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## **Trade Liberalization Policy and Competitiveness of Cocoa Beans Exports in Nigeria (1961-2017)**

**Abstract.** The cocoa sector in Nigeria has experienced decline in production, yield, exports coupled with its inability to attain global standards and targets and, gradual loss of competitiveness at the world market. Trade liberalization was government's panacea to the sector's problem although, cocoa competitiveness remains an issue since liberalization. Therefore, the relationship between trade liberalization policy and competitiveness of Nigeria's cocoa exports was examined in this study using data for the period 1961-2017. Cocoa market share was used to measure competitiveness while analytical tools employed were: ADF test, Johansen co-integration test and the vector error correction model (VECM). Market share, quantity of cocoa export and inflation rate were stationary at original level while others, at first difference. The co-integration test showed seven co-integrating equations. Trade liberalization policy was found to be an important driver of competitiveness. In addition, area harvested, production quantity and export quantity positively influenced competitiveness while world price of cocoa, interest rate on agricultural loans, exchange rate and trade liberalization influenced negatively. Therefore, appropriate trade policy formulation and implementation is recommended while, specific attention should be paid to monetary policies and cocoa production by the government.

**Keywords:** cocoa, competitiveness, market share, trade liberalization policy and vector error correction model

**JEL Classification:** F13, F16, F17, F47, Q17

### **Introduction**

Global cocoa production in **2019** stands at about 4.6 million tons of cocoa beans with Africa contributing the largest share to production of 66%, followed by Asia (18%), Americas (15%) and Oceania with 1% (FAO, 2020). Cote d'Ivoire is the largest producer of cocoa with 1.96 million tons which makes up 32% of global production. Ghana follows as the second largest producer in the world with an output of 0.95 million tons which makes up 18% of global production. Indonesia, the third largest producer, contributes 17% of global cocoa production with its output of 0.60 million tons. Nigeria's output of 0.33 million tons makes the country the fourth leading producer of cocoa in the world, contributing 8% of global production (FAOSTAT, 2019). In terms of exports, Cote d'Ivoire and Ghana are the leading cocoa exporters with 1.51 million tons and 0.57 million tons, respectively while Nigeria is the third largest exporter with 0.29 million tons (FAOSTAT, 2019). Most of the cocoa exported are processed into chocolate. Interestingly, none of the largest producers are among the chocolate exporting countries which are led by led by

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Germany, Belgium and France (FAO, 2020). Chocolate trade is a high value industry and substantial foreign exchange earner for exporting countries. For instance, in 2019 the value of Germany's chocolate export is about \$4 billion USD whereas, the United States spends about \$2 billion on chocolate imports annually (FAO, 2020).

In Nigeria, only about three percent of cocoa is consumed domestically while processing into chocolate is not wide spread (FAO, 2012). Cocoa occupied a pride of place in the Nigerian economy between the 1960s and the early 1970s; prior to the oil boom era; along with cotton, groundnut, oil palm and rubber which were principal export crops of the country. The agriculture sector was however generally neglected upon the discovery of oil in Nigeria, causing production and exports of cocoa and other products to decline. In the bid to revamp the cocoa sub-sector, Nigeria became the first African country to liberalize cocoa trade in 1986, following the liberalization of foreign exchange. The government abolished marketing boards in the bid to achieve more efficiency in the system (Abiwon, 2017; Gilbert and Varangis, 2002), although, the liberalization of export crops did not stop the decline in the sector. Cocoa liberalization, led to a decline in use of agricultural inputs and poorer quality of cocoa beans (Nwachukwu *et al.*, 2010). Quality control and export coordination declined creating less opportunities for forward selling, sales by tender and sales on Cost, Insurance, and Freight (CIF) basis. Hence, negative implications set in for the country's market share in the global market.

Decreasing cocoa production in Nigeria can be attributed to low yields, inconsistent production patterns, disease incidence, pest attack, low agricultural mechanization and ageing cocoa trees (Nwachukwu *et al.*, 2010 and Samuel, 2017). Ageing of cocoa trees also contribute to the problem of low productivity while about 60 percent of cocoa farms in Nigeria are over 40 years old. Farms in Southern/southern Eastern Nigeria tend to be younger and generally more productive (Nwachukwu *et al.*, 2010). Low productivity and output have also contributed to Nigeria's inability to meet the daily price of cocoa beans (International Cocoa Organisation - ICCO, 2017). The target of 2129.19 US\$/ton was allotted by ICCO and the country's failure to meet the set target has resulted in huge revenue losses of about US\$ 1 billion annually (NBS, 2017). The country no longer receives premium on cocoa due to the dismantling of the Nigerian cocoa board and relaxation in quality control in the 1990s (Oxfam, 2012). Thus, the country has gradually lost its competitiveness on the world market.

Several studies have dwelt on trade liberalization and Nigeria's cocoa export determinants but few on trade liberalization and determinants of cocoa competitiveness in Nigeria (Taiwo, 2016; Boansi, 2013; Nwachukwu, 2013; Verter and Becvarova, 2014; Yusuf and Akinlade, 2011). These studies assessed cocoa competitiveness between two countries or among a group of countries such as West African countries. This study however, differs from previous studies on Nigeria as it models competitiveness of Nigeria's cocoa as its share in the cocoa world market, that is, using the market share as the index to measure the country's competitiveness. The market share is an appropriate index for comparing competitiveness of a country's product with the rest of the world (Biswajit, 2008). The advantage of using market share over other measures of competitiveness is that it is accurate when dealing with a single product and also, is less dependent upon macro environmental variables such as the state of the economy or changes in tax policy. Further, this study analyzed the effect of trade liberalization policy on the competitiveness of Nigeria's cocoa export, using a more robust and appropriate econometric tool; vector error correction model (VECM); The VECM eigen values ( $\lambda$ ) allow to test cointegration

hypothesis, have a good interpretation with short term and long term equation, offers possibility to apply vector autoregressive model to integrated multivariate time series and also allows for two or more endogenous variables. **Therefore, this study established the trend of Nigeria's cocoa beans market share before and since liberalization, and also investigated some determinants of Nigeria's exports market share of cocoa beans.**

### **Trend in Nigeria's market share of cocoa beans in the World Market before and since trade liberalization**

The pattern of competitiveness for Nigeria's cocoa beans export from 1960-1985 is shown on Figure 1, for the period prior to liberalization, and from 1986-2017 on Figure 2, for the period since liberalization. The trend actually shows that the lowest market shares were attained since liberalization while prior to liberalization higher market share were attained. The trend does not show that market share was on the increase but somewhat stable between 1965-71 and a steady decline till 1983 and then a sharp decline in 1985 or there about when we recorded the highest market share of 30.5% in 1965 as a result of consistent production pattern, increased yield and affordable tax imposed on cocoa farmers. Since the adoption of liberalization policy, Nigeria had been on consistent decline till 2015, where we recorded 2.5% market share and rose a bit to 7.5% in 2016. This may have been as a result of the oil dominated economy, economic variables, political factors and international relationships. The calculation is presented on Table A1.

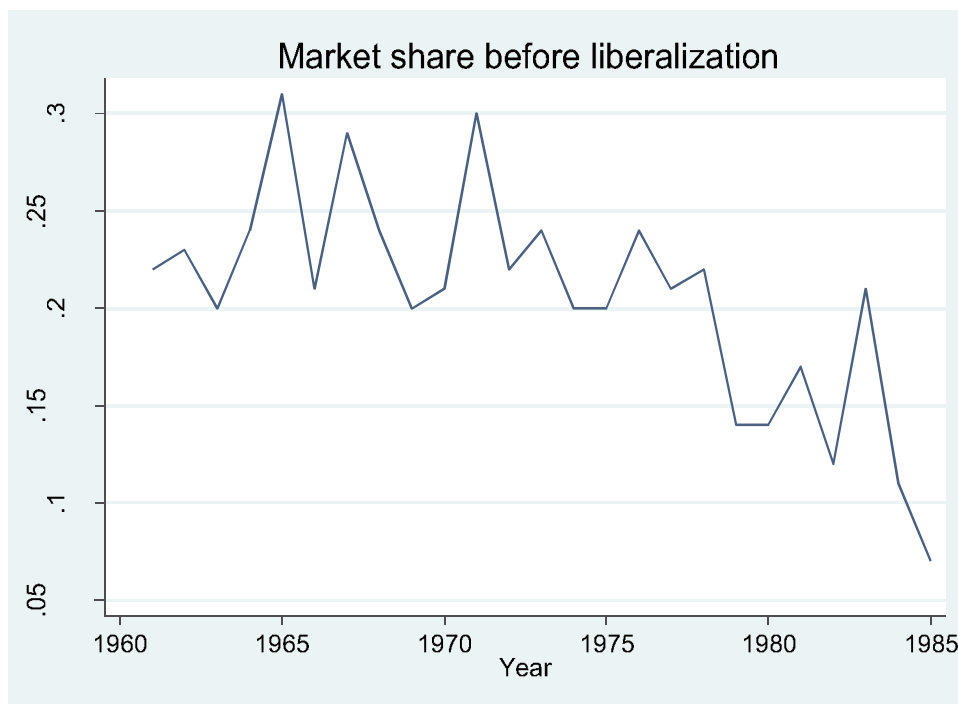


Fig. 1. Nigeria's cocoa beans Market share from 1961-1985

Source: FAO, (2019).

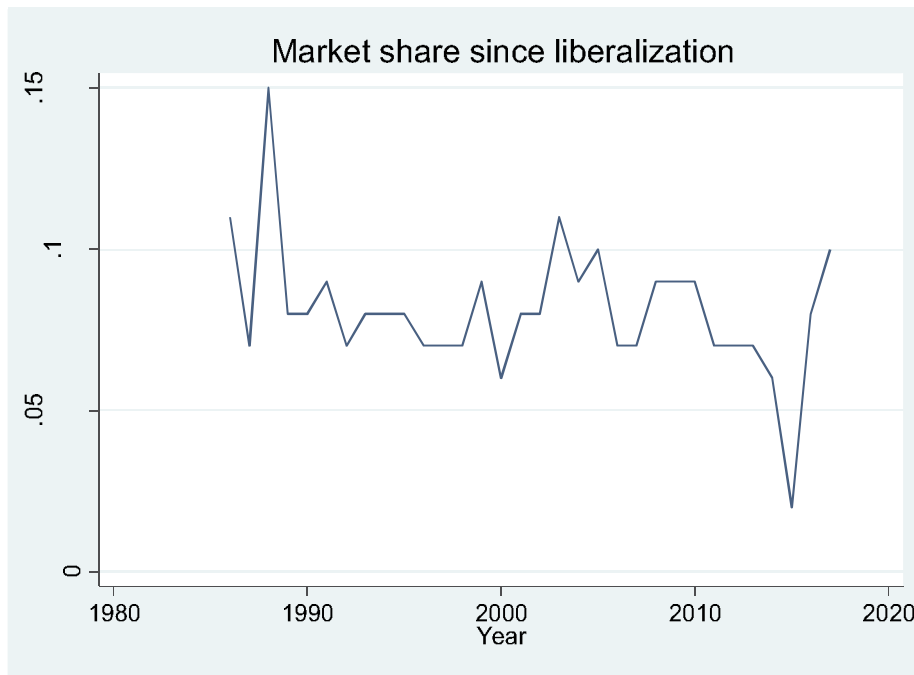


Fig. 2. Nigeria’s cocoa beans Market share from 1986-2017

Source: FAO, (2019).

### Theoretical framework

The Ricardian theory of comparative advantage is used in this study to explain competitiveness. The Ricardian model of international trade proposes that countries specialize in goods in which they hold the greatest relative advantage in total factor productivity. Assuming an industry consisting of a number of firms that produces identical output faces market demand is given by the following:

$$Q_t = Q(P_t, Z_t) \dots \dots \dots (1)$$

Where  $Q$ , is the total quantity demanded,  $P_t$  is the market price,  $Z_t$  is a vector of exogenous variables such as the prices of substitutes and income, and  $t$  is a time subscript. Since  $Q$  and  $P$  are determined simultaneously, the demand function can also be written in inverse form,  $P_t = P(Q_t, Z)$ . Suppose also that the aggregate marginal cost  $t$  facing the industry is given by

$$MC_t = MC(Q_t, W_t) \dots \dots \dots (2)$$

Where  $W_t$  is a vector of exogenous variables such as input costs. Assuming that the industry is perfectly competitive, equilibrium price and quantity will be determined by

$$P_t = P(Q_t, Z_t) = MC_t = MC(Q_t, W_t) \dots \dots \dots (3)$$

More generally, if the industry is imperfectly competitive, equilibrium is where perceived industry marginal revenue equals industry marginal cost. If industry revenue is defined as:

$$R_t = PQ_t = P(Q_t, Z_t)Q_t, \dots\dots\dots(4)$$

The equilibrium condition can be rewritten as:

$$MR(\lambda) = [P(Q_t, Z_t) + dP/dQ_t(Q_tZ_t)Q_t]=MC(Q_t, W_t)\dots\dots\dots(5)$$

$\lambda$  can be interpreted as an index of market power being exerted in an industry, that is, the wedge, in equilibrium, between industry price and industry marginal cost. The value of  $\lambda$  falls in the range  $0 \leq \lambda \leq 1$ ; if the industry is perfectly competitive, the parameter  $\lambda = 0$ , and (4) becomes the usual condition that price equals marginal cost. If the industry is either a monopoly or firms demonstrate perfectly collusive behavior,  $\lambda = 1$ .

## Methodology

### Data sources

Annual time series data obtained from secondary sources covering (1961-2017) was used for this study. Sources include the Central Bank of Nigeria (CBN), Bank of Agriculture (BOA) and Food and Agriculture Organization (FAO).

Market share is the share of total exports of a given product (cocoa beans) from the region under study (Nigeria) in total world exports of the same product (Biswajit, 2008). It is given as:

$$MS_a^i = \frac{XS_a^i}{XS_a^w} \times 100 \dots\dots\dots(6)$$

Where  $XS$  refers to exports, subscript  $a$  to a commodity, and  $i$  to home country, and  $w$  to the world.

### Model specification

Vector Error Correction Model (VECM) was used to analyze trade liberalization policy and competitiveness of Nigeria’s cocoa export. The econometric model for the vector error correction model is:

$$\ln mktsh = \beta_0 + \beta_1 \ln pric_t + \beta_2 \ln area_t + \beta_3 \ln exch_t + \beta_4 \ln prod_t + \beta_5 \ln int_t + \beta_6 \ln exp_t + \beta_7 \ln inf_t + \beta_7 Libr_t + \ln ECM_{t-1} + \mu_t \dots\dots\dots(7)$$

Where:

- $\ln mktsh$  = log of market share for cocoa beans (in tons),
- $\ln pric$  = log of world price of cocoa beans (in US\$),
- $\ln area$  = log of area harvested of Nigeria cocoa (in hectares),
- $\ln exch$  = log of currency exchange rate (in Naira/US\$),
- $\ln prod$  = log of quantity of cocoa produced (in tons),
- $\ln int$  = log of interest rate on agricultural loans (percentage),
- $\ln exp$  = log of quantity of cocoa beans export (in tons),
- $\ln inf$  = log of rate of inflation in the economy (percentage),

*libr* = trade liberalization policy (1= before liberalization and 0= after liberalization),  
*β's* = unknown parameters to be estimated,  
 ECMt = error correction factor.

Table 1. Analysis of variables influencing the competitiveness of Nigeria’s cocoa beans

Variables	Description	Expected sign
<i>lnmktsh</i>	Market share (Dependent variable)	
<i>lnpric</i>	World price of Nigeria cocoa beans (USD)	+/-
<i>lnarea</i>	Area harvested (Hectares)	-
<i>lnexch</i>	Exchange rate (Naira/USD)	-
<i>lnprod</i>	Quantity of cocoa produced in tons	+
<i>lnint</i>	Interest rate on agricultural loans (Percentage)	-
<i>lnexp</i>	Quantity of cocoa beans export (tons)	+
<i>lninf</i>	Inflation rate (Percentage)	-
<i>libr</i>	Trade liberalization policy (1=before liberalization, 0= since liberalization)	-

Source: own Authors’ study.

### Unit root test

Annual time series data is prone to spurious regression results when *x* and *y* series are non-stationary (random walk). Time series data is the difference to produce other sets of observations such as the first-difference and the second-difference values. The order of integration using Augmented Dickey- Fuller (ADF) unit root test (Muhammed, 2008) is presented thus:

- X level  $x_t$
- X 1<sup>st</sup> - differenced value  $x_t - x_{t-1}$
- X 2<sup>nd</sup> - differenced value  $x_t - x_{t-2}$  .....(8)

### Cointegration test

This approach involved the investigation of long run equilibrium relationship among the series that have the same order of integration through the application of the Johansen cointegration test. The model of the cointegration is illustrated as follows:

$$LR_{trace}(r/n) = -T \sum_{i=r+1}^n \ln(1 - \hat{\lambda}_i) \dots\dots\dots(9)$$

$$LR_{max}(r/n+1) = -T \ln(1 - \hat{\lambda}) \dots\dots\dots(10)$$

Where  $\lambda$  is the estimated values of the characteristic roots obtained, and *T* is the sample size or number.



## Results and discussion

The order of integration using ADF unit root tests is revealed on Table 2. The test results showed that three variables (*Lnmktsh*, *Lnexp* and *Lninf*) were stationary at level while six variables (*Lnpric*, *Lnarea*, *Lnexch*, *Lnprod*, *Lnint* and *Libr*) became stationary at first difference.

Table 2. Unit root test result

Variable	I(0)	I(1)
<i>Lnmktsh</i>	-5.276***	-11.942***
<i>Lnpric</i>	-2.947	-9.632***
<i>Lnarea</i>	-2.428	-4.956***
<i>Lnexch</i>	-1.438	-6.025***
<i>Lnprod</i>	-2.724	-10.329***
<i>Lnint</i>	-1.235	-8.016***
<i>Lnexp</i>	-5.173***	-12.616***
<i>Lninf</i>	-4.759***	-6.866***
<i>Libr</i>	-1.848	-7.354***
Critical value		
1%	-4.137	-4.139
5%	-3.494	-3.495
10%	-3.176	-3.177

Note: The asterisks (\*\*\*) denote statistically significant level at 1%.

Source: Authors' Computation.

The result of the Johansen co-integration test is presented on Table 3. The model selection for co-integration was computed using the Schwarz information criterion, known as lag-order selection criteria, where lags of 2 was chosen, as shown on Table A2 and proceed to run the Johansen co-integration test. According to the table, the null hypothesis of no co-integration was rejected by both statistics. The two statistics used showed that the variables have long run relationship since there were seven (7) co-integrating equations.

Table 3. Co-integration test result

Hypothesized No of CE(s)	Trace test k=2		Maximum Eigen value test k=2	
	Statistic	5% critical value	Statistic	5% critical value
None	383.7215	192.89	86.8667	57.12
At most 1	296.8548	156.00	74.5717	51.42
At most 2	222.2832	124.24	63.9514	45.28
At most 3	158.3318	94.15	53.5787	39.37
At most 4	104.7531	68.52	35.1715	33.46
At most 5	69.5816	47.21	29.7374	27.07
At most 6	39.8442	29.68	19.2917	20.97
At most 7	20.5525	15.41	17.0389	14.07
At most 8	3.5136*	3.76	3.5136	3.76

Source: Authors' Computation, 2019.



Table 4. Estimated Vector Error Correction Model

Error Correction	D(Lnmktsh)	D(Lnpric)	D(Lnara)	D(Lnexh)	D(Lnprd)	D(Lnint)	D(Lnep)	D(Lninf)	D(Libr)
Ecm	-0.0120** (2.12)	-0.1861** (-2.37)	-0.0015 (0.05)	0.0553 (1.26)	0.0914* (1.80)	-0.1384*** (-4.07)	-0.0012 (-0.14)	0.9012*** (5.72)	-0.0417 (-1.23)
D(Lnpric (-1))	-0.8349*** (2.74)	-0.4336 (-2.82)	-0.0271 (-0.48)	0.0315 (0.37)	-0.1583 (-1.60)	0.0248 (0.37)	-0.0806 (-0.44)	-0.8347*** (-2.74)	0.0128 (0.19)
D(Lnara (-1))	0.3439** (2.08)	0.9392* (1.82)	-0.2441 (-1.29)	-0.2629 (-0.91)	0.3883 (1.17)	0.0870 (0.39)	0.9515 (1.56)	0.9154 (0.89)	-0.0586 (-0.26)
D(Lnexh (-1))	-0.6409** (-2.18)	-0.3538 (-0.93)	0.0873 (0.63)	-0.0174 (-0.07)	-0.0174 (-0.07)	-0.1246 (-0.76)	0.1125 (0.25)	-1.6409** (-2.18)	0.1299 (0.79)
D(Lnprod (-1))	0.4054** (2.30)	-0.4115 (-1.56)	-0.0053 (0.06)	0.1501 (1.02)	0.1640 (0.50)	-0.3283 (-2.87)	0.0555 (0.18)	1.7839*** (3.40)	-0.0870 (-0.76)
D(Lnint (-1))	-0.4949** (-2.20)	0.4735 (1.36)	0.0794 (0.62)	0.0663 (-0.34)	-0.4949** (-2.20)	-0.1510 (-1.00)	0.0902 (0.22)	1.8897 (-2.73)	0.1852 (1.23)
D(Lnep (-1))	0.8305** (-2.45)	-0.0214 (-0.07)	0.0789 (0.75)	-0.0161 (-0.10)	0.2934 (1.58)	0.2307 (1.86)	-0.8305** (-2.45)	-0.8289 (-1.45)	-0.0481 (-0.39)
D(Lninf (-1))	-0.0786 (-2.51)	-0.0406 (-0.61)	-0.0065 (-0.27)	0.0204 (0.55)	0.0440 (1.02)	-0.0662** (-2.30)	0.0082 (0.11)	-0.1062 (-0.80)	-0.0283 (-0.98)
D(Libr)	-0.8400*** (-2.32)	0.3062 (-0.07)	-0.1064 (-0.64)	0.1334 (0.53)	0.0466 (0.16)	0.2506 (0.20)	-0.2915 (-0.54)	1.2609 (1.40)	-0.0939 (-0.48)
C	0.0208 (0.30)	0.4391 (-0.07)	0.0106 (0.52)	0.0014 (0.05)	0.0028 (0.08)	-0.0114 (-0.48)	0.0125 (0.19)	-0.0020 (-0.00)	0.0216 (0.91)
R-squared	0.6346	0.4391	0.1171	0.2566	0.5500	0.5485	0.5879	0.6099	0.1107
Chi2	60.7765	27.3957	4.6749	12.0816	42.7818	42.5191	49.9287	54.7299	4.3574
P>chi2	0.0000	0.0040	0.9459	0.3575	0.0000	0.0000	0.0000	0.0000	0.9583

Note: Figures in parentheses are z-values associated with the respective parameters.

The asterisks (\*, \*\*, \*\*\*) denote statistically significant level at 10%, 5%, and 1% respectively.

Source: Authors' Computation, 2019.

The result of the vector error correction model is revealed on Table 4. The coefficient of multiple determinations ( $R^2$ ) is 0.6346, implying that 63.46% variation in the dependent variable is explained by the independent variables. The estimation results indicate that the value of ECM to be -0.012. The negative value of the ECM implies that the model is dynamically stable and this implies that 1 percent of the disturbance in the short run is corrected for each year at 12 percent speed of adjustment. The significance of the error correction term supports co-integration and suggests the existence of long run steady equilibrium relationship between competitiveness and its selected determinants specified in the model. The coefficient of world price of cocoa beans in US\$ is negative and significant at ( $p \leq 0.01$ ), indicating that a dollar increase in the world price will lead to a fall in Nigeria's market share by 83.46%. This result corroborates the findings of Asante-Poku and Angelucci (2013) who found similar effect of world price on competitiveness. The coefficient of area harvested is positive and significant ( $p \leq 0.05$ ), implying that a percentage increase in hectares of land harvested will lead to 34.39% increase in Nigeria's market share. This result supports the result of Onwusiribe and Okpokiri, (2015). The coefficient of exchange rate is negative and significant ( $p \leq 0.05$ ), meaning that a percentage increase in

exchange rate will lead to 64.09% decrease in Nigeria's market share. This result is in accordance with Yusuf and Yusuf (2007); Okoruwa *et al.*, (2003). The coefficient of production quantity is positive and significant ( $p \leq 0.05$ ), implying that a percentage increase in quantity of cocoa produced will lead to 40.54% increase in Nigeria's market share. This result supports the result of Nwachukwu (2013) and Boansi (2013). The coefficient of interest rate on agricultural loan is negative and significant ( $p \leq 0.05$ ), indicating that a percentage increase in interest rate on agricultural loan will lead to 49.49% decrease percent in Nigeria's market share. This result is in consonance with the findings of Taiwo (2016). The coefficient of export quantity is positive and significant ( $p \leq 0.05$ ), this implies that a percentage increase in quantity of cocoa exported will lead to 83.05% increase in Nigeria's market share. This result supports the result of Nwachukwu (2013). The coefficient of the trade liberalization policy which is a dummy variable is negative and significant ( $p \leq 0.01$ ), revealing that market share of cocoa beans is lower since liberalization at about 84% compared to before liberalization. This result affirms the result of Taiwo (2016); Yusuf and Akinlade (2011).

## Conclusion

Having investigated the effect of trade liberalization policy on the competitiveness of Nigeria's cocoa export, it is established that trade liberalization policy significantly influences cocoa competitiveness. Further, it is established that increasing area harvested, production quantity and export quantity while lowering interest rates and exchange rates will improve cocoa competitiveness in the long run. This study therefore recommends appropriate governance framework that would institutionalize best practices in policy formulation and implementation. Also, government should pay specific attention to cocoa production and monetary policies such as exchange rates and interest rates, since increase in these rates reduce the country's market performance.

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## Appendix I: Pre-estimation tests results

Table A1. Nigeria's Cocoa beans market share estimate (1961-2017)

Year	Production (metric tons)	Cocoa beans export (metric tons)	World export (metric tons)	Market Share (%)
1961	197000	186860	836594	22.34
1962	182000	197770	845671	23.39
1963	223000	177410	872117	20.34
1964	298300	199980	846971	23.61
1965	184600	305550	1000579	30.54
1966	267200	193252	935942	20.65
1967	238000	248181	847324	29.29
1968	191800	208882	857088	24.37
1969	220800	173605	847840	20.48
1970	304800	195907	939228	20.86
1971	256600	271738	920823	29.51
1972	241100	227532	1023248	22.24
1973	215000	213897	896119	23.87
1974	214000	197125	999538	19.72
1975	216000	194692	964933	20.18
1976	181000	222966	924749	24.11
1977	193000	167521	803752	20.84
1978	157000	192761	891896	21.61
1979	151000	114147	814074	14.02
1980	153000	133861	929698	14.40
1981	174000	194567	1135901	17.13
1982	156000	136656	1112170	12.29

Year	Production (metric tons)	Cocoa beans export (metric tons)	World export (metric tons)	Market Share (%)
1983	140000	206024	993126	20.75
1984	160800	130800	1209994	10.81
1985	160000	92891	1290673	7.20
1986	148000	148426	1407397	10.55
1987	150000	106000	1503199	7.05
1988	253000	211766	1453485	14.57
1989	256000	138940	1765246	7.87
1990	244000	147915	1745208	8.48
1991	268000	155691	1737686	8.96
1992	292000	108024	1656655	6.52
1993	306000	152079	1957842	7.77
1994	323000	142361	1723045	8.26
1995	203000	132713	1686711	7.87
1996	323000	170009	2340492	7.26
1997	318000	140000	2005404	6.98
1998	370000	128065	1962488	6.53
1999	225000	196377	2245728	8.74
2000	338000	139000	2361064	5.89
2001	340000	175272	2210735	7.93
2002	362000	180723	2258244	8.00
2003	385000	230560	2169035	10.63
2004	412000	255000	2783119	9.16
2005	441000	267700	2709346	9.88
2006	485000	189500	2831203	6.69
2007	360570	174900	2582310	6.77
2008	367020	227303	2445928	9.29
2009	363510	247000	2741787	9.01
2010	399200	226634	2464381	9.20
2011	391000	219000	3086407	7.10
2012	383000	199800	2772787	7.21
2013	367000	182900	2532084	7.22
2014	248000	189985	3088306	6.15
2015	195000	76197	3157669	2.41
2016	236521	227494	3022663	7.53
2017	219841	297984	3767207	7.91

Source: Computed from FAOSTAT, (2019).

Table A2. Lag order selection criteria

Lag	Log L	LR	FPE	AIC	HQIC	SBIC
0	-22.7045		0.148335	0.92959	0.944065	0.967469
1	-10.5354	24.338	0.095727	0.491585	0.520534	0.567343
2	-8.1321	4.8066	0.09061	0.436553	0.479977*	0.55019*
3	-7.93889	0.38641	0.09354	0.468192	0.52609	0.619708
4	-5.87792	4.1219*	0.089756*	0.426585*	0.498959	0.61598

Source: Authors' Computation, 2019.

## Appendix II: Post-estimation tests results

Table A3. Diagnostic test results

Tests	F-statistics	Probability
Breusch-Pagan Heteroscedasticity test	1.10	0.2950
Ramsey Reset test	2.37	0.0853
Durbin Watson test	2.614042	

Source: Authors' Computation, (2019).

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