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Does Agriculture Matter for Economic Development? Empirical Evidence from Nigeria

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Abstract: In this study we aimed at answering the question, 'Does agriculture matter for economic development in Nigeria?' Life expectancy is modeled against agricultural output and agricultural expenditure, amongst other variables. Agricultural output is also modeled against a host of socio-economic, natural and human factors, which influence agricultural productivity. Applying Augmented Dickey-Fuller unit root test, Ordinary Least Squares, and the Newey-West method on secondary data and dummy variable used in the study, it was found that agricultural output has negative and significant impact on life expectancy in Nigeria. The impact of agricultural expenditure was found to be positive but nonsignificant. Real gross domestic product and industrial output were also found to influence life expectancy. Careful examination of the hypothesized socio-economic factors (political instability and industrial output), natural factor (rainfall), and human factor (carbon emission) showed that only industrial output and rainfall matter for agricultural output in the country: both variables have positive impacts on agricultural output. The study submits that as much as agriculture may matter for economic development, reliance on the sector alone without corresponding and simultaneous development of other crucial sectors such as education, health, and industry will not yield positive fruits for economic development in Nigeria.

JEL Classifications: O13, Q14

Keywords: agricultural output; carbon emission; economic development; industrial output; life expectancy; rainfall

1. Introduction

Agriculture has often been touted crucial in the economic development of most third world countries. Recent researches on the causes of development and underdevelopment have identified agriculture as key to the economic emancipation of ailing states. In this perspective, the words of Gunner Myrdal that "it is in the agricultural sector that the battle for long-term economic development will be won or lost", could be considered a truism. However, how we go about the contest for economic development using agriculture as weapon, and how we hope to win, indeed, remains a moot issue.

Relatively, Todaro & Smith (2009) avers that to a large extent, agriculture and rural development has come to be considered as the sine qua non of national development. They went further to ask: is raising agricultural productivity sufficient to improve rural life, or must there be concomitant off-farm employment creation along with improvements in education, medical, and other social services? In other words, they recognize that agriculture may not exclusively guarantee national development.

Nigeria is a third world country, largely rural and an agrarian society. Thus she qualifies fully for a study aimed at yielding answers for Todaro & Smith's question above. According to recent statistics, Nigeria has a larger proportion of its population in the rural areas. This makes agriculture and the rural sector major policy concerns in the country. In recent years, Nigeria has been offhand with agriculture, yet the sector still accounts for a significant proportion of her gross domestic product. Agriculture was the leading sector in the pre-oil boom era, contributing 63 and 54 percents to GDP in the 1950s and 1960s respectively (Aigbokhan, 2001). The sector's share in gross domestic product though fell in the post-oil boom period, maintained, yet, persistent increase. For instance, between 1970 and 1980, the share of agriculture in real gross domestic product (RGDP) in Nigeria averaged 29.2%; it was 33.3% between 1980 and 2000, and 41.2% between 2001 and 2009[1]. This performance depicts the relevance of the sector to the Nigerian economy.

Also worthy of emphasis is that agriculture employs a majority of the Nigerian labor force – 65 per cent according to Emeka (2007). This majority consists of peasants who engage in agriculture not merely as a source of income or even as just an occupation; rather they have subsistence agriculture as a way of life. They solely depend on agriculture to eke out a living, which they really do achieve – having a miserable existence; a life plundered by disease, malnutrition and poor housing, poor clothing, and poor access to energy. This scenario is not disconnected from the position of Okuneye, *et al.* (2004) that the incidence of poverty is highest among households in which the head is engaged in agriculture as the main source of income.

Yet, agriculture plays crucial roles in economic development. Generally, the sector contributes to the development of an economy in four major ways: product contribution, factor contribution, market contribution and foreign exchange contribution (Mackie 1964; Abayomi 1997; Abdullahi 2002; World Bank 2007). In Nigeria, it is estimated to be the largest contributor to non- oil foreign exchange earnings. This means that agriculture holds abundant potential for enhancing and sustaining the country's foreign exchange (Iganiga & Unemhilin, 2011).

Already emphasized is the large proportion of the Nigerian labor force engaged in agriculture. However, the frenzy over agriculture in Nigeria as well as many other developing states mainly resides not just in this perceived employment which this sector can provide, but in the output/income and food security which it can ensure.

1.1 Problem and Objective

Agricultural output in Nigeria has witnessed appreciable acclivity over the years; the period under review also witnessed simultaneous rise in food prices, growth in food production and worsening poverty levels. As such, despite the improvement in the sectors output growth, corresponding improvements were not recorded in the standards of living and poverty measures in the country. Either that the rise in global food crisis more than outweighed the benefit from output growth or that the growth did not trickle down to the lowly placed farmers. This is debatable.

Figure 1 below captures the movement of agricultural output and poverty measures in Nigeria. It is evident in the figure that although the share of agriculture in real gross domestic product (RGDP) rose over time, poverty levels in the country did not improve in any way: they rather worsened. Looking at the individual measures, we observe that as agricultural output rose, the proportion of non-poor Nigerians fell, whereas the proportion of moderately poor and extremely poor Nigerians rose respectively: the proportion of extremely poor has the most significant rise.

Also raising issues is that the rural areas, which happen to be most active in agriculture in the country, also harbor the most food poor and deprived population. The rural Nigeria according to the

[1] Figures computed from the Central Bank of Nigeria Statistical Bulletin 2010.

NBS (2010) has dismal 48.3% food poverty as against the urban area with only 26.7% food poverty: what a paradox.

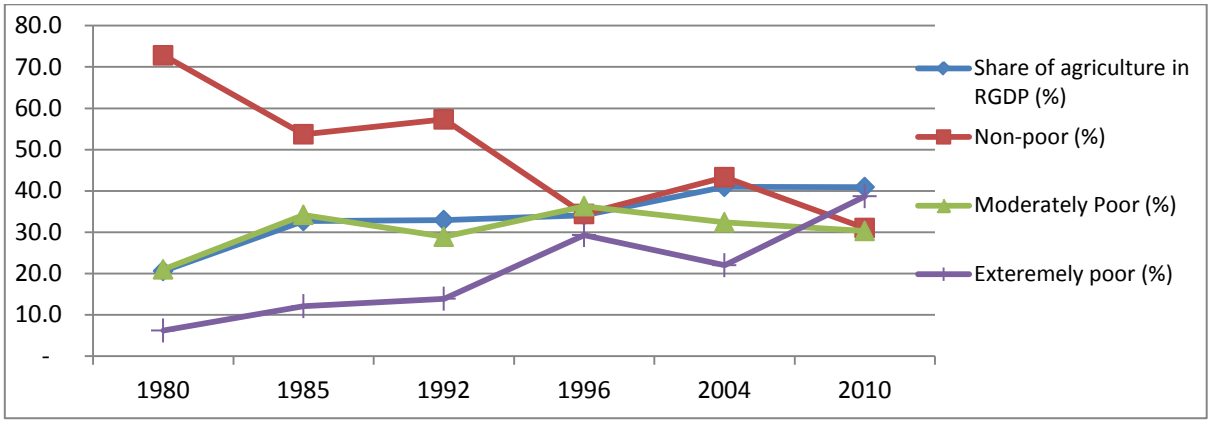

Figure 1. Poverty Measures and Agricultural Output in Nigeria

Source: Nigerian Bureau of Statistics (NBS), Harmonized Nigerian Living Standard Survey, 2010 and the CBN Statistical Bulletin 2010.

Following the above, one cannot but wonder what the real impact of agricultural output is on economic development in Nigeria; could there be evidence of a significant relationship between the two? More so, does improvement in the agricultural sector trigger better development outcomes in Nigeria? This study intends to address these questions with the following objectives: first, to empirically verify the importance of agricultural output and agricultural expenditure to economic development in Nigeria; second, to examine the impact of socio-economic factors (political instability and industrial production), natural factor (rainfall), and human factor (carbon emission) on agricultural output in Nigeria. The verification is basically occasioned by the perceived simultaneous increase in food production and food prices; hence, food insecurity and its attendant trouble: poverty increase as shown earlier.

1.2 Literature Review

Prior to the growth of modern development thinking, economic development has often been strongly associated with industrialization. This warranted the perception of agriculture, not as a primary stimulant of development, but a subsidiary of the industrial sector, which in the words of Todaro & Smith (2009) was thought to be the dynamic and "leading sector" in any overall strategy of economic development. It was believed that the role of agriculture is merely to ensure food surplus and to transfer surplus labor – without decline in productivity – to the industrial sector. The Lewis's famous two-sector model (Todaro & Smith, 2009) and the Harrod-Domar model types (Thorbecke, 1970) are classical examples of development models that foregrounded industrialization in the process of economic development while conceiving agriculture as playing only a passive role: providing cheap food and surplus labor.

Modeling economic development along the above lines was successful in creating severe distortions in many backward regions of the world. Economic development models based solely on industrialization rather than solving the problem of hunger, unemployment and human deprivation created issues of rural-urban drift and its attendant sordid implications. People grew poorer in both the rural and urban regions in much of the third world countries. The exodus of young people from the rural areas – ignoring agriculture – created more poor people in the urban centers, while the flagrant neglect suffered by agriculture from the government made rural people poorer. As a result,

the neglect of agriculture and the romance with industrialization, not only failed in delivering economic development, but also deepened underdevelopment.

Evolution of modern development thinking brought agriculture back to the fore of development strategies. As a result of past experiences and the presence of more luscious theoretical conjectures, "development economists became less sanguine about the desirability of placing such heavy emphasis on rapid industrialization. They came to realize that far from playing a passive, supporting role in the process of economic development, the agricultural sector in particular and the rural economy in general must play an indispensable part in any overall strategy of economic progress" (Todaro & Smith, 2009).

Much as agriculture may matter in their conception (the promoters of the new paradigm)[2], they still conceived that certain conditions must be achieved simultaneously for any development effort based on and foisted on the new paradigm to yield desired results. As Mellor (1986) rightly put it, "an agriculture – and employment – based strategy of economic development requires at a minimum three basic complementary elements: first, accelerated output growth through technological, institutional, and price incentive changes designed to raise the productivity of small farmers; second, rising domestic demand for agricultural output derived from an employment-oriented urban development strategy; and third, diversified, nonagricultural, labor-intensive rural development activities that directly and indirectly support and are supported by the farming community."

Of course, these are the minimum requirements; more may be required of a polity given its peculiar circumstances. In passing note, the idea of the above complementary elements implicitly conveys a thought which is the hall mark of modern development thinking. This crucial idea, which lies concealed, is the interdependence of agriculture and the industrial sector necessary for economic development to occur. As Thorbecke (1970) put it, the recognition of this active interdependence was a large step forward from the naive industrialization-first prescription, because the above conceptual framework no longer indentified either sector as leading or lagging.

It therefore suffices to say that though deserved attention has been turned to agriculture, its ability to deliver is still dependent on other crucial factors. Absence of these factors may in fact become a barrier to agriculture as a weapon of economic development.

Several empirical studies have also appraised the relevance of agriculture in the quest for economic development. For instance, a paper produced by DFID (2004) emphasizes the historically close correlation between different rates of poverty reduction over the past 40 years and differences in agricultural performance – particularly the rate of growth of agricultural productivity. The authors see links between agriculture and poverty reduction as being forged through four transmission mechanisms: 1) direct impact of improved agricultural performance on rural incomes; 2) impact of cheaper food for both urban and rural poor; 3) agriculture's contribution to growth and the generation of economic opportunity in the non-farm sector; and 4) agriculture's fundamental role in stimulating and sustaining economic transition, as countries (and poor people's livelihoods) shift away from being primarily agricultural towards a broader base of manufacturing and services. They go on to note that the potential for future poverty reduction through these transmission mechanisms depends on the extent to which agricultural productivity can be increased where it is most needed.

Bresciani & Valdes (2007) frame their analysis in terms of three key channels, which in their view, link agricultural growth to poverty: 1) labour market, 2) farm income, and 3) food prices. They

[2] The early proponents of agriculture as a crucial and indispensable component of the process of economic development – the new paradigm of development thinking. See also Ghata, S. (1987). Agriculture and economic development. In N. Gemmell (ed.), *Surveys in Economic Development* (chap. 10). Oxford, Blackwell.

provide a theoretical framework for investigating the quantitative importance of those various channels and then report findings from six country case studies. They conclude that when both the direct and indirect effects of agricultural growth are taken into account, such growth is more poverty reducing than growth in nonagricultural sectors.

In a paper written as background for the World Bank's 2008 World Development report, Ligon & Sadoulet (2008) combine time series and cross-sectional data to estimate regression coefficients connecting consumer expenditures by deciles to agriculture and non-agriculture GDP. Their findings are consistent with claims that agricultural sector growth is substantially more important than non-agricultural sector growth for those households in the lower deciles of the expenditure distribution, *i.e.*, the poorer segments of the population. They find the opposite result for richer households, *i.e.*, that the expenditure elasticity for non-agricultural growth is much higher than for agricultural growth, leading them to conclude that their findings are consistent with claims that agricultural sector growth is pro-poor.

Similarly, Montalvo & Ravallion (2009) find that the primary sector rather than the secondary (manufacturing) or tertiary sectors was the real driving force in China's spectacular success against absolute poverty. They conclude that the idea of a trade-off between these sectors in terms of overall progress against poverty in China is moot, given how little evidence they found of any poverty impact of non-primary sector growth.

Seeking to answer the question, 'why are some countries performing better than others?' Cervantes-Godoy & Dewbre (2010) looked for shared characteristics of twenty-five developing countries posing extraordinary success in reducing extreme poverty over the past twenty to twenty-five years. These countries were compared using indicators of their macroeconomic characteristics and, especially, their agricultural economic characteristics. The countries chosen for analysis constitute a highly diverse mix. The group includes some of the poorest and some of the richest developing countries in the world, representing virtually all geographic regions. Their findings from time-series, cross-section regression analysis, reveal that while economic growth generally was an important contributor to poverty reduction, the sector mix of growth mattered substantially, with growth in agricultural incomes being especially important.

In like manner, copious works investigating the determinants of agricultural output exist in the literature. Amid such works, Nkamleu (2007) investigated the sources and determinants of agricultural growth over the last three decades. The analysis employs the broader framework of empirical growth literature and recent developments in Total Factor Productivity (TFP) measurement to search for fundamental determinants of growth in African agriculture. One main contribution is the quantification of the contribution of the productivity growth and the contribution of different inputs such as land, labour, tractor, and fertilizer in agricultural growth. Growth accounting highlights the fact that factor accumulation rather than TFP accounts for a large share of agricultural output growth and that fertilizer has been the most statistically important physical-input contributor to agricultural growth. The study also highlights the extent to which agricultural growth contributors vary in different country contexts.

Anyanwu (2009) applying Ordinary Least Squares technique, studied the determinants of aggregate agricultural productivity among smallholder farmers in Rivers State, Nigeria. Cross- sectional data generated from 288 food crop farmers randomly selected from 5 out of the 23 Local Government Areas were used. Results of the analysis showed that farm land, labour input, planting materials, age of the farmers, farming experience, and level of education are the main significant determinants of aggregate agricultural productivity in the State.

Eboh, *et al.* (2012) examined the factors that drive Nigeria's agricultural growth. Using hypothesized traditional factor inputs, they estimated a global agricultural production function for Nigeria based on the Cobb-Douglas model, assuming Hicks-neutral technological progress. Also,

they estimated an econometric model of total factor productivity (TFP) based on 'Solow Residual'. There analysis showed that Nigerian agricultural sector is characterized by increasing returns to scale, which implies that farmers are operating at the low end of the production function. The relatively more important factors that were found to influence Nigeria's agricultural value added include rainfall, technology (efficiency parameter) and fertilizer use; land area is the least important factor. Capital expenditure on agriculture, price of agricultural commodities, per capita income and investment rate in agriculture, human capital and access to credit are positive influences on total factor productivity. On the other hand, agricultural trade (openness), environmental degradation and agricultural output variability have negative influences.

Other empirical studies that have examined the determinants of agricultural output in and outside Nigeria include: Nkonya *et al*. (2010), Oni *et al*. (2009), Diao *et al*. (2009) and Benin *et al*. (2008).

1.3 Statement of Hypotheses and Decision Rule

Hypothesis testing is the building block of any scientific research. To this end, we will test the following hypotheses in line with our stated objectives:

1. **H0:** Agric sector public expenditure and agricultural output do not have significant impacts on the economic development of Nigeria.

   H1: Agric sector public expenditure and agricultural output have significant impacts on the economic development of Nigeria.

2. **H0:** Socio-economic factors (political instability and industrial production), natural factor (rainfall), and human factor (carbon emission) do not have significant impacts on agricultural output in Nigeria.

   H1: Socio-economic factors (political instability and industrial production), natural factor (rainfall), and human factor (carbon emission) have significant impacts on agricultural output in Nigeria.

The above hypotheses will be tested at the 0.05 level of significance. The null hypothesis will be rejected if the probability at which the t-value is significant is less than the chosen level of significance. Otherwise, the null hypothesis will be accepted.

2. Method

The analytical approach of this study is inferential. A quantitative testing of the hypotheses as highlighted is used. In this case, an econometric model will be formulated and adequate econometric techniques adopted. These techniques include: The Augmented Dickey-Fuller unit root test, Ordinary Least Squares technique, White heteroskedasticity test and the Newey-West method.

2.1 Model Specification

Model 1: Agricultural Sector and Economic development

In this model which embodies the first objective, we express life expectancy against the explanatory variables. Life expectancy is used as a proxy for economic development in Nigeria. The motivation for this proxy is due to the unavailability of data for human development index (HDI) spanning the period of the study (1970 – 2010). In addition, life expectancy is one of the three crucial variables that fall into the computation of the HDI. It also enjoys a very high positive correlation with HDI. The model is as follows:

$$LER = \beta_0 + \beta_1 AGE + \beta_2 AGP + \beta_3 RGDP + \beta_4 IND + \mu_t \quad \ldots \quad (1)$$

Expectations: + + + +

Where: *LER* is life expectancy at birth (years)*; AGE* is agric sector expenditure by the government (N million)*; AGP* is agricultural output (N million)*; RGDP* is real gross domestic product (N million)*; IND* is industrial output (N million)*;* μ_t is the stochastic disturbance (or error term).

Given that we intend to standardize all the variables and interpret the resulting partial slope coefficients as elasticities, the structural form of the equation above is rewritten in log form as follows:

$$LNLER = \beta_0 + \beta_1 LNAGE + \beta_2 LNAGP + \beta_3 LNRGDP + \beta_4 LNIND + \mu_t \quad \ldots \quad (2)$$

Model 2: Socio-Economic Factors, Natural Factor, Human Factor, and Agricultural Output

Also employing a linear regression model, we investigate the importance of selected socio-economic, natural, and human factors on agricultural output in Nigeria. The model is presented below:

$$AGP = \beta_0 + \beta_1 PINS + \beta_2 IND + \beta_3 RAIN + \beta_4 CAB + \mu_t \quad \ldots \quad (3)$$

Expectations: - + +/- +/-

Where: *AGP* is agric sector output (N million); *PINS* is political instability (dummy); *IND* is industrial production (N million); *RAIN* is average rainfall statistics (millimeters); *CAB* is carbon emission (kt); μ_t is the stochastic disturbance (or error term).

For the same reason as in model 1, we log the variables in equation 3 with the exception of *PINS* (dummy variable) as follows.

$$LNAGP = \beta_0 + \beta_1 PINS + \beta_2 LNIND + \beta_3 LNRAIN + \beta_4 LNCAB + \mu_t \quad \ldots \quad (4)$$

2.2 Data Sources

Secondary data (comprising annual time series) as well as dummy variable is used. Data for the variables – Agricultural sector expenditure, Agricultural output, Real Gross Domestic Product, Industrial Output and Rainfall are sourced from the Central Bank of Nigeria Statistical Bulletin. For Life Expectancy rate and Carbon Emission, the data are sourced from the World Development Indicators database. The dummy for political instability was created by the authors – wherein 1 represents presence of political instability and 0 no serious political instability. The periods 1979 – 1983 and 1999 – 2010 have the value 0, meaning no serious political instability, whereas all other years have the value 1, meaning presence of political instability. All data range from 1970 – 2010.

3. Results

Following the methodology stated in the previous section, ADF unit root tests have been carried out on the various series. The results shown in table 1 below reveal that aside industrial output, all other variables' series are non-level stationary. However, stationarity was achieved in the variables after

first differencing. Accordingly, whereas industrial output is integrated at order zero, i.e., I(0), the variables – life expectancy at birth, agric sector public expenditure, agricultural output, real gross domestic product, rainfall statistics, political instability, and carbon emission are all integrated at order one, i.e., I(1). These differenced series are thereafter fed in for OLS with the Newey-West method to ensure Heteroscedasticity and Autocorrelation Consistent (HAC) standard errors.

Table 1. Summary of Stationarity Tests

Variable	ADF statistic	Level of Sig	Lagged difference	Critical Values	Order of Integration	Assumption
LER	-2.969893	5%	5	-2.9378	I(1)	Intercept
AGE	-6.735233	1%	1	-3.6117	I(1)	Intercept
AGP	-4.930852	1%	1	-3.6117	I(1)	Intercept
RGDP	-4.578334	1%	1	-3.6117	I(1)	Intercept
IND	-3.230132	5%	1	-2.9378	I(0)	Intercept
PINS	-4.239454	1%	1	-3.6117	I(1)	Intercept
RAIN	-6.324736	1%	1	-3.6117	I(1)	Intercept
CAB	-4.243301	1%	1	-3.6117	I(1)	Intercept

Applying the White heteroskedasticity test and OLS, alongside the Newey-West method, to equations 2 and 4, we have the following results:

3.1 Agricultural Sector and Economic Development

From the OLS result in table 3, we have the coefficient of multiple determinations (R2) as 0.8960 and the adjusted R2 as 0.8845. The value of the R2 implies that the variables – agricultural output, agric sector expenditure, real gross domestic product, and industrial output account for approximately 89.60 per cent of the variation in life expectancy in Nigeria. The observed F-statistic is 77.56 and has a probability value of 0.0000, which is less than the 0.05 level of significance. This indicates that the regressors in equation 2 have significant impacts on the regressand – life expectancy at birth. The Durbin-Watson statistic is 2.0, and going by the rule of thumb, indicates the absence of first-order autocorrelation in the residuals. The result of the White test in table 2 below has probabilities 0.0000 and 0.0017. These probabilities, being less than the 0.05 level of significance, warrant the rejection of the null hypothesis that the residuals are not heteroskedastic. This justifies the application of Newey-West method in the study.

Looking at the individual significance of estimated coefficients, we observe from the result in table 3 that aside agric sector expenditure with an observed absolute t-value of 0.88 (which is less than the 1.96 critical t-value), all other regressors – agricultural output, real gross domestic product and industrial production with observed absolute t-values of 2.39, 3.47 and 4.82 (which are greater than the 1.96 critical t-value) respectively, are statistically significant. While agric sector expenditure and real gross domestic product conformed to their a priori expectations. Agricultural output and industrial output do not conform. We save the implications of this for section 4.

Agric sector expenditure and industrial output with coefficients 0.07 and -0.28 respectively are both inelastic. As such, changes in these variables warrant less than proportionate responses from life expectancy and by extension, economic development in Nigeria. Agricultural output and real gross domestic product with coefficients -1.71 and 1.69 respectively, are both elastic: there coefficients

are greater than unity. Variations in these variables warrant more than proportionate responses from life expectancy in Nigeria. Specifically, a percentage rise in the inelastic variables – AGE and IND will warrant only a 0.07% rise and a 0.28% fall respectively in life expectancy (economic development) in Nigeria. Also, an equal percentage rise in the elastic variables – AGP and RGDP warrant a 1.71% fall and a 1.69% rise respectively in life expectancy (economic development) in Nigeria.

Table 2. White Heteroskedasticity Test Result

White Heteroskedasticity Test:

F-statistic	10.11968	Probability	0.000000
Obs*R-squared	34.64248	Probability	0.001660

Table 3. OLS Result

Dependent Variable: LNLER

Method: Least Squares

Date: 10/07/12 Time: 21:14

Sample: 1970 2010

Included observations: 41

Newey-West HAC Standard Errors & Covariance (lag truncation=3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.157808	1.479560	2.810164	0.0080
LNAGP	-1.710992	0.713701	-2.397352	0.0218
LNAGE	0.069860	0.079691	0.876641	0.3865
LNRGDP	1.685581	0.485106	3.474667	0.0014
LNIND	-0.282551	0.058662	-4.816576	0.0000

R-squared	0.896030	Mean dependent var	2.237743
Adjusted R-squared	0.884478	S.D. dependent var	1.886533
S.E. of regression	0.641206	Akaike info criterion	2.062916
Sum squared resid	14.80121	Schwarz criterion	2.271888
Log likelihood	-37.28978	F-statistic	77.56339
Durbin-Watson stat	2.003081	Prob(F-statistic)	0.000000

3.2 Socio-Economic Factors, Natural Factor, Human Factor, and Agricultural Output

Table 4. White Heteroskedasticity Test Result

White Heteroskedasticity Test:

F-statistic	29.25487	Probability	0.000000
Obs*R-squared	38.28219	Probability	0.000260

Table 5. OLS Result

Dependent Variable: LNAGP

Method: Least Squares

Date: 10/07/12 Time: 21:18

Sample: 1970 2010

Included observations: 41

Newey-West HAC Standard Errors & Covariance (lag truncation=3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.018657	1.271710	0.014671	0.9884
PINS	-0.213607	0.174388	-1.224900	0.2286
LNIND	0.282159	0.101837	2.770690	0.0088
LNRAIN	1.140724	0.455328	2.505280	0.0169
LNCAB	-0.123027	0.217594	-0.565397	0.5753

R-squared	0.941864	Mean dependent var	5.673171
Adjusted R-squared	0.935405	S.D. dependent var	2.874980
S.E. of regression	0.730694	Akaike info criterion	2.324205
Sum squared resid	19.22088	Schwarz criterion	2.533177
Log likelihood	-42.64620	F-statistic	145.8100
Durbin-Watson stat	2.971537	Prob(F-statistic)	0.000000

From the OLS result in table 5 above, we have R^2 and adjusted R^2 to be 0.9419 and 0.9354 respectively. The value of the R^2 shows that 94.19% of the variations in agricultural output in Nigeria are explained by the mix of socio-economic, natural, and human factors considered as regressors in the model. The F-statistic with a probability value of 0.0000 proves that the regressors (political instability, industrial output, rain fall and carbon emission) have significant impacts on agricultural output. The Durbin Watson statistic with a value of 2.97 indicates the presence of negative autocorrelation. Also, the White heteroskedasticity test result in table 4 above, with

probabilities 0.0000 and 0.00026 less than the 0.05 level of significance, warrants the rejection of the null hypothesis of no heteroskedasticity. Evidence of both heteroskedasticity and autocorrelation in this result indicate that the standard errors of the estimated coefficients will be misleading. This will then engender wrong inferences regarding the statistical significance of variables based on t-values. However, this probable outcome does not hold since its possibility has been nullified by the use of the Newey-West method.

Judging the significance of the estimated coefficients based on the observed t-values, we surmise that at 95% confidence level, only industrial production and rainfall (with calculated absolute t-values of 2.77 and 2.51 respectively) have significant impacts on agricultural output. Political instability and carbon emission with calculated absolute t-values of 1.22 and 0.57 respectively are nonsignificant. All four variables conformed to their respective a priori expectations. Both industrial production and carbon emission with coefficients 0.28 and -0.12 respectively are inelastic to agricultural output. Rainfall on the other hand with estimated coefficient of 1.14, which is greater than unity, is elastic. Looking at the responses specifically, if industrial output, rainfall and carbon emission happen to increase by, say, 1 per cent respectively, agric sector output will rise by only 0.28% in the case of industrial output, 1.14% in the case of rainfall, and, of course, fall by only 0.12% in the case of carbon emission. Looking at political instability, we first recall that the periods of political instability are given the value 1, while periods of no political instability assume the value 0. Since the coefficient of a dummy variable tells us the differential intercept, it is easy to fathom that the coefficient -0.21 of political instability implies the difference between the log of agricultural output in periods of political instability and that in periods of no political instability. Since this coefficient is negative, we infer that periods of political instability in Nigeria have log of agricultural output that is less than that of periods of no political instability by 0.21.

3.3 Test of Hypotheses

In the first set of hypothesis, since the probabilities of agric sector public expenditure and agricultural output are 0.39 and 0.02 respectively (see table 3), we do not reject the null hypothesis in the case of agric sector expenditure and do not accept it in the case of agric sector output. This decision implies that whereas agric sector spending in Nigeria does not significantly influence economic development, agricultural output exhibits significant impact on economic development in the country. The nature of this impact, far from expectation, is negative.

In the second set of hypotheses, we also have mixed results. Sequel to the decision rules, we do not reject the null hypothesis that political instability and carbon emission with probabilities 0.23 and 0.58 respectively (see table 5) do not significantly affect agricultural output in Nigeria. In the case of industrial output and rainfall with probabilities 0.009 and 0.02 respectively (see table 5), we do not accept the null hypothesis, and conclude that both variables have significant effects on agricultural output in Nigeria. As expected, these effects are positive.

4. Discussion

4.1 Agricultural Sector and Economic Development

As the findings have it, agricultural output has significant detrimental effects on economic development in Nigeria. This finding, at face level, appears to dispute existing knowledge as regards the relevance of agriculture in the process of economic development. However, a deeper diagnosis will reveal things worth knowing. It is apposite that we ask the following questions: what would be the consequences of rising agricultural output on economic development when such

incremental output are, in fact, the contribution of infants denied access to school[3]? What will be the impact of higher agricultural output on economic development when the peasants that generate this incremental output have no health security? What will be the impact of higher agricultural output on economic development when, in fact, food insecurity persists in the country due to extortionate food prices in the globe?

In all the above cases, the answers are quite self-evident: economic development will surely decline. It will decline, at least, in the long run if infants lack access to education due to their involvement in family agricultural activities[4]. Muhammed & Adeoye (2006) in their study centered on Kwara state, Nigeria, surmised that children's participation in agriculture was very high and have adverse effects on the educational and social development of children. The same outcome holds when, though agricultural output rises and yields higher earnings at both the national and family levels, poor health care systems persist in the rural areas that generate the agricultural output. Also, to the extent that food insecurity remains a global phenomenon and perpetuating in Nigeria, there is little hope for life expectancy to improve, nay economic development.

Expounding the issue further is the verity that higher food production does not ensure food security or even adequate nutrition, which might crystallize to economic development. As Rosset (2011) rightly recorded, higher food output in the world has co-occurred with rising food prices; hence more hunger. Also supporting our finding is the position of Collier (as cited in Gollin, 2009) who argued explicitly "that the agricultural sector is unlikely to play a key role in generating growth or reducing poverty in Africa".

The above scenario is in fact crucial in comprehending the critical difference between economic growth and economic development. It suffices to say that in isolation of certain crucial factors such as those explicated above, the obvious consequence of higher agricultural production on economic growth could be positive; it has been proven not to be so for economic development. Other factors that matter for development must not suffer, for, say, agricultural output if the latter must have positive impacts on development. It was Todaro & Smith (2009) who asked the crucial question: "is raising agricultural productivity sufficient to improve rural life, or must there be concomitant off-farm employment creation along with improvements in educational, medical and other social services?" And the findings of this study answer as follows: Agricultural productivity is not sufficient to improve rural life. There must be corresponding off-farm employment creation along with improvements in education, medical and other social services for rural life and national wellbeing to improve.

The lesson, therefore, is that even if agricultural output is increasing, for economic development to occur, other relevant variables such as those earlier stated must improve (or at least not suffer at its expense). Also, prices of agricultural outputs must not move at a rate that could engender or prolong enduring food crisis.

[3] According to Nwiro (2010), Nigerian NGO's Report reveals that a staggering 15 million children under the age of 14 are working across Nigeria. Also, According to the Director Women's Consortium of Nigeria (WOCON), Mrs Olateru-Olagbegi, a large percentage of children in Nigeria were engaged in one form of child labour or another; thirty-nine per cent of children aged five to 14 years in Nigeria are engaged in child labour (see Olukoya, 2012).

[4] The involvement of children in agriculture denies them access to quality education. This in the long run makes their earning potentials low. They tend to end up poor and probably repeat their childhood experience with their wards. These people, due to poverty, lack access to adequate health care, and therefore have a high tendency of dying early. All this could have been avoided and development outcomes more rosy had the children gained basic education at the expense of their services in family agriculture.

Coming to agric sector public expenditure, we could not establish a significant relationship between this variable and economic development in Nigeria. Notwithstanding, the nature of interaction between both variables is found to be positive. But why would agric sector spending not have significant effect on economic development in Nigeria? It could be that quoted expenses on agric sector projects, such as provision of subsidized fertilizers, high breed crops and livestock, etc., are, in fact, not spent on the projects. Also even when these monies are spent, given the spate of corruption in Nigeria, it will not be out of place to assert that the projects do not benefit the target groups, for as Omanukwue (2005) reported; a large proportion of the funds allocated to agriculture do not go directly to farmers. In essence, the schemes are often hijacked; the poorest farmers remain poor, with little or no improvement in their economic fortunes.

The fact that agric sector spending is found to interact positively with economic development in Nigeria (though not significant) is evidence that if the right things are done right, i.e., if certain schemes targeted at the poorest farmers get to them as it should, agric spending by the government will, most likely, bear reasonable fruits for economic development in the country. Similar findings as we have here were evolved by studies by Yee et al. (2002) – in terms of the positive effect, and Iganiga & Unemhilin (2011) – in terms of the nonsignificant impact.

Going forward, the neglect and blatant snub suffered by the agricultural sector (in terms of minute government budgetary allocations) is the final straw that breaks the camel's back. This neglect exhibited in the form of inadequate finance is critical in understanding the observed nonsignificance of agric sector spending to economic development in Nigeria. As stated by Iganaiga & Unemhilim (2011), the Food and Agricultural organization (FAO) recommended that 25 percent of government capital budget allocation be assigned to the agricultural development capital budget. In Nigeria, this has never been achieved by the government; thereby affecting government programs and policies for the sector. Of course, spending alone is not what counts but spending the right amount and on the right projects.

Aside the two agric sector variables captured in the hypothesis, the study also found real gross domestic product and industrial output to have significant effects on economic development in Nigeria. Real gross domestic product is found to have positive effects on economic development, while industrial output is found to have negative effects on economic development. In the case of real gross domestic product, we offer that higher RGDP creates higher earnings for the government as well as individuals at the macro level. Parts of these higher earnings are then spent on crucial developmental areas such as education and health, hence raising development outcomes.

On the part of industrial production, the finding informs that higher productivity in the sector could have been capital intensive driven. This is at the expense of labor employment. If human services are being displaced by machines to generate higher productivity in the industries, it is normal to expect rising poverty levels.

4.2 Socio-Economic Factors, Natural Factor, Human Factor, and Agricultural Output

The finding with respect to the interaction of political instability and agricultural output follows our expectation. This implies that in Nigeria, the more unstable the polity is, the less our agricultural output.

Also, carbon emission which was found to be nonsignificant interacts inversely with agricultural output. This interaction implies that higher emission leads to higher global warming and its attendant consequences on our environment. Of course, the more this warming caused by carbon emissions, the harsher the effect of sunlight on our crops and streams, and consequently the lower their yield (for most of the crops and forage plants). Notwithstanding this submission, the interaction between agricultural output and carbon emission remains nonsignificant.

Now, looking at the two variables that exhibit significant impacts on agricultural output in Nigeria, we first recall that both variables strictly followed theoretical expectations. Increase in industrial output in Nigeria brings about rising agricultural output. This is expected since the agric sector, to a large extent, serves as a subsidiary industry for the industrial sector. Most of the inputs utilized in the consumer goods industries are the outputs of the agricultural sector. Therefore, higher demand on industrial goods translates into higher demands on agricultural outputs.

In the case of rainfall, we have little task in attempting to offer an explanation. It is a popular knowledge that most farm products depend on the availability of adequate rainfall to bring forth good yield. Therefore, as the finding has it, more rainfall in Nigeria brings about increase in agricultural output. In fact, not only does agricultural output rise with rainfall, but it increases more than proportionately as earlier shown. This crucial observation points towards the decisive role water plays in agriculture. Extending this finding, we bring in the idea of irrigation. We surmise that using irrigation schemes to keep the soil wet is key to promoting agricultural output: with irrigation, farm plantation can go on even when rainfall is proving insufficient, or even in dry seasons when farm activities cannot rely on rainfall.

5. Recommendations and Conclusion

5.1 Recommendations

The foregoing has dwelt largely on identifying the issues that will suffice for policy recommendations. The following are born out of the study.

- Align/integrate development strategies effectively: this is particularly essential because of the finding with respect to the impact of agricultural output on economic development in Nigeria. As was offered in the discussion, if development strategies are not properly aligned, such that improvements in the agricultural sector occur at the expense of other crucial sectors, the outcome will be counter-productive. Also, if improvements in the agricultural sector co-occur with severe slumps in other crucial sectors, the positive effects of agricultural sector growth on economic development can be overwhelmed by the negative consequences of these slumps. The key, therefore, is to ensure simultaneous and even development of all the sectors; none should grow at the expense of the other.
- Raise and Monitor Agricultural public spending to the letter: this action is relevant because of the finding that agric sector public spending does not significantly influence economic development in Nigeria. This observed nonsignificance is believed not to imply that appropriate and well monitored spending on specific and desired agric sector projects will not bear positive fruits for economic development, but that agric sector spending in Nigeria has often been a delusion so to say. It has often been boycotted and grossly mismanaged. Also, the funding has for much of the period been too paltry for the job at hand. Agric sector allocation should, therefore, be raised by the government to something close to the FAO prescription (25% of capital budget). Of course, spending this right amount and on the right agric sector project will be telling but not enough unless there is adequate monitoring to ensure efficient utilization.
- Encourage industrial development: as found, industrial output has a significant and positive interaction with agric sector output. Therefore, improving the performance of the industrial sector through the provision of appropriate incentives, will not only promote industrial output, but also stimulate the agricultural sector. Government will, therefore, find it worthy to make credit for industrial development accessible at concessional rates, develop infrastructure (roads, rail ways, power and industrial zones), extirpate insecurity,

and ensure significant linkage and integration between the industrial and agricultural sectors of the Nigerian economy.

- Adopt widespread irrigation schemes and make them adoptable by the rural farmers: since rainfall is found to have positive and significant interaction with agric sector output in Nigeria, we can go ahead to ask for more rain. But rainfall is a natural phenomenon, and can only be supplemented by artificial means – irrigation. We therefore urge government at various levels in the country to make widespread efforts at making irrigation a popular and affordable option for farmers, especially those at the rural areas. This is particularly important to not only spurt agricultural output but also to ensure food security in the country by guaranteeing year long cultivation. In this regard, adequate sitting of dams (for irrigation) around the country should be encouraged. Presently, Nigeria has a total of 17 dams (out of which 8 are specifically for irrigation) all located in the northern region. But Nigeria has two basic agro-ecological zones – tropical forest zone of the South and Savannah land of the North. These two zones support different variety of crops; they should be adapted and specialized in by the regions. This should then be supported by irrigation, made possible by nation-wide dams to allow all year cultivation. As such, dams should no longer be restricted to the Northern region of the country.

5.2 Conclusion

The age-old advocacy for agriculture in economic development is not in any way misleading. The input of this study is supportive rather than discrediting. It is evident from the findings that as much as agriculture matter in economic development, reliance on the sector alone without corresponding and simultaneous development of other crucial sectors such as education and health (to ensure adequate human capital development), industrial development (to deliver the needed interdependence) will not yield positive fruits for development. Therefore, the economic gospel from the foregoing holds thus: *only by giving deserved attention to deserving sectors will agriculture play its crucial role in the process of economic development of Nigeria*.

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