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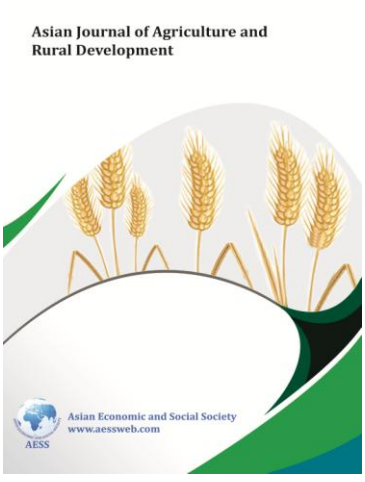

Econometric Analysis of Food Crops' Response to Climate Variability and Macroeconomic Policies' Reforms in Nigeria (1978-2009)

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Abstract

This study investigated the extent to which climate variability (proxied by rainfall variability) and macroeconomic policies influenced food crop output in Nigeria. It used time series data obtained from Central Bank of Nigeria and National Bureau of Statistics (1978-2009). Four functional forms of OLS models were tried. The Cobb-Douglas function was finally adopted based on standard econometric model selection criteria and diagnosis. Chow test was used to test the hypotheses of the study. It was found that rainfall variability influenced crop output negatively. Climatic factor, loans guaranteed by Agricultural Credit Guarantee Scheme Fund and lending rate were all statistically significant drivers of crop output in the economy at $p<0.05$, $p<0.01$ and $p<0.05$ respectively. Their elasticities were respectively 4.01%, 0.52% and 0.98%. No structural difference between the economic reform era and the preceding era's regression coefficients was found. Programmes to stem corruption and loan diversion; subsidization of agricultural credit and climate change adaptation capacity building programmes were recommended to bring about sustainable food security in the country.

Keywords: food security, macroeconomics, agricultural finance, environmental economics, climate change, econometrics

Introduction

In 2008 the world saw food prices explode, causing havoc in developed and developing countries alike. Poor people were hit especially hard and many more became poor (Christiansen, 2009). Malnutrition among pre-schoolers rose and children dropped out of school early, rendering the damage long lasting. Christiansen noted that world food prices have come down since, and the attention has shifted to staving off worldwide depression. In effect, the world can consider itself fortunate in not having experienced even higher price peaks. Given the 2008 record low cereal stock-to-use ratios (second lowest in 30 years), prices may have gone up much further if aggregate harvests had been even a few per cent lower. And, domestic food prices have remained high in many developing countries (FAO, 2009).

In Nigeria, the largest African country in terms of population (with over 157,000,000 people), food production and malnutrition remains a problem in the agricultural sector (Ajieroh, 2010). The roots of the current food crisis in Nigeria can be traced to her long-term agricultural policies at the macro level (Kwanashie, et al, 1998). Additionally, studies have shown clearly that numerous factors including climate variability, research and basic rural infrastructure influence food production and farm profits (Kwanashie, et al, 1998, Christiansen, 2009 & FAO, 2009). In addition to the above identified problems, there are signals that individual crops and sub-sectoral aggregates were not responding significantly to macroeconomic reform policies especially the aspect of capital expenditure on agriculture in Nigeria (Kwanashie, et al, 1998). Wrong priorities in agricultural policies could have also led to poor response of food crop to agricultural investment in Nigeria. For instance, it was noted that early research on commodities focused primarily on cash crops because these crops served colonial interests (Okigbo, 1982).

The need for a balance between food and cash crops was taken for granted until the collapse of cash exports in the 1970s. This problem was, however, addressed in the first long-range plan for agricultural development in Nigeria. Yet during the second national development plan (1970–1974), 63% of total allocation for agricultural research went to export crops, compared with the 33% for food crops (Idachaba, 1980). It was therefore not surprising to observe that Nigerian economy which had come to be dominated by crude oil relegated agricultural sector to the background over time (Mogues et al, 2008). The decline was precipitous during the first two decades after independence, when the GDP share of agricultural value added dropped from 60 percent to 20 percent.. Since 1980, the GDP share of agricultural value added had fluctuated around a flat trend line, ranging between 20 and 35 percent for much of that period. More recently it had started to rise again as a result of growth in the sector, combined with a contraction in oil revenues. Consequently the share of the labor force employed in agriculture, and the share of the nation's export earning derived from agricultural commodity exports also retarded.

Interestingly, the relative importance of agriculture declined even though private investment in the sector increased as a share of overall private investment in the country (Mogues et al, 2008). Between 1981 and 2000, aggregate domestic capital investment in agriculture, measured by gross fixed capital formation in the sector, steadily increased as a share of domestic capital investment across all sectors, rising from around 5% early in the period to around 14% during the later years (Manyong et al. 2005). During the same period, foreign private investment in the sector increased as a share of overall foreign private investment in the Nigerian economy. Kwanashie, et al, 1998 stressed that long-term growth in agriculture requires investment and capital accumulation in that sector and increasing utilization of the relatively abundant labour in the economy. Investment in the agricultural sector is also required to stem the continuous migration of rural workers into urban areas. Unfortunately only a very small proportion of public sector investment spending goes to agriculture. Although the share of agriculture in total public sector investment is relatively low, the actual expenditure has been on the increase (Kwanashie, et al, 1998; & Mogues, et al, 2008). In fact, a huge amount of resources has been pumped into the agricultural sector, on paper, in Nigeria within the last decades. The issue is the extent to which these expenditures actually go for what they are meant. The leakages in the sector, as with nearly all government expenditures, could be very high, accounting for the low response of the sector to increased expenditures. The improved performance of Nigerian agriculture is certainly encouraging, but the sustainability of current high growth rates is subject to question (Mogues et al, 2008). Word Bank (2006), Mogues et al (2008) and Ajieroh (2010) added that the recent upsurge in agricultural GDP growth in Nigeria had been driven mainly by production increases resulting from the expansion in land area planted to staple crops. Productivity has remained flat, and yields of most crops have actually declined over the past two decades. Arable land being a finite resource, area expansion is not a sustainable source of agricultural growth. This suggests that public investments in agriculture must be reoriented to spur productivity gains (Mogues et al, 2008). Unfortunately empirical evidence to give the current state of the relationship between national investment in agriculture and food crops output or growth are scant in Nigeria. More worrisome is the relative dearth of research at macro level in Nigeria exploring the influence of climate change and climate variability on crop production in Nigeria. The above background and the need to respond to this yawning knowledge gap underlie the need for this research. Findings from this study are expected to guide Nigerian government and other Sub-Saharan African countries in formulating and implementing major policy elements that relevant for making agriculture regain its rightful place in their economies especially as they struggle to meet up with Comprehensive Africa Agriculture Development Programme (CAADP) target by 2020 especially the cardinal pillar of "increasing food supply and reducing hunger" in Africa.

Objectives of the Study: Given the above background this study was therefore designed to find out the effect of public spending and other macroeconomic policies implemented to reform the Nigerian economy on food crops output in Nigeria. Specifically the study's objectives were to: 1) ascertain the influence of public and private agricultural expenditures on food crop output in Nigeria during the pre-deregulation and post deregulation/economic reform eras in Nigeria; 2.) find out the differences in influence of public and private expenditures in crop output in Nigeria during the pre-economic reform era (during the earlier civilian and military regime era, i.e. 1978 to 1986 through), and the current economic reform era of the civilian administration which started in 1999).

Theoretical Framework

The Nigerian economic reform depicts a paradigm shift from the Keynesian to more or less neoclassical theories promoted by the World Bank under the aegis of economic *deregulation*. Following Kwanashie, Ajimil and Garba (1998) the literature discussing these ideological premises may be generally classified into three arguments: 1) that economic agents are responsive entirely to price variables; 2.) that because of the structural rigidities that are dominant characteristics of less developed economies, price mechanisms are less capable of inducing significant response among economic agents.; and 3.) that economic agents respond simultaneously to price and non-price variables. The World Bank (1981), Kuester et al. (1990) and Krueger et al. (1990) as cited in Kwanashie, Ajimili & Garba (1998) belong to the first group, whose propositions are classified as the neo-classical counter-revolutionary paradigm. The group is neo-classical because its propositions are neo-classical and it is counter-revolutionary because it represents a negation of the revolution of Keynes. Though market failures and externalities justify government intervention, especially in less-developed countries, the World Bank justification of Structural Adjustment Programme (SAP) was anchored on the grounds that state intervention had distortionary effects in three key areas: resources use, domestic absorption and use of scare foreign exchange. The economic crisis of Nigeria in the 1980s, which had been well documented in the Central Bank of Nigeria (CBN) Annual Reports 1981–1989, appears at face value to vindicate the World Bank's position that poor domestic policies are the causal factors. However, Killick (1990a/b) and Yagci et al. (1985) as cited in Kwanashie, et al (1998) suggested the need for caution in ascribing the crisis of less-developed economies entirely to domestic policies. At least two sets of factors could be identified. The first, referred to as external factors, are linked to the asymmetrical relationship that exists between less developed and developed capitalist countries. These factors include dependence on a few primary exports and on capital goods imports, low income elasticities for primary products, competing synthetics, terms of trade deterioration, weak infrastructure of international trade, and so on. The second set consists of internal factors, which include policies, climatic vagaries, population growth, political instability, wars, etc. Some amount of consensus on the importance of both price and non-price factors is shared by an increasing number of economists. Phillips (1987), and Barau and Isitor (1988) are among several studies that have provided econometric evidence to show that some Nigerian crops respond significantly to price incentives. Eyo (2008) found that several macroeconomic policies have been used in Nigeria, which have directly and indirectly influenced agricultural output growth. The study found that the country's exchange rate regime did not encourage agricultural export lately. Although credit to the sector had no significant effect on agricultural output growth, its availability greatly depends on how high the nominal interest rates are. On the whole, macroeconomic policies that reduce inflation, increase foreign private investment in agriculture, introduce favorable exchange rates, make agricultural credit to have significant effect on agricultural output growth would be invaluable in fortifying government expenditure in the sector and ensure agricultural output growth in Nigeria, the study concluded. Kwanashie, Ajimili and Garba (1998) found that food crops are less sensitive to external factors but more responsive to domestic prices and policy than are tradeable crops. This, according to them suggests that the emphasis of SAP on tradeables would not raise aggregate agricultural productivity or output, or

put the economy on the path of structural transformation. In addition, discrimination in favour of tradeable crops violates the requirement for optimal social use of resources if it is less responsive to prices and policy than food. They suggested that more research should be undertaken to test the robustness of their estimates so that if their results are found to be robust, food should be the core of a socially optimal Nigerian agriculture policy, which should aim at creating the best enabling environment for food production and farmers' incomes. This study builds on this premise.

Research Methods

The Study Area: The study area, Nigeria has land area of 923,769 square kilometers and a population of about 157 million people. It is bounded on the West by the republic of Benin and the republic of Niger; on the East by the republic of Cameroon; on the north by Niger and Chad republics and on the South by the Gulf of Guinea (Manyong et al , 2005).. The climate is equatorial and semi-equatorial. There are two seasons; the wet and the dry season and agriculture is a major employer of labour. Cereals, roots and tubers dominate Nigerian crop production and Nigeria is the world's leading producer of cassava, yam and cowpea (Ajieroh, 2010).

Source of Data and Data Analysis: This study uses principally secondary data obtained from the Central Bank of Nigeria the Nigerian National Planning Commission. Existing literature indicate that prices, government expenditure in agriculture, volume of credit to the agricultural sector, nominal interest rate and exchange rate which are indicators of monetary, exchange rate and price policies determine activities in the agricultural sector [Garba, 2000 & Akpokodge, 2000]. Consequently, in this study, data on exchange rate, nominal interest rate, world prices, credit to the agricultural sector and government expenditure on the agricultural sector, inflation rate and foreign private investment in agriculture were obtained between 1978 and 2009 and used as indicators of the macroeconomic environment. The method of data analysis is the multiple regression analytical technique (Ordinary Least Square Procedure). The problem of violation of assumption of normality of residuals in OLS, autocorrelation, multicollinearity and heteroscedasticity were forestalled by conducting the relevant econometric tests; namely the Durbin Watson test, LM Tests , VIF test, and White's tests respectively besides selecting the best model aout of the three tried. The selection of the lead equation was based on the model selection criteria in econometric parlance which includes the Akaike Information criterion, Schwarz criterion, F-raio tests and R-square besides evaluation of the conformation of the slopes' coefficients of the explanatory variables with theoretical expectations. The model used was similar to the structural response function used by Fosu (1992), Amin (1996), Kwanashie *et al*. (1997) and Umoh (2003) with a slight modification which involves trying different functional forms and selecting models based on the earlier mentioned model selection criteria.

The Model in explicit form was stipulated thus:
Ycrp = f (ACGSFCR, AGRICEXP, FOREX, INTRATE, RAINFALL, AGRINVST, WPIAgric + μ)

In explicit forms, the models are presented thus:
$Ycrp_i = \beta o + \beta_1 ACGSFCR_i + \beta_2 AGRICEXP_i + \beta_3 FOREX_i + \beta_4 INTRATE_i + \beta_5 RAINFALL_i + \beta_6 AGRINVST_i + \beta_7 WPIAgric_i + \mu$ …….. Linear Model

$logLog(Ycrp)_i = \beta o + \beta_1 ACGSFCR_i + \beta_2 AGRICEXP_i + \beta_3 FOREX_i + \beta_4 INTRATE_i + \beta_5 RAINFALL_i + \beta_6 AGRINVST_i + \beta_7 WPIAgric_i + \mu$ ……Semi-log Model

$logYcrp_i = \beta o + \beta_1 log(ACGSFCR)_i + \beta_2 log(AGRICEXP)_i + \beta_3 log(FOREX)_i + \beta_4 log(INTRATE)_i + \beta_5 log(RAINFALL)_i + \beta_6 log(AGRINVST)_i + \beta_7 log(WPIAgric)_i + \mu$ ..... Double log Model

Where , Ycrp = Crop output (share of GDP) in millions of naira; ACGSFCR = Amount of loans (farm credit) guaranteed to the agricultural sector by Agricultural Credit Guarantee Scheme Fund (of the Central Bank of Nigeria), ACGSF, in millions of naira each year; AGRICEXP = Recurrent expenditure on agricultural sector in millions of naira over time period; FOREX = Average nominal foreign

exchange (ratio of N to $US1); INTRATE = Nominal interest rate in percentage; RAINFALL = Mean annual rainfall across Nigeria in mm/annum; PRIVINVAGR = Annual private investment in agricultural sector in millions of naira; WPIAGRCRPS = Index of world price of crops produced in Nigeria; μ = stochastic error term; β o = intercept of the model.

$\beta_1 - \beta_8$ = respective coefficients of the various variables' slopes ; i = time (year); and LOG = log to base 10 of respective variable.

The Chow test was also conducted to test the hypotheses about the presence or absence of structural changes (breaks) in the slope coefficients of the pooled regression during the SAP period and the post SAP era (economic reforms era started during the civilian administration in 1999 to date). The formula for the Chow test, according to Koutsoyiannis (2001) is given by:

$$F^* = \frac{[\sum e_p^2 - (\sum e_1^2 + \sum e_2^2)]/K}{(\sum e_1^2 + \sum e_2^2)]/(n_1 + n_2 - 2K)}$$

Where, n = number of observation (sample size); $(\sum e_1^2 + \sum e_2^2)$ = total unexplained variation, $\sum e_p^2$ = pooled residual variance of the regression based on the two samples (n1 + n2) (i.e.$\tilde{Y} = \dot{\alpha}_0 + \dot{\alpha}_1 X$) = $\sum Y_p^2 - \sum \tilde{Y}_p^2$, with $(n_1 + n_2 - K)$ degrees of freedom. (p stands for 'pooled' and K = total number of coefficients including βo). The first null hypothesis, Ho, is that there is no difference in the coefficients obtained from the two samples (before SAP and after SAP in Nigeria i.e $\boldsymbol{\beta_i = \beta_j}$). Ho1, which held that: "there is no significant difference in the estimated slope coefficients of crop output determinants of farmers under pre-SAP and Post-SAP era in the study area" was tested using this model. To test whether there was a difference in the sub-sample of post Sap era (1999-2009), from the pre_Sap (1978-1985) to Sap era (1986-1998), we also tested another hypothesis which held that "there is no significant difference in the estimated slope coefficients of crop output determinants of farmers under pre-SAP to Post-SAP era and the economic reforms era (of the civilian government) in Nigeria" was tested using this model.

Results and Discussion

Diagnosis; The econometric tests for normality of the residuals and the tests for multicollinearity indicated that the series was normally distributed with a Jarque-Bera statistics of 2.811, a value that was not statistically significant, which implies that the null hypothesis of the series not having a skewed distribution remained accepted even at above 10 percent significance level. The mean Variance Inflation Factor (VIF) recorded was slightly above 10 (11.64) and so was not considered too severe a threat to warrant dropping the explanatory variables of the models. We had to tolerate it.

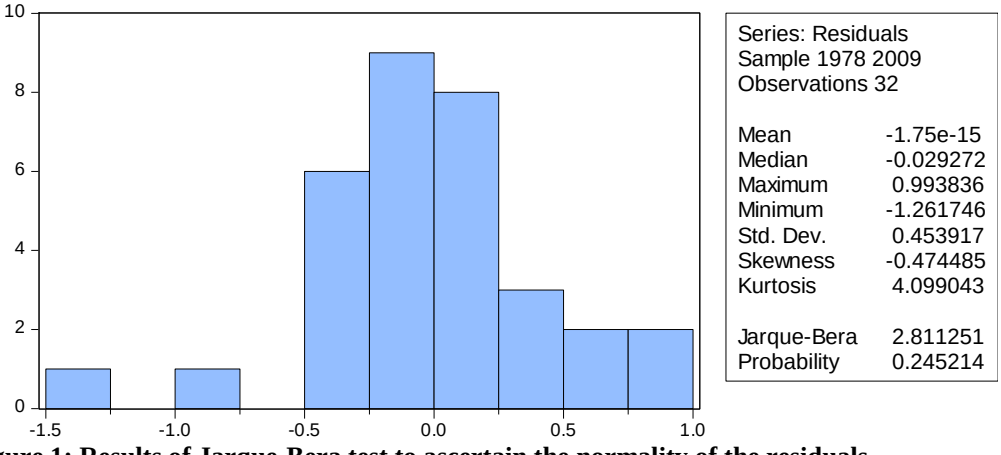

Figure 1: Results of Jarque-Bera test to ascertain the normality of the residuals

The test for heteroskedasticity using the Breusch-Pagan-Godfrey test gave an F-statistics of 3.7187, a figure statistically significant at 1 percent. It was therefore confirmed that the model in the form it was without transformation was fraught with heteroscedasticity. So the OLS that was later estimated with the lead model was based on White heteroskedasticity-consistent standard errors & covariance (See Appendix 1). This ensures that heteroscedasticity was no longer present in the model following Gujarati and Sangeetha (2007) and Greene (2008). The F-statistics estimated (1.68096) to test for autocorrelation using Breusch-Godfrey Serial Correlation LM Test was not significant even at above 10 percent statistical significance level. This implies that the series was devoid of 1st order serial correlation in the residuals of the model used. (See Appendix 1B). The test for model fitness before selecting the best of the three models was done by considering the estimates of the Akaike Criterion and with the Schwarz criterion of the model which both indicated that the double log model was the best model considering that it had the lowest estimates of these statistics. In addition the double log model had high F-statistics which is significant at 1 percent.

Table 1.0 OLS Parameter Estimates of the Three Functional Forms Used in Estimating the influence of macroeconomic policies and Government Expenditures on Crop Output in Nigeria (1978-2009)

	Linear Model		Semi-log Model		Double log Model	
Variable	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**
Intercept	86660.65NS	1.5346	15.63728***	7.9801	25.6514***	2.8964
$ACGSFCR_i$	0.021503***	6.9328	1.92E-07*	1.7795	0.5195***	4.1102
$AGRICEXP_i$	0.044385NS	0.1692	3.28E-06NS	0.3608	-0.027889NS	-0.2718
$FOREX_i$	7.537197NS	0.0614	-0.006542NS	-1.5349	-0.078851NS	-1.3119
INTRATE	2294.977**	2.8937	0.048440*	1.7601	0.978735**	2.7563
$RAINFALL_i$	-221.4996NS	-1.5319	-0.016561***	-3.3007	-4.017202**	-2.6212
$PRIVINVAGR_i$	-12.96072NS	-1.0380	-5.46E-05NS	-0.1261	0.254822NS	1.6171
$WPIAGRCRP_i$	10.15295***	5.3893	0.000162**	2.4792	-0.178527NS	-1.0370
R-squared	0.95973		0.77483		0.82459	
Adjusted R^2	0.94798		0.70915		0.77342	
F-statistic	81.7006***		11.7979***		16.1169***	
Prob(F-statistic)	0.0000		0.0000		0,0000	
Akaike info criterion	22.51367		1.9761		1.726447	
Schwarz criterion	22.8801		2.3425		2.0928	
Durbin-Watson stat	1.7111		1.6052		1.6294	

Source: Econometric Analysis output using E Views Programme by Author. *NB:* Coefficients with ('***') have t-ratios significant at 1% alpha level; ('**") = figures are statistically significant at 5%; while ("*") = Figures are coefficients whose t ratios are significant at 10 %. NS = "Not significant at any of the three levels specified.

Alpha level indicating that the model was fit and that at 1 percent statistical significance level the hypothesis of joint effects of the slope coefficients of the explanatory variables in the model was not equal to zero (See Table 1.0). The high adjusted R-square of the model which was 0.82 implies that 82 percent of the variation in crop output as share of Nigerian Agricultural

GDP was explained by the independent variables (or factors) used in the double log model. Only 18 percent of the variation of the crop output was not accounted for by the variables in the model. Besides, it was observed that some of the variables had slope coefficients which returned expected signs that are in tandem with a priori expectations. These all attest to the fitness of the double model. Given the foregoing we therefore justify the use of the double log model in our economic analysis.

The slope coefficients of the variables estimated in the double log models usually represent elasticities (See Gujarati and Sangeetha, 2007 and Greene, 2008). The signs of the intercept and ACGSF were positive which are in tandem with our *a priori* expectations. Credit supply is necessary to build capital formation in the agricultural sector, a development that can bring about improved crop output or agricultural productivity (Mogues, et al, 2008). The findings imply that the state of technology and amount of credit guaranteed by the ACGSF (loans guaranteed to farmers in the economy) were positively contributing to the crop output in Nigerian economy during the period in review. In terms of elasticity, the slope coefficient of ACGSF indicated a 1.78 elasticity, which stated in another form means that for every unit of loan guaranteed by ACGSF in Nigeria over the period in review, an increase in share of crop output in Nigerian GDP of 1.78 percent was recorded. This goes to emphasize the role credit can play in boosting crop output in Nigerian farms. The findings contrasts with that of Eyo (2008) who noted that credit supply to Nigerian economy had no significant influence on agricultural production but agree with Kwanishie, Ajimili and Garba (1998) who found that all tradeable crops responded negatively to agricultural loans, while most food crops responded positively. Increase in interest rate is expected to influence the output of crops negatively. However, the reverse is the case in the results of this analysis. The relationship between cost of borrowing and credit demand pattern could have influenced the result noticed here. The negative sign could be attributed to non-response of demand of farmers to rise in cost of capital since farm credit is always required by farmers for their farm expansion regardless of the cost of capital prevailing in the market. The negative sign may equally be explained by the availability of credit guarantee fund scheme (a programme of CBN) which has been shielding the farmers from risks inherent in loan utilization by paying up loans not paid back due to defaults arising from loan diversion to other personal or farm household problems and farm uncertainties (e.g. disease outbreak or poor yield). This variable (interest rate) had a very low elasticity of 0.98 percent implying that for every percent rise in nominal interest rate in Nigerian financial market, crop output was rising slightly by about 1 percent. The variable's slope coefficient was statistically significant at 5 percent. The non-significance of slope coefficients of public agricultural expenditure in Nigerian economy recorded in the study's results is not a surprising outcome. It could be recalled that Kwanashie, et al (1998) and Mogues et al (2008) noted that public expenditure in Nigerian agriculture had made no significant impact on agricultural productivity or output in Nigeria owing to corruption and diversion of fund from the intended targets. The findings of this study also corroborate the earlier findings of other scholars in the past with respect to government agricultural spending in Nigeria. World Bank (2008) reported that the level of public spending on agriculture in Nigeria was exceptionally low. Agricultural spending averaged only 1.7 percent of total federal spending from 2001-2005, lagging behind spending in other key sectors such as education, health, and water. World Bank also noted that while agricultural spending expressed as a share of total spending is generally low in African countries compared to countries in other developing regions, Nigeria fared unfavourably even within the African context. In 2000, agricultural spending in Nigeria expressed as a share of total public spending was the lowest among all 17 sub-Saharan African countries for which data were available, and in other years it was among the lowest. It is even more worrisome to observe that private investment in agriculture was not also significant in determining the output of crops in Nigeria over the review period. This could be as a result of poor infrastructure, policy incentives and poor productivity of farms in Nigeria. Nigerian agriculture is noted to be characterized by low productivity and poor policy environments

especially with respect to implementation of well intended policies (Idachaba, 1982; Kwanashies, et al, 1998; Manyong et al 2005 & Mogues et al, 2008). The influence of weather symbolized by mean annual rainfall over the period in review indicates that the influence of physical environment cannot be underrated in production decisions of crop farming. This factor or variable slope coefficient had a t ratio that was statistically significant at 5 percent. The negative sign cannot be categorically said to be a deviation from a priori expectations because sometimes too much rainfall can bring about poor crop yield in some food crops. The influence of climate change which is under hot discourse at the moment globally now may be gleaned from this result. The negative effects could have resulted from flooding (one of the signs of global warming) and the consequence of leaving food crop productions to the vagaries of weather (without irrigation). The elasticity of this variable (mean annual rainfall), 4.017, implies that for every percent rise in annual mean rainfall in the country during the period in review, a 4.02 percent drop in crop output in agricultural GDP was recorded. The findings agree with the Keynesian theory which asserted that the presence of externalities in production environment or systems and market imperfections make it rather risky to completely depend on pricing mechanism in growing the economy but rather calls for government intervention to bring the economy to equilibrium through some incentives or policies that boost aggregate demand.

The results of Chow tests (See Appendices 2A, 2B and 2C) aimed at testing the research's hypotheses indicated that there was a significant structural break (i.e. difference) in the slope coefficients of the pre-SAP (civilian/military leadership 1978-1995) era, post-SAP era (military leadership 1996-1999) and the economic reform era (of the civilian governments from 1999-2009) with a F-Statistics (107.96) significant at 1 percent statistical level thus enabling us to reject the hypothesis of no structural break in these sub-sample regressions' slope coefficients. However, further test indicated that when the two eras before the economic reform era of the civilian leadership in Nigeria (1999 to 2009) was compared with the other two eras as one period (i.e. 1978-1999 made up of tow era, preSAp and post-SAP) there was no structural break in the regressions' slope coefficients (with F-statistic of 0.387) which was not significant even above 10 percent (p value = 0.9120).The implication of this is that there is no significant difference in the effects of agricultural expenditures and other macroeconomic policies on crop output during the pre-reform and economic reform eras despite claims of the current civilian regime and others after 1999 who claimed they were transforming the agricultural sector by their various presidential initiatives on food crop production and the Seven Point Agenda (i.e. the Government of Olusegun S. Obasanjo and Umaru Yardua respectively). The initial difference observed in the first hypothesis test must have resulted from difference in policy and environmental effects of the pre-SAP and post SAP regimes.

Conclusion

Against the backdrop of continuous announcements of budgetary allocations to agriculture and launching of several agricultural programmes, some sponsored by World Bank and international development agencies others in collaboration with Nigerian Federal and State governments, and all, in a bid to address the problem of food scarcity, food insecurity or food importation in Nigeria, this study was designed to find out to what extent such funds and various eras of government reform programmes (deregulation in the shades of SAP and economic reforms of both military and civilian regimes) fared in changing the level of food crop output in Nigeria. The study applied econometric approaches to conduct the investigation which spanned across 32 years (1978-2009) and found that all the public recurrent expenditures claimed against agriculture (crop production in this case) were of little or no effect in boosting food production in Nigeria over the review period. It was even more disappointing to note that there was no significant difference in the way agricultural programmes of the pre economic reform era (1978 through 1999) and that of the post economic reform era (1999 – 2009) influenced food crop production in the country. The effectiveness of the policy environment and

implementations of government agricultural policies over the years are hereby questioned. The issue of strengthening agencies involved in tackling corruption or opacity in government implementation of agricultural programmes especially administration of credit to the agricultural sector requires urgent actions by the present Federal and State governments in order to bring about positive changes in addressing low food output in Nigerian economy. The fact that ACGSF is having a significant influence on food crop output in Nigeria over the years in review despite the fact that nominal interest rate exerted a decreasing effect on food crop output bears witness to the urgent need to increase credit supply to Nigerian farmers at less than 10 percent interest rate. Subsidy of agricultural credit is therefore a welcome policy in increasing food crop output or solving problem of food insecurity in Nigeria. Finally, the study also indicated that climate change (or weather variability) which was proxied by negative influence of annual mean rainfall on food crop output in Nigeria over the period in review calls for proactive programmes to be set up by Nigerian government to address the issue of adaptation to climate change and variability in the country by crop farmers. The time to start that is now otherwise even the gains from the controversial petroleum subsidy removal which the Federal Government claimed will be used in partially addressing the problem of poor food output in Nigeria will be a journey in futility.

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APENDIX 1 A

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	3.718694	Prob. F(7,24)	0.0073
Obs*R-squared	16.64947	Prob. Chi-Square(7)	0.0198
Scaled explained SS	14.51178	Prob. Chi-Square(7)	0.0428

APPENDIX 1B

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.680961	Prob. F(2,22)	0.2092
Obs*R-squared	4.241851	Prob. Chi-Square(2)	0.1199

APPENDIX 2 A

Chow Breakpoint Test: 1986
Null Hypothesis: No breaks at specified breakpoints
Varying regressors: All equation variables
Equation Sample: 1978 2009

F-statistic	84.37858	Prob. F(8,16)	0.0000
Log likelihood ratio	120.4990	Prob. Chi-Square(8)	0.0000
Wald Statistic	3.11E+09	Prob. Chi-Square(8)	0.0000

APPENDIX 2 B

Chow Breakpoint Test: 1986 1999
Null Hypothesis: No breaks at specified breakpoints
Varying regressors: All equation variables
Equation Sample: 1978 2009

F-statistic	107.9602	Prob. F(16,8)	0.0000
Log likelihood ratio	172.1450	Prob. Chi-Square(16)	0.0000
Wald Statistic	5.54E+09	Prob. Chi-Square(16)	0.0000

APPENDIX 2 C

Chow Breakpoint Test: 1999
Null Hypothesis: No breaks at specified breakpoints
Varying regressors: All equation variables
Equation Sample: 1978 2009

F-statistic	0.386928	Prob. F(8,16)	0.9120
Log likelihood ratio	5.659526	Prob. Chi-Square(8)	0.6853
Wald Statistic	26.31951	Prob. Chi-Square(8)	0.0009

APPENDIX 3

Dependent Variable: LOG(YFDCR)
Method: Least Squares
Date: 01/07/12 Time: 14:30
Sample: 1978 2009
Included observations: 32
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	25.65144***	8.856447	2.896358	0.0079
LOG(ACGSFCR)	0.519496***	0.126391	4.110224	0.0004
LOG(AGRICEXP)	-0.027889NS	0.102626	-0.271757	0.7881
LOG(FOREX)	-0.078851NS	0.060104	-1.311894	0.2020
LOG(INTRATE)	0.978735**	0.355094	2.756269	0.0110
LOG(RAINFALL)	-4.017202**	1.532594	-2.621178	0.0150
LOG(PRIVINVAGR)	0.254822NS	0.157580	1.617102	0.1189
LOG(WPIAGRCRP	-0.178527NS	0.172158	-1.036997	0.3101

R-squared	0.824585	Mean dependent var	11.14714
Adjusted R-squared	0.773423	S.D. dependent var	1.083787
S.E. of regression	0.515884	Akaike info criterion	1.726447
Sum squared resid	6.387263	Schwarz criterion	2.092881
Log likelihood	-19.62315	Hannan-Quinn criter.	1.847910
F-statistic	16.11696	Durbin-Watson stat	1.629449
Prob(F-statistic)	0.000000		

The average uncentred VIF was slightly above 10 (11.64529), so we tolerate the minor level of multicollinearity in the model.