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Effects of Exchange Rate Variability on Cocoa Export in Nigeria (1970 - 2007)

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Abstract

This study evaluated the effect of exchange rate variability on cocoa export in Nigeria from 1970 to 2007 under the regulated and deregulated periods of exchange rate regimes. The objectives were to analyze the trend and growth rate of cocoa exports and to determine the impact of exchange rate variability on cocoa export. Data for the study were obtained from secondary sources which include reports of National Bureau of Statistics (NBS), Annual Reports and Statement of Accounts of CBN. Analyses of data were carried out using trend analysis and OLS multiple regression analysis. Findings indicated that cocoa export exhibited positive trend in the regulated and deregulated periods. OLS regression analysis showed that relative price, producer price and real exchange rate were significant and positively related to cocoa export while exchange rate variability and trend variable were significant but negatively related to cocoa export. Chow's test analysis showed a significant difference in the two periods for cocoa export. It was recommended that stability in exchange rate of the naira vis-à-vis the US dollar will increase export earnings. Also policies that will lead to intervention measures which will act as incentives for increased domestic production will lead to higher exports.

Keywords: *Cocoa, exchange rate, Nigeria, regulation and variability.*

1.0 Introduction

Prior to the 1970's, Nigeria was a major exporter of cocoa and it still remains the major agricultural commodity export of Nigeria in terms of foreign exchange earnings (Ogunkola, Bankole & Adewumi, 2006). Cocoa export's contribution to the exports earning during the last two decades dropped considerably due to the enormity of foreign exchange earning of crude oil; despite this, cocoa remains Nigeria's major agricultural export of which the country is the fifth largest exporter of the crop in the world (ICCO, 2007; Abiodun and Solomon, 2010; Nse-Nelson, 2015). In fact, cocoa had remained the single most important agricultural export commodity of the country followed by palm kernel (Akanni, Akinyele & Oyebanjo, 2009). However, Cocoa marketing in Nigeria has not been swift due to price fluctuations and instability of exchange rate.

Economists have long recognized the importance of exchange rates influence on trade. However the volatility, frequency and instability of the exchange rate movements since the beginning of the floating

exchange rate raise a concern about the impact of such movements on agricultural trade flows (Mazila, 2007). The effect of exchange rate variability on exports is still a debatable issue. One strand of literature argues that flexible exchange rates are beneficial to the economy as they promote trade and overall macroeconomic stability and that short run fluctuations in exchange rates have no effects on trade volumes (Nkang, Abang, Akpan & Ofem, 2006). On the other hand, some economists argue that partly because of market imperfections particularly in Low Developing Countries (LDC's), hedging is both imperfect and very costly as a basis for avoiding exchange risk. Hence, exports may be negatively correlated with exchange rate variability in line with aversion hypothesis (Doroodian, 1999; Kihangire, Potts and Cameron, 2006; Aliyu, 2008).

Exchange rate variability is a measure that tends to capture the uncertainty faced by exporters due to unpredicted fluctuations in exchange rate. The link between exchange rate variability and agricultural export trade is found in the frame work of supply and demand. There is no unique measure or definition of exchange rate variability. Variability can be in terms of deviations from trend or differences between actual and predicted (forward quotation) levels. Standard deviation can also be used as a measure of variability (Kihangire *et al*., 2006). The use of four quarter moving standard deviation avoids much problems of severe data loss (Mazila, 2007).

Various researchers have examined the influence of exchange rate variability on agricultural trade (prices, supplies and demand) but disagreement persists on the magnitude of the effect (Adubi and Okunmadewa, 1999; Garba, 2000; Kihangire *et al*., 2006; Olusegun, 2009). A sub-sectoral focus is important because exchange rate variability may affect sub-sectors differently, with some sub-sectors being more exposed to risk than others. Sub-sectors may differ as to their openness to international trade, the length of contract and extent of the trade contracts being denominated in foreign currencies. Hence, exports may be negatively correlated with exchange rate variability in line with aversion hypothesis (Doroodian, 1999; Kihangire *et al*., 2006). The objectives of the study are to analyze the trend in growth rate of cocoa export and determine the effect of exchange rate variability on cocoa export.

2.0 Materials and Methods

2.1 Study Area

This study was carried out in Nigeria.

2.2 Method of Data Collection

The data for the study were obtained from secondary sources which covered the period from 1970 to 2007. The sources of data include reports of National Bureau of Statistics (NBS), The Food and Agriculture Organization's online agricultural database (FAOSTAT), Production Yearbook of Central Bank of Nigeria (CBN), Ministry of Agriculture and Rural Development (FMARD), several issues and publications of Central Bank of Nigeria (CBN), as well as Annual Reports and Statement of Accounts.

2.3 Data Analysis

In Nigeria's post independent history, the period up to 1985 is commonly regarded as that of restrictive trade policies. The period from 1970 – 1985 is known as regulation era. Structural Adjustment Programme was implemented between 1986 and 1988 and exchange rate of the naira was deregulated among other policy measures, thus the period is generally referred to as deregulation era. The period from 1986 to 2007 forms part of the deregulation era – a period of further economic recovery and consolidation of the gains of the period.

For the first objective, growth rates were computed by fitting exponential function in time to the data following Onyenweaku and Okoye, (2005) and Okoye *et al.*, (2008). The exponential function is specified as follows:

$$Q = b_0 e^{bt} \quad (1)$$

To estimate the coefficients b_0 and bt, the regress and was converted into its logarithm and the function when linearized in logarithms becomes

$$InQ = b_0 + bít \quad (2)$$

Where

Q = Total value of agricultural export (Cash Crop) in ₦.

b_0, bí = The regression parameters to be estimated.

í = 1(for cocoa)

t = Time (years in number)

The estimating equation (2) was fitted to the total value of cocoa export for three distinct periods: regulated (1970–1986), deregulated (1987 – 2007) and the entire period (1970-2007).

The coefficients from equation (2) were used to derive the growth rate (r) in the value of the export as :

$$r = (e^b - 1) \times 100/1 \quad \text{(Onyenweaku and Okoye, 2005)} \quad (3)$$

where e is Euler's exponential constant (2.71828).

The second objective which was on effect of exchange rate variability on cocoa export in the two periods, was estimated through a regression model expressed as:

$$Qt = b_0 + b_1(REP)_t + b_2(AWP)_t + b_3(PRP)_t + b_4(RER)_t + b_5(ERV)_t + b_6(T)_t + et \quad (4)$$

Where;

Q_t =Total value of export (cocoa) in time t (₦)

REP_t = Relative price in time t

AWP_t= Average world price in time t (₦ / $)

PRP_t= Producer price in time t (₦)

RER_t = Real exchange rate in time t (₦ / $)

ERV_t = Exchange rate variability. This was the focus variable. Exchange rate variability was measured as the standard deviation of each series of observation from the average nominal exchange rates of the naira vis-à-vis the US dollar. This is in line with Mazila (2007); Zubair and Jega (2008) who measured variability by the standard deviation of each series through their sample.

$$\sqrt{ERV_t} = \frac{\sum(NER_{i,t} - \overline{NER_t})^2}{n - 1} \quad (5)$$

NER = Nominal exchange rate**.** This is the actual foreign exchange quotation in contrast to real exchange rate which has been adjusted for the different rates of inflation.

T = Time trend variable. Trend represents technological change.

et = error term

b's = coefficients to be estimated by the OLS method.

Four functional forms of the model were tested which include linear, double logarithm, semi-logarithm and exponential functional forms. The form that gives the best fit was chosen as the lead equation. The lead equation was chosen based on the signs of the regression coefficients, the value of the coefficient of determination (R^2) and the number of significant variables. The results of the first and second regressions were used to obtain the residual sums of square for regulated period ($\sum e_1^2$) and deregulated period ($\sum e_2^2$). To test for equality between the coefficients from the two regressions, the data for the two periods were pooled together and used to run a third regression from which the residual sum of squares ($\sum e_3^2$) for the pooled data were obtained. The Chow's F* statistics as used by Onyenweaku (1997) and Iheke (2010) is given as :

$$F = \frac{\sum e_3^2 - [(\sum e_1^2 + \sum e_2^2) / k_3 - (k_1 - k_2)]}{(\sum e_1^2 + \sum e_2^2) / (k_1 + k_2)} \quad (6)$$

Where;

$k_1 = n_1 - m$;

$k_2 = n_2 - m$;

n_1 = number of observations for first regression (regulated period)

n_2 = number of observations for second regression (deregulated period)

m = number of regression estimates including b_o

$\sum e_3^2$ and k_3 = residual sum of squares and degree of freedom for the pooled data of the two (regulated and deregulated) periods.

$\sum e_1^2$ and k_1 = residual sum of squares and degree of freedom for the regulated period.

$\sum e_2^2$ and k_2 = residual sum of squares and degree of freedom for the deregulated period.

The computed F* statistics was compared to the tabulated Chow's F ratio. Where Chow's F* statistic exceeds tabulated F ratio, then differences exist between the regulated and deregulated periods. For the test of homogeneity of slope, the Chow's F* statistic was calculated as follows:

$$F = \frac{\sum e_4^2 - [(\sum e_1^2 + \sum e_2^2) / k_4 - (k_1 - k_2)]}{(\sum e_1^2 + \sum e_2^2) / (k_1 + k_2)} \quad (7)$$

This involved the introduction of a dummy variable (D_t, taking 1 for regulated period and 0 for deregulated period) into the model. Thereafter, the data for the two periods were pooled together to run a fourth regression from which the residual sum of squares ($\sum e_4^2$) were obtained. This was further verified by testing the intercept of the fitted functions for heterogeneity and the Chow's F - statistics is given in equation 8 below as:

$$F = \frac{[(\sum e^2_3 - \sum e^2_4)/ (k_3 - k_4)]}{\sum e^2_4 / k_4} \quad (8)$$

Where $k_3 = n_3 - m$;

$k_4 = n_4 - m$;

n_3 = number of observations for third regression

n_4 = number of observations for fourth regression

m = number of regression estimates including b_0

$\sum e_3^2$ = residual sum of squares (unexplained variation) for third regression

$\sum e_4^2$ = residual sum of squares (unexplained variation) for fourth regression. The computed Chow's statistic was then compared to the tabulated Chow's F ratio. If the F statistic is significant (i.e. F cal > F tab), then the intercepts are assumed to be heterogenous. This implies that there is significant difference between the functions of the regulated and deregulated period.

3.0 Results and Discussion

Table 1: Estimated trend equations for cocoa export.

Dependent variable/period	B_0 (constant)	B_1 (slope)	r^2	n (sample size)	F-ratio
Cocoa					
Regulated period	11.748 (115.78)***	0.032 (3.08))***	0.504	15	9.50***
Deregulated period	13.369 (62.35)***	.059 (3.67))***	0.501	21	13.44***
Entire period	11.399 (72.48)***	0.092 (13.14)***	0.827	36	172.64***

Source: Central Bank of Nigeria (CBN) Annual Report, National Bureau of Statistics (NBS).

Figures in parentheses are the t-ratios, ***, ** and * implies significant at 1, 5, and 10 % levels respectively.

The result in Table 1showed that the coefficient of the time trend was positive and significant at one percent for the three periods (regulated, deregulated and the entire period) indicating that time trend is a significant

determinant at one percent level of the aggregate level of cocoa export. The implication is that the regulated and deregulated periods affected the export of cocoa positively and led to increases in cocoa export, though the increase in cocoa export may not have attained its desired objective in terms of the naira value because more quantity was being exported with a reduced naira value since the value keep depreciating from the dollar value and exports are purchased based on the naira value. This conforms with Akanni *et al*.**,** (2009) on free trade policy and the market prices of the Nigerian cash crops. The result showed that trend variable was a significant determinant of exported cocoa before and during the implementation of the free trade policy.

Table 2: Influence of exchange rate variability and other factors on cocoa export for the regulated period.

Variables	**Linear**	**Exponential**	**Double log +**	**Semi log**
Constant	-2009	8.498	-11.118	-4875
	(-0.45)	(5.43)***	(-2.07)**	(-2.24)**
Relative price	7897.064	1.692	1.596	8038.720
	(0.68)	(4.13)***	(3.58)***	(0.44)
Average world price	41.678	0.006	0.127	3341.033
	(1.89)*	(0.88)	(0.62)	(0.40)
Producer price	25.216	0.009	1.393	4242.459
	(1.98)*	(3.23)***	(3.28)***	(0.25)
Real exchange rate	1149.278	0.059	4.457	1386
	(1.06)	(1.55)	(2.32)**	(1.78)*
Exchange rate variability	-884.325	-0.045	-0.897	-2479
	(-0.57)	(-0.83)	(-1.93)*	(-1.31)
Trend variable	358.762	0.033	-0.032	703.420
	(2.96)***	(2.68)**	(-1.69)*	(1.82)*
R^2	0.860	0.894	0.925	0.791
$\overline{R}^2$	0.767	0.823	0.862	0.613
F-ratio	9.25***	12.66***	14.54***	4.44***
DW	1.776	2.272	2.197	1.848

Source: CBN, Annual Report, NBS. Note: Figures in parentheses are t-ratios, ***, ** and * implies significant at 1, 5, and 10% levels respectively. DW = Durbin Watson Statistic.

Based on the magnitude of the coefficient of multiple determination, the number of significant variables and conformity of most of the explanatory variables to *a-priori* expectations, the double log functional form was chosen as the lead equation for the examination of the influence of exchange rate variability and other factors on cocoa export for the regulated period. The R^2 value for the lead equation indicated that the exogenous variables accounted for about 92 percent of the variations in cocoa export for the period 1970 - 1985 (regulated period). Durbin Watson Statistic was used to test for autocorrelation and it showed that there was no autocorrelation of the error terms and that the relationships in the models were valid.

In Table 2, relative price, producer price and real exchange rate were positive and significant factors that influence cocoa export. This suggests that an increase in the level of these positive variables will bring about increase in cocoa export. It implies that these positive variables boosted cocoa export. Exchange rate variability and trend variable were significant but negative factors that influenced cocoa export in the regulated period. This means that a unit increase in exchange rate variability and trend variable would bring about a decrease in cocoa export and it implies that exchange rate variability and trend variable did not favor cocoa export in the regulated period.

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