DETERMINANTS OF CASHEW NUTS EXPORTS SUPPLY IN NIGERIA (1980-2020)

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Abstract

Cashew is an emerging agricultural export crop in Nigeria. However, significant export earnings have not been recorded in recent years from cashew exports. The study investigated the determinants of the cashew nuts export supply in Nigeria between 1980 and 2019. Secondary data extracted from the publications of the Food and Agriculture Organization statistical database (FAOSTAT), the National Bureau of Statistics (NBS), and the Central Bank of Nigeria (CBN). Means, percentages, and coefficient of variations were the descriptive statistical tools used, while Augment Dickey-Fuller (ADF), Johansen co-integration and vector error correction model (VECM) were the inferential statistical tools employed in the study. ADF and Johansen's results show that the variables of the model were stationary after the first difference and co-integrated. Domestic production export supply and earnings fluctuated over the period of the study with a mean of 247,560.70 tonnes, 33,010.22 tonnes, and ₦47,462.43 million respectively. The average annual growth rate of cashew nuts production, export supply, and export earnings was 197.98 percent and 565.79 percent respectively VECM result reveals that domestic cashew nut production and exchange rate have asymmetric influence and cashew nuts export supply in the short run, while agricultural land area, cashew nuts production and inflation rate negatively influence cashew nuts export supply in the short run, but exchange rate positively influences cashew nut export supply in the long run. It is concluded that agricultural land area domestic production, of cashew nuts, exchange, and inflation rate significantly influence the export supply of cashew nuts in the study area. Thus, significant policy reform on the production of cashew nuts, exchange, and the inflation rate would improve exports supply of cashew nuts significantly.

Key words: *cashew nuts, value addition, exchange and inflation rates, error correction mechanism*

INTRODUCTION

Cashew is an important crop in the agriculture of many countries. According to Food and Agriculture Organisation (FAO), Nigeria ranks among the top five cashew-producing nations after Ivory Coast, India, Burundi and Vietnam. Other countries facing poverty, like Benin and Indonesia, cultivate cashew to diminish its effect and bring income to producers [8, 16].
In 2014, Nigeria was ranked the second largest producer of cashew with an annual production of 836,500 tonnes, behind Vietnam which was the highest producer with 1,190,900 tonnes [11]. Three main cashew products are traded in the international market: raw nuts, cashew kernels, and cashew nut shell liquid (CNSL) [3] and [5].

Annually, Nigeria generated ₦24b in 2012 from the cashew trade, providing about 600,000 jobs to people engaged in the cashew value chain [1]. Health-wise, cashew is of immense benefits; cashew apple contains five times more vitamin C than an orange which makes them unique among other fruits [2]. The apple is also used traditionally as a curative for scurvy and stomach ailments like dysentery and diarrhea. Fresh or distilled, it is a potent diuretic, possessing antiscorbutic properties, and is useful for kidney troubles and in advanced cases of cholera. Clinically, cashew nut consumption has also been proven to improve sperm count and reduce infertility among couples [20] and [9].
Cashew nut contains 47% fat, 21% protein, and 22% carbohydrate [19] and [23].

Cashew is widely cultivated in Nigeria with production spanning 27 out of 36 States in all the geo-political zones. The production of cashew nuts is estimated to be about 100,000 tons of raw nuts per annum. About 60 to 70% of the local output is commercialized of which about 90% is exported as raw nuts [21]. Cashew is a high-potential export-oriented agricultural crop and represents 7 to 8% of non-oil export earnings [13]. Despite the dominance of this crop in many states, yield per hectare is not encouraging.

According to [11], Nigeria's yield in terms of cashew nuts is relatively low at 23, 922 kg/ha in 2016, when compared to yields from other countries within the same period such as Peru (47,756 kg/ha), Philippines (75,521 kg/ha), Vietnam (43,447kg/ha) and Mexico (24,971 kg/ha). The yield potential is yet to be actualized as a result of varied factors ranging from low-yielding plantations to inadequate farm management, processing facilities, and marketing problems.

The average nut yield of a mature tree is in the range of 7-11 kg per annum [6]. Cashew is largely produced on small scale, and the average delivery per farmer is roughly 300kg per hectare per season. The export free on board price of raw cashew nuts has fluctuated between US$3,000 - 3,500 per tonne from January to August 2010, while the local market price of cashew nuts per ton ranges from US$2,667 to 3,333 (₦400,000.00 to ₦500,000.00) to deliver it to Lagos, Nigeria, point of export (1 USD = 150 NGN) [4] and [5].

Annually, Nigeria's export earnings from cashew nuts ranged from Nigeria varies from US$ 25 to 35 million. However, low-value addition has resulted in a low supply of high-quality cashew nuts with Nigerian raw nuts prices discounted in the world market (20% to 30%) compared to those of neighboring countries [22]. Cashew is a strategic export-oriented crop in Nigeria capable of providing enormous foreign exchange earnings and employment opportunities and curb desertification in Nigeria. The crop is of industrial importance in Nigeria, with rising demand in the confectioneries, food, and beverage industries. There is also an increasing demand for cashew nuts in the global market. Sustainable production and continuous rise in cashew nuts export earnings will rely on the production, export supply, international competitiveness, and the outcomes of policy interventions [15].

From the foregoing, the study investigated the determinants of cashew export supply in Nigeria between 1980 and 2020. The specific objectives of the study are to: examine the trend in cashew nuts production in Nigeria, examine the trend in cashew nuts export supply in Nigeria, examine the trend in the contribution of cashew nuts to agricultural exports in Nigeria, and determine the effect of significant factors on cashew nuts export supply in Nigeria during the period covered by the study.

MATERIALS AND METHODS

The study area for this research is Nigeria. Nigeria lies between 40 and 140 North of the equator and between longitudes 30 and 150 east of Greenwich. Nigeria has a total land area of 923,768.622 km or about 98.3 million hectares, and a population of 149,229,090140 million people (National Population Commission (NPC), 2009 [18]. It is bordered in the West by the Republic of Niger and the Republic of Benin, and on the East by the Republic of Cameroon. On the North, she shares her border with the Republic of Niger and the Chad Republic, and on the South the Gulf of Guinea.

The data for this research were in annual time series. The data set was obtained from secondary sources. These sources will include publications of the Central Bank of Nigeria (CBN) [7], the National Bureau of Statistics (NBS) [17], and Food and Agriculture Organization (FAO) Statistics (FAOSTAT) [10, 11, 12], International Trade Commission, ITC [14]. Specifically, data were collected on agricultural land area, cashew nuts production and export quantities, inflation rates, exchange rates, producer, and export and world prices of cashew nuts. The period for data analysis is between 1980 and 2019.

This study employed a number of analytical methods based on the objectives of the study

as stated earlier. These include: means, standard deviation, coefficients of variation, percentages, and average growth rate. These were used to describe trends in cashew nuts production and export quantities.

The Augmented Dickey-Fuller statistics were used to examine the stationarity of time series data. Johansen's method was used in verifying co-integration among the variables of the model. The error correction mechanism (ECM) was used to investigate the determinants of cashew nut export supply over the study period. The implicit model that was utilized in this study is specified as:

$$\Delta LnY_t = \alpha_1 + \alpha_2 \Delta lnY_{t-1} + \alpha_3 \Delta lnX_{2t-1} + \alpha_4 \Delta lnX_{3t-1} + \alpha_5 \Delta lnX_{4t-1} + \alpha_6 \Delta lnX_{5t-1} + \alpha_7 \Delta lnX_{6t-1} + \lambda_1 ECT_{t-1} + u_{t1} \dots\dots\dots\dots\dots\dots(1)$$

where:
Y is the export supply of cashew nuts in metric tonnes
X_1 is the agricultural land area in square kilometres
X_2 is cashew nuts production quantity measured in metric tonnes
X_3 is the exchange rates was measured as amount of Naira exchanged for United States Dollar
X_4 is the interest rate in the economy measured in percentage
X_5 is the inflation rate in the economy measured in percentage
ECM_t is the error correction factor.
Δ is the difference operator
$t-1$ is the lagged values of variables
Ln is the logarithm operator
U_{ts} are stochastic random errors
$\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6,$ and λ_1 are parameters to be estimated.

RESULTS AND DISCUSSIONS

Trend in cashew nuts production in Nigeria (tonnes)

The trend in cashew nuts production in Nigeria between 1980 and 2020 is shown in the Table 1 and Figure 1. The result in the table reveals an increasing trend in cashew nuts production over the sub-periods

averaging 247,560.70 tonnes between 1980 and 2020. However, the average annual growth rate of cashew nuts production stagnated between 1980 and 1989, improved significantly between 1990 and 1999, but suffers a serious decline in the 2000-2009 sub-period. The trend in the coefficient of variation shows a high degree of instability in cashew nuts production during the study period.

Table 1. Trends in cashew nuts production in Nigeria (1980-2020) (tonnes)

Sub-periods	Mean (tonnes)	Annual percent growth rate (%)	Coefficients of variation (%)
1980-89	2,500	00.00	0.00
1990-99	118,900	129.00	106.98
2000-09	59,926.60	71.67	571.71
2010-20	2,554,416.30	87.37	73.21
All Period	247,560.70	300.00	104.40

Source: Computed from FAOSTAT, NBS and CBN Statistical Bulletin, 2021 [10, 11, 12, 17, 7].
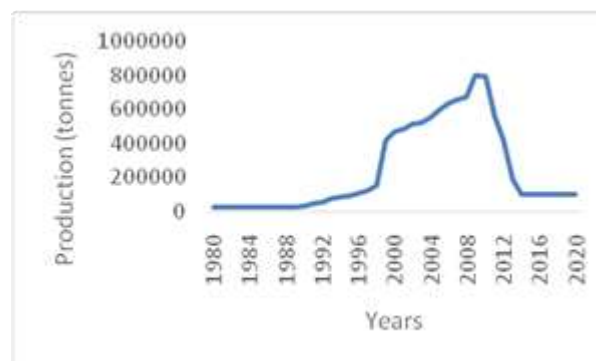

Fig.1. Trends in cashew nuts production (tonnes) in Nigeria (1980-2020)
Source: FAOSTAT, 2021 [12].

Trend in cashew nuts export supply (tonnes) in Nigeria

Table 2 and Figure 2 present the trend in the export supply of cashew nuts in Nigeria from 1980 to 2019. The table shows that the average export supply of cashew nuts fluctuated between 1980 and 2020. Average supply of cashew nuts ranged from 3,110.40 tonnes in the 1980-1989 sub-period to 95,961.70 tonnes in the 2010 to 2020 sub-period averaging 33,010.22 tonnes for the entire study period. The average annual growth rate of the export supply of cashew nuts decrease and increase alternately across the sub-periods, averaging 197.98 percent

over the study period. The trend in the coefficients of variation reveals a high degree of instability in cashew nuts over the study period.

Table 2. Trend in cashew nuts export supply in Nigeria (1980-2020) (tonnes)

Sub-period	Mean (Tonnes)	Annual percentage change (%)	Coefficient of variation (%)
1980-89	3,110.40	847.70	86.11
1990-99	17,052.80	260.16	176.48
2000-09	15,916.80	532.88	243.29
2010-20	95,961.70	290.99	138.48
All period	33,010.22	197.98	152.36

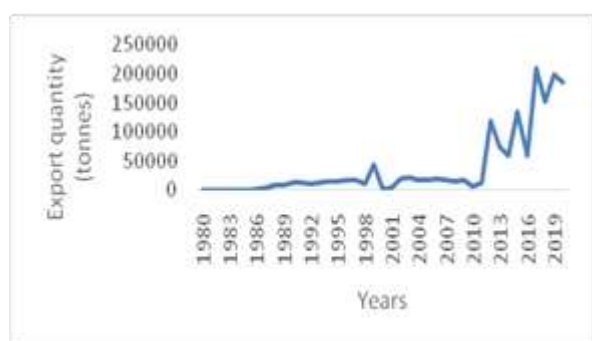Source: Computed from FAOSTAT, NBS and CBN Statistical Bulletin, 2021 [10, 11, 12, 17, 7].

Fig. 2. Trend in cashew nuts export supply (tonnes) in Nigeria (1980-2020)
Source: FAOSTAT, 2021 [12].

Trend in cashew export earnings in Nigeria
The trend in cashew nut export earnings is presented in Table 3 and Figure 3.
Results in Table 3 and Figure 3 reveal an alternating increase and decrease in average cashew nut export earnings across the sub-periods, with an average of $47,462.43 thousands for the entire study period.
However, the average annual growth of cashew nut export earnings increases progressively across the sub-periods, averaging 565.75 percent over the entire period of the study.

Table 3. Trend in cashew nuts export earnings in Nigeria (1980-2020) (₦millions)

Sub-periods	Mean ($)	Annual percent growth rate (%)	Coefficients of variation (%)
1980-89	1,917.10	128.00	81.62
1990-99	10,344.40	766.55	114.43
2000-09	8,703.70	369.83	244.08
2010-20	168,884.43	402.91	11.46
All Period	47,462.43	565.75	30.58

Source: Computed from FAOSTAT, NBS and CBN Statistical Bulletin, 2021 [10, 11, 12, 17, 7].

The coefficient of variation range from 11.46 percent in the 2010-2020 sub-period, with an overall mean of 30.58 percent for the duration of the study, showing a high degree of instability in cashew nuts export earnings over the study period.
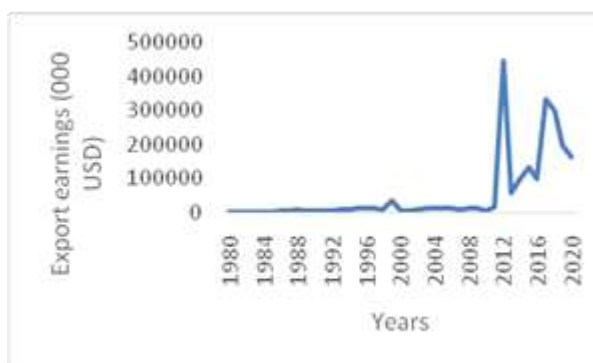

Fig. 3. Trend in cashew nuts export earnings ('000 USD) in Nigeria (1980-2020)
Source: FAOSTAT, 2021[12].

Results of time series analysis
Unit root test
In analyzing time series data, it is pertinent to examine the behavior of the data set over the analytical period. An important factor in this regard is to confirm if the series is stationary over time or if they are time-invariant. If the series is not stationary over time, it is evidence that the series contains a unit root or not. The presence of a unit root (when the data is not stationary) in a time series will lead to spurious results if such a series is used in regression analysis. Therefore, non-stationary time series data must be converted to a stationary form before they can be used in regression analysis for the results to be valid for statistical inference and policy recommendations.
The unit root test results using the Augmented Dickey-Fuller (ADF) technique are presented in Table 4. The table reveals that the variables of the model are not stationary in their original values, since the ADF statistics are less than critical values at 1%, 5%, and 10% respectively. Under this condition, the null hypothesis of the presence of unit roots in the variables of the model cannot be rejected. The variables cannot be used for regression analysis in their original form because they will give spurious results.

Table 5 presents the ADF unit root tests of the first difference of the variables of the model. The table shows that the ADF statistics are greater than the critical values at 1%, 5%, and 10% respectively. Hence, the null hypothesis of the presence of a unit root can be rejected. Thus, the variables of the model in their first difference form can be used for regression analysis because the results will be valid for statistical inference and policy formulation.

Table 4. Results of ADF unit root test for variables (original values)

Variables	ADF value	Mackinnon critical values			Decision
		1%	5%	10%	
LnY	-3.02	-3.67	-2.97	-2.62	Non-stationary
lnX_1	-1.61	-3.67	-2.97	-2.62	Non-stationary
lnX_2	-2.30	-3.75	-3.00	-2.63	Non-stationary
lnX_3	-2.11	-3.75	-3.00	-2.63	Non-stationary
lnX_4	-3.13	-3.75	-3.00	-2.63	Non-stationary
lnX_5	-3.47	-3.75	-3.00	-2.63	Non-stationary

Source: Data Analysis, 2021.

Table 5. Result of ADF unit root test for variables (first difference values)

Variables	ADF value	Mackinnon critical values			Decision
		1%	5%	10%	
$DlnY$	-7.88	-3.68	-2.97	-2.62	I(1)
$dlnX_1$	-5.03	-3.68	-2.97	-2.62	I(1)
$dlnX_2$	-4.45	-3.68	-2.97	-2.62	I(1)
$dlnX_3$	-5.02	-3.68	-2.97	-2.62	I(1)
$dlnX_4$	-6.10	-3.68	-2.97	-2.62	I(1)
$dlnX_5$	-4.62	-3.68	-2.97	-2.62	I(1)

Source: Data Analysis, 2021.

Co-integration test
The results of the Johansen co-integration test of the variables of the model are presented in Table 6. The results reveal that there is 1 co-integrating equation among the variables of the model. This reflects a long-run relationship among the variables of the model. Therefore, they can progress to vector error correction (VECM) regression analysis.

Table 6. Results of Johansen tests for co-integration

Maximum rank	Parms	LL	Eigen value	Trace statistics	5% critical value
0	42	-1271.7593		105.8961	94.15
1	53	-1252.7836	0.64146	67.9447*	68.52
2	62	-1238.1584	0.54641	38.6942	47.21
3	69	-1228.912	0.39335	20.2015	29.68
4	74	-1220.8324	0.35386	4.0423	15.41
5	77	-1218.8267	0.10275	0.0307	3.76
6.	78	-1218.8113	0.00083		

Source: Data Analysis, 2021.

Results of vector error correction model (VECM)
Results of short-run vector error correction model (VECM) regression analysis
The results of the short-run results of vector error correction mode (VECM) regression analysis are presented in Table 7.
Results in the Table show that the value of R^2 is 0.75 and is statistically significant at 1% level, showing that the estimated model has a good fit.

The error correction factor (-0.950) is negative and statistically significant at a 1% level as expected.
Short-run results show that the coefficient of cashew nuts production (X_2) is negative and statistically significant at the 1% level showing that the variable is inversely related to the export supply of cashew nuts (Y).
However, the coefficient of the exchange rate is positive and statistically significant at the 10% level, showing that an improved

exchange rate will stimulate an increased export supply of cashew nuts (Y).

Table 7. Short run vector error correction model regression analysis results

Variables	Coefficients	Standard error	z-value	p-value
Ce_1	-0.955	0.289	-3.40	0.01*
Export supply of cashew nuts (Y)	-0.394	0.189	-2.08	0.037**
Agricultural land area (X_1)	23,324.400	19559.800	1.190	0.233
Cashew nuts production quantity (X_2)	-0.217	0.058	-3.77	0.000*
Exchange rate (X_3)	515.134	284.312	1.81	0.007*
Interest rate (X_4)	320.828	980.404	0.330	0.743
Inflation rate (X_5)	259.437	255.110	1.020	0.309
Constant	-1,623.513	4741.363	-0.340	0.732
R^2	0.750			
Chi-square	88.716*			
p-value	0.000			
AIC	77.425			

* mean significant at 1% level
** mean significant at 5% level
Source: Author computation 2021

Results long - run vector error correction model (VECM) regression analysis
The long-run results of the VECM regression analysis are shown in Table 8. From the Table, long-run results reveal that agricultural land area (X_1), cashew nuts production (X_2), and inflation rate (X_5) negatively affect the export supply of cashew nuts, while exchange rate (X_3) positively affects the export supply of cashew nuts in the study area.

Table 8. Long run vector error correction model regression analysis results

Variables	Coefficients	Standard error	z-value	p-value
Export supply of cashew nuts (Y)	1	-	-	-
Agricultural land area (X_1)	-14,735.010	6138.52	-2.40	0.016*
Cashew nuts production quantity (X_2)	-0.045	0.017	2.540	0.011*
Exchange rate (X_3)	596.160	125.218	4.760	0.000*
Interest rate (X_4)	41.907	657.903	0.330	0.949
Inflation rate (X_5)	631.955	183.599	3.44	0.001*
Constant	-120979.300			-

*mean significant at 1% level
Source: Author Computation, 2021.

CONCLUSIONS

Based on findings from the study, it is concluded that domestic production of cashew nuts and macroeconomic variables (exchange and inflation rate) significantly influence the export supply of cashew nuts in the study area. Hence, policy measures should ensure the production of high-quality cashew nuts that will command a premium price in the international market that will improve earnings from cashew nuts exports. Furthermore, there is a need to ensure a macro-economic friendly environment for cashew nuts exports through effective and efficient monetary policies on macro-economic variables such as exchange rate and interest rate in order to improve earnings from cashew nuts exports significantly.

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