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Chapter Twenty Two

Macroeconomic Environment and Agricultural Sector Growth: The Nigerian Experience

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Introduction

Nigeria is the 8th most populous nation in the world, with about 150 million inhabitants (NBS 2009). With more than half of Nigeria's population currently employed in the agricultural sector (Manyong et al. 2005), and with high concentration of rural dwellers, the agricultural sector is predominant in Nigeria's economic development. Though agriculture accounts for about 40 percent of GDP, the level of growth in that sector has lagged behind other sectors. Real annual GDP growth from 2000 to 2009 in the Nigerian economy averaged 8.8 percent, while the agriculture sector grew at 3.7 percent in 2007 (Phillip et al. 2009). Due to its important role in nation building, the agricultural sector has continued to be a target of government policies overtime.

In fact, the government recognized the unhealthy condition of Nigerian agricultural sector since 1970, and has formulated and introduced a number of programmes and strategies aimed at remedying this situation. These measures included but are not limited to the setting up of large-scale mechanized farms by state and federal government, introduction of scheme such as the River Basin Development Authority (Enoma 2010). Other measures include, National Accelerated Food Production (NAFP), Operation Feed the Nation (OFN), Green Revolution (GRP) and the Directorate for Food, Roads and Rural Infrastructure. In addition to these measures, financial measures such as the establishment of agricultural credit scheme were introduced by successive governments.

However, with these measures, the development of the agricultural sector has been slow and the impact of this sector on economic growth and development has been negligible. This dwindling growth of agricultural production has generated some issues, among them are, the role of agriculture in providing food for the population; its role in supplying adequate raw materials to a growing industrial sector, its roles as a major source of foreign exchange earner.

Usually several factors are accountable for the dismal performance of the Nigerian agricultural sector. Paramount among these factors is the macroeconomic policies. The macroeconomic policies comprises fiscal, monetary, exchange rate, income and other policies that are used to regulate production activities not only in the agricultural sector but in the other sectors of the economy (Eyo 2008).

With this background the study basically investigates the effect of macroeconomic policies on agricultural output growth over time, and to establish the causal relationship between real GDP and agricultural growth in Nigeria. Therefore this paper is divided into

five sections. Section 1 is introduction; section 2 is literature review; section 3 is methodology; section 4 is results and discussion and section 5 is conclusion and recommendations.

Review of Relevant Literature

Agricultural growth began to accelerate after 2000, and since 2003, the annual growth rate has been above the 6 percent mark, a target set under the National Empowerment and Economic Development Strategy (NEEDS) which is a poverty reduction programme founded in 2004. Agricultural policies under NEEDS were basically designed to allow certain level of protection to domestic investors. Concretely, the policies were translated into tariff escalation and lower import duties on raw materials and relatively high import duties on finished goods which compete with local production. Duty exemptions and concessions were some of the quantitative policy instrument adopted in favor of domestic producers. Despite the macroeconomic incentives to the agricultural sector, the agricultural GDP witnessed a negative growth rate of about -28.21% between 2004 and 2005. However, following the marginal increase in the agricultural output in recent years, many economic analysts have attributed the growth to the expansion in cultivated land which has implication on the sustainability and environment deterioration in the long run. In addition, this growth has not been able to trickle down to the poorest of the poor, and has not helped tackle the problem of unemployment and underemployment of the rural youth (Sunday, et al 2012)

The macroeconomic environment consists of the fiscal, monetary, exchange rate regimes and trade policies among other policies tended to regulate production activities in the real sectors and other sectors including the agricultural sector. Regrettably, macroeconomic policy outcomes in any economy vary greatly depending in part on the policy targets and instruments employed as well as operating environment. Sound macroeconomic policies are important to achieve national development targets through agricultural development. Macroeconomic variables have serious economic and development implication for the sustenance of agricultural production and stimulation of export. Trade Import restrictions and trade barriers lead to less efficient use of scarce resources. Oil exports have led to large foreign exchange inflows. In turn, the foreign exchange inflows have not only depreciated the value of Nigeria's currency but have also eroded the competitiveness of domestic produced agricultural goods in comparison with low-priced imported goods, leading to a reduction in agricultural activities in the country. The exchange rate regime adopted during the Structural Adjustment Programme (SAP) neither has not resulted in any meaningful export of agricultural produce over time. For instance, in 1993 agricultural export amounted to only 1.7 percentage of the total export in the country. More must be done to ensure a favorable macroeconomic environment for pro-poor investments and growth(Sunday et al 2012). Many authors (Binswanger, 1989; Kwanashie and Ajilima, 1997 have reported the influence of macroeconomic variables fluctuations on the agricultural output. In Nigeria, Garba (2000) and Akpokodje, (2000) confirmed that However, several authors (Binswanger 1989, Kwanashie, et al 1997, and Killick 1990) agree that agricultural production marketing and financing decisions are influenced by the macroeconomic environments. More so, Garba (2000) and Akpokodje (2000) confirm that major macroeconomic policy shifts heighten agricultural policy instability.

Zepeda (2001) examined agricultural investment and productivity in the context of developing countries. The study used number of models of production growth (index

numbers or growth accounting techniques, econometric estimation of production relationships and nonparametric approaches) to measure the change in output, to identity the relative contribution of different inputs to output growth and to identify the Solow residual or output growth not due to increases in inputs. Results show a relatively weak relationship between physical capital and growth, as compared to investment in technology and human capital. Other factors found to be stimulants to growth included; the policy environment, political stability and natural resources degradation.

In their study on "Agricultural policy, Investment and Productivity in sub-Sahara Africa (SSA)", Wiebe *et al* (2001) indicated that an expected increase in output from improved infrastructure and price policies were difficult to quantify, but such improvements were probably prerequisites to make possible the increases in productivity from the use of conventional inputs and research. Other important constraints to agricultural productivity were the quality and availability of education, research and extension services, as well as institutional uncertainties that weaken incentives to invest in the maintenance or improved of land quality. The study concluded that education of rural labour force and agricultural research is needed to improve the future prospects for productivity growth in SSA. That being the case agricultural production has been increasing in SSA at over 2% per year in recent years. Land productivity increased by an average of 1.9% between 1950 and 1993 (and labour productivity declined by an average annual rate of 1.0% between 1980 and 1995). Levels of physical capital, livestock, fertilizer, and non-conventional inputs have also changed, contributing to an estimated 11.3% annual increase in total factor productivity between 1961 and 1991. Further analysis indicates that food production in SSA would have to grow at a rate of 3.3% to 4.5% annually in order to maintain per capita consumption levels or meet nutritional requirements over the next decade.

Agricultural sector plays a vital role in the economy development of Nigeria. The agricultural sector contributes significantly to the gross domestic product (GDP) and employed about 86 percent of the rural households in the country (CBN, 2010; Fan *et al.,* 2008 and Akpan, 2012). It is increasingly obvious that improvement in the agricultural development and growth can offer a pathway from rural poverty, but evidence-based macroeconomic policies and instruments are prerequisite. The country's agricultural policies and programmes over the years have been inconsistent, poorly implemented and mostly emerged as ad hoc attempts. Such agricultural policies have stunted the realization of the sector's full potentials.

Agu (2007) noted that macroeconomic policy outcomes in any economy vary greatly depending on the policy targets and instruments employed as well as operating environment. Sound macroeconomic policies are important to achieve national development targets through agricultural development. Macroeconomic variables have serious economic and development implication for the sustenance of agricultural production and stimulation of export. Trade Import restrictions and trade barriers lead to less efficient use of scarce resources. Oil exports have led to large foreign exchange inflows. In turn, the foreign exchange inflows have not only depreciated the value of Nigeria's currency but have also eroded the competitiveness of domestic produced agricultural goods in comparison with low-priced imported goods, leading to a reduction in agricultural activities in the country (Fan *et al., 2008).*

Memon *et al.,* (2008) found bi-directional Granger-causality relationship between total exports and agricultural GDP in the case of Pakistan. Hye and Zameer (2011) .in

Pakistan showed a significant positive long run relationship between trade openness and the real agricultural growth. While Salih (2006), present empirical evidence showing a significant long run relationship between agricultural output growth and economic growth that assumes bidirectional causation. It therefore implies that, the resilience of the agricultural sector depends largely on the level of economic growth in the country which is largely hinged on the stability of some key macroeconomic fundamentals.

Sunday et al., (2012) in their study established the empirical relationship between value of agricultural GDP as the ratio of total GDP and some key macroeconomic variables in Nigeria. The empirical results revealed that in the short and long run periods, the coefficients of real total exports, external reserves, inflation rate and external debt have significant negative relationship with the agricultural productivity in the country; whereas industry's capacity utilization rate and nominal exchange rate have positive association with agricultural productivity in both periods. However, per capita real GDP influence on the agricultural productivity was positive and significant only in the ECM model. The empirical results were further substantiated by the variance decomposition and impulse response analysis of the dependent variable with respect to changes in the explanatory variables. The findings call for appropriate short and long term economic policy packages that should stimulate investment opportunities in the agricultural sector so as to increase agricultural component in the country's total export. Appropriate policy package to stabilize inflation rate in the country should be implemented.

Therefore, this study explicitly established the short and the long run links between agricultural growth to real GDP and some key macroeconomic fundamentals in Nigeria. Such relationship is vital and is a dependable tool needed to accelerate growth in the agricultural sector in the country. The result of this study provides an alternative policy area that could be used to accelerate the slow-moving growth rate in the agricultural sector in the Nigerian economy.

Methodology

This study used mainly secondary data obtained from the Central Bank of Nigeria Existing literature indicate that prices, government expenditure in agriculture, volume of credit to the agricultural sector and exchange rate which are indicators of monetary, exchange rate and price policies determine activities in the agricultural sector. In this study, data on exchange rate, nominal interest rate, and government expenditure on the agricultural sector and inflation rate were obtained between 1986 and 2010 and used as indicators of the macroeconomic environment.

The method of data analysis is VAR model and Granger causality test. The VAR approach sidesteps the need for structural modeling by treating every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system. Since only lagged values of the endogenous variables appear on the right-hand side of the equations, simultaneity is not an issue and OLS yields consistent estimates. The granger causality test was also used to test the relationship within the variables of interest in this study.

In estimating the model, the dependent and independent variables are separately subjected to unit root tests. The unit root test is evaluated using the Augmented Dickey-Fuller (ADF) test which can be determined as:

$$\Delta Y_t = \alpha + \beta_t + \delta Y_t + \sum_{i=1}^{p} \Delta Y_t + \varepsilon_t \quad \cdots \quad \cdots \quad 1$$

Where represents the drift, t represents deterministic trend and p is a lag length large enough to ensure that ε_t is a white noise process. If the variables are stationary and integrated of order one I(2), we test for the possibility of a co-integrating relationship using Eagle and Granger (1987) two stage Var Auto-Regression (VAR). The study employs the Var Auto-Regression (VAR) because it is an appropriate estimation technique that captures the relationship among the inflows variables.

Model Specification

To establish the impact of macroeconomic policies on the growth of Agricultural output, the following model can be specified:

The specification is expressed as a function:

$$Y = \beta_0 + \beta_1 EXR + \beta_2 INT + \beta_3 CAS + \beta_4 GEA + \beta_5 INF + \varepsilon_t \quad \cdots \quad \cdots \quad 2$$

Where Y = Real GDP on agricultural products
EXR = Foreign Exchange rate
INT = Nominal interest rate
CAS = Credit to the Agricultural Sector
GEA = Government Expenditure on Agriculture
INF = Rate of inflation
ε_t = is the error tern

Before the causality test, some preliminary tests are performed on the time series. First, unit root tests are conducted to check if the time series are stationary. Augmented Dickey Fuller, (ADF) unit root tests are used. If unit root is found, a difference filter is employed to obtain stationarity. Second, the VAR model is tested for the rank of cointegration, following Johansen (1988, 1991). The VAR impulse response function was used to check how real GDP on agricultural product response to the macroeconomic environment.

Following Gries et al. (2011), Granger causality is tested in a modified structure proposed by Hsiao (1979, 1982). In standard Granger causality analyses, all variables are constrained to enter at the same lag length; this may lead to inconsistent results (Braun and Mittnik, 1993). The procedure followed in this study avoids such problems as the variables may enter at different lag lengths. Granger's (1969) definition of non-causality states that if one is able to better predict a series X_t when including information from a series Y_t instead of only employing lagged values of X_t, then Y_t Granger-causes denoted Y_t X_t. Bidirectional causality, or feedback, is present when X_t also Granger-causes Y_t. By combining this causality definition with Akaike's (1969) Final Prediction Error (FPE), causality can be tested for in the Hsiao–Granger sense. In its basic form, the causality testing procedure requires first the consideration of an autoregressive process.

To avoid the possibility of spurious causality, empirical analyses are conducted in trivariate systems, so we test for causality between two series, conditional upon the presence of a third one. Short-run causality inferences are made by comparing the minimal FPE of the bivariate and trivariate system. If a cointegration relationship is found, an Error Correction Model (ECM) is included; hence any VAR passes into a VECM (Engle and Granger, 1987). In VECM, the ECM estimate is interpreted as evidence of long run causality, where such an interpretation is only feasible if the ECM term is negative and statistically significant (Wickens, 1996). If no cointegration is accounted for, then we run the analyses in simple trivariate VAR in differences. Here, we examine the respective F-test results that indicate

significance of the VAR coefficients; if the F-test statistics are not significant, then causality inferences may be spurious (Gries et al., 2011).

Results and Discussions

Table: 1 Augmented Dickey Fuller (ADF) Unit Root Test Result

Variables	Level & 1st	Calculated tau	5 %	Stationary
Y	Level	-1.4333	-2.9969	Non stationary
	1st	-3.2541	-3.0038	Stationary
EXR	Level	-1.6607	-2.9969	Non stationary
	1st difference	-3.2541	-3.0038	Stationary
INT	Level	-3.0606	-3.0038	Stationary
CAS	Level	-2.0565	-2.9969	Non stationary
	1st difference	-5.9329	-3.0038	Stationary
GEA	Level	-1.5292	-2.9969	Non Stationary
	1st difference	-5.6570	-3.0038	Stationary
INF	**Level**	**-2.3859**	**-2.9969**	Non Stationary
	1st difference	**-3.8123**	**-3.0038**	Stationary

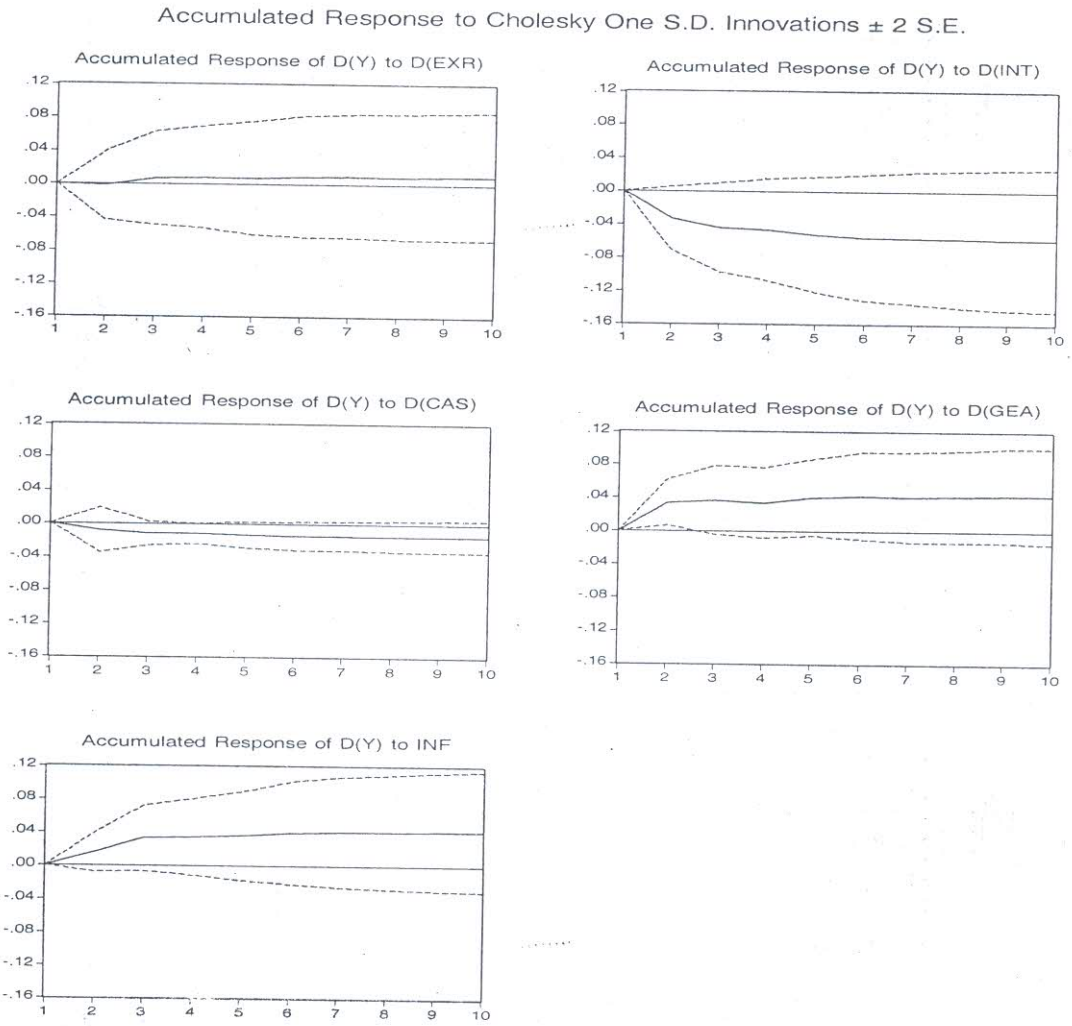
**significant at 5% level, ADF test > Critical Value then Stationary that is there is no presence of unit root.*

The results in the above table show all the variables were stationary at first difference accept interest rate that was stationary at level. Hence the variables are stationary at different order. This can be seen by comparing the observed values (in absolute terms) of both the ADF test statistics with the critical values (also in absolute terms) of the test statistics at the 5% level of significance. The table reveals that all the variables are stationary but at different level on the basis of this, the null hypothesis of non-stationary was rejected and it is safe to conclude that the variables are stationary.

Impulse Response Function of Y, EXR, INT, CAS, GEA and INF

Impulse responses trace out the response of current and future values of each of the variables to a one unit increase in the current value of one of the VAR errors, assuming that this error returns to zero in subsequent periods and that all other errors are equal to zero. The implied thought experiment of changing one error while holding the others constant makes most sense when the errors are uncorrelated across equations, so impulse responses are typically calculated for recursive and structural VARs. The extent to which shock in different variables influence Y, EXR, INT, CAS, GEA and INF can be assessed through impulse response function. The simulation horizon covers 10 quarters. The solid lines are impulse response. In this study accumulated impulse response function is depicted for a horizon of 10 quarters in the figure 1 below which enables us to trace out the response of Y, EXR, INT, CAS, GEA and INF to a shock in policy variables. The impulse response function depicts the growth rate relative to the base period when the shocks occurred.

Figure 1: Accumulated Impulse Response Function



The accumulated response of real GDP on agricultural product (Y) to credit in agricultural sector (CAS) shows that, there exists a slight negative relationship between the two variables from the 1st quarter to the 10th quarter. So also, with the response of real GDP on agricultural product (Y) to interest (INT) this implies that, a negative relationship exit between real GDP on agricultural product and interest rate in Nigeria. However, real GDP on agricultural product (Y) to exchange rate (EXR) shows that a slight positive relationship existed between the two variables. Furthermore, response of real GDP on agricultural product (Y) to government expenditure on agriculture (GEA) and to inflation rate (INF) shows that positive relationship exists between these variables from the 1st quarter to the 10th quarter.

Table:2
Pairwise Granger Causality Tests
Date: 04/12/13 Time: 18:29
Sample: 1986 2010
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
EXR does not Granger Cause Y	23	4.48447	0.02628
Y does not Granger Cause EXR		1.22260	0.31778
INT does not Granger Cause Y	23	0.92210	0.41567
Y does not Granger Cause INT		1.10101	0.35392
CAS does not Granger Cause Y	23	0.73727	0.49232
Y does not Granger Cause CAS		3.30940	0.05971
GEA does not Granger Cause Y	23	1.35346	0.28341
Y does not Granger Cause GEA		4.87718	0.02030
INF does not Granger Cause Y	23	3.37874	0.05677
Y does not Granger Cause INF		4.18366	0.03220
INT does not Granger Cause EXR	23	0.06263	0.93949
EXR does not Granger Cause INT		0.77866	0.47388
CAS does not Granger Cause EXR	23	1.11635	0.34912
EXR does not Granger Cause CAS		1.61261	0.22687
GEA does not Granger Cause EXR	23	0.42440	0.66054
EXR does not Granger Cause GEA		7.49895	0.00428
INF does not Granger Cause EXR	23	5.91986	0.01058
EXR does not Granger Cause INF		0.91959	0.41662
CAS does not Granger Cause INT	23	0.24496	0.78530
INT does not Granger Cause CAS		5.55156	0.01324
GEA does not Granger Cause INT	23	1.99010	0.16564
INT does not Granger Cause GEA		0.47602	0.62886
INF does not Granger Cause INT	23	3.40663	0.05563

INT does not Granger Cause INF		1.01397	0.38258
GEA does not Granger Cause CAS	23	2.62933	0.09958
CAS does not Granger Cause GEA		0.14830	0.86322
INF does not Granger Cause CAS	23	1.63593	0.22243
CAS does not Granger Cause INF		1.28537	0.30075
INF does not Granger Cause GEA	23	1.22614	0.31679
GEA does not Granger Cause INF		1.90799	0.17721

Based on the granger causality test result among the macroeconomic variables understudy in relation to real GDP to agricultural activity in Nigeria, it was very obvious that EXR granger cause Y, Y granger cause GEA, EXR granger cause GEA, INF granger cause EXR and INT granger cause CAS in unidirectional form indicating short run effect.

Conclusion and Recommendations

From the mid 1980's it has become increasingly difficult to achieve steady increase in the growth of agricultural output in Nigeria. Generally, the macroeconomic policies such as , exchange rate, credit to agricultural sector, interest rate, government expenditure on agriculture and inflation rate position marred in undesirable direction the manor source of problem in monetary control frame work. This shows that macroeconomic policies are vital for the growth of the agricultural sector in Nigeria. Therefore, macroeconomic policies which encourage favorable exchange rate; reduction in the level of inflation and boost the level of investment in agriculture through availability of agricultural credit to farmer at an affordable low interest rate, and also have significant effect on agricultural output would not only strengthen government investment in the sector but would be very useful in supporting agricultural output growth in Nigeria.

It is increasingly obvious that improvement in the agricultural development and growth can offer a pathway from rural poverty, but evidence-based macroeconomic policies and instruments are prerequisite. The country's agricultural policies and programmes over the years have been inconsistent, poorly implemented and mostly emerged as ad hoc attempts. Such agricultural policies have stunted the realization of the sector's full potentials. A paradigm shift towards a sound evidence-based policies anchored on sound macroeconomic policies is needed to promote a more equitable and environmental sustainable growth in the agricultural sector.

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