Trade Liberalization and Food Security in Nigeria (1981-2021)

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Abstract

The study examined the impact of trade liberalization on food security in Nigeria (1981-2021). It utilized time series data which was extracted from the Central Bank of Nigeria annual statistical bulletin. Unit root test was performed with the use of Phillips-Perron test in order to ascertain the stationarity of the variables and they were found to be stationary at first difference. Vector Autoregression Model (VAR) was used to analyze the data in order to relate current observations of a variable with past observations of itself and past observations of other variables in the system. The results of the unit root test indicated that agricultural output, trade openness, exchange rate, and agricultural foreign direct investment were all integrated of order one (I (1)). The Johansen Co-integration test showed that there was no co-integrating equation, which means there was no long-run relationship among the variables. The Vector Autoregression (VAR) estimates revealed that LNTOP (-1) and LNEXCHR (-1) have positive but statistically insignificant effects on agricultural output which is a proxy for food security in the country while LNAGRFDI (-1) has a negative and statistically insignificant effect on food security. In addition, LNEXCHR (-1) has a positive and statistically significant impact on Trade openness.

The study concluded that the trade liberalization variables (Trade openness (TOP), Agricultural Foreign Direct Investment (FDI), and Exchange rate (EXCHR)) have significant impact on food security in Nigeria within the period under evaluation. The study recommended that the government should enact policies that would improve Trade openness with a view to boosting food security in Nigeria and provide an enabling environment that would foster investment in the agricultural sector in Nigeria.

Keywords: Trade liberalization, Food security, VAR, Nigeria

1. BACKGROUND TO THE STUDY

The importance of external trade in the development process has been of interest to developmental economists and policymakers alike. Trade plays a vital role in shaping the economic and social performance and prospects of countries around the world, especially those of developing countries. Various literatures on external trade recognize trade as a vital catalyst for economic development. For developing countries, the contribution of trade to overall economic development is immense, owing largely to the obvious fact that, most of the essential elements for development such as capital goods, raw materials, and technical know-how are almost entirely imported because of inadequate domestic supply (Rahman, 2009).

Trade liberalization is a process of becoming open to international trade through a systematic reduction and eventual elimination of tariffs and other barriers between trading partners. Trade liberalization measures may include, among others, reducing or eliminating trade barriers such as tariffs, quotas, import and export licensing requirements, foreign exchange control, export subsidies, and taxes (Benuneh and Zelealem, 2014).

The problem of food security has continued to receive great attention in both developing and developed countries (Sun & Zhang, 2021). This situation has been further exacerbated especially in developing countries with the advent of the COVID-19 pandemic (Amare *et al.*, 2021).

The conceptualization of food security has evolved over the years ranging from "the volume and stability of food supplies" at the global and national levels to "adequate nutrition and well-being" at the individual level (FAO, 2003). According to the prevailing view, food security is said to be achieved "when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life" (FAO, 2003). This definition of food security encompasses four dimensions: availability, stability, and utilization of food as well as access to it. The dominant narrative put forward by advocates of trade liberalization is that food security is enhanced under an open trade model. In other words, more open trade policies make food more available and affordable (Jennifer, 2014). Trade liberalization is related to food security in the sense that it influences both global and national food availability through exports, imports, and food production.

There have been several policies by successive governments towards improving food security such as the National Development programme, Operation Feed the Nation, agricultural revolution and trade liberalization policies of the federal government, among others, but despite all these, the issue of food security is still a great concern in Nigeria. Also, over the last six decades, foreign trade and the cross-border movement of technology, labour, and capital have been massive and irresistible. But in recent years, concerns have grown

about the negative aspects of openness and questions are being asked as to whether developing countries share in its benefits. The beliefs that openness favors only the advanced capitalist economies and that volatile capital markets hurt developing countries the most have led economists and other researchers to direct their research energy to the issues generated by the regime of open trade (Abdulgafar and Usman, 2010).

Debates over trade and food security in this context have tended to either be fought over broad ideological divides, with free trade advocates and critics frequently talking past each other, or quickly get lost in minute details on specific provisions within trade agreements, such as the on-going WTO negotiations on a new Agreement on Agriculture (AoA). The result is often a stalemate - ideological or political - from which it is difficult to reach a consensus (Jennifer, 2014).

Similarly, there is no consensus in terms of the impact of trade liberalization on food security. Some critics posited that trade liberalization has a positive impact on food security (Ismaelline and Giscard, 2014, Madeley and Solagral, 2001). For instance, trade seems to be an opportunity for African countries to resolve the food security problem as long as necessary conditions, such as access to markets and subventions are put in place (Ismaelline and Giscard, 2014). The increase in foreign exchange earnings (as the economy becomes more competitive and the export sector expands) enhances the capacity of the economy to finance food imports and augment domestic production (Madeley and Solagral, 2001).

On the other hand, others believe there is a negative relationship between trade liberalization and food security (Abdulgafar and Usman, 2010, Madeley and Solagral, 2001). For instance, the trade policy did not impact the development of the agriculture sector and major policy efforts did not address the fundamental problem of food production. (Usman and Abdulgafar, 2010).

One of the contentious issues relating to understanding the impact of trade liberalization on food security is the fact that different methodologies have been adopted to conceptualize the exact relationship between the two key variables. For instance, Usman and Ijaiya (2010) made use of the Computable General Equilibrium (CGE) model, while Ugagu (2012) employed the Cobb-Douglas production function.

Research findings in the area of food security are limited, there is a dearth of literature in the area of food security hence the need for this study. Moreso, despite Nigeria's participation in trade liberalization, it has been observed that over the years, the impact had not been felt particularly in the area of food security.   Therefore, given the above statement of problem, the research questions are: What are the effects of trade liberalization on food security in Nigeria? What is the causal relationship between food security and the macroeconomic variables (trade openness, agricultural foreign direct investment, and exchange rate)?

The main objective of the study is to investigate the impact of trade liberalization on food security in Nigeria between 1981 and 2021. The specific objectives of the study are to: examine the impact of trade liberalization on food security in Nigeria during the period of the study and; determine the causal relationship between trade liberalization and food security in Nigeria. The following hypotheses are formulated: $H_{01:}$ Trade liberalization does not have any significant effect on food security; $H_{02;}$ There is no causal relationship between trade liberalization and food security

This study is expected to contribute to the existing literature on trade liberalization and food security in Nigeria as the research findings in this area are limited. Trade liberalization is expected to have an impact on agricultural sector output and its export sub-sector through various transmission channels: mainly through exchange rate, capital formation, prices etc. The results of this study would widened the previous scope and understanding of trade liberalization and food security in Nigeria.

Therefore, findings from the study yielded data that would ascertain whether trade liberalization has strengthened the Nigerian agricultural sector output or food security in Nigeria. The output of this study also serves as a policy guide to governments and agencies, particularly in the area of trade liberalization and its impact on food security. The study covers the period of 1981-2021 and the choice of the study period is influenced by the fact that Nigeria had adopted structural economic reforms whose main focus was liberalization within that period. The study also employs the use of trade openness, agricultural foreign direct investment, and exchange rate variables sourced from various publications.

2. EMPIRICAL REVIEW
The relationship between trade liberalization and food security has been of interest and debatable discourse in the various literature by scholars. There is no consensus in terms of the impact of trade liberalization on food security. The relationship between trade liberalization and food security is, therefore, an empirical question. It has been the subject of numerous empirical investigations, mostly case studies, using different food security indicators, such as per capita food consumption, calorie, and protein intake, malnutrition, domestic production (self-sufficiency), food imports, and food prices, as indicators of food security.

Madeley and Solagral (2001) conducted an empirical study on the effects of agricultural trade liberalization on the economy of Mexico and the study reveals that trade liberalization has the potential to enhance developing countries' food security position and reduce their food gap. Ravallion *et al* (2004) used the computable General Equilibrium (CGE) model to investigate the impact of trade liberalization on the

Agricultural sector of the economy of developing countries, the result suggests that full liberalization of trade in developing countries reduces poverty and improve the production efficiency and output of the less developed countries. They conclude that periods of trade liberalization have the most positive effects on Agriculture and Poverty.

Tokarick (2005) used a partial equilibrium model of ten Agricultural outputs to investigate the effects of trade liberalization, in his analysis he compared the impact between developed and developing countries, and the result shows that full trade liberalization in developing countries leads to an increase in agricultural output and export expansion.

A study by Anderson (2003) and Olhan (2006) confirmed some of these general findings. They used an 18-region computable general equilibrium (CGE) model to evaluate the impact of trade liberalization between developed and developing nations in the agricultural sector, according to this model, the global benefits or the distribution of gains between developed and developing nations depends on which countries liberalized. Their results confirmed the principles that the benefits a country or region derives from trade liberalization are determined by the degree to which it participates in the global market. Also, an empirical study by Vamvakidis (1999), using, 51 cases of trade liberalization events concluded that countries have grown faster after liberalization. The increase in economic growth implies a reduction in poverty and an improvement of food security.

Bouët et al. (2005) used the Computable General Equilibrium (CGE) model for their study. The study investigated the impact of multilateral liberalization in the agricultural sector of developing countries. The study suggests that full liberalization of trade in developing countries reduces poverty and improves the production efficiency and output of the less developing countries. They concluded that periods of trade liberalization had the most positive effects on agricultural sector output.

Chang and Sumner (2004) conducted an econometric study on the trade impact on food security in China. Their study used 1200 rice-consumption households as a metric for food security. An analysis of their study concluded that opening the border to grain imports has resulted in lower domestic price which has improved the general level of food security for rural farming households in China. The study used data from 1991 to 2000. Similarly, Herath (2014) observed that after the formation of the Association of South East Asian Nations' Free Trade Agreement (ASEAN- AFTA) per-capita daily dietary energy supply in these countries has improved.

Zakaria and Xi, (2014) also used econometric panel analysis to examined the effects of trade liberalization reforms on food security in South Asian Countries (SACs) over the period 1972 to 2013. Their results indicated that trade liberalization had a positive effect on food production and food security in the region. Similarly, Dorosh (2008) argued that trade liberalization policies pursued in Bangladesh through which there was private participation in the rice and wheat production have largely contributed to the enhancement of national food security. He further highlighted that permitting the involvement of the private sector in trade would enhance the level of food availability for domestic consumption during periods of low food production.

According to Heidhues and Obare (2011), Ghana, Kenya, Uganda, and Malawi were the first to adopt trade liberalization policies in the 1980s under the SAPs. Ghana, for example, witnessed a positive effect on agricultural supply together with a decline in food insecurity (FAO, 2012). Similarly, Imad and Karim (2003) analyzed the implications of world trade liberalization on trade and food security in Sudan. Using an extended form of a multi-market partial equilibrium model which includes other characteristics of agriculture in Sudan like substitution effects and stages of production. The model revealed that a higher world market price would lead to measurable increases in food security and agricultural trade in Sudan. Their estimates also showed an adverse effect if the cost of production is higher. A further investigation shows that national and international policies in Sudan matter in boosting domestic food supply. The paper recommends that the country should reorient its domestic policies towards export promotion to gain from the emerging trading opportunities in the world market.

Opolot and Kuteesa (2006) studied the impact of Policy Reforms on Agriculture and Poverty in Uganda using a before and after analysis. Their study concludes, that policy reforms have yielded positive results on food security. A similar study by Oyejide et al. (2006) shows a positive effect of trade liberalization on food security in Nigeria. The study used undernourishment, calorie intake, and import dependence as a proxy for food security and import tariff reduction as a measure of open trade.

Duncan and Chen (2008) have used a computational general equilibrium model to examine the effects of trade reforms on food security in China. Their study identified a decline of 1.548 percent in overall food self-sufficiency. There was also a drop of 0.063 percent in grain self-sufficiency over the period. This result indicated that food insecurity had worsened after the adoption of the reforms. Another survey by Madeley and Solagral (2001) from multilateral agencies, such as UN agencies, IMF, World Bank, and national governments indicated that the evidence was mixed. Some of these studies found evidence to support the view that trade liberalization contributes to poverty reduction, augments prosperity, and accelerates the development process

of a country, while others report that trade liberalization has caused many farmers to leave farming and countries to become increasingly dependent on food imports.

Similarly, a synthesis of findings by Thomas and Morrison (2006) of 15 country case studies launched by FAO in 2003 and conducted by national consultants shows that the food security outcomes of liberalization varied by country and the food security indicator used. The empirical examination included quantitative and qualitative analysis of the impact of policy reforms on prices, production, and trade flows in the agricultural sector and on target variables, such as the real incomes of farmers. By this indicator, seven of the study countries reportedly experienced an improvement in food security, while the outcomes for the rest were negative or ambiguous.

Ivica (2013) conducted a study on food security and agricultural policies using panel data of 58 developing countries between 1990 and 2009. For a more robust study, the study employed OLS, GMM, and 2SLS estimators. The study expected that a higher degree of agricultural trade liberalization would encourage the production of export crops at the expense of staple foods in the domestic economy leading to food insecurity. However, the paper found evidence to support that equal land distribution, greater trade openness, and higher domestic food production had a positive impact on food production in the selected countries. In her findings, domestic food production had a strong positive effect on food security.

Nyangito *et al*. (2006) studied trade-related reforms and food security in Kenya. Their study employed a before and after comparison of agricultural trade policy on households and national food consumption, malnutrition, and self-sufficiency ratio for Kenya from 1992 to 2001. The trade reform characteristics of the study included quantitative restrictions, tariff reduction and elimination of non-tariff barriers. Based on their findings, food security worsened coupled with rising malnutrition in the country after the adoption of the agricultural trade policies.

Sharma and Morrissey (2006) argued that even Adam Smith, who was an ardent proponent of trade liberalization, warned that, no country should completely liberalize because of the problem of cheap imports. This may deprive the nationals of the home country employment and subsistence. This was further confirmed by Sharma and Morrissey (2006) who argued that the aftermath of the trade liberalization policy resulted in a loss of rural livelihood, rising unemployment, and an increased rural-urban migration which further led to a decline in agricultural exports. Under the structural adjustment trade liberalization program, credit was tied with crop diversification. This led to a shift from staple food crop production to cash crop production for export. This situation, resulted in a decline in domestic food crop production. Similarly, Clover (2003) discoursed that trade liberalization is the primary cause of food insecurity in SSA as they emphasized that the region has over the years seen a reversal from being an exporter to a net importer of agricultural commodities.

The African Continental Free Trade Area (AfCFTA) is one of the few notable current attempts to advance freer trade. The concrete steps towards economic integration of the African continent started when the Abuja Treaty was signed in 1991 by the African Union (AU) member states envisioned an African Economic Community as a long-term goal. The AfCFTA has the potential for improving the African food security situation. *Fusacchia et al. (2022)* considered the global value chain aspects of the AfCFTA and their implications on agricultural and food trade. The analysis assumes a complete intra-Africa tariff liberalization without Non-Tariff Measures (NTM) reductions. The authors found that the AfCFTA would deepen the agricultural and food value chains at the regional level and increase the value-added shares of trade. African countries will become less dependent on exporting agricultural intermediates.

Developing countries still face many food security risks, and Africa's proportion of hungry people with 21%, is the highest in the world (FAO, 2021). According to FAO, the global reduction of hunger stopped in 2014, and the Covid-19 pandemic has worsened the situation. In 2020, 768 million people were undernourished, and one-third of them, 282 million, were Africans. Furthermore, a dynamic computable general equilibrium (CGE) analysis by the FAO projects a significant deterioration in African food security by 2030 while the global situation simultaneously improves slightly. Therefore, enhancing food security in Africa is likely to remain high on the development policy agenda for the coming decades.

Wonyra and Gnedeka (2022), reexamines the effect of trade openness on food security in Sub-Saharan African countries. Panel data covering 37 Sub-Saharan African countries over the period from 2004 to 2018 were used. To control the unobserved heterogeneity and the potential endogeneity of explanatory variables, the method of generalized moments in the system was adopted. The empirical results showed that trade openness significantly improved food security in Sub-Saharan Africa. However, in the presence of political instability, a deterioration of the food security situation was observed.

It is therefore evident that the empirical literature on the nature of the relationship between trade liberalization and food security is ambiguous and filled with mixed results which thus necessitates further research with a view to providing new evidence using recent data.

3. METHODOLOGY

Model specification

The survival of the population of Sub-Saharan Africa, especially Nigeria remains largely dependent on agriculture. Thus, to assert their sovereignty, at the continental level and within regional groupings, food security issues are the underpinning of policy lines such as the Comprehensive Africa Agriculture Development Program, Agenda 2063, common trade and agricultural policies. Thus, the model showing the relationship between trade liberalization and food security is stated below in its implicit form:

FDS = f (TRADE LIB) 3.1

Equation 3.1 is further expanded with the inclusion of other variables as stated in equation 3.2

FDS = f (TOP, AGRFDI, and EXCHR) 3.2

Expanding the above model (equation 3.2) in econometric form, it is written as:

$$FDS_t = \alpha_0 + \beta_1 TOP_t + \beta_2 AGRFDI_t + \beta_3 EXCHR_t + \varepsilon_t \qquad \text{.... 3.3}$$

By using the natural logarithm, the equation (3.3) becomes:

$$InFDS_t = \alpha_0 + \beta_1 InTOP_t + \beta_2 InAGRFDI_t + \beta_3 InEXCHR_t + \varepsilon_t \qquad \text{.... 3.4}$$

Where:

FDS = Food security, proxied with agricultural output (₦'billion'),

TOP = Trade openness ($\frac{EXP+IMP}{GDP}$),

AGRFDI = Foreign direct investment into the agricultural sector (₦'billion),

EXCHR = Exchange rate (₦ to $),

$\beta_1, \beta_2, \beta_3$ = Parameters to be estimated,

t = Period (1981-2021),

ε = Error term,

In = Natural logarithm.

Estimation Techniques

- Inferential Analysis: Phillips-Perron (PP) was employed to test for series stationarity.
- Co-integration was used to determine if there was existence of a long run equilibrium relationship among the variables.
- **Unit root test**

  A unit root test indicates whether a series variable is non-stationary and possesses a unit root. The null hypothesis is generally defined as the presence of a unit root and the alternative hypothesis is either stationarity, trend stationarity , or explosive root depending on the test used.
- **Vector Autoregression Model**

  The vector autoregressive (VAR) model is a workhouse multivariate time series model that relates current observations of a variable with past observations of itself and past observations of other variables in the system. VAR models differ from univariate autoregressive models because they allow feedback to occur between the variables in the model.

Apriori expectation

According to economic theory, it is expected that the variables to be used in this study (trade liberalization) will have a positive effect on food security. That is, ($\beta_1, \beta_2 > 0$), while β_3 can either be > or < 0.

Granger causality

This was adopted to determine the causal relationship between trade liberalization and food security, the following causality model is estimated as stated below:

Causality between FDS and TOP Model

$$FDS_t = \theta_1 + \sum FDS_{t-1} + \sum TOP_{t-1} + U_t \qquad \text{.... 3.5}$$

$$TOP_t = \theta_2 + \sum TOP_{t-1} + \sum FDS_{t-1} + U_t \qquad \text{.... 3.6}$$

4. RESULTS

Table 1. Unit Root Test using Phillips-Perron approach

PHILLIPS-PERRON			
Variables	**Level**	**1st difference**	**Level**
LogFDS	-0.283143 (0.9185)	-6.011146 (0.0000)	I(1)
LogTOP	-1.485210 (0.5307)	-6.911433 (0.0000)	I(1)
LogAGRFDI	-0.784787 (0.8126)	-22.19340 (0.0001)	I(1)
LogEXCHR	-2.458498 (0.1330)	-5.369248 (0.0001)	I(1)

Source: Researchers computation (2023)

Table 1 shows the result of the Phillips-Perron test. It indicates that all the variables were non-stationary at level, but all variables were integrated of order one, that is, the series were stationary at first difference [I (1)]. Because the variables are I (1) variables, a co-integration test was carried out to find out if there exists a long-run relationship among the variables.

Table 2. Johansen Co-integration Test Results

No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.450931	40.18142	47.85613	0.2161
At most 1	0.227806	16.79969	29.79707	0.6548
At most 2	0.094733	6.717440	15.49471	0.6107
At most 3	0.070136	2.835965	3.841466	0.0922

Source: Researchers computation (2023)

Table 2 above displays the Johansen Co-integration Test carried out on the model. The result shows that the null hypothesis of no cointegrating equation was accepted at the 5% level. The Maximum Eigenvalue and Trace Statistic further shows that the null hypothesis of no cointegrating equation among the variables was not rejected. This means that there was no long-run relationship among the variables. In this case, VAR was used.

Table 3. Lag Length Selection Criteria for the Model

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-156.9892	NA	0.056228	8.473116	8.645493	8.534447
1	-0.131417	272.4372*	3.41e-05*	1.059548*	1.921436*	1.366201*
2	11.09847	17.14035	4.52e-05	1.310607	2.862004	1.862582
3	21.47296	13.65065	6.57e-05	1.606686	3.847594	2.403984

Source: Researchers computation (2023)

Table 3 revealed the result of the lag length selection analysis. The lowest values of Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hannan-Quinn Information Criterion (HQ) are 1.059548, 1.921436, and 1.366201 respectively and these were at lag 1.

Table 4. Vector Autoregression Estimates

	LNFDS	LNTOP	LNAGRFDI	LNEXCHR
LNFDS(-1)	0.937735	-0.145073	0.917875	0.028430
	(0.04386)	(0.18298)	(0.47504)	(0.17493)
	[21.3808]	[-0.79285]	[1.93220]	[0.16252]
LNTOP(-1)	0.006312	0.637110	0.029875	-0.029472
	(0.02252)	(0.09397)	(0.24397)	(0.08984)
	[0.28024]	[6.77987]	[0.12246]	[-0.32805]
LNAGRFDI(-1)	-0.009488	0.024471	0.451758	0.000964
	(0.01365)	(0.05696)	(0.14789)	(0.05446)
	[-0.69486]	[0.42959]	[3.05466]	[0.01770]
LNEXCHR(-1)	0.025136	0.401497	0.149977	0.974921
	(0.02493)	(0.10399)	(0.26998)	(0.09942)
	[1.00843]	[3.86089]	[0.55551]	[9.80641]
C	0.557072	1.239809	-4.339722	0.109673
	(0.30923)	(1.29008)	(3.34931)	(1.23333)
	[1.80149]	[0.96103]	[-1.29571]	[0.08892]
R-squared	0.991201	0.983125	0.864174	0.980422
Adj. R-squared	0.990195	0.981196	0.848651	0.978185
Sum sq. resides	0.176517	3.072269	20.70798	2.807945
S.E. equation	0.071016	0.296275	0.769192	0.283244
F-statistic	985.6531	509.7666	55.67053	438.1902
Log-likelihood	51.70683	-5.428280	-43.59033	-3.629013
Akaike AIC	-2.335341	0.521414	2.429517	0.431451
Schwarz SC	-2.124232	0.732524	2.640627	0.642561
Mean dependent	8.824664	4.074317	7.828404	3.702945
S.D. dependent	0.717196	2.160601	1.977173	1.917709

Source: Researchers computation (2023)

Table 4 shows the vector Autoregressive estimates. The table reveals that a positive relationship exists between trade openness (TOP) and agricultural output which is a proxy for food security. The positive relationship shows that a percentage increase in LNTOP (-1) is associated with a 0.006312% increase in

LNFDS. A percentage increase in LNEXCHR (-1) is associated with a 0.025136% increase in LNFDS. A percentage increase in LNAGRFDI (-1) is associated with a 0.009488% decrease in FDS ceteris paribus. The R-squared shows that 99% of the total variation in LNFDS is being explained by the explanatory variables (LNTOP, LNAGRFDI and EXCHR).

From the VAR regression results, an increase of 0.937735 in the one-period lag of FDS causes FDS in the current period to increase by about 93.77%. The T-statistic value for LNTOP (-1) of 0.28024 which is less than 2 indicates that LNTOP (-1) has no significant impact on LNFDS. The T-statistic value for LNAGRFDI (-1) of -0.69486 which is less than 2 indicates that LNAGRFDI (-1) has no significant impact on LNFDS. The T-statistic value for LNEXCHR (-1) of 1.00843 which is less than 2 indicates that LNEXCHR (-1) has no significant impact on LNFDS.

A one-period lag in Trade Openness (LNTOP (-1)) has a coefficient of 0.637110. Thus, indicating that a percentage increase in the previous value of Trade Openness will cause the current Trade Openness to significantly increase by 63.7%. A one-period lag in Agricultural Foreign Direct Investment (LNAGRFDI (-1)) has a coefficient of 0.024471. This indicates that a percentage increase in the previous value of Agricultural Foreign Direct Investment causes the current Agricultural Foreign Direct Investment to significantly increase by 2.4%. A one-period lag in Exchange Rate LNEXCHR (-1) has a coefficient of 0.974921. This indicates that a percentage increase in the previous value of Exchange Rate causes the current Exchange Rate to significantly increase by 97.4%. The same parameter has a coefficient of 0.401497 against Trade Openness which implies that a percentage increase in one period lag in Exchange Rate LNEXCHR (-1) causes Trade Openness to increase by 40.1.

Table 5. Probability values of the VAR model

	Coefficient	Std. Error	t-Statistic	Prob.
LNFDS(-1) (C1)	0.937735	0.043859	21.38078	0.0000
LNTOP(-1) (C2)	0.006312	0.022525	0.280244	0.7797
LNAGRFDI(-1) (C3)	-0.009488	0.013654	-0.694863	0.4883
LNEXCHR(-1) (C4)	0.025136	0.024926	1.008429	0.3150
C(5)	0.557072	0.309229	1.801489	0.0738
LNFDS(-1) (C6)	-0.145073	0.182976	-0.792855	0.4292
LNTOP(-1) (C7)	0.637110	0.093971	6.779866	0.0000
LNAGRFDI(-1) (C8)	0.024471	0.056964	0.429592	0.6682
LNEXCHR(-1) (C9)	0.401497	0.103991	3.860893	0.0002
C(10)	1.239809	1.290079	0.961034	0.3382
LNFDS(-1) (C11)	0.917875	0.475042	1.932197	0.0554
LNTOP(-1) (C12)	0.029875	0.243968	0.122456	0.9027
LNAGRFDI(-1) (C13)	0.451758	0.147891	3.054660	0.0027
LNEXCHR(-1) (C14)	0.149977	0.269982	0.555507	0.5794
C(15)	-4.339722	3.349311	-1.295706	0.1972
LNFDS(-1) C(16)	0.028430	0.174927	0.162523	0.8711
LNTOP(-1) C(17)	-0.029472	0.089838	-0.328054	0.7434
LNAGRFDI(-1) C(18)	0.000964	0.054459	0.017700	0.9859
LNEXCHR(-1) C(19)	0.974921	0.099417	9.806406	0.0000
C(20)	0.109673	1.233335	0.088924	0.9293

Source: Researchers computation (2023)

Table 5 shows the probability values for the Vector Autoregression estimates. The table reveals that LNTOP (-1) which represents (C7), LNAGRFDI (-1) representing (C13), and LNEXCHR (-1) representing (C9) are significant at 1% with probability values of 0.0000, 0.0027 and 0.0002 respectively. LNFDS (-1) representing (C11) is significant at 5% with a probability value of 0.0554. LNEXCHR (-1) representing (C19) is significant at 1% with a probability value of 0.0000.

Table 6. Results of the Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.	Remark
LNTOP does not Granger Cause LNFDS	40	3.53942	0.0678	Unidirectional
LNFDS does not Granger Cause LNTOP		0.08925	0.7668	

Source: Researchers computation (2023)

Table 6 shows the Granger causality relationship among the variables in the study. The Granger causality test was conducted to determine the direction of influence or causality among the variables in the model. The results revealed that LnTOP does not granger cause LnFDS with an F-Statistic value of 3.53942 and the probability value of 0.0678 which is significant at 10%, and in the same vein, LnFDS does not granger cause

LnTOP with F-Statistic value of 0.08925 and probability value of 0.7668 which is not significant at either 5% or 10%. Thus, the causality is a uni-directional relationship which implies that LNFDS granger caused LNTOP.

DISCUSSION OF RESULTS

The study evaluated the impact of trade liberalization on food security in Nigeria between 1981 and 2021. The results however found that there is significant impact of trade liberalization variables (Trade openness (TOP), Agricultural Foreign Direct Investment (FDI), and Exchange rate (EXCHR)) on food security in Nigeria within the period under evaluation. This result is in conformity with Anowor *et al.* (2013) conducted a similar study titled 'The impact of trade liberalization on Nigeria's agricultural sector' and the study found that Agricultural exports and imports price ratio, foreign investment in agriculture, and agricultural degree of openness have statistically significant effects on Nigerian agricultural productivity. Similar results were obtained by the study conducted by Madeley and Solagral (2001); Ravallion et al., (2004) and Tokarick 2005 to mention but a few among various researchers.

Surprisingly, Bezuneh and Yiheyis (2014) who researched the topic 'Has Trade Liberalization Improved Food Availability in Developing Countries? An Empirical Analysis had a result which found that trade liberalization exerted a negative short-run effect on food availability in the sample countries.

CONCLUSION AND RECOMMENDATIONS

The study examined the impact of trade liberalization on food security in Nigeria. Based on the findings, the study concluded that there is significant impact of trade liberalization variables (Trade openness (TOP), Agricultural Foreign Direct Investment (FDI), and Exchange rate (EXCHR)) on food security in Nigeria within the period under evaluation. Similarly, the results of Granger causality concluded that the causality was a uni-directional relationship which implies that it was LNFDS that Granger caused LNTOP. Based on the research findings and conclusion, the following recommendations were made: The government should enact policies that would improve Trade openness to boost food security in Nigeria and the government should provide an enabling environment that would foster investment in the agricultural sector in Nigeria.

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