



**EFFECT OF TRADE LIBERALIZATION ON OUTPUT OF SELECTED
AGRICULTURAL CROPS IN NIGERIA**

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ABSTRACT

The study assessed the effect of trade liberalization on output of selected agricultural crops (rice, wheat, cocoa and cassava) in Nigeria (1986-2020). Data on the variables of the study were collected from the records of Central Bank of Nigeria (CBN), National Bureau of Statistics (NBS) and Food and Agriculture Organization (FAO) and World Bank database. Data were analyzed using Augmented Dickey-Fuller (ADF) unit root test and Vector Error Correction Model (VECM). The result of the Augmented Dickey Fuller (ADF) test for unit root revealed that cassava output, cocoa output, rice output, wheat output, exchange rate, tariff and trade openness were found to have unit roots and became stationary on first differencing. The result of the long and short-run effects of trade liberalization on agricultural output using the Vector Error Correction Model (VECM) showed that in the long run, a unit increase in trade openness will increase cassava output by 0.603 units, decrease cocoa output by 0.53 units, increase wheat output by 6.03 units and increase rice output by 3.30 units *ceteris paribus*. The study concludes that trade liberalization is healthy for the agricultural sector in Nigeria. The study therefore recommended that Nigeria should adopt more policies on reducing or eliminating quotas on agricultural produce that will enable the sector to grow at spectacular rates.

Keywords: Agriculture, Liberalization, Output, Trade and Vector

INTRODUCTION

Trade liberalization plays an important role in economy and assumed to be an engine of growth. Trade is taking place not only in terms of commodities but also in terms of flows of ideas and knowledge spill over. Trade liberalization in global economy during time is considered by economists that it has a positive impact on growth and it will lead micro and macro-economic activities. Trade liberalization is most important for Nigerian agricultural sector to enhance the economic growth. Trade liberalization can be seen as the reduction or removal of imports and exports restrictions (tariff and quotas) and making an easy access to the trading partners (Muhammad *et al.*, 2018). According to Echekeba *et al.* (2015) the main purpose of trade Liberalization is to allow countries to export those goods and services that they can Produce efficiently while they import the goods and services that they produce inefficiently.

The agricultural sector is strategically positioned to have a high multiplier effects on any nation's quest for socio-economic and industrial development. The Nigerian economy, like that of Brazil during the first decade after independence, could reasonably be described as an agricultural economy because agriculture served as the engine of growth of the overall economy (Ogen in Onuaguluchi, 2014). Considering the occupational distribution and contribution to the GDP, agriculture was the leading sector. During this period, Nigeria was the world second largest producer of Cocoa, largest exporter of palm kernel and largest producer and exporter of palm oil. Nigeria was also a leading exporter of other major commodities such as cotton, groundnut, rubber, hides and skin (Onuaguluchi, 2014).

The dismal performance of the agricultural sector in terms of its contribution to Nigeria's yearly total revenue in the last three decades prompted the government to initiate several



agricultural schemes and programs and international trade policies such as trade liberalization and trade restrictions to enhance agricultural productivity and overall macro-economic growth in Nigeria. Previous studies by Muhammad and Akanegbu (2015); Onuaguluchi (2014) asserted that successes of all the various agricultural programs and policies have been minimal, hence the country has not been able to achieve a sustained rate of growth in the agricultural sector.

In the decades following independence, most African countries adopted heavily interventionist policies (such as trade liberalization and trade restrictions) in agricultural and food commodity value chains. Governments were involved in agricultural marketing and food processing through the creation of marketing boards, parastatals processing units, and government-controlled cooperatives. This generally prevailed for basic food crops and in particular coarse grains. This was also the case for important export crops such as coffee, cotton, and tea (Engel *et al.*, 2013).

The debate over the effects of trade liberalization and trade restrictions on agricultural output in particular and economic growth in general have occupied a central seat in international and development economics literature for more than a century now. The literature generated by the debate, especially since the 1960s concludes that although trade offers a long term benefit for developing countries, trade liberalization alone is not sufficient for economic growth as some have argued that erecting restrictions to shield infant industries from all forms of competition abroad remain a major key to economic development in developing nations (David-Wayas, 2014). More so, Ekrann (2013) argued that the reasons for imposing trade barriers ranges from economic, social or purely political reasons. Anyanwuocha (1993) also posited that the higher the level of international trade the greater the level of specialization. This raises the level of efficiency and productivity of the various economic units.

High tariffs, import quota and bans and other forms of trade restrictions have been regarded as impediments to macro-economic and sectoral growth. Most critics of these restrictions have focused on the higher costs of domestically produced goods. The Nigeria scenario is no exception where trade restriction on some selected commodities brought about an upward surge in prices of domestically produced goods. While tariffs from agriculture in Nigeria have come down substantially in the past two decades (except for the most recent case in Nigeria), the persistence of trade restrictions in Nigeria presents a substantial obstacle to increasing intra-regional trade in agriculture generally and specifically, food staples. This manifests itself both in a substantial 'border effect (i.e. the additional trade costs created by the presence of a border), as well as large price differentials between consumption and production zones (Haggblade *et al.*, 2012).

International trade in agriculture, as that in most other sectors, is controlled and regulated by various trade measures (Ekrann, 2013). A wide array of these exist and their nature, significance, extent and impact vary considerably from nation to nation and product to product. Despite the fact that, the arguments in favour of trade liberalization came in many forms, none of these arguments is generally accepted by most economists. This is because empirical findings on the impact of trade liberalization and restrictions on the economy have shown mixed results (Muhammad *et al.*, 2014; David-Wayas, 2014). The precise relationship between the twin sisters, trade liberalization and trade restriction and agricultural growth has long remained a difficult theoretical issue that is being explored in a variety of ways. This study therefore seeks to establish the relationship between trade liberalization and agricultural output in Nigeria.

MATERIALS AND METHODS

The Study Area

The study area is Nigeria. Nigeria with a projected population of 210.87 million in 2021 (NBS, 2021) and a total geographical area of 923,768 square kilometers is located between latitudes 4° N and 14° N and longitudes 2°2' and 14° 30' East. The nation is bordered in the north by the Republic of Niger and Chad, in the south by Atlantic Ocean, in the east and west by Republic of Cameroon and Benin respectively.

Nigeria has five main vegetation belts; these are the Mangrove forest, Savannah grassland, Equatorial forest, Semi desert, Guinean savannah. The country has a wide range of climatic conditions but as a tropical country, it is generally hot and humid. The specific location is of advantage in terms of environmental diversity, culture, cultivation and human practices; thus the country is blessed with favourable climatic conditions which is good for almost all the food crops. The agricultural sector is particularly important in terms of its employment generation and its contribution to Gross Domestic Product (GDP) and export earnings. Administratively, Nigeria has 36 states with six geopolitical zones and FCT Abuja. These are; South-East, South-South, South-West, North-East, North-West and North-Central.

Methods of Data Collection and Analytic Technique

The study used time series data spanning from 1986 to 2020. Data on the variables of the study were collected from the archive of National Bureau of Statistics (NBS) and Food and Agriculture Organization (FAO) and World bank database. Specifically, data on selected crops output were collected from FAO, data on trade openness, tariff, import, export and exchange rate were collected from World bank while data on inflation were collected from CBN. Data for this study were analyzed using Augmented Dickey-Fuller (ADF) unit root test and Vector Error Correction Model (VECM).

Model Specification

Unit root test

As part of the preliminary analysis, the data series used the Augmented Dickey Fuller (ADF) model to test for unit root in the research. Following Oyinbo and Rekwot (2013) the Augmented Dickey Fuller (ADF) model with the constant term and trend can be specified as follows:

$$\Delta Y_t = \alpha_0 + \alpha_1 t + \beta Y_{t-1} + \sum_{i=1}^p \delta_i \Delta Y_{t-i} + \varepsilon_t \quad \dots(1)$$

Where:

Y is the value of the variable of trade openness, exchange rate, tariff, cocoa output, wheat output, rice output and cassava output

α_0 = constant;

α_1 = coefficient of the trend series,

p = lag order of the autoregressive process,

Y_{t-i} = lag value of order one of Y_{t-i} and

ε_t = error term

The null hypothesis that $\sigma = 0$ means existence of a unit root in Y or that the time series is non-stationary. The decision rule is that if the computed ADF statistics is greater than the critical at the specified level of significance, then the null hypothesis of unit root is accepted otherwise it is rejected.

Vector Error Correction Model (ECM)

Suppose we hypothesized that the series under investigation have unit roots and possibly co integrated, the Granger representation theorem asserts that error correction model (ECM) or restricted VAR of the form:

$$R_t = \gamma_2 + \lambda_j(TL_{t-1} - \alpha_1 R_{t-1} - \alpha_2 W_{t-1} - \alpha_3 C_{t-1} - \alpha_4 CS_{t-1}) + \sum_{i=1}^{p-1} A_{2i} \Delta TL_{t-i+1} + \sum_{i=1}^{p-1} \beta_{2i} \Delta R_{t-i+1} + \sum_{i=1}^{p-1} \phi_{2i} \Delta W_{t-i+1} + \sum_{i=1}^{p-1} \alpha_{2i} \Delta C_{t-i+1} + \sum_{i=1}^{p-1} \mu_{2i} \Delta CS_{t-i+1} + \varepsilon_{2t} \dots \dots \dots (2)$$

$$W_t = \gamma_3 + \lambda_j(TL_{t-1} - \alpha_1 R_{t-1} - \alpha_2 W_{t-1} - \alpha_3 C_{t-1} - \alpha_4 CS_{t-1}) + \sum_{i=1}^{p-1} A_{3i} \Delta TL_{t-i+1} + \sum_{i=1}^{p-1} \beta_{3i} \Delta R_{t-i+1} + \sum_{i=1}^{p-1} \phi_{3i} \Delta W_{t-i+1} + \sum_{i=1}^{p-1} \alpha_{3i} \Delta C_{t-i+1} + \sum_{i=1}^{p-1} \mu_{3i} \Delta CS_{t-i+1} + \varepsilon_{3t} \dots \dots \dots (3)$$

$$C_t = \gamma_4 + \lambda_j(TL_{t-1} - \alpha_1 R_{t-1} - \alpha_2 W_{t-1} - \alpha_3 C_{t-1} - \alpha_4 CS_{t-1}) + \sum_{i=1}^{p-1} A_{4i} \Delta TL_{t-i+1} + \sum_{i=1}^{p-1} \beta_{4i} \Delta R_{t-i+1} + \sum_{i=1}^{p-1} \phi_{4i} \Delta W_{t-i+1} + \sum_{i=1}^{p-1} \alpha_{4i} \Delta C_{t-i+1} + \sum_{i=1}^{p-1} \mu_{4i} \Delta CS_{t-i+1} + \varepsilon_{4t} \dots \dots \dots (4)$$

$$CS_t = \gamma_5 + \lambda_j(TL_{t-1} - \alpha_1 R_{t-1} - \alpha_2 W_{t-1} - \alpha_3 C_{t-1} - \alpha_4 CS_{t-1}) + \sum_{i=1}^{p-1} A_{5i} \Delta TL_{t-i+1} + \sum_{i=1}^{p-1} \beta_{5i} \Delta R_{t-i+1} + \sum_{i=1}^{p-1} \phi_{5i} \Delta W_{t-i+1} + \sum_{i=1}^{p-1} \alpha_{5i} \Delta C_{t-i+1} + \sum_{i=1}^{p-1} \mu_{5i} \Delta CS_{t-i+1} + \varepsilon_{5t} \dots \dots \dots (5)$$

$$TL_t = \gamma_1 + \lambda_j(TL_{t-1} - \alpha_1 R_{t-1} - \alpha_2 W_{t-1} - \alpha_3 C_{t-1} - \alpha_4 CS_{t-1}) + \sum_{i=1}^{p-1} A_{1i} \Delta TL_{t-i+1} + \sum_{i=1}^{p-1} \beta_{1i} \Delta R_{t-i+1} + \sum_{i=1}^{p-1} \phi_{1i} \Delta W_{t-i+1} + \sum_{i=1}^{p-1} \alpha_{1i} \Delta C_{t-i+1} + \sum_{i=1}^{p-1} \mu_{1i} \Delta CS_{t-i+1} + \varepsilon_{1t} \dots \dots \dots (6)$$

produce consistent estimates of the system parameters. The parameter λ_j in (2), (3), (4) (5) and (6) measures the speed of adjustment of short run disequilibrium to long run equilibrium position; while the parameter A, β, ϕ, α and μ measure the short run temporary influence of the past values of endogenous variables, such that if the coefficient in eqn ((2), (3), (4) (5) and (6) are respectively such that,

$$\begin{aligned} A_{11} &= A_{12} = A_{13} \dots \dots \dots A_{1p-1} = 0 \\ \beta_{11} &= \beta_{12} = \beta_{13} \dots \dots \dots \beta_{1p-1} = 0 \\ \phi_{11} &= \phi_{12} = \phi_{13} \dots \dots \dots \phi_{1p-1} = 0 \\ \alpha_{11} &= \alpha_{12} = \alpha_{13} \dots \dots \dots \alpha_{1p-1} = 0 \\ \mu_{11} &= \mu_{12} = \mu_{13} \dots \dots \dots \mu_{1p-1} = 0 \end{aligned}$$

The past values of the variable rice output, wheat output, cocoa output and cassava output is said not to Granger cause the current value of trade liberalization (TL). Furthermore, the optimal lag order for the model was determined by the lag order that minimizes Akaike information criterion (AIC). The Information criterion is based on the model log likelihood and lag length such that: $AIC = -2(l/T) + 2(k/T)$ where l is the value of the log likelihood function; T is the sample size; and K is the number parameters.

RESULTS AND DISCUSSION

Summary Statistics of the Variables

The summary statistics of the variables used in the study is presented in Table 1. The result showed that the variables rice output, wheat output, tariff and trade openness were positively skewed to the right tail implying the presence of higher values than the sample mean while the variables cassava output, cocoa output and exchange rate were negatively skewed to the left tail implying the presence of lower values than the sample mean. The result further showed that the variables cassava output and exchange rate were platykurtic (negative kurtosis) with a kurtosis value less than 3 implying that the distribution had a flatten curve relative to the normal. This shows that there were lower values than the sample mean. Also, the variables cocoa output, wheat output, tariff and trade openness were leptokurtic (positive kurtosis) with a kurtosis value greater

than 3 showing that the distribution had a peaked curve relative to the normal. However, the variable rice output was mesokurtic showing a normal distribution of the variable.

More so, the result of the Jarque-Bera probability test of normality showed that the variables; rice output, cocoa output, cassava output and exchange rate were not statistically significant at 5% significant level which indicated the normal distribution of the variables used in the study. However, wheat output, tariff and trade openness were statistically significant at 5% thereby leading to the rejection of the null hypothesis of normal distribution of the variable.

Table 1. Summary statistics of the variables

	CASSAVA	COCOA	RICE	WHEAT	TARIFF	TPS	EXR
Mean	37930128	324211.7	4145977	70804.03	17.63422	21.71657	34.95288
Median	36304000	329870.0	3298000	60000.00	12.55496	16.77000	34.45783
Maximum	59565916	485000.0	8435000	165000.0	72.83550	87.19000	53.27796
Minimum	12388000	148000.0	1416322	32600.00	3.920000	9.940000	9.135846
Std. Dev.	13519936	73513.76	1948619	30030.52	15.88030	16.04282	10.29688
Skewness	-0.076741	-0.521235	1.103508	1.427150	2.222764	2.601482	-0.363513
Kurtosis	2.185714	3.428691	3.131456	4.691342	7.060646	10.33616	2.836300
Jarque-Bera	1.001318	1.852839	7.128627	16.05284	52.86688	117.9646	0.809906
Probability	0.606131	0.395969	0.028316	0.000327	0.000000	0.000000	0.667008
Sum	1.33E+09	11347411	1.45E+08	2478141.	617.1978	760.0800	1223.351
Sum SqDev.	6.21E+15	1.84E+11	1.29E+14	3.07E+10	8574.249	8750.648	3604.874
Observations	35	35	35	35	35	35	35

Source: Data analysis (2022)

Unit root test

The Augmented Dickey Fuller (ADF) test for unit root was employed to test whether or not the variables are stationary and also determine the order of integration of the variable (Table 2). The result indicated that the variables cassava output, cocoa output, rice output, wheat output, tariff, trade openness and exchange rate were found to have unit roots and became stationary on first differencing. This indicates that the variables exhibit random walk (unit roots) or the future values of these variables do not converge from their past values.

Table 2. Result of Augmented Dickey-Fuller (ADF) Test

Variable	Level				First Difference				Inference
	ADF	1%	5%	DW	ADF	1%	5%	DW	
Cocoa	-3.175**	-3.639	-2.951	2.030					I (0)
Wheat	-3.277**	-3.639	-2.951	1.840					I (0)
TP	-3.038**	-3.639	-2.951	2.073					I (0)
Cassava	-1.336	-3.639	-2.951	2.355	-6.719***	-3.646	-2.954	1.925	I (1)
Rice	1.231	-3.646	-2.954	1.714	-3.209***	-3.654	-2.957	1.854	I (1)
EXCR	1.723	-3.639	-2.951	1.628	-3.944***	-3.646	-2.954	1.790	I (1)
Tariff	-1.449	-3.699	-2.976	2.367	-2.727***	-2.660	-1.955	1.189	I (1)

Source: Data analysis (2022). *** Significant at 1%

Long Run and Short Run Effects of Trade Liberalization on Agricultural Output in Nigeria Effects of trade liberalization on cassava output

The Vector Error Correction Model (VECM) was estimated to ascertain the long and short-run effects of trade liberalization on cassava output. The result of VECM as shown in Table 3 indicated that in a long run, the coefficient of trade openness (0.603) was positive and statistically significant at 1% probability level. This implies that a unit increase in trade openness will increase cassava output by 0.603 units *ceteris paribus*. Also, the coefficient of exchange rate (-0.182) was negative and statistically significant at 1% probability level. This implies that a unit increase in exchange rate will decrease cassava output by 0.182 units *ceteris paribus*. This means that trade liberalization can boost cassava output in Nigeria as it provides opportunity for competitiveness, specialization and efficiency. This finding was consistent with the studies of Bamwesigye and Pomazalova (2015) who reported that trade liberalization has led to a boom in the agricultural sector and competitiveness has also increased in the sector thus, trade liberalization has a positive impact on the agricultural sector.

The result of the short run indicated that Error Correction Term [ECT (-1)] is statistically significant and negative (-0.176) indicating a moderate speed of adjustment (that is, the speed at which the deviation from long run equilibrium is adjusted quickly where 0.176 of the disequilibrium is removed immediately in each period). The result implies that 17.6% deviation from equilibrium position is corrected within the year. The result however shows that in the short run, trade liberalization has no significant effect on cassava output.

Table 3. The Vector Error Correction Model of Long and Short-run Effects of Trade Liberalization on Cassava Output

Long run		Estimates			
Regressors		CointEq1			
Cassava (-1)		1.000000			
Trade Openness(-1)		0.603 (3.756***)			
Tariff (-1)		-0.102 (-0.863)			
Exchange rate (-1)		-0.182 (-3.119***)			
Constant		-18.502			
Short-run		Estimates			
ECM		Cassava Output	Trade Openness	Tariff	Exchange rate
CointEq1		-0.176 (-2.066**)	-0.810 (3.927***)	0.613 (2.293**)	-0.0007 (-0.002)
Δ Cassava (-1)		0.028 (0.145)	-0.316 (-0.694)	0.553 (0.939)	0.906 (1.391)
Δ Cassava (-2)		0.151 (0.768)	-0.699 (-1.470)	0.716 (1.163)	-0.136 (-0.200)
Δ Trade Opn (-1)		0.024 (0.344)	-0.122 (-0.718)	0.225 (1.021)	-0.235 (-0.965)
Δ Trade Opn (-2)		0.034 (0.509)	-0.092 (-0.575)	0.273 (2.323)	0.195 (0.854)
Δ Tariff (-1)		0.003 (0.056)	-0.005 (-0.033)	-0.049 (-0.249)	-0.012 (-0.055)
Δ Tariff (-2)		-0.029 (-0.507)	-0.227 (-1.619)	-0.121 (-0.668)	0.107 (0.530)
Δ Exch rate (-1)		-0.067 (-0.075)	-0.004 (-0.021)	0.399 (1.855*)	0.060 (0.254)
Δ Exch rate (-2)		-0.030 (-0.458)	-0.023 (-0.144)	0.233 (1.129)	-0.003 (-0.011)
Constant		0.044 (1.730*)	0.067 (1.084)	0.191 (2.396**)	0.091 (1.035)
R ²		0.285	0.555	0.375	0.161
F statistics		0.976	3.046	1.466	0.471

Likelihood 52.098 Akaike Information Criteria -0.506 Schwarz Criteria 1.509

Figures in parentheses are t-values, *significant at 10%, **significant at 5%, ***significant at 1%

Effects of trade liberalization on cocoa output

The result of VECM as shown in Table 4 indicated that in a long run, the coefficient of trade openness (-0.527) was negative and statistically significant at 1% probability level. This implies that a unit increase in trade openness will decrease cocoa output by 0.527 units *ceteris paribus*. Also, the coefficient of exchange rate (-0.073) was negative and statistically significant at 1% probability level. This implies that a unit increase in exchange rate will decrease cocoa output by 0.073 units *ceteris paribus*. These findings are consistent with the studies of Anowor *et al.* (2013) who posited that trade liberalization has a positive impact on agriculture and free trade strengthens the Nigerian agricultural sector. The result however shows that in the short run, trade liberalization has no significant effect on cocoa output.

Table 4. The Vector Error Correction Model of Long and Short-run Effects of Trade Liberalization on Cocoa Output

Long run	Estimates				
Regressors	CointEq1				
Cocoa output (-1)	1.000000				
Trade Openness(-1)	-0.527 (-6.192***)				
Exchange rate (-1)	-0.073 (-2.638***)				
Tariff (-1)	0.014 (0.234)				
Constant	-10.557				
Short-run	Estimates				
ECM	Cocoa Output	Trade Openness	Exchange rate	Tariff	
CointEq1	-0.372 (-1.466)	1.203 (2.576***)	-0.186 (-0.367)	-0.215 (-0.364)	
Δ Cocoa (-1)	0.028 (0.145)	-0.316 (-0.694)	0.553 (0.939)	0.906 (1.391)	
Δ Cocoa (-2)	0.151 (0.768)	-0.699 (-1.470)	0.716 (1.163)	-0.136 (-0.200)	
Δ Trade Opn (-1)	0.024 (0.344)	-0.122 (-0.718)	0.225 (1.021)	-0.235 (-0.965)	
Δ Trade Opn (-2)	0.034 (0.509)	-0.092 (-0.575)	0.273 (2.323)	0.195 (0.854)	
Δ Exch rate (-1)	0.003 (0.056)	-0.005 (-0.033)	-0.049 (-0.249)	-0.012 (-0.055)	
Δ Exch rate (-2)	-0.029 (-0.507)	-0.227 (-1.619)	-0.121 (-0.668)	0.107 (0.530)	
Δ Tariff (-1)	-0.067 (-0.075)	-0.004 (-0.021)	0.399 (1.855*)	0.060 (0.254)	
Δ Tariff (-2)	-0.030 (-0.458)	-0.023 (-0.144)	0.233 (1.129)	-0.003 (-0.011)	
Constant	0.044 (1.730*)	0.067 (1.084)	0.191 (2.396**)	0.091 (1.035)	
R ²	0.635	0.411	0.266	0.209	
F statistics	4.254	1.706	0.887	0.647	

Likelihood 25.417 Akaike Information Criteria -0.963 Schwarz Criteria -0.505

Figures in parentheses are t-values, *significant at 10%, **significant at 5%, *** significant at 1%

Effects of trade liberalization on wheat output

The result of VECM as shown in Table 5 indicated that in a long run, the coefficient of trade openness (6.029) was positive and statistically significant at 1% probability level. This implies that a unit increase in trade openness will increase wheat output by 6.029 units *ceteris paribus*. Also, the coefficient of exchange rate (1.519) was positive and statistically significant at 1% probability level. This implies that a unit increase in exchange rate will increase wheat output by 1.519 units *ceteris paribus*. Furthermore, the coefficient of tariff (3.275) was positive and statistically significant at 1% probability level. This implies that a unit increase in tariff will increase wheat output by 3.275 units *ceteris paribus*. These findings show that trade liberalization enhances the output of wheat in Nigeria. This consistent with findings by Ojeyinka and Adegboye (2017) who opined that free trade has a significant and positive impact on the agricultural output. The result however shows that in the short run, trade liberalization has no significant effect on wheat output.

Table 5: The Vector Error Correction Model of Long and Short-run Effects of Trade Liberalization on Wheat Output

Long run	Estimates			
Regressors	CointEq1			
Wheat output (-1)	1.000000			
Trade Openness (-1)	6.029 (3.166***)			
Tariff (-1)	3.275 (2.492***)			
Exchange rate (-1)	1.519 (2.604***)			
Constant	-48.477			
Short-run	Estimates			
ECM	Wheat Output	Trade Openness	Tariff	Exchange rate
CointEq1	-0.019 (-0.783)	-0.066 (-3.108***)	-0.021 (-0.751)	-0.039 (-1.495)
ΔWheat (-1)	0.185 (0.879)	0.209 (1.143)	-0.143 (-0.597)	0.366 (1.616)
ΔWheat (-2)	-0.110 (-0.625)	0.124 (0.811)	0.122 (0.613)	0.096 (0.508)
ΔTrade Opn (-1)	-0.301 (-1.354)	-0.233 (-1.212)	0.479 (1.907**)	-0.201 (-0.843)
ΔTrade Opn (-2)	0.166 (0.757)	-0.028 (-0.148)	0.063 (0.254)	0.240 (1.024)
ΔTariff (-1)	-0.093 (-0.465)	-0.005 (-0.031)	0.125 (0.552)	0.077 (0.358)
ΔTariff (-2)	-0.062 (-0.347)	-0.110 (-0.707)	-0.157 (-0.770)	0.189 (0.982)
ΔExch rate (-1)	-0.205 (-1.085)	0.219 (1.335)	0.177 (0.826)	0.053 (0.259)
ΔExch rate (-2)	0.029 (0.151)	0.351 (2.055**)	-0.091 (-0.408)	0.118 (0.557)
Constant	0.026 (0.392)	-0.061 (-1.084)	-0.044 (-0.592)	0.120 (1.711)
R ²	0.243	0.456	0.221	0.230
F statistics	0.783	2.045**	0.694	0.732

Likelihood 19.054 Akaike Information Criteria 1.559 Schwarz Criteria 3.575

Figures in parentheses are t-values, *significant at 10%, ** significant at 5%, ***significant at 1%

Effects of trade liberalization on rice output

The result of VECM as shown in Table 6 indicated that in a long run, the coefficient of trade openness (3.301) was positive and statistically significant at 1% probability level. This implies that a unit increase in trade openness will increase rice output by 3.301 units *ceteris paribus*. Also, the coefficient of tariff (1.444) was positive and statistically significant at 1% probability level. This implies that a unit increase in tariff will increase rice output by 1.444 units *ceteris paribus*. The findings of the study imply that trade liberalization is beneficial to rice production in Nigeria. Altaee and Jafari (2014) posited that trade liberalization has a wide range of benefits to trading nations: it delivers benefits through market access, expanding the demand for goods and services of domestic firms, enabling firms to reach larger markets gains from economies of scale, and increase economic growth rates due to short run gains from resource reallocation. The policy implication of this finding is that trade should be open in order to increase rice output in Nigeria.

The result of the short run indicated that Error Correction Term [ECT (-1)] is statistically significant and negative (-0.112) indicating a moderate speed of adjustment (that is, the speed at which the deviation from long run equilibrium is adjusted quickly where 0.112 of the disequilibrium is removed immediately in each period). The result implies that 11.2% deviation from equilibrium position is corrected within the year. The result further shows that in the short run, a unit increase in trade openness will decrease rice output by 1.053 and 1.016 units in the first and second lagged period respectively *ceteris paribus*.

Table 6. The Vector Error Correction Model of Long and Short-run Effects of Trade Liberalization on Rice Output

Long run	Estimates			
Regressors	CointEq1			
Rice output (-1)	1.000000			
Trade Openness(-1)	3.301 (6.196***)			
Tariff (-1)	1.444 (3.403***)			
Exchange rate (-1)	0.273 (1.557)			
Constant	-32.288			
Short-run	Estimates			
ECM	Rice Output	Trade Openness	Tariff	Exchange rate
CointEq1	-0.112 (-3.768***)	-0.255 (-5.209***)	-0.021 (-0.273)	-0.007 (-0.819)
ΔRice (-1)	-0.637 (-3.217***)	-1.053 (-3.068***)	0.722 (1.321)	0.589 (1.091)
ΔRice (-2)	-0.105 (-0.542)	-1.016 (-3.014***)	0.280 (0.521)	-0.201 (-0.379)
ΔTrade Opn (-1)	0.055 (0.451)	0.395 (1.882*)	0.135 (0.403)	-0.316 (-0.958)
ΔTrade Opn (-2)	0.076 (0.876)	0.126 (0.833)	0.209 (0.874)	0.324 (1.368)
ΔTariff (-1)	-0.071 (-0.856)	0.165 (1.143)	0.025 (0.109)	0.050 (0.222)
ΔTariff (-2)	-0.001 (-0.018)	-0.271 (-2.099**)	-0.098 (-0.476)	0.149 (0.738)
ΔExch rate (-1)	-0.023 (-0.306)	0.323 (2.433***)	0.189 (0.897)	0.049 (0.239)
ΔExch rate (-2)	-0.058 (-0.802)	0.182 (1.459)	0.015 (0.074)	0.004 (0.021)
Constant	0.087 (2.962***)	0.035 (0.692)	-0.114 (-1.396)	0.107 (1.332)
R ²	0.679	0.647	0.250	0.199
F statistics	5.177***	4.475***	0.815	0.606

Likelihood 53.185 Akaike Information Criteria -0.575 Schwarz Criteria 1.441

Figures in parentheses are t-values, *significant at 10%, **significant at 5%, ***significant at 1%

Source: Data analysis (2022)

CONCLUSION AND RECOMMENDATIONS

The agricultural sector amongst other sectors has gained significantly from free trade which results from liberalized trade policies as agricultural products need to be more competitive to get expected agricultural production levels. The study found out that an increase in trade openness have the tendency to bring about a resultant increase in output of selected crops except cocoa. This suggests that there is a need for trade liberalization in the agricultural sector in Nigeria so a boost agricultural output and make the sector more competitive. The results of the study suggest some policy recommendations which would be helpful and applicable to the Nigerian economy.

- Nigeria should adopt more policies on trade liberalization like reducing reduce tariffs, reducing or eliminating quotas on agricultural produce that will enable the sector to grow at spectacular rates.
- There is need for Nigeria to specialize in crops where it has comparative advantage so as to maximize gains from trade openness.

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