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Response of Nigeria's Agricultural Sector to Selected Macroeconomics Policy Variables

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Abstract
This study analyzed the growth rate (output) of the agricultural sector in terms of the selected crops (cocoa and rubber) and the effect of macroeconomic variables on output of cocoa and rubber in Nigeria. The study covered the period between 1986 and 2010. Data were generated from secondary sources, including CBN, FAO and World Bank. Data were analysed through the use of descriptive statistics and the Ordinary Least Square regression analysis. The study shows that the production level of cocoa and rubber have been fluctuating over the period under review. Cocoa production rose to its peak between 1991 and 1995 with average output of 278.4 tones and fell to 189.3 tonnes between 2001 and 2005. Rubber production consistently increased throughout the period under review. Its average output in 1986-1990 was 172 tones, this rose to its peak of average output of 294.68 between 2006 and 2010. From the regression result, Output price affected the production output of Cocoa at the 0.05 level, while for Rubber production, capital and recurrent expenditures on agriculture are the main determining factors on output. While the capital expenditure is significant at the 10% level the recurrent expenditure on agriculture is significant at the 5% level. Based on the findings it is recommended that government percentage share of expenditure on agriculture should be increased and sector-specific and there should be incentive geared towards encouraging increased participation of the organized private sector in commercial agriculture. This will guarantee continual flow of investment resources, technologies and entrepreneurial skills in agriculture.
Keywords: Cocoa, Rubber, Macroeconomic variables, Agriculture, Nigeria.

INTRODUCTION

In the 1960s, Nigeria's agricultural sector was the most important in terms of its contributions to domestic production, employment and foreign exchange earnings. The situation remained almost the same three decades later with the exception that it is no longer the principal foreign exchange earner, a role now being played by crude oil. The sector was stagnant during the oil boom period of the 1970s, which accounted largely for the declining share of agriculture's contributions. The trend in the share of agriculture GDP shows a substantial variation and long-term decline from 60 percent in the early 1960s through 48.8 percent in the 1970s, 22.2 percent in the 1980s and 26 percent in 2000 CBN (2004). Unstable and often inappropriate economic policies (of pricing, trade and exchange rate), the relative neglect of the sector and the negative impact of the oil boom were also important factors responsible for the decline in its contributions.

The leading cash crops in the country are cocoa, cotton, groundnuts (peanuts), palm oil, palm kernel, benni seed, and rubber. Cocoa and Rubber are the focus of this study. Cocoa is a bean that is in high demand all over the world especially by developed countries. Cocoa has several uses and benefits to an economy. Africa is the largest producer of cocoa to the international market, which are normally in Europe and America. According to the United Nations Conference on Trade and Development (UNCTAD) (2004), Ivory Coast, Ghana and Nigeria share the largest contribution to the world market and with Ivory Coast by far the highest producer producing up to 44% of world output (UNCTAD, 2004). While the contributions of Ghana, Nigeria to World output of cocoa are 14% and 11% respectively (UNCTAD, 2004).

Nigeria is blessed with a varied ecology but the rainforest belt provides the most suitable and edaphic condition for growth of natural rubber (NR) (Omo-Ikerodah 2011). Rubber is grown in Edo, Delta, Abia, Imo, Rivers, Akwa Ibom, Cross River, Bayelsa, Anambra, Oyo, Ondo, Taraba, Ogun, and marginally in areas like Ebonyi, Enugu, Ekiti, and southern Kaduna. The Nigeria rubber industry has enormous potentials for sustainable growth and development. It provides employment opportunity and also serves as source of foreign exchange for the country. It has been estimated that about 18 million hectares of land is suitable for the cultivation of natural rubber in Nigeria. The country has about 247,000 hectares of land under natural rubber cultivation; however, only about 154,000 ha are under tapping. Small holding (usually 1 -5 ha) account for between 75 – 85 % of the total land area planted to rubber while the remainder is held by the Estate plantation (Aigbekean, et. al., 2000, Okwu et al., 2005, Giroh and Adebayo, 2007a). Annual total production is 95,000 metric tonnes; while about 60,000 mt is exported leaving a balance of 35,000 mt for local consumption.

As at 1984, the growth rate of the agricultural sector at constant basic prices had a negative figure of -5.20 percent yet the crop subsector which was the major source of food still accounted for about 30 percent of the Gross Domestic Products (GDP), livestock about five percent, forestry and wildlife about 1.3 percent and

fisheries accounted 1.2 percent (CBN 2010). In a bid to mitigate the negative growth effect of the agriculture, manufacturing and oil sectors, the government introduced Structural Adjustment Programme (SAP) in 1986. The policy introduced deregulation of interest rates, which enabled interest rates to be determined by financial market forces rather than being determined by government. As at 1990, the growth rate of the economy had grown from a negative figure to a positive figure of 4.30 percent and in year 2003, the growth rate was 6.50 percent (CBN, 2004).

Agricultural production in Nigeria is determined by the functions of macroeconomic environment. However, other factors such as political instability, civil unrest and unfavourable policies have also been found to affect agricultural output (Eyo, 2008). The combined effects of all these factors either cause a fall or rise in commercial food production, exportation and food supplies. According to Mogues *et al* (2008), the major constraints to agricultural production include limited use of modern agricultural inputs, declining agricultural terms of trade and international debt, seasonal production bottlenecks, the risks of depending on market, lack of government financial support, government indifference and high levels of taxation, low food prices, poverty and lack of capital, land tenure systems, problems of competition with cheap food imports and food aid as well as the general world recession. Agricultural output, inflation, subsidy, exchange rate, food import and export influence the GDP of the agricultural sector at various degrees. Nwachukwu *et al*, (2008) suggested that government should provide credit finance incentives to farmers to bring about reduction in production cost and thus encourage increased output.

The fundamental objectives of macroeconomic policy in Nigeria are economic growth and development, price stability, self reliance and social equity. However, it was evident by 1981 that the above objectives could not be attained with the performance of the economy which depends solely on non-renewable natural resources – oil, with its attendant shocks generated by the oil glut in the world market. Many policy options were tried to correct the distortions in the structure of the economy, but by and large, it was aimed at stabilizing and not adjusting. The Fourth National Development Plans was consequently abandoned and policy changed to rolling plan within a perspective plan.

Over the years, there has been a growing recognition that macroeconomic policy is a key element of Agricultural development. In the Nigerian economy, as indeed in most other economies, the agricultural sector is an integral part of the domestic economy, which is itself an integral part of the global economy (Kwanashie, *et al*, 1997). These interdependencies generate two trade-offs that are significant to the response of the agricultural sector to macroeconomic variables: Fiscal, Monetary, Exchange Rate and Price. How does this affect the production level of agricultural commodities?

The specific objectives of the study are to:

(i) examine the trend in production of Cocoa and Rubber between 1986-2010.
(ii) estimate the effect of macroeconomic variables on the output of Cocoa and Rubber.

METHODOLOGY

Nigeria is the study area. Cocoa and Rubber are produced predominantly in the southern part of the country. The study period covers from 1986 to 2010.

Sampling Techniques and Data Collection

The data used in this study is secondary data. Secondary data were obtained from the Central Bank of Nigeria. These include: CBN Statistical Bulletin (various editions), Annual Report and Statement of Accounts, Economic and Financial Review, Federal office of statistics (FOS) publications, World Bank Publications, Food and Agricultural Organization (FAO).

Data collection/Analysis

The data collected for the study are the estimated output (production level), in tonnes of Cocoa and Rubber as well as the macroeconomic variables such as producers price of commodities, average rain fall, recurrent and capital expenditure, inflation rate, exchange rate, and gross domestic product.

Analytical Technique

Annual macroeconomic data series on relevant macroeconomic variables were used to estimate the model. The analytical tool for the study is the Ordinary Least Square multiple regression technique. This was employed in order to be able to quantify the relationship between various independent variables and the output variables with the aid of dummy variables to represent the regimes, based on the assumption that macroeconomic variables measure can be assessed by differential seasonal break (regimes) effect of macroeconomic policy measure in Nigeria.

To distinguish the five regimes, four dummy variable D_2, D_3, D_4 and d_5 were used; where the intercept represent the first regime (D1) in order to avoid the situation called dummy variable trap (Gujarati 2006). The model consists of a system of stimulus-response Production function.

To compare the coefficients of the variables for the five regimes,

$$Y = a_1D_1 + a_2D_2 + a_3D_3 + a_4D_4 + a_5D_5 + Ut.$$

Where

Y = Dependent variables

D_1 = Bench period (1986 – 1990 = 1 , 0 for other)

D_2 = (1991 – 1995 = 1 , 0 for other)

D_3 = (1996 – 2000 = 1 , 0 for other)

D_4 = (2001 – 2005 = 1 , 0 for other)

D_5 = (2006 -2010 = 1 , 0 for other)

$a_1 – a_5$ = coefficients

Ut = stochastic disturbance term

The effect of the independent Variables on production output becomes:

$$Y = a_1D_1 + a_2D_2 + a_3D_3 + a_4D_4 + a_5D_5 + a6_V + U_t$$

Where

V = selected independent variables

Others = as defined earlier

The joint Effect of all Independent Variables on the production of cocoa and rubber is given as:

$$Q_t == a_1D_1 + a_2D_2 + a_3D_3 + a_4D_4 + a_5D_5 + a_6P_t + a_7Q_t + a_8RF_t + a_9REA_t + a_{10}CEA_t + a_{11}FN_t + ut$$

Where

Q_t = the total quantity in tones of the commodity produced at time t.

p_t = Producers price of the commodity in year t. (Naira)

Qt = production level of commodity (tones)

RF_t = Average rainfall at time t

REAt = Recurrent expenditure on Agriculture at time t

CEA_t = Capital expenditure on agric in years t (Naira)

FN_t = Inflation rate

$a_1 – a_{11}$ = Coefficients

Ut = Error term

Three functional models were estimated. These are linear, semi-log and double log. The general form of each of the functional form is expressed below:

1. Linear function
   $Yt = a_0 + a_1 X_1 + a_2 X_2 + \ldots a_n Xn + Ut$
2. Semi-log function
   $Yt = a_0 + a_1 Ln X_1 + a_2 Ln X_2 + \ldots + a_n LnXn + Ut$
3. Double log function
   $LnYt = a_0 + a_1 LnX_1 + a_2 LnX_2 + \ldots a_n LnX_n + anLnXn + U_t$

RESULTS AND DISCUSSION

Trends in Production of Cocoa and Rubber (1986 – 2010)

The trends in production of cocoa and rubber over the period of study are as discussed.

Cocoa production

Cocoa is one of the three major agricultural export crops in Nigeria. The average production of cocoa between 1986 and 1990 stood at 200.2tonnes (Table 1). This increase was also sustained in subsequent year that followed. For instance, cocoa output increased by over 39 percent between 1991and 1995. The recorded outputs for this period stood at 278.4 tones. As observed by (Cadoni, 2013), following to investments in the oil sector, the 1970s and 1980s saw a constant economic down turn and decline in cocoa production in the country. Subsequent to the launch of the Structural Adjustment Programme (SAP) in 1986 and overall economic liberalization policy, cocoa production is still primarily managed by smallhodlers with a low use of both inputs and product enhancing agricultural techniques.

However, from1996-2000, output fell to 265.6 tones, which accounted for about -4.59 percent. Between 2001 and 2005 average output was 189.3 tones. This stood for about 28.7 percent decrease in cocoa production. From 2006 – 2010, average output increased to 256.69 tones.

Rubber production

Rubber is produced on 154,000 hectares of the agricultural land in Nigeria (Udofia, 2006). Rubber production kept on increasing throughout the period of study (Table 2). Its production averaged 172 tones between 1986 and 1990. It increased by 77 percent which stood for average of 249 tones between 199-1995. In 1996 – 2000, rubber production averaged 258 tones which amount for 9.0 percent increase. Between 2001 and 2005, average production was 288.1 tones. This increased to 294.68 tonnes between 2006 and 2010.

Analysis of Regression Results

Multiple regression analytical technique was employed to estimate the effect of the independent variables on the output of cocoa and rubber in Nigeria under the period of study. The lead equation with best fit for each commodity is chosen on the basis of the magnitude of the coefficient of determination (R^2), smallness of standard errors as well as appropriateness of the signs of the coefficient of the parameters.

Effect of Macroeconomic Variables on Output of Cocoa

The Double-log functional model was chosen and it gave a coefficient of determination of 0.43 and the adjusted coefficient of determination of 0.22 (Table 3). This implies that about 43 percent of the total variation in cocoa output/production is explained by the explanatory variables in the model. The unexplained variation is due partly to other relevant variables not included in the model such as technical problems of production. The F – Value of 2.291 is significant at five percent implying that the whole regression equation is significant.

Output price of cocoa with a coefficient of 0.078 and a t-value of 2.136 is significant at the 5 percent level. This implies that a percentage increase in the output price will result in a 7.8% increase in production output of cocoa. This finding is in support of the work of Cadoni (2013) on the analysis of incentives and disincentives for cocoa production in Nigeria. In the study he found that the poor price transmission between export markets and producers level prevented producers from receiving prices reflecting international price trends and that the export market is characterized by a high concentration of export companies benefiting from high market power compared to producers. The numerous intermediaries involved in the value chain create inefficiencies and also affect prices received by producers, hence leading to low production.

Effect of Macroeconomic Variables on Output of Rubber

For Rubber, the lead equation chosen is the Double – log function. The R^2 Value is 0.518 while the Adjusted R^2 is 0.348. This shows that only 51 percent of the variation in Rubber production is being accounted for by the explanatory variables. The F-Value of 3.043 is significant at one percent implying that the whole regression equation is significant. The detailed result indicates that both the coefficients of capital and recurrent expenditures on agriculture are positive and statistically significant in determining the output of rubber in Nigeria. The coefficient of capital expenditure is significant at the 10% level while recurrent expenditure on agriculture is significant at the 5% level. The implication of this is that an increase in budgetary allocation to the agricultural sector (particularly the permanent crops such as rubber) will translate to improved production in natural rubber in Nigeria.

CONCLUSION

This study analyzed the growth rate (output) of the agricultural sector in terms of the selected crops (cocoa and rubber) and the effect of macroeconomic variables on output of cocoa and rubber in Nigeria. The study shows that the production level of cocoa and rubber have been fluctuating over the period under review. Cocoa production rose to its peak between 1991 and 1995 with average output of 278.4 tones and fell to 189.3 tonnes between 2001 and 2005. Rubber production consistently increased throughout the period under review. Its average output in 1986-1990 was 172 tones, this rose to its peak of average output of 294.68 between 2006 and 2010.

From the regression result, Output price affected the production output of Cocoa at the 0.05 level, while for Rubber production, capital and recurrent expenditures on agriculture are the main determining factors on output. While the capital expenditure is significant at the 10% level the recurrent expenditure on agriculture is significant at the 5% level.

Based on the research findings, the following recommendations are made:

1 Government percentage share of expenditure on agriculture should be increased and sector-specific to justify the huge investment in capital project and for ease of evaluation for possible intervention.
2 There should be government incentive geared towards encouraging increased participation of the organized private sector in commercial basis. This will guarantee continual flow of investment resources, technologies and entrepreneurial skills in agriculture.
3 Government should facilitate credit flow into the agricultural sector and the formulation of policy and effective implementation that will attract the youths into agriculture with the view of empowering them and equipping them to replace the aging farmers.

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Table 1: Output of Cocoa and percentage Growth

Year	Cocoa output (000 tonnes)	Percentage
1986	148.0	7.50
1987	100.0	32.43
1988	253.0	153.00
1989	256.0	1.19
1990	244.0	4.69
1991	268.0	9.84
1992	292.0	8.96
1993	306.0	4.79
1994	323.0	5.56
1995	203.0	37.15
1996	323.0	59.11
1997	325.0	0.62
1998	345.0	6.15
1999	165.0	52.17
2000	170.0	3.03
2001	171.0	0.59
2002	172.0	0.58
2003	185.5	7.84
2004	202.6	9.21
2005	215.4	6.31
2006	227.72	5.71
2007	240.20	5.48
2008	253.65	5.59
2009	271.98	7.22
2010	289.9	6.58

Legend

Year	1986 -1990	1991 -1995	1996 -2000	2001 -2005	2006 -2010
A .Q	200.2	278.4	265.6	189.3	256.69

A.Q = Average Output in 000tonnes
Source: CBN: Annual Report and statement of Account (various issues).

Table 2: Output of rubber and percentage Growth

Year	Rubber output (000 tonnes)	Percentage
1986	190	-5.26
1987	180	17.22
1988	211	-37.44
1989	132	11.36
1990	147	46.25
1991	215	48.83
1992	320	-29.68
1993	225	2.22
1994	230	10.86
1995	255	-3.92
1996	245	2.04
1997	250	2.00
1998	255	3.92
1999	265	3.77
2000	275	1.09
2001	278	2.16
2002	284	7.18
2003	304.4	0.80
2004	328.9	-25.45
2005	245.2	5.87
2006	259.6	6.86
2007	277.4	6.37
2008	295.06	5.72
2009	311.95	5.59
2010	329.4	

Legend

Year	1986 – 1990	1991 – 1995	1996 – 2000	2001 - 2005	2006 - 2010
A. Q	172	249	258	288.1	294.68

A .Q Average output in tones
Source: CBN: Annual Report and Statement of Account (various issues)

Table 3: Regression Result on Effect of Macroeconomic Variables on output of Cocoa.

Variable	Linear			Semi-log			+Double- log		
	Coeff.	Std. error	t-value	Coeff.	Std. error	t-value	Coeff.	Std. error	t-value
Constant	163.67	88.612	1.847	-313.8	454.037	-.691	.977	.884	1.105
INF	.704	.691	1.019	55.310	37.662	1.469	.121	.073	1.645
EXCH	-.673	.396	-1.69	-68.220	49.865	-1.368	-.119	.097	-1.227
PRICE	.000	.000	1.242	36.512	184.798	1.936	.078**	.037	2.136
RAF	.277	.331	.837	153.79	184.798	.832	.400	.360	1.113
CAP	.000	.001	.267	-11.071	49.260	-.225	-.021	.096	-.223
REA	.000	.000	.785	29.299	29.405	.996	.056	.057	.972
R^2	.325			.388			.433		
Adjust R^2	.099			.183			.224		
F	1.442			1.898			2.291		
D.W	1.410			1.380			1.465		

Source: Author Computed Result, 2014
+ = Selected equation (functional form)
** = Value significant at 5 percent

Table 4: Regression Result on Effect of Macroeconomic Variables on Output of Rubber

Variable	linear			Semi-log			+Double- log		
	Coeff.	**Std. err**	**t-value**	**Coeff.**	**Std. err**	**t-value**	**Coeff.**	**Std. err**	**t-value**
Const.	202.80	64.72	3.133	267.48	308.87	.866	2.588	.614	4.217
INF	.342	.496	.689	7.648	24.039	.318	.008	.048	.168
EXCH	.327	.289	1.130	3.116	33.945	.092	.017	.067	.251
PRICE	7.247E	.000	.333	8.453	12.787	.661	.024	.025	.948
RAF	.003	.243	.010	-9.307	125.43	-.074	-.099	.249	-396
CAP	-.001	.001	-.964	-63.235	32.607	-1.939	-.119*	.065	-1.841
REA	.000	.000	1.730	51.170	20.447	2.503	.093**	.041	2.292
R^2	.356			.513			.518		
Adj R^2	.129			.341			.348		
F	1.568			2.979			3.043		
D.W	1.125			1.756			1.707		

Source: Author Computed Result, 2014
+ = Selected equation (functional form)
** = Value significant at 5 percent
*= Value significant at 10 percent

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