	4
Critical value bounds		
Significance level	I(0) Bound	I(1) Bound
10%	2.2	3.09
5%	2.56	3.49

Table 6.
ARDL bounds test.

Test statistic	Value	K
F-statistic	7.68	4
Critical value bounds		
Significance level	I(0) Bound	I(1) Bound
10%	2.2	3.09
5%	2.56	3.49

Tables 5 and 6 present the results of the ARDL bounds test for cointegration for unemployment and aggregate productivity, respectively. In this procedure, the first step involves comparing the calculated f-statistic values with the critical value bounds. The estimated f-statistic of 4.269614 at k = 4 (number of explanatory variables) for the unemployment equation and 7.680624 at k = 4 for the aggregate productivity growth equation both exceed the upper critical bounds at the 10 and 5 per cent levels of significance. Consequently, the null hypotheses of no long-run relationship among the variables in the unemployment equations are rejected, indicating the presence of a long-run relationship in both equations. The subsequent step entails investigating the short- and long-run relationships.

Table 7 Long-Run ARDL (1,0,1,1,0) is based on Akaike Information Criterion (AIC) Selection.

Table 7.
Results of estimated long run coefficients using ARDL approach ARDL, (1, 0, 1, 1, 0) selected based on Akaike information criterion.

Variable	Coefficient	Std. error	t-statistic	Prob.*
LUNEMP(-1)	0.88	0.07	11.7	0.00***
LPHYSC	-0.37	0.17	-2.22	0.03**
LPHYSC(-1)	0.37	0.17	2.20	0.04**
LHCD	-0.28	0.17	-1.74	0.09*
LHCD(-1)	0.38	0.17	2.23	0.03**
LFTAS	0.04	0.08	0.59	0.56
LECOG	-1.55	0.68	-2.28	0.03**
LECOG(-1)	1.85	0.70	2.63	0.01**
C	-3.47	4.04	-0.86	0.39

Note: (*) indicates significant at the 10%, (**) significant at the 5% and (***) significant at the 1%.

Table 5 confirms the presence of a long-run relationship between the dependent variable unemployment (UNEMP) and its independent variables. The long-run coefficients are estimated using the ARDL method, with the maximum lag length set to 1 and the optimum lag order determined through Akaike Information Criterion (AIC) selection. This selection process was automated. According to the model, when holding all other variables constant, a one-unit increase in UNEMP (-1) positively influences UNEMP by 0.881804. Additionally, the coefficient of PHYSC is negatively associated with UNEMP and statistically significant at the 5% level, implying that a 1% increase in physical capital in Nigeria leads to

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a 37% decrease in unemployment. Similarly, the negative coefficient of human capital development (HCD) indicates a 28% decrease in unemployment, significant at the 10% level. On the other hand, the negative coefficient of economic growth (ECOG) suggests a 1.6% decrease in unemployment, significant at the 5% level, which contradicts the neoclassical theory of growth. This finding aligns with Ajakaiye, Jerome, Nabena, and Alaba (2016) study but contradicts the findings of Huijskens (2017).

Table 8.
Results of estimated long run coefficients using ARDL approach ARDL, (1, 0, 1, 1, 0) selected based on Akaike information criterion.

Variable	Coefficient	Std. error	t-statistic	Prob.*
APG(-1)	0.20	0.13	1.54	0.13
LFTAS	0.03	0.03	0.91	0.36
LHCD	0.03	0.10	0.27	0.78
LHCD(-1)	0.10	0.07	1.35	0.18
LMSPG	0.30	0.14	2.14	0.04**
LMSPG(-1)	-0.32	0.12	-2.61	0.01***
LPHYSC	-0.00	0.02	-0.34	0.73
C	0.15	0.18	0.87	0.38

Note: (*) indicates significant at the 10%, (**) significant at the 5% and (***) significant at the 1%.

The long-run estimates of the aggregate productivity growth in Table 8 revealed that the positive sign of sectoral productivity growth (SPG) will increase the aggregate productivity with (0.303149), which is 30%, and is statistically significant at 5% level. The negative sign of sectoral productivity growth (MSPG(-1)) will decrease the APG with (-0.320752), which is 32%, and is statistically significant at 5% level, influencing the aggregate productivity growth. This finding is also in line with the studies of Khalid et al. (2020), Sunge and Ngepah (2020a) and Joël and Glory (2018) contrary to the studies of Heshmati and Sun (2010) and Amassoma and Nwosa (2013).

Table 9.
Error correction model.

Variable	Coefficient	Std. error	t-statistic	Prob.
D(LPHYSC)	-0.37	0.12	-3.05	0.00***
D(LHCD)	-0.29	0.13	-2.27	0.03**
D(LFTAS)	0.05	0.07	0.65	0.53
D(LECOG)	-1.55	0.53	-2.94	0.00***
CointEq(-1)	-0.12	0.02	-5.45	0.00***

Note: (**) significant at the 5% and (***) significant at the 1%.

In Table 9, the estimated coefficient value of ECM (-1) is -0.118194, indicating that the variables are well defined due to the customary negative sign. This allows it to adjust to the equilibrium position whenever the system deviates from equilibrium. The ECM value is moderate, being less than unity and statistically significant at the 1% level. This estimated coefficient suggests that approximately 12% of the disequilibrium in the economy is corrected annually. Put differently, almost 12% of the previous year's shock to equilibrium is adjusted back to the long-run equilibrium in the current year.

Table 10.
Result of heteroskedasticity and serial correlation test.

Heteroskedasticity test: Breusch-Pegan-Godfrey			
Null hypothesis: No Heteroskedascitity			
F-statistic	1.07	P-value	0.39
Breusch-Pegan-Godfrey serial correlation LM test			
Null hypothesis: No serial correlation			
F-statistic	0.64	P-value	0.53

Table 11.
Result of heteroskedasticity and serial correlation test.

Heteroskedasticity test: Breusch-Pegan-Godfrey			
Null hypothesis: No Heteroskedascitity			
F-statistic	0.78	P-value	0.60
Breusch-Pegan-Godfrey serial correlation LM test			
Null hypothesis: No serial correlation			
F-statistic	1.77	P-value	0.19

To ensure robustness, the estimated model underwent evaluation for the presence or absence of serial correlation and heteroskedasticity using the Breusch-Godfrey Serial Correlation LM test and the Breusch-Pagan-Godfrey Heteroskedasticity test, respectively. Both tests were conducted under the null hypotheses of "no serial autocorrelation" and "no heteroskedasticity," respectively. The results indicated that the estimated model was free from these econometric problems, as the F-statistics in both tests were statistically insignificant (both P-values were greater than 0.05), leading to rejection of the null hypotheses in the tests, as presented in Tables 10 and 11.

5.4. Cumulative Sum of Recursive Residuals of CUSUM and CUSUM Square

Model stability is crucial for prediction and economic inference, representing a sufficient condition. Therefore, the study conducted stability tests for estimated parameters by employing the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares (CUSUMS Q) tests. The graphical presentation of these tests is depicted in Figures 2 and 3.

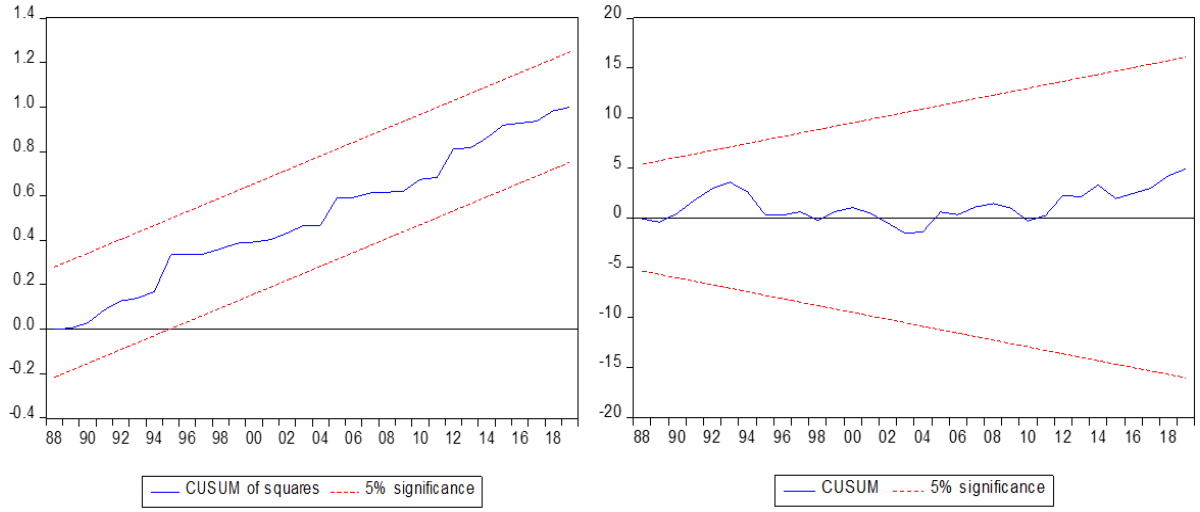

Figure 2.
CUSUM and CUSUM square (Unemployment).

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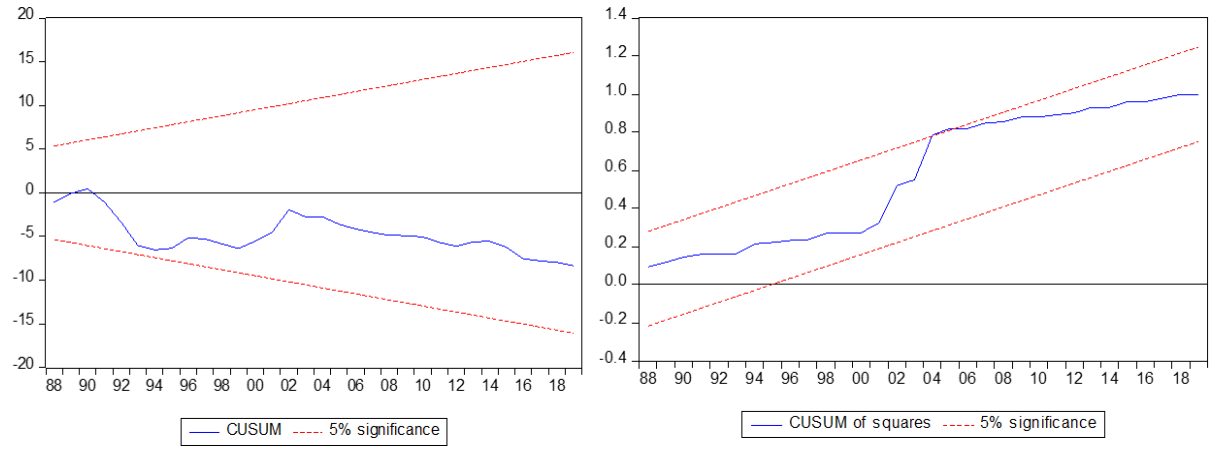

Figure 3.
CUSUM and CUSUM square (Aggregated productivity growth).

6. Conclusion and Recommendations

The effect of FTAs on macroeconomic variables especially concerning productivity growth has been studied and discussed by eminent researchers all over the world (though, analysis concerning aggregated productivity growth, manufacturing and agricultural sectors has also been presented on TVs and radio stations. The analysis has also based on different theoretical frameworks including the neoclassical growth theory. A proper investigation has revealed that the productivity increases benefits of FTAs are fully realized from the past agreements signed by Nigeria. FTAs signed by Nigeria in the past are not sustainable. Therefore, do not have a long-run significant effect on productivity, but in the short-run, FTAs contribute meaningfully to productivity, especially aggregated productivity growth.

Based on the research findings the following policy recommendations are proffered: Government should put in place safeguards to ensure vulnerable industries especially in the manufacturing and agricultural sectors are protected, government should put in place the institutional framework needed to ensure that FTAs is beneficial to the country, including setting up a platform to address the logistics challenges of exports under FTAs signed by Nigeria and government should also facilitate the development of human capital by ensuring increase availability of adequate education support measures.

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Data Availability Statement:

The corresponding author may provide study data upon reasonable request.

Competing Interests:

The authors declare that they have no competing interests.

Authors' Contributions:

All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

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