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IMPACT OF EXCHANGE RATE VOLATILITY ON SELECTED CROPS (COCOA, RUBBER and CASHEW) EXPORT PERFORMANCE IN NIGERIA (1980-2016): A GARCH APPROACH

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ABSTRACT

The study investigated the impact of exchange rate volatility on the export performance of selected agricultural products mainly cash crops in Nigeria using time series data from 1980 to 2016. The selected agricultural commodities were cocoa, rubber, and cashew. The study used the Granger causality test, GARCH, and OLS regression models for the data analyses. From the results, the GARCH test for volatility revealed that the exchange rate was highly volatile for the period of study. The Granger causality test showed that a unidirectional causality from exchange rate volatility to export performance of cocoa and rubber existed, while the causality between exchange rate volatility and export performance of rubber was bidirectional. For the OLS regression analysis, it was found that exchange rate volatility had a significant impact on the export performance of cocoa, rubber, and cashew which led to the conclusion that exchange rate volatility is an important factor to consider in export trade. Based on the findings, it was recommended that monetary authorities should adopt a mechanism that will lead to the stability of the exchange rate.

Keywords: *Exchange Rate, Volatility, Selected Cash Crops, Export, Performance*

INTRODUCTION

Exchange rate is the price of one country's currency expressed in terms of some other currencies. It determines the relative prices of domestic and foreign goods, as well as the strength of external sector participation in international trade. In Nigeria, the exchange rate has changed within the time frame from regulated to deregulated regimes.

Ewa (2011) opined that the exchange rate of the naira was relatively stable between 1973 and 1979 during the oil boom era and due to the stability of the naira, agricultural products accounted for more than 70% of the nation's gross domestic product (GDP). In 1986 the Federal government adopted the Structural Adjustment Policy (SAP). The country moved from a peg regime to a flexible exchange rate regime where the exchange rate is left completely to be determined by market forces but rather, the prevailing system is the managed float whereby monetary authorities intervene periodically in the foreign exchange market to attain some strategic objectives (Mordi, 2006). This inconsistency in policies and lack of continuity in exchange rate policies aggregated the unstable nature of the naira rate (Gbosi, 2005).

In Nigeria, agricultural exports have played a prominent role in economic development by providing the needed foreign exchange earnings for other capital development projects. From the initial trade in Palm oil, Nigeria's agricultural exports have enlarged to include cocoa beans and palm kernels. Available statistics indicate that in 1960, agricultural export commodities contributed well over 75% of total annual merchandise exports (Ekpo and Egwaikhide 1994). Nigeria also ranked very high in the production and exportation of some major crops in the world in the 1940s and 1950s. For instance, Nigeria was the largest exporter of palm oil and palm kernel, ranked second to Ghana in cocoa, and occupied a third position in groundnut. Olayide and Essang (1976) observed that Nigeria's export earnings from major agricultural crops contributed significantly to the Gross Domestic Product (GDP). Similarly, Ekpo and Egwaikhide (1994) observed a long-term relationship between agricultural exports and economic growth in Nigeria.

In literature, there seems to be a consensus view on the fact that devaluation or depreciation could boost domestic production by stimulating the net export components. This assertion has mixed support as evidenced in our empirical study. Many authors argue that devaluation most of the times leads to contractionary growth of the economy. Based on this fact, we found the need to research the subject matter.

METHODOLOGY

Prior to modeling the exchange rate return series, we determined the order of integration of the variables. We employed the Augmented Dickey-Fuller (ADF) and the test was based on the following regression:

$\Delta yt = \emptyset + \beta t + \alpha yt\text{-}1 + \sum_{i=1}^{k} di\, \Delta yt - 1 + ut$ ……..**(1.1)**

Where u is a white noise error term and $\Delta yt\text{-}1 = yt\text{-}1 - yt\text{-}2$

$\Delta yt\text{-}2 = yt\text{-}2\text{-}yt\text{-}3$, ... **(1.2)**

GARCH MODEL (General Autoregression Conditions Heteroscedasticity) Model:

There are several GARCH specifications for modeling the conditional variance, or volatility of a variable. Generalizing this, the standard GARCH specification is expressed as:

$yt = \alpha + \sum_i^k = 1ni\ Xt - 1\ \in t$……..... **(1.3)**

$\partial = \sqrt{\frac{1}{N}\sum_{\mathrm{i}}^{\mathrm{N}} = 1\ (\mathrm{Xi} - \mathrm{X})2}$……..**(1.4)**

$\partial^2{}_{\mathrm{t}} = \mathrm{w} + \sum_i^p = 1\ di \sum_t^2 - i + \sum_i^e = 1\ \beta 0t2 - 1$……. .**(1.5)**

Causality Test Model

The model of the causality test is thus specified as follows:

EXPORT = $\sum \emptyset i$ EXCRt-1 + $\sum$Øj Export$_{t-1}$ +u_t1 ……. **(1.6)**

EXCR = $\sum \emptyset i$ EXCR$_{t-1}$ + $\sum_{dj}$ EXPORT$_{t-1}$ + U_t2 ……..... **(1.7)**

From the model, it is expected that $\emptyset i$ = 0, $\emptyset i \neq 0$, ai = 0 and dj ≠ 0. ($\emptyset i$and di are expected to be statistically insignificant whereas Øj and dj are expected to be statistically significant. However, if the estimates of the parameter turn up with signs or size not conforming to economic theory, they should be rejected, unless there is a good reason to believe that in the particular instance, the principles of economic theory do not hold.

RESULTS AND DISCUSSION

Table 1: Presentation of Data
The data used for the study is as follows:

Table 1: Data used for the analysis

Year	Value of cocoa exports (₦' Billion)	Value of rubber export (₦' Billion)	Value of cashew export (₦' Billion)	Exchange rate ₦/USD
1980	1.32	0.16	0.90	0.61
1981	2.01	0.19	0.70	0.61
1982	1.56	0.12	0.40	0.67
1983	1.68	0.18	0.30	0.72
1984	1.82	0.23	0.20	0.76
1985	6.23	1.31	0.30	0.89
1986	7.35	1.69	0.70	2.02
1987	7.82	3.36	1.00	4.02
1988	7.46	3.58	1.30	4.53
1989	1.99	3.35	2.20	7.39
1990	2.04	3.65	2.31	8.03
1991	6.00	3.58	5.00	9.90
1992	5.99	3.79	6.60	17.29
1993	4.73	1.34	6.30	22.05
1994	61.95	1.01	31.00	21.88
1995	71.40	96.10	21.40	21.88
1996	94.79	2.49	35.10	21.88
1997	48.12	12.22	32.70	21.88
1998	69.18	62.63	35.40	21.88
1999	172.20	13.13	38.50	92.69
2000	258.44	12.31	54.30	102.10
2001	273.06	126.98	82.20	111.94
2002	257.67	140.10	38.10	120.97
2003	305.01	116.44	37.70	129.35
2004	312.11	17.89	38.80	133.50
2005	94.79	2.44	44.30	132.14
2006	48.12	12.22	62.50	128.65
2007	59.68	62.63	115.50	125.83
2008	170.10	13.12	117.20	118.56
2009	268.44	12.31	84.00	148.88
2010	263.06	126.97	93.30	150.29
2011	247.67	139.11	117.40	153.86
2012	305.01	116.44	155.70	157.49
2013	312.11	17.89	242.20	157.31
2014	163.39	197.92	455.60	158.55
2015	194.01	141.62	393.10	193.27
2016	354.27	262.41	273.60	253.49

Source: National Bureau of Statistics; Central Bank of Nigeria Statistical Bulletin; Food and Agriculture Organization (FAO), FAOSTAT website.

The trend analysis was done for each of the variables as follows in Figures 1, 2, and 3:

Cocoa exports

Figure 1 captures the trend of the export performance of cocoa as follows:

From Fig 1, the value of cocoa exports maintained a steady increase from ₦1.32 billion in 1981 to ₦7.82 billion in 1987. By 1988, the value of cocoa exports slightly decreased to ₦7.46 billion and further decreased to ₦1.99 billion in 1989. In 1990, the figure rose to ₦2.04 billion which further increased to ₦5.99 billion, ₦61.95 billion, and ₦71.40 billion in 1992, 1994, and 1996 respectively. The aggregate value for cocoa exports fell to ₦59.68 billion in 1998 increasing to ₦268.44 billion in 2000 and slightly declined to ₦247.67 billion in 2002. By 2005, the figure dipped to ₦94.79 billion and further to ₦48.12 billion in 2006. From the 2006 figure, the value began to rise again to ₦59.68 billion, ₦172.20 billion, and ₦268.44 billion in 2007, 2008 and 2009 respectively. By 2013, the figure had reached ₦312.11 billion which later dropped to ₦163.38 billion and ₦194.00 billion in 2014 and 2015 respectively. The figure shows that the 2016 figure marked the peak of cocoa export value as it reached the highest of ₦354.26 billion.

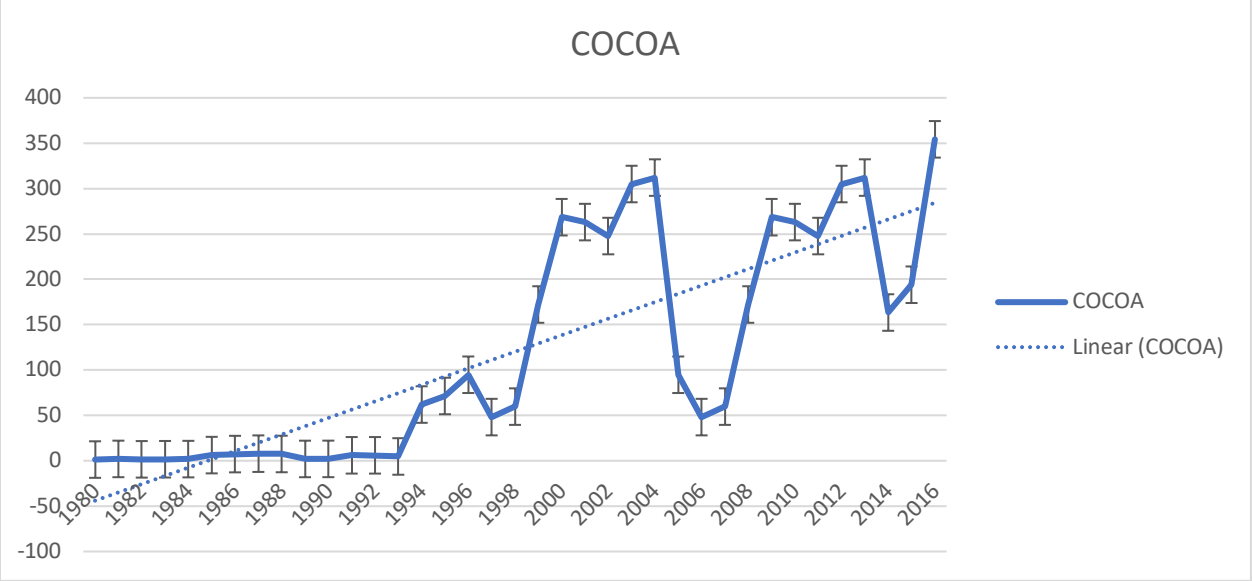

Figure 1: Trend of cocoa exports (1980-2016)

Rubber Exports

Figure 2 displays the trend of rubber export performance in Nigeria.

The trend of rubber exports as displayed in Figure 2 revealed that from 1980, the value of rubber exports increased from ₦0.16 billion to ₦3.58 billion in 1988. By 1990, the figure decreased to ₦3.65 billion and later increased to ₦3.79 billion in 1992 and decreased to ₦1.01 billion in 1994. The figure increased sharply to ₦96.10 billion in 1995 and decreased again to ₦2.44 billion in 1996. From the sharp decrease in 1996, the value of rubber exports increased to ₦62.63 billion in 1998 and dropped to ₦12.31 billion in 2000. By 2002, the figure reached ₦140.10 billion which decreased to ₦12.30 billion in 2009. The figure which rose to ₦126.97 billion in 2010 had

decreased to ₦17.89 billion and further increasing to ₦197.91 billion in 2014 Declining to ₦141.62 billion in 2015, rubber export value reached its peak of ₦262.41 billion in 2016.

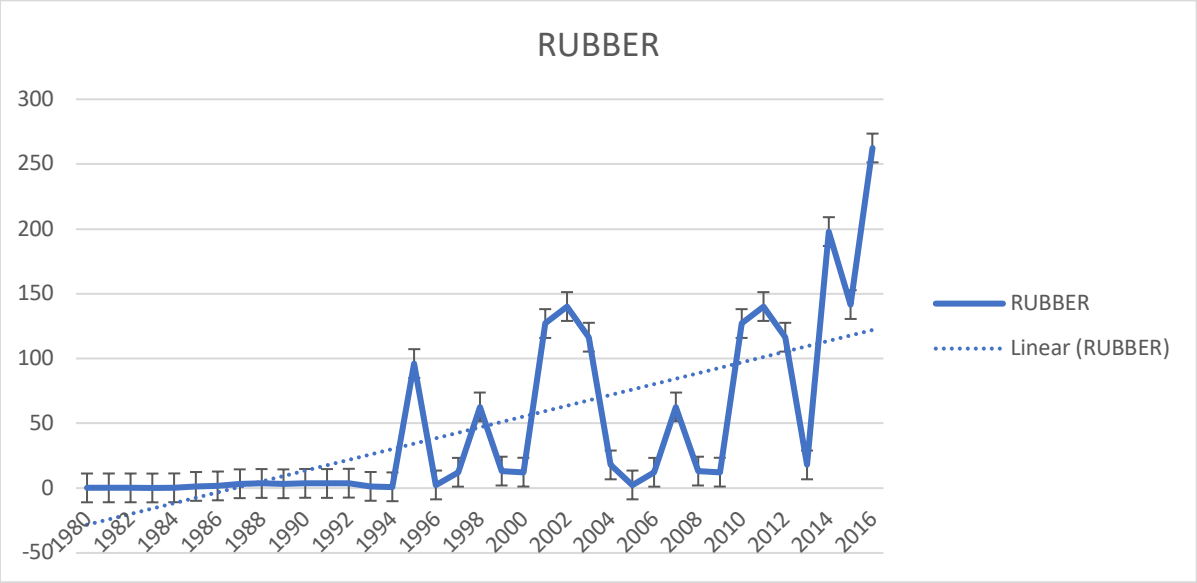

Fig.2: **Trend of rubber exports value in Nigeria (1980-2016)**

Cashew Export

The trend of export performance of cashews is as presented in Figure 3:

Figure 3 revealed that the trend of cashew export was low compared with the other cash crops earlier analyzed. For instance, cashew export value increased from ₦0.90 billion to ₦5.0 billion in 1990. Also, from the 1990 value, cashew export value increased to ₦54.30 billion in 2000. Further, by 2010, the figure increased to ₦93.30 billion. Most importantly, the peak of cocoa exports was reached in 2014 when the figure leapfrogged to ₦455.60 billion which later declined to ₦393.10 billion and ₦273.60 billion in 2015 and 2016 respectively. This shows that cashew exports are the lowest among the cash crops considered in the study.

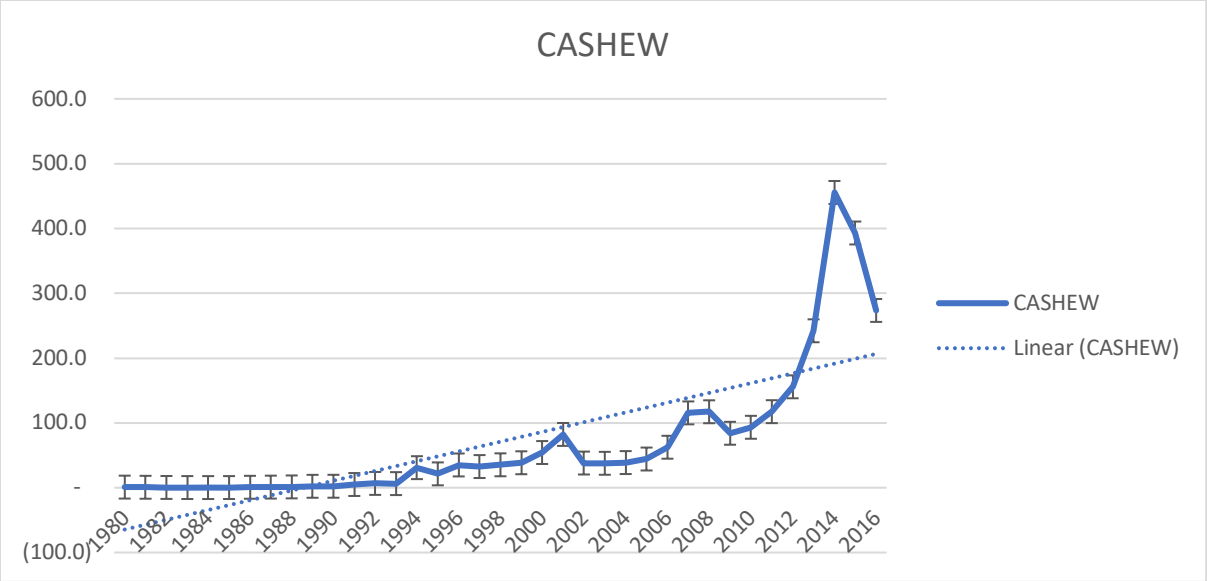

Figure 3: Trend of cashew export (1980-2016)

Trend of exchange rate

Figure 4 captures the trend in exchange rate over the period of study:

From figure 4, the exchange rate i.e. ₦/USD increased persistently from ₦/0.61/I USD in 1980 to ₦/21.88/I USD in 1998. From ₦/92.69/I USD in 1999, exchange rate reached ₦/150.29/I USD in 2010. By 2016, exchange rate reached its peak of ₦/253.49/I USD when the economy sank into recession. These figures revealed that exchange rate in Nigeria had depreciated significantly over the period of study.

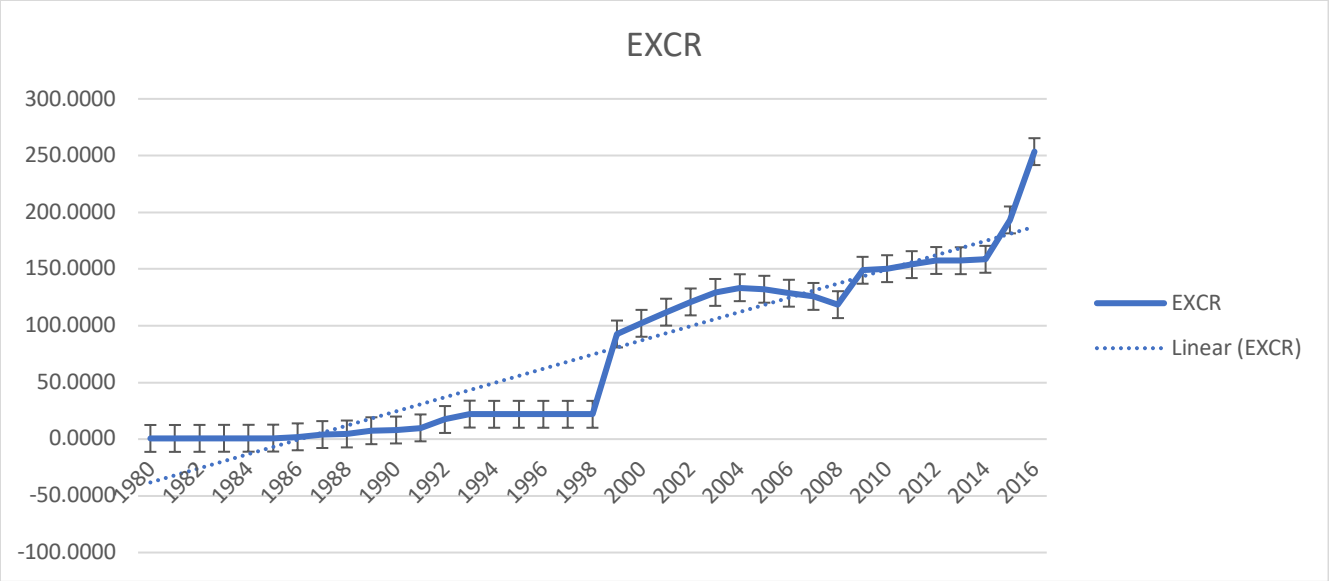

Figure 4: Trend of exchange rate

Test of Volatility

The GARCH equation was used to estimate the volatility of the exchange rate as shown in Table 2. The GARCH was used to calculate the volatility series to be used in the subsequent estimation procedures. All the coefficients in the equation are significant hence the GARCH effects are present which means that the exchange rate was volatile throughout the study.

Table 2: Estimation of GARCH

Variable	Coefficient	Std. Error	z-Statistic	Prob.
EXCR	0.097833	0.001890	1705.683	0.0021
C	-3.223147	4.558478	-0.128727	0.0000
	Variance Equation			
C	1.696084	0.239092	7.093850	0.0000
RESID(-1)^2	-0.879015	0.058450	-15.03868	0.0000
GARCH(-1)	0.301661	0.089275	0.379021	0.0007

Source: E-Views 9.0 output, 2018.

Causality test

The Granger causality test measures the direction of the relationship among the dependent and independent variables. The results of the pair-wise Granger causality tests are captured in Table 2: From Table 2 the pair-wise Granger causality result shows that there is a unidirectional relationship running from exchange rate volatility to export values of cocoa and rubber. This implies that the exchange rate of the Naira influences the values of cocoa and rubber exports since the p-values

(0.0009 and 0.0197) are less than 0.05. This is in line with Aihgbokan (2001) that fluctuations in exchange rates are major determinants of revenue from export commodities in Nigeria. However, there is no causal relationship between cocoa and rubber export values to exchange rate volatility since the p-values (0.6651 and 0.1038) are greater than 0.05. The results also reveal that a bidirectional causal relationship exists between exchange rate volatility and cashew export value which means that the two variables (cashew export value and exchange rate volatility) influence each other.

Table 2: Pair-wise Granger causality test

Null Hypothesis:	Obs	F-Statistic	Prob.
EXCR does not Granger Cause COCOA	35	8.88882	0.0009
COCOA does not Granger Cause EXCR		0.41344	0.6651
EXCR does not Granger Cause RUBBER	35	4.48751	0.0197
RUBBER does not Granger Cause EXCR		2.44547	0.1038
EXCR does not Granger Cause CASHEW	35	2.92564	0.0491
CASHEW does not Granger Cause EXCR		9.95719	0.0005

Source: EViews 9.0 computations, 2018

CONCLUSION

In export markets of Nigeria's agricultural products, exchange rate volatility has a significant impact on agricultural exports, so it could make the national trade balance deteriorate. In conclusion, the results authenticate the idea from literature that exchange rate volatility accounted for significant changes in export performance of agricultural products. Hence, the study establishes the desirability of stabilizing the exchange rate.

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