International Journal of Food and Agricultural Economics
ISSN 2147-8988
Vol. 2 No. 3 pp. 91-104

DYNAMICS OF AGRICULTURAL EXPORTS IN SUB-SAHARA AFRICA: AN EMPIRICAL STUDY OF RUBBER AND COCOA FROM NIGERIA

Ifeanyi Ndubuto Nwachukwu
Dept of Agribusiness and Management, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria

Abstract

The study analyzed empirically the dynamics of rubber and cocoa exports from Nigeria within 1961 – 2010. It specifically estimated the determinants of their export performance and determined the degree of export diversification of the agricultural sector. Both export crops were chosen because they remained the most exported agricultural commodities after the number of agricultural exports commodities shrank from the traditional 12–15 commodities of the 1960s. Published national aggregates on specific trade and macroeconomic variables from reputable secondary sources were used. In the course of data analysis, descriptive statistics, diversification index and Error Correction Model (ECM) were employed. Prior to estimation, Unit root and Cointegration tests were conducted. The results revealed that export supply of cocoa was found to be influenced by export cost and rainfall in the long run while output, cost of production and export affected it in the short run. Rubber export supply was influenced by cost of export and exchange rate in the long run while world export-output ratio and cost of export affected it in the short run. The study results further revealed that export diversification measure showed that the sector experienced fluctuations with varying Hirschman indices which ranged from 1.3 x 10^{-7} to 5.1 x 10^{-7}, depicting decreasing concentration. Invariably, this implies increasing leanness of the export basket. On the basis of the result, it is necessary to explore policy options such as export financing and foreign exchange policies to promote production in the export subsector of agriculture and industrial sector to diversify the national export basket.

Keywords: *Agriculture, export, diversification, Africa, macroeconomics*

1. Introduction and Background

Agricultural commodity trade has played a prominent role in Africa's economic development. As suppliers of raw materials to western economies, African countries have continued to produce primarily crops for export. Thus the agricultural exports sector is still the most important single activity for Africans (Amoro & Shen, 2013).

In Sub-Saharan Africa (SSA), about 75 percent of people live in rural areas, and almost all of them depend on agriculture for their livelihoods. Agriculture accounts for 40 percent of gross domestic product (GDP), 15 percent of exports, and 60–80 percent of employment. Agriculture therefore remains highly important for sustainable development and poverty reduction, as well as a source for livelihood, economic growth, and provider of environmental services (World Bank, 2008). Support to the agricultural sector, however, has not been commensurate with its importance. Since 1980, agricultural spending as a share of

total spending in Africa ranged from 4 to 6 percent in the aggregate, which has led to general stagnation (Omilola *et al.* 2010; Dramé – Yayé *et al*., 2011).

More so, African agricultural production is largely subsistence in nature with a high dependence on the rain; farmers suffer price competition with large scale farmers in more developed countries who flood their products in Africa while export capacity of locally produced agricultural products from Africa is very limited (Mkpado, 2013). Other worrisome agricultural characteristics and trends shared by African countries include high degree of production variability, relatively low crop yields and dependency on primary exports with low income elasticity and high price volatility. Relative to other developing regions, Africa's agriculture is undercapitalized, uncompetitive and underperforming; the sector is relatively weak as its productivity lags behind that of other regions and often declining performance is symptomatic of the myriad challenges it faces.

FAO (2011) observed that the distribution of available arable land in the world indicates that Latin America and the Caribbean had 166 million hectares (ha), sub Saharan Africa 1031 million ha, East Asia 366 million ha, South Asia 226 million ha, Near East and North Africa 99 million ha, industrialized countries 874 million ha, and Transition countries 497 million ha. The 2nd position of Africa in arable land distribution shows great potential Africa has in agricultural production.

Africa's agricultural commodity exports may be categorized into traditional and non - traditional. The prominent traditional export commodities include cocoa, palm oil, palm kernel, rubber, cotton, groundnut, kola nut among others. The non - traditional export commodities include pineapple, cashew, eggs, processed fruits, alcoholic beverages to mention but a few which have emerged as the most demanded products in the international markets (UNIDO, 1992). Nigeria has a long history of thriving exports of top quality produce like cocoa, groundnut, cotton, gum Arabic, sesame seed, rubber, ginger, mangoes, pineapples, coffee and a host of others. Export markets for these products exist in United States of America (USA), European Union, Gulf States, Japan, Singapore, China to mention but a few countries. Nigeria appears to have an added advantage over major agricultural producers and exporters in the Eastern and Southern Africa in terms of fertile land, proximity to traditional and terminal markets in Europe by air or by sea (Sasore, 2004).

In the 1960s, agricultural exports were Nigeria's main source of foreign exchange. During this period, 3 - 4% annual output growth rates for agricultural and food crops were achieved and the share of agriculture in Gross Domestic Product (GDP) was above 60 per cent (see Table 1). Government revenues also depended heavily on taxes on the export crops. However, between 1970 and 1974, agricultural exports as a percentage of total export earnings fell from about 80 per cent to slightly over 55 per cent with the massive inflow of petroleum export earnings. From the mid 1970s, the average annual growth rate of agricultural exports declined by 17 per cent. Large receipts of foreign exchange from oil exports resulted in the neglect of agriculture from the early 1970s to mid 1980s (see Osuntogun *et al.*, 1997).

As a consequence of the above scenario, Nigeria began to import some of those products it formerly exported and other food crops it had been self – sufficient in. The worsening trend especially between 1970 and 1982, culminated in the loss of over 96.6 per cent of agricultural exports in nominal terms and the unprecedented hike in the food import bill to the tune of US$4 billion in 1982 (Oyejide, 1986).

By 1986, the situation reached a crisis stage, dramatizing the ineffectiveness of the policy of industrialization through import substitution that has prevailed in the post-independence era. One of the failures of this policy was inability to fill the gap for imported consumer goods arising from the negative oil price shock manifestation and the attendant fall in foreign exchange earnings. By mid 1986, an outward – looking external trade policy stance was adopted under the Structural Adjustment Programme (SAP). In SAP, the emphasis was on

diversifying Nigeria's export base away from oil and increasing non-oil foreign exchange earnings. To achieve the objectives of the programme, government put in place a number of policy reforms and incentives to encourage the production and export of non-oil tradable goods as well as broadening Nigeria's export market (Osuntogun et al., 1997).

Table 1: Trends of Agricultural Export Performance in Nigeria, 1960 - 2009

Period (Yearly Av.)	Value ofAgric. Export (Nm)	Index of Agric Production	Agric Share in Total Export Earnings (%)	Share of Agric in GDP (%)
1960 – 1964	284.6	111.6	79.5	62.5
1965 - 1969	295.6	106.4	56.8	54.3
1970 - 1974	241.2	111.0	15.0	32.8
1975 - 1979	352.2	96.9	4.9	22.3
1980 - 1984	271.5	95.9	2.9	36.2
1985 - 1989	1,233.4	124.1	4.3	41.4
1990 - 1994	3,233.1	197.3	2.0	38.3
1995 - 1999	16,216.4	234.0	1.5	39.6
2000 - 2004	19,122.8	180.6	0.8	40.3
2005 - 2009	44,678.6	234.2	1.5	44.0

Source: CBN Annual Reports (various issues)

The introduction of SAP notwithstanding, the decline of the Nigerian economy continued unabated. By 1996, agriculture accounted for only 2 per cent of exports. As the number of agricultural exports commodities shrank from the traditional 12–15 commodities of the 1960s, Nigeria became a net importer of most commodities that it formerly exported. The market for Nigeria's agricultural exports has not improved appreciably as roughly, a vast proportion still goes to the European Union and America, almost in its primary form, without any appreciable value addition (Daramola, 2004). In the 1999 – 2004 period, the decline in the Nigerian economy and in agricultural export continued uninterruptedly before the global economic crisis in early 2008.

The rationale for this study derives from a combination of factors. Recent falls in the price of crude oil coupled with losses arising from incessant theft of the product and vandalization of oil pipe lines has caused a drastic decline in the volume of revenue from Nigeria's foremost income earner. The development has heightened calls for the diversification of the Nigerian economy towards improving agricultural exports. Resuscitating the agricultural production and exports is considered much easier in terms of capital investment than reviving or growing the manufacturing industries.

2. Methodology

2.1 Study Area

The Study location is Nigeria. Nigeria is derived from the word 'Niger' which is the name of the river that constitutes the most remarkable geographical feature of the country. The country is located in West Africa and is bordered by Cameroon to the south east, Benin to the south west and Niger to the north. The latitude and longitude of Nigeriaare 10^{o} North and 8^{o}East respectively. The population according to the 2006 census was 140,003,542 million and currently projected to about 167 million at the rate of 2.8%. Nigeria has a land area of 98.3 million hectares, of which only 71.2 million hectares are cultivable; only 34.2

million hectares (about 48 per cent of the cultivable area) are actually being cultivated and less than 1 per cent of the arable land is irrigated (NBS, 2007; FMARD, 2001).

The climate is semi-arid in the north and becomes increasingly humid in the south, with mean annual temperature ranging from 28^0- 31^0c in the south. Rainfall is one of the important climatic factors influencing agriculture and three broad ecological zones are commonly distinguished: the northern Sudan savannah (500 – 1000mm), the guinea savannah zone or middle belt (1,000 – 1,500mm) and the southern rainforest zone (1,500 – 4,500mm). Generally, rainfall patterns are marked by an alteration of wet and dry seasons of varying duration. In the north, rainfall lasts from May to September with a peak in August, while in the south, rainfall is bimodal, increasing steadily from January and reaching its peak in September. About two thirds of the area cropped is located in the north with the rest equally divided between the middle and southern zones (ADB, 2006).

Over time, cocoa and natural rubber has remained the most exported agricultural commodities after the number of agricultural exports commodities shrank from the traditional 12–15 commodities of the 1960s. At the global level, Nigeria is the fourth highest producer of cocoa and the crop ranks the fifth most exported commodity from the country with a value of ₦ 2, 031, 216, 380 in 2006 (NBS, 2007). In rubber export, Nigeria is ranked the ninth highest exporter in the world. Rubber is currently grown in Edo, Delta, Ondo, Ogun, Abia, Anambra, Akwa-Ibom, Cross River, Rivers, Ebonyi and Bayelsa States where the amount of rainfall is about 1800 mm to 2000 mm per annum. In terms of price, the FOB prices range from USD2,500-3,000 /MT depending on quality and time of year (Ayemibo, 2010). The country encompasses a large variety of climatic and ecological zones, enabling the cultivation of many crops and harvesting of natural products, including rubber trees, peanuts, cotton, oil palms and others. Food staple crops are dominated by cassava and yams, followed by sorghum, millet, maize and rice. Nigeria produces a number of export crops in large quantities with cocoa, palm oil and groundnut emanating from the western, eastern and northern parts respectively (Oyedele, 2007).

2.2 Sources of Data

The data employed were national aggregates that were obtained from secondary sources. The data covered the periods, 1961 – 2010. The major sources include several issues of the Production Yearbook published by the Food and Agriculture Organization (FAO), FAOSTAT website, the National Bureau of Statistics (NBS) Annual Abstract of Statistics and several issues of the Central Bank of Nigeria's (CBN) Annual Reports and Statement of Accounts, United Nations and World Bank databases.

2.3 Method of Data Analysis and Model Specification

To analyze the determinants of cocoa and rubber export, the following model was formulated and estimated.

$$LnQ_{it} = \beta_0 + \beta_1 LnPP_{it} + \beta_2 LnPX_{it} + \beta_3 LnRF_{it} + \beta_4 LnER_{it} + B_5 LnWX_{it} + \beta_6 (ECM)_{t-1} + \varepsilon_{it} \quad (1)$$

Where:

PP_{it} = the ratio of the producer price to the domestic price index. This ratio tries to model the behaviour of the farmers. This domestic price index is intended to reflect changes in the cost of producing the export crops and was proxied by the consumer price index (CPI).

PX_{it} = the ratio of the export price to the producer price. PX_t measures the behaviour of exporters and it is expressed as a ratio of the export price to what is paid to farmers (producer price). The price paid to producers represents a cost to exporters.

RF_{it} = Average annual rainfall (millimeters). RF_t was used because Nigerian agriculture is essentially rain fed and also most of the export crops are raised under rain fed system.
Q_{it} = Total export quantity (tonnes)
Q_{t-1} = Lagged export quantity (tonnes)
ER_{it} = Exchange rate (%)
WX_{it}= the ratio of world export quantity to world output
ECM = the error correction factor
ε_{it} = stochastic error term

The data set was subjected to unit root and cointegration tests prior to Error Correction Model estimation procedure in the bid to estimate the short run dynamics. As a preliminary test in time series econometrics, the unit root test was necessary to ascertain stationarity of the data set in an to avoid running spurious regression if ordinary least squares (OLS) is applied. However, cointegration test was assures the existence of long run relationship became imperative as a necessary conditionality for the application of ECM.

In realizing export diversification of the sector, the Sectoral Hirschman (H) concentration index was employed. The sectoral Hirschmann index is a measure of the sectoral concentration of a region's exports and tells us the degree to which a sector or country's exports are dispersed across different economic activities. The index is based on the ratio of the value of each exported commodity to total exports in the sector. The index can be calculated thus:

$$H = [\sum_{i=1}^{n}(X_i/X_e)^2]^{1/2} \quad (2)$$

Where:
X_i = value of the export of a particular industry or (export sector) in a given year
X_e= total value of exports of the country in a given year
n = number of export commodities or export commodity classes

Where there is export diversification, the index tends to zero because X_i/X_e gets smaller. When exports are concentrated on a few commodities, the value of X_i approaches the value of X_e causing the H to tend to unity. Thus H ranges from zero to one. The H measure is useful when compared intertemporally (Osuntogun *et al*., 1997).

3. Results and Discussion

3.1Summary Statistics of the Data

The summary statistics for all the variables employed in the study within the period of the study, 1961-2010 are presented in Table 2. All the price variables were deflated using consumer price index (CPI) in conformity with Sustanto (2006). During the study period, the total export quantity of cocoa and rubber had a mean of 180,331.83 tonnes and 48,047.70 tonnes respectively. The corresponding standard deviations of the quantity exported were 46,386.38 and 22,319.09 tonnes. The gap between the minimum and maximum values of both crops was quite large, which implied that there had been tremendous increase in their export volumes during the period of study.

The export prices of both commodities showed similar upward trend during the sample period. The difference between the minimum and maximum prices for cocoa was $2,426.91 per tonne representing 179.10 percent increase while that of rubber was $1,038.59 per tonne

depicting 121.58 percent rise. Probably, increase in price may have contributed to increase in the quantity exported in line with theory.

Table 2. Summary Statistics of the Data

Variable	Mean	Minimum	Maximum	Standard Deviation
Cocoa				
Export quantity (tonnes)	180,331.83	9,289.83	305,550.00	46,386.38
Export value ($000)	226,878.49	28,695.00	638,328.00	120,537.75
Producer price (N)	96,035.62	10,158.00	267,435.00	47,716.17
Rubber				
Export quantity (tonnes)	48,047.70	14,575.00	113,028.00	22,319.09
Export value ($000)	39,914.66	11,173.00	155,000.00	31,063.65
Producer price (N)	64,263.75	1,395.33	207,750.00	61,604.03
Value of Agric. Export	12,938,340.15	471,901.00	605,000.00	13,295,894.01
Value of World Agric. Export	3.20	0.14	14.00	3.31
Real Exchange rate	74.50	0.02	201.00	72.26
Annual average rainfall (mm)	1295.81	897.00	1,597.00	172.05

3.2 Determinants of Nigeria's Cocoa and Rubber Export

3.2.1 Preliminary Tests (Stationarity and Cointegration Tests)

Prior to the estimation of the determinants of cocoa and rubber export performance, the test variables were subjected to stationarity and cointegration tests. The Augmented Dickey – Fuller (ADF) and Phillips – Perron (PP) unit root tests were used for determining the order of integration of the variables under consideration and the results were presented for both export crops in Tables 3 and 4.

As can be observed in Table 3, the test variables for determining cocoa export were non-stationary in their level form. This implies that none rejects the null hypothesis of non-stationarity. After differencing, the ADF estimates for the test variables became stationary. This implies that the null hypothesis of non-stationarity at all levels of significance is rejected. The variables were further subjected to PP test.

Table 3. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Tests for Integration for Cocoa (Determinants)

Variable	ADF		PP	
	1(0)	1(1)	1(0)	1(1)
LnQ_1	-2.510	-3.532	-3.510	-4.406
$LnPP_1$	-1.817	-3.982	-3.817	-4.877
$LnPX_1$	-1.910	-3.208	-3.910	-4.346
$LnRF_1$	-3.061	-3.901	-2.462	-4.492
$LnER_1$	-2.535	-3.564	-3.036	-5.134
$LnWX_1$	-2.521	-3.620	-3.015	-4.305

NB: Critical values of ADF at 1% (***), 5% (**) and 10% (*) are -4.187, -3.516 and -3.190 respectively. The PP test critical values at 1% (***), 5% (**) and 10% (*) are -4.196, -3.520 and -3.192 respectively.

Although the PP test is non-parametric, it was found to produce a superior result that corrects for serial correlation and heteroscedasticity. The PP test is also known to be better in

the presence of regime shift which is a problem usually encountered with African macroeconomic data (Yusuf & Yusuf, 2007). On application of PP test, the test variables attained stationarity after differencing once and thus, one may conclude that the variables are integrated of order one, 1(1). Stationarity is confirmed when the test statistic is greater than the critical value in absolute terms.

On the other hand, the variables for determining rubber export were also subjected to stationarity test using ADF and PP tests. These results are presented in Table 4. From Table 4, all the test variables for determining rubber export were not stationary in levels but became stationary in differences on the basis of their ADF statistics. As such, one could reject the null hypothesis of non-stationarity.

Table 4. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Tests for Integration for Rubber (Determinants)

Variable	ADF		PP	
	1(0)	1(1)	1(0)	1(1)
LnQ_1	-3.032	-3.880	-3.167	-4.955
$LnPP_1$	-3.095	-3.852	-3.095	-4.378
$LnPX_1$	-3.065	-3.524	-3.190	-4.502
$LnRF_1$	-2.356	-3.756	-2.356	-4.387
$LnER_1$	-2.492	-3.874	-3.481	-5.556
$LnWX_1$	-2.638	-3.540	-3.138	-4.606

NB: Critical values of ADF at 1% (***), 5% (**) and 10% (*) are -4.187, -3.516 and -3.190 respectively. The PP test critical values at 1% (***), 5% (**) and 10% (*) are -4.196, -3.520 and -3.192 respectively.

The variables were further subjected to PP tests which also established their stationarity after differencing. By this, it indicates that the null hypothesis of non-stationarity at all levels of significance is rejected.

In the bid to ascertain the existence of long – run relationship, the cointegration test was performed using both the ADF and PP test. This was to confirm that the residuals of the non – stationary series that are 1(1) are actually 1(0). Prior to the cointegration test, the ordinary least squares estimation was performed on the variables in levels and tested the residuals for the presence of unit roots. The results as presented in Table 5 showed that both the ADF and PP statistics were significant and also larger than the critical values in both crops.

Table 5. Results of Cointegration Test

Crop	ADF	PP
Cocoa	-6.135	-6.024
Rubber	-7.060	-7.060

Critical values at 1%(***), 5%(**) and 10%(*) are -2.631, -1.950 and -1.607 respectively.

The results of the cointegration test which is a precondition for the specification of an error correction model indicate that there is presence of cointegration. This is evident as shown by the stationarity of the residuals of the static regression for both crops in Table 5.

3.2.2 Estimation of the Error Correction Model (ECM)

Having fulfilled the necessary conditions by applying ADF and PP test to residual based cointegration determination, the short run error correction model can be estimated. In the ECM, the one period lagged residual for annual data acts as the error correction term. The

result of the ECM estimation is shown in Table 6. With respect to economic interpretations, the demand function in Table 6 is basically similar to the regular demand. The disparity is that it constitutes both long run and short run estimates. This is in line with Susanto (2006).The short run parameters are indicated by the variables in differences and the long run parameters are represented by the variables in levels.

From Table 6, the results indicated that cocoa export supply was affected negatively by the ratio of export price to the producer price and positively by rainfall in the long run. These variables were statistically significant at 5% level of probability. The negative coefficient of the price ratio implies that cocoa export supply decreases as the cost of exporting the commodity increases. This is plausible given the fact that the ratio of export price to producer price was more or less the price paid to producers which represents a cost to exporters. The result is inconsistent with the findings of Gbetnkom and Khan (2002) that had a positive coefficient in a similar study in Cameroon. Rainfall supports export supply and can be impinged on the premise that water enhances fruiting and growth which by extension increases production. Nkang *et al* (2006) in their study had also a positive coefficient for rainfall and posited that adequate rainfall is required for increased cocoa export supply.

In the short run, cocoa export supply responded positively to changes in the one – year lag of the ratio of producer price to domestic price, ratio of export price to domestic price and the quantity exported. This implies that the previous year's values of the price ratios and quantity exported enhanced export supply. Real exchange rate negatively affected export supply, in disalignment with a priori expectation. It may likely mean that the previous year's exchange rate was not favourable to encourage export supply of the commodity in the current year. Exporters are anticipated to take necessary actions to reduce or eliminate the negative effect of exchange rate movements on their output which determine profit in most situations. Actions such as price, non – price or a combination of both can be employed depending on the competitive strength or market power of the exporting nations (Wisdom & Granskog, 2003).

Furthermore, it could be observed that the significant response of the price ratios to export supply of Cocoa is inelastic in the short run. This is because any 10 percent increase (decrease) in export of Cocoa leads to 4.1 percent and 0.4 percent increase (decrease) in the cost of production and export of the commodity respectively. These results have serious implications in the sense that as export supply has been observed to be trending downwards from 2005, the profit accruable to producers and exporters will also reduce. This result contradicts the empirical findings by Onyenweaku and Madu (1991) on the supply response of Nigeria's Cocoa that posted evidence of negative output even in the face of rising producer price.

The error correction coefficient of -0.656 for Cocoa and -0.085 for Rubber measures the speed of adjustment towards long – run equilibrium carried the expected negative sign. Both coefficients were significant. For Cocoa, a long - run equilibrium for export supply of the commodity was completed in one year was observed.

Conversely, rubber exhibited a very low feedback of about 8.5 percent. This indicates that a little above 8 percent of the adjustment towards a feed back of 65.6 percent of the previous year's disequilibrium from the long run values of the independent variables was observed. The result also showed that the coefficients of multiple determination (R^2) of rubber supply was 0.815 while that of cocoa was 0.631. Their adjusted values were also appreciably high and they indicate that the regressors explained 81.5 percent and 63.1 percent of the variations in the dependent variable in rubber and cocoa respectively. This is a testimony of good fit. However, the F-statistic for both crops was significant and confirms the explanatory power of the entire model.

The Breusch – Godfrey Lagrange Multiplier (LM) test was employed instead of Durbin – Watson (DW) test. This is because the DW is not applicable if the regressors contain lagged

dependent variable(s) as is the case in this study. Also, the DW test is a test only for first order serial correlation. The LM test is a general test, which overcomes all these obstacles (Gbetnkom and Khan, 2002). The LM statistic of 1.45 and 7.08 for cocoa and rubber respectively are significantly different from zero. Based on that, the null hypothesis of serial correlation is rejected.

The RESET test developed by Ramsey was employed to serve as a check of the regression (correct) specification. The statistics for both crops (1.520 and 1.510 for cocoa and rubber respectively showed no evidence of functional form misspecification at 1% probability level.

Table 6. Estimates of the Determinants of Cocoa and Rubber Export

Long-run		
Variable	Cocoa	Rubber
Intercept	158,570.911 (1.308)	7.162** (2.805)
$LnPP_1$	0.086 (0.197)	0.692*** (5.672)
$LnPX_1$	-1,233,142.320** (3.231)	-0.028 (0.220)
$LnRF_1$	104.968 (2.866)	0.608** (2.111)
$LnER_1$	166.177 (0.495)	-0.008* (-2.667)
$LnWX_1$	-153,604.110 (0.951)	0.979 (1.187)
Short-run		
Intercept	9.381 (0.817)	9.439* (2.164)
$LnPP_{t-1}$	4.052 (1.069)	-0.732 (1.591)
$LnPX_{t-1}$	0.396** (2.891)	-0.049*** (4.900)
$LnRF_{t-1}$	1.002 (1.042)	0.229 (0.666)
LnQ_{t-1}	0.088** (4.171)	0.721*** (5.504)
$LnER_{t-1}$	-0.609* (3.000)	0.178 (1.328)
$LnWX_{t-1}$	-0.063 (0.516)	1.450** (2.827)
ECM_{t-1}	-0.656* (2.791)	-0.085** (2.656)
R^2	0.631	0.815
Adjusted R^2	0.555	0.740
F-Statistic	2.282	10.981
LM	1.450	7.060
RESET	1.520	1.510

NB: Figures in parentheses are t-test values; ***, ** and * represent significance at 1%, 5% and 10% probability levels respectively

More so, export supply of rubber was found to be influenced positively by ratio of export price to producer price and negatively by real exchange rate in the long run. By implication, any 6.9 percent increase in the price ratio and 6.1 percent rise in rainfall boost export supply of rubber by 10 percent. The negative coefficient of real exchange rate shows that the exchange rate during the study period did not favour export supply of the commodity.

The short run supply relation was influenced by the one year lag of the world export ratio, export price ratio and export quantity. The lag of the world export ratio and export quantity had the expected signs while export price ratio possessed a negative sign. The low short run and long run elasticities of supply imply that the producers of rubber in Nigeria did not make significant short and long run production adjustments in response to changes in prices. This result consolidates the findings of Mesike et al (2010) who also had low elasticities in his supply response study of rubber farmers.

3.2.3 Degree of Export Diversification of the Agricultural Sector

To measure the degree of export diversification of the agricultural sector, the Hirschman concentration index which is based on the ratio of the value of exported commodities to total exports in the sector was used. The measure is useful when compared intertemporally and the result is presented in Table 7.

Table 7. Export Diversification Measure of the Agricultural Sector

Years	Hirschman Concentration Index
1962	1.3×10^{-7}
1967	5.0×10^{-7}
1972	5.0×10^{-7}
1977	4.9×10^{-7}
1982	6.3×10^{-7}
1987	5.1×10^{-7}
1992	5.6×10^{-7}
1997	5.7×10^{-7}
2002	7.6×10^{-7}
2007	5.1×10^{-7}

Source: Computed from FAO (2010)

From the result in Table 7, export diversification in Nigeria in the 60s and early 70s showed that the sector enjoyed a relatively stable diversified export structure and this shows that the agricultural export was dispersed across different economic activities at that time. According to Acemoglu and Zilibotti (1997), diversification may favour growth by reducing the country's vulnerability to idiosyncratic sectoral shocks.

The index plummeted slightly in the late 70s, probably due to the civil war and rose again between early and mid 80s. At that time, the economy commenced the process of recovery. The need for accelerated recovery triggered the introduction of the Structural Adjustment Programme (SAP) in 1986. According to Daramola *et al* (2007), the emphasis of SAP was to diversify Nigeria's export base away from oil and increase non-oil foreign exchange earnings. The index increased slightly all through the 90s, showing decreasing diversification and increasing concentration on few products. Diversification began to increase again as the index declined. This could be attributable to the emergence of non – traditional export commodities in the export basket of Nigeria. UNIDO (1992) acknowledged that there has been a wide fluctuation of non-traditional export crops from Nigeria (which cashew is one of

them) have emerged as most demanded in the international market. This result from Nigeria is comparable to the Hirschman index for South Africa. According to Naude and Rossouw (2008), diversification levels in South Africa first increased in the 60s (0.05), declining thereafter (0.03 in the 70s), with the economy becoming relatively more concentrated in its exports (0.07) between 1980 and 1995. This was followed by an increase in export diversification (0.04) during 1996-2000. Other countries in Africa like Egypt, Morocco and Tunisia had their H index revolving around 0.3 while Algeria had a less diversified export structure with an index of 0.6. According to Mubarik (2004), the future prospects of agricultural export and diversification in developing countries will depend in part on their ability to develop only those products where they have competitive advantage. Such "product champions" may include in many cases high value products with niche markets. The enhancement of the international competitiveness of these products will also increasingly depend on how well a country is able to exploit the advantages of a knowledge-based agriculture.

4. Conclusion

Having investigated the dynamics of agricultural exports in sub-Sahara Africa with particular focus on Nigerian cocoa and rubber, it could be observed that export supply of Nigerian cocoa was influenced by export cost and rainfall in the long run while output, cost of production and export affected it in the short run. However, rubber export supply was influenced by cost of export and exchange rate in the long run while world export-output ratio and cost of export affected it in the short run. Export diversification measure showed that the sector experienced fluctuations with varying Hirschman indices which depicted decreasing concentration. It is glaring from the findings of the study that it is necessary to explore policy options such as fiscal and monetary to promote production of export crops to expand the national export basket. This is necessary to encourage diversification. More so, adding value to our primary export commodities is important because it will not only command higher prices but will enhance patronage at the international market. The need to employ favourable export financing and foreign exchange policies to encourage production of value added agricultural exports has become both expedient and imperative.

References

Acemoglu D. & Zilibotti, F. (1997). Was Prometheus unbound by chance? Risk, Diversification, and growth, *Journal of Political Economy*, 115(4), 709 – 51.

African Development Bank (ADB) (2006). National Programme for Food Security (NFPS).Staff Appraisal Report.

Amoro, G. & Shen, Y. (2013). The Determinants of Agricultural Export: Cocoa and Rubber on Cote d'Ivoire, *International Journal of Economics and Finance*, 5(1), 228 – 233.

Ayemibo, B. (2010). Exporting from Nigeria: Cocoa Beans.A Certified Documentary Credit Specialist (CDCS) Tutorial.www.linkedin.com/in/bayemibo. Accessed 28/2/2011.

Central Bank of Nigeria (CBN).*Annual Report and Statement of Account*. 1960 - 2007, CBN, Abuja.

Daramola, A. (2004). Competitiveness of Nigerian Agriculture in a Global Economy: Any Dividend of Democracy? Inaugural Lecture Series 36, Federal University of Technology, Akure, Nigeria.

Daramola, A., Ehui, S., Ukeje, E. & McIntire, J. (2007). Agricultural Export Potential: In P. Collier and C. Pattillo (Eds.), *Economic Policy Options for a Prosperous Nigeria*, London: Palgrave Macmillan.

Dramĕ – Yayĕ, A, Chakeredza, S. & Temu, A.B. (2011). Why do Agricultural Faculties fail toAttract the Best Students? Background Paper Prepared for the ASTI-IFPRI/FARA Conference "Agricultural R&D: Investing in Africa's Future; Analyzing Trends, Challenges & Opportunities" held in Accra, Ghana on 5th – 7th December

FAO (2011). Medium-term prospects for Agricultural Commodities. http://www.fao.org/docrep/006/y5143e/y5143e0x.htm

FMARD (2001).*National Fadama Infrastructure Survey Report*, Sheda-Abuja: World Bank/Projects Coordinating Unit, Federal Ministry of Agriculture and Rural Development, Abuja.

Gbetnkom, D. & Khan, S. A. (2002). Determinants of Agricultural Exports: The Case of Cameroon. AERC Research Paper 120, AERC, Nairobi, Kenya.

Mesike, C.S., Okoh, R.N. & Inoni, O.E. (2010). Supply Response of Rubber Farmers in Nigeria: An Application of Vector Error Correction Model. *Journal of American Science*, 6(9), 52 – 56.

Mkpado, M. (2013). Some Indicator of African Agriculture Situations, Exports and Opportunities, *Journal of Business Administration and Education*, 3(2), 123 – 155.

Mubarik, A. (2004). Agricultural Diversification and International Competitiveness. Report of the APO study meeting on Agricultural Diversification and International Competitiveness, Tokyo, 16 – 23 May

Naude, W. & Rossouw, R. (2008). Export Diversification and Specification in South Africa: Extent and Impact. Research Paper No. 2008/93,United Nations University, UNU-WIDER, Helsinki, Finland.

NBS (National Bureau of Statistics)(2007). Details of the Breakdown of the National andStateProvincial Population Totals 2006 Census. National Bureau of Statistics, Federal Republic of Nigeria Official Gazette, 24(94), 1 – 26

Nkang, N.M., Abang, S.O., Akpan, O.E. & Ofem, K.J. (2006). Cointegration and Error – Correction Modelling of Agricultural Export Trade in Nigeria: The Case of Cocoa. *Journal of Agriculture and Social Sciences*, 2(4), 249 – 255.

Omilola, B., Yade, M., Karugia, J. & Chilonda, P. (2010). Monitoring and Assessing Targets of Comprehensive Africa Agricultural Development Program (CAADP) and the First Millennium Development Goal (MDG) in Africa. Regional Strategic Analysis and Knowledge Support System (ReSAKSS) Working Paper, No. 31. July 2010. <http://www.resakss.org> (accessed July 16, 2011).

Onyenweaku, C.E. & Madu, E.N. (1991). Perennial Crop supply Response: The Case of Nigeria Cocoa. Paper Presented at the 1st International Conference on Tree Crops, MANR, Imo State.

Osuntogun, A., Edorodu, C. C. & Oramah, B. O. (1997). Potentials for Diversifying Nigeria's Non – Oil Exports to Non – Traditional Markets. AERC Research Paper 68, African Economic Research Consortium, Nairobi, Kenya.

Oyedele, J.O. (2007). Enhancing the Sustainability of Cocoa Growing in Nigeria. A Paper Presented at the ICCo Roundtable Congress on Sustainable World Cocoa Economy at Accra, Ghana.3rd – 6th October.

Oyedije, T. A. (1986). The Effects of Trade and Exchange Rate Policies on Agriculture in Nigeria. Research Report, 55. International Food Policy Research Institute, Washington, DC.

Sasore, G. M. (2004). Nigeria's Export Trade of Agricultural Commodities: Quality Control and Standards. A Paper presented at Nigeria National Crop Outlook Conference held at Durbar Hotel, Kano. 26th – 27th May.

Susanto, D. (2006). Measuring the Degree of Market Power in the Export Demand for Soybean Complex. Unpublished Ph.D Thesis, Department of Agricultural Economics and Agribusiness, The Louisiana State University, USA.

UNIDO (United Nations Industrial Development Organization (1992). Report of the Export Group Meeting on the Implication of the single European Market for Industrialization in Developing Countries. March ID/WG 253/8

Wisdom, H.W. & Granskog, J.E. (2003).The Effect of Exchange Rates on Southern Pine Exports, *Forest Product Journal*, 53(10), 19 – 23.

World Bank (2008) Growth and Poverty Reduction in agriculture's three world http://www.siteresources.worldbank.org/NTWDR2008/Resources/2795087-1192112387976.pdf

Acknowledgement

The author is most grateful to Professors Christian Onyenweaku, Jude Nwaru and Aloysius Nwosu for their helpful comments and advice.