International Journal of Food and Agricultural Economics
ISSN 2147-8988
Vol. 2 No. 1 pp. 13-22

EXAMINATION OF EMPIRICAL RELATIONSHIPS BETWEEN INDUSTRIAL ACTIVITIES AND AGRICULTURAL POLICY OUTPUTS IN NIGERIA (1970-2012)

Sunday Brownson Akpan
Department of Agricultural Economics and Resources Management, Akwa Ibom State University, Ikot Akpaden, Mkpat-Enin, Nigeria, E-mail:brownsonakpan10@gmail.com

Samuel James Udoka
Department of Agricultural Economics and Resources Management, Akwa Ibom State University, Ikot Akpaden, Mkpat-Enin, Nigeria

Uwemedimo Eyo Okon
Department of Agricultural Economics and Resources Management, Akwa Ibom State University, Ikot Akpaden, Mkpat-Enin, Nigeria

Abstract

The study investigated relationships between agricultural policy output (proxy by the agricultural productivity index, agricultural GDP/total GDP and crop productivity index) and output of industrial sector (proxy by the industrial capacity utilization rate) from 1970 to 2012 period in Nigeria. The study employed time series variables obtained from the Central Bank of Nigeria (CBN), National Bureau of Statistics and Food and Agricultural Organization (FAO). Augmented Dickey-Fuller unit root test was conducted on the specified time series, and the result showed that all non-growth rate series were integrated of order one, while growth rate series were stationary at level. The two-step Engle Granger method was employed to test for the presence of co-integration among specified variables. The result revealed that variables were not co-integrated. To avoid spurious regression, the specified models for non-growth rate series were estimated at first difference of the log variables. The empirical result revealed that, the industrial activities Granger cause crop activities in Nigeria. Also, the industrial activity has insignificant relationship with agricultural productivity indices in Nigeria. The same result was also obtained for industrial activities and agricultural GDP/total GDP. However, the result further revealed that, the industrial activity has significant negative correlation with the crop productivity index in Nigeria. These imply that, agricultural production had not played significant role in industrial development in Nigeria. This result suggests that, there is no significant impact of the backward integration policy of the agricultural sector on industrial sector in Nigeria. In addition, the result revealed that, agricultural policies during liberalization era (1986 - 2012) shifted the coefficient of the industrial activities positively. Therefore, it is recommended that the agricultural production in Nigeria should be boosted so as to generate sufficient demand and raw materials for the industrial sector. Agricultural policy of the liberalization period should be promoted as an alternative way to bring on positive growth in industrial activities and hence economic development in Nigeria.

Key words: *Agriculture, policy, industry, linkage, impact, Nigeria*

1. Introduction

Agricultural sector has long been regarded as provider of raw materials to agro-based industries; while the industrial sector on the other hand was saddled with responsibilities including; provision of farm tools, equipments, chemicals and machineries needed in the agricultural sector (Oji-Okoro, 2011; Akpan *et al.,* 2012). Both sectors in the literature are regarded as major components of economic development due to their mutual interdependence and symbiotic relationship (Saikia, 2011). However, the degree of interdependence of the two sectors is time dependent. In most developing countries, this supposed bi-directional relationship between the industrial and agricultural sector has proved inactive or unsustainable due to the backwardness of the industrial sector. Agricultural activities in the Sub-Saharan Africa like Nigeria are still characterized by extensive use of traditional tools and implements; while the industrials sector is faced with uncertainties mostly due to low and poor technologies. Government of Nigeria over the years has prioritized these two sectors through formulation

of policies, development plans, heavy subventions and the design of institutional frameworks to fast track activities in these sectors. The two sectors are considered major movers of the Nigerian economy. For instance in 2012, the percentage contribution of agricultural and industrial sectors to the gross domestic product (GDP) of Nigeria stood at 30.90% and 43.00% respectively (CIA, World Fact book, 2013).

In literature, agricultural sector has been considered the hallmark of the first stage of development, while the degree of industrialization has been taken to be the most relevant indicator of a country's progress along the development path (Nurkse, 1953; Rostow, 1960; FAO, 2012). Koo and Lou, (1997), Adelman, (1984) and Ranis, (1984) opined that, agricultural growth depends on the industrial demand for agricultural commodities. Similarly, that industrial growth depends on increase in the purchasing power of the agricultural sector for industrial commodities and on the supply of raw materials for processing. Most of the proponents of this concept perceived that growth emanated from the agricultural sector and moves gradually to the industrial sector, with the onus on agriculture to finance the shift in the first stage. The Food and Agricultural Organization (FAO, 2012) had stressed the significant of the agricultural sector to the industrial development especially in developing countries. The report reiterated that, the role of agriculture has been elevated from a sector destined to provide raw materials to promote industrialization, to a critical sector meant for deriving foreign earnings, generating quality jobs and sustaining food security (Business day, 2012).

Several literature have linked the industrial revolution in developed countries to increase in agricultural productivity (Nurkse, 1953; Rostow, 1960). The economic history also provides evidences that, agricultural revolution is a fundamental pre-condition for economic development (Eicher & Witt, 1964; Oluwasanmi, 1966; Jones & Woolf, 1969). Classical models of structural transformation had stressed that productivity growth in agriculture increases income per capita and generate demand for manufacturing goods (Murphy *et al.,* 1989; Golin *et al.,* 2002). Most recently, the Asian industrial revolution has been linked to vibrant and technology based agricultural sector (Koo & Lou, 1997). For instance, Koo and Lou (1997) reported one way relationship between agricultural sector and industrial sector in China. He asserted that, the growth of the Chinese agricultural sector depended on the industrial growth, while the growth in industrial sector was not significantly affected by the agricultural growth. Whether the contribution of the Agricultural sector to the industrial sector is seen in terms of transfer of surplus labour to the industrial sector, creating demand for the industrial sector or in provision of raw materials, it is obvious that agricultural sector has a place in the development of modern industrial sector and economic development at large. The agricultural sector has the potential to be the industrial and economic springboard from which a country's development can take off. The agricultural sector has a multiplier effect on any nation's socio-economic and industrial fabric because of the multifunctional nature of agriculture (Stewart, 2000; Ogen, 2007).

In Nigeria, there is a long history of agro-based industry. Currently, the agro-based industry constitutes significant proportion of the country's industrial sector (CBN, 2005). For instance, sugar industry, textile, flour mills, and confectionery industries have long periods of operation in the country. These industries depend heavily on agro-based raw materials from the agricultural sector. Though the industrial sector in the country is not well rooted, there is need to test the hypothesis of agriculture-industry linkage in Nigeria. Following series of industrial and agricultural policies implemented in the two sectors in the country, there is an overwhelming need to ascertain the two sectors' productivity correlation. For instance, incentives such as tax reduction, import restrictions, tariff adjustment, reduction in excise duty and the liberalization of the industrial sector as well as various monetary policies are among several interventions government has implemented in the industrial sector (Ogun, 1987; Nwosu, 1992; Udoh & Elias, 2011; Akpan, 2012). In addition to others fiscal and monetary policies, provision of credit facilities to farmers, liberalization of the agricultural sector and provision of rural infrastructures are some of the areas government has touch in agricultural sector (Nwosu, 1992; Akpan *et al*., 2012). These boosters were implemented to encourage the forward and backward integration of the two sectors and stimulate sufficient demand and supply among sectors in the economy. Following the huge investment the government at various tiers have dump in the two sectors, the need to test for the interdependency between the two sectors becomes imperatives especially considering the millennium development goal's (MDG's) target of Nigeria in 2015. To accomplish this aim, the research was set up specifically to test the relationship between agricultural activities (measured by index of agricultural productivity, crop productivity index and the contribution of agricultural sector in the country's gross domestic products) and industrial activities proxy by the industrial capacity utilization rates in Nigeria. These indicators were selected based on the fact that, they represent the aggregate contributions of all factors of production in each of the two sectors.

2. Research Methodology

2.1. Study Area

The study was conducted in Nigeria; the country is situated on the Gulf of Guinea in the sub Saharan Africa. Nigeria lies between 4^0 and 14^0 North of the Equator and between longitude 3^0 and 15^0East of the Greenwich.

The country has a total land area of about 923,769km^2 (or about 98.3 million hectares) with 853km of coastline along the northern edge of the Gulf of Guinea and a population of over 140 million (NPC, 2006). Nigeria is bounded by the Republic of Benin in the west, Chad and Cameroon in the east and Niger to the north.

2.2. Data source

Secondary data were used for the study. These data were sourced from several publications of Central Bank of Nigeria (CBN) and National Bureau of Statistics as well as Food and Agricultural Organization (FAO). Data covered the period 1970 to 2012.

2.3. Analytical Techniques

The study applied statistical and econometric techniques to investigate the association between industrial capacity utilization and indicators of agricultural productivity in Nigeria. The tests applied include; the trend analysis, Granger causality tests and regression analysis. Each of the tests is explained in both explicit and implicit forms as described in the following sub-sections:

2.3.1. Trend Analyses of industrial capacity utilization rate, crop productivity index, agricultural productivity index and agricultural GDP from 1970 to 2012 in Nigeria

To investigate the nature of growth rates in industrial capacity utilization rate and indicators of agricultural productivity in Nigeria, the exponential growth rate equation was specified as thus:

$$CUR_t = b_o e^{bt} e^{ut} \quad (1)$$

$$log_e CUR_t = log_e b_0 + b_1 t + U_t \quad (2)$$

Where exponential growth rate (r) is given as: $\left(e^{b1} - 1\right) * 100$. To ascertain whether the growth rate in the specify variables did increase at accelerated or decelerated rates over the period considered, the quadratic exponential trend equation was also specified as thus:

$$\log_e P_t = b_o + b_1 t_1 + b_2 t_2^2 + u_t \quad (3)$$

If $b_2 > 0$; the variable investigated had accelerated growth rate. On the other hand, when $b_2 < 0$; the variable has decelerated growth rate over time. In this study, the exponential trend analyses were conducted on the following variables:

$CUR_t = Industrial\ capacity\ utilization\ rate\ in\ period\ t\ (\%)$
$AGP_t = Agricultural\ GDP\ as\ a\ ratio\ of\ Toal\ GDP\ in\ period\ t\ (\%)$
$API_t = Agricultural\ productivity\ index\ in\ period\ t\ (1990\ based\ year)(\%)$
$CRP_t = Crop\ Productivity\ Index\ in\ period\ t\ (2004 - 2006\ based\ year)(\%)$
t = time trend (1, 2… 42).

2.3.2. Bilateral Granger Causality Test between Industrial Capacity utilization rate and indicators of Agricultural Productivity in Nigeria

A time series *X* is said to Granger-cause *Y* if it can be shown, usually through a series of t-tests and F- test on lagged values of *X* (and with lagged values of *Y* also included), that those *X* values provide statistically significant information about the future values of *Y* (Granger,1969). This test assumes that the information relevant to the prediction of X and Y is contained solely in the time series data on these variables (Gujurati and Dawn, 2009). In this study, the bilateral Granger Causality tests were conducted on the capacity utilization rate and each of the indicators of Agricultural productivity in Nigeria. The primary model in Vector Autoregressive Regression forms are represented as thus:

$$\Delta LnCUR_t = \beta_0 + \beta_1 \sum_{i=1}^{n} \Delta LnCUR_{t-1} + \beta_2 \sum_{i=1}^{n} \Delta LnAPI_{t-1} + \varepsilon_{1t} \quad (4)$$

$$\Delta LnAPI_t = \delta_0 + \delta_1 \sum_{i=1}^{n} \Delta LnAPI_{t-1} + \delta_2 \sum_{i=1}^{n} \Delta LnCUR_{t-1} + \varepsilon_{2t} \quad (5)$$

$$\Delta LnCUR_t = \gamma_0 + \gamma_1 \sum_{i=1}^{n} \Delta LnCUR_{t-1} + \gamma_2 \sum_{i=1}^{n} \Delta LnCRP_{t-1} + \varepsilon_{3t} \quad (6)$$

$$\Delta LnCRP_t = \alpha_0 + \alpha_1 \sum_{i=1}^{n} \Delta LnCRP_{t-1} + \alpha_2 \sum_{i=1}^{n} \Delta LnCUR_{t-1} + \varepsilon_{4t} \quad (7)$$

$$\Delta LnCUR_t = \gamma_0 + \gamma_1 \sum_{i=1}^{n} \Delta LnCUR_{t-1} + \gamma_2 \sum_{i=1}^{n} \Delta LnAGP_{t-1} + \varepsilon_{3t} \quad (8)$$

$$\Delta LnAGP_t = \alpha_0 + \alpha_1 \sum_{i=1}^{n} \Delta LnAGP_{t-1} + \alpha_2 \sum_{i=1}^{n} \Delta LnCUR_{t-1} + \varepsilon_{4t} \quad (9)$$

For equation 4 and 5, there is a bilateral Granger causality from agricultural productivity index (API_t) to CUR_t (industrial capacity utilization rate), if $\beta_2 \neq 0$ and $\delta_2 = 0$. Similarly, there is unilateral Granger causality from the CUR_t to API_t, if $\beta_2 = 0$ and $\delta_2 \neq 0$. The causality is considered as mutual or bidirectional if $\beta_2 \neq 0$ and $\delta_2 \neq 0$. Finally, there is no link between CURt and API_t, if $\beta_2 = 0$ and $\delta_2 = 0$. The same interpretation follows for the rest of the equations. The variables are as defined previously in equation (1), (2), and (3). The tests were also performed for specified variables in growth rates.

2.3.3. Impact of Agricultural productivity indicators on Industrial Capacity Utilization Rates in Nigeria

Following the result of the unit root test, and the attempt to avoid the tendency of having spurious regression; a time dependent multiple regression model to capture the dynamic nature of industrial activity (proxy by industrial capacity utilization, CUR_t); the industrial capacity utilization equation was specified at the first difference of the log variables. The lag length was kept at level to improve the degree of freedom and the confident interval of estimates. We specified three independent equations to avoid the incidence of multicollinearity. This is because; the three independent variables were similar.

$$\Delta LnCUR_t = \gamma_0 + \gamma_1 \sum_{i=1}^{n} \Delta LnAPI_t + \gamma_2 \sum_{i=1}^{n} D + \gamma_3 + U_1 \quad (10)$$

$$\Delta LnCUR_t = \gamma_0 + \gamma_1 \sum_{i=1}^{n} \Delta LnCRP_t + \gamma_2 \sum_{i=1}^{n} D + \gamma_3 + U_2 \quad (11)$$

$$\Delta LnCUR_t = \gamma_0 + \gamma_1 \sum_{i=1}^{n} \Delta LnAGP_t + \gamma_2 \sum_{i=1}^{n} D + \gamma_3 + U_3 \quad (12)$$

Where;

D_t = Policy dummy (1 for liberalization period (1986 to 2012); 0 otherwise)

U_t = Stochastic error term which is assumed to be independently and normally distributed with zero mean and constant variance. Other variables are as described in equation 3.

3. Result and Discussion

3.1. Descriptive Analysis for industrial capacity utilization rate, Agricultural productivity index, Agricultural GDP and Crop productivity index in Nigeria (1970 to 2012)

Table 1. Descriptive Statistic of Variables Used in the Model

	CUR	AGP	API	CRP
Mean	52.390	33.669	107.29	56.944
Median	53.380	32.850	111.50	54.400
Minimum	29.290	20.171	55.200	24.960
Maximum	78.700	48.785	170.97	105.31
Standard deviation	15.648	6.929	44.356	28.965
Coefficient of Variation	0.287	0.206	0.413	0.509
Skewness	0.109	0.134	0.068	0.295
Kurtosis	-1.254	-0.313	-1.716	-1.484

Note: Computed by authors. Variables are as described in equation 3.

The descriptive statistics for the industrial capacity utilization rate, Agricultural productivity index, and Agricultural GDP as well as the Crop productivity index used in the analyses is shown in Table 1. For the period 1970 to 2012; the average industrial capacity utilization rates was 52.390%; 33.67% for agricultural GDP per total GDP, 107.29% for Agricultural productivity index and 56.94% for crop productivity index. Also, the coefficient of variability for industrial capacity utilization rate stood at 28.70%. In the similar way, it was 20.60%, 41.3% and 50.90% for agricultural GDP, Agricultural productivity index and Crop productivity index respectively.

3.2. Unit Root Test for Variables Used in the Analysis

To ascertain the stationary of variables used in the study, the standard Augmented Dickey–Fuller test for unit root was performed. Test statistics for each variable in level and first difference involving both trend and constant are presented in Table 2.

Table 2. Result of ADF Unit Root test for Variables Used in the Analysis

Variable	At level	First difference	Order of integration
LnAPI	-2.486	-5.605***	1(1)
LnCUR	-1.387	-6.706***	1(1)
LnCRP	-2.807	-5.605***	1(1)
LnAGP	-3.253	-6.360***	1(1)
GRLnAPI	-5.537***	-	1(0)
GRLnCUR	-6.914***	-	1(0)
GRLnCRP	-4.836***	-	1(0)
GRLnAGP	-6.494***	-	1(0)
Residual (LnCUR Vs LnAPI)	-1.686	-	
Residual (LnCUR Vs LnCRP)	-1.521	-	
Residual (LnCUR Vs LnAGP)	-1.886	-	
ADF Critical value (5%)	-3.52	-3.52	
ADF Critical value (1%)	-4.19	-4.20	

Note: Asterisk, *** represent 1% significance level. GR means growth rate, it represents log growth rate of respective variable. Estimated equations contain trend and constant. Variables are as defined in equation 1 to 3.

The test result reveals that at levels, all non-growth rate variables were non-stationary but stationary at first difference; while all growth rate variables were stationary at level. It therefore implies that the non-growth rate variables cannot be specified at levels without the risk of obtaining spurious regression. To avoid this phenomenon and incidence of auto correlation that could lead to bias and inconsistent estimates; non –growth rate variables were specified and estimated at the first logged difference; while growth rate variables were specified and estimated at their respective log levels. The unit root test for error terms generated for equations 10 to 12 is also presented in the lower portion of Table 2. The result indicated that, the error terms were not stationary at level. This means that, there is no co –integration between the industrial capacity utilization rates and the specified independent variables in equation 10 to 12. This implies that, there is no short run relationship between agricultural productivity indicators and industrial capacity utilization rates in the period under consideration in Nigeria.

3.3. Trend in Industrial Capacity Utilization Rates, Agricultural Productivity Index, Agricultural GDP And Crop Productivity Index in Nigeria (1970 – 2012)

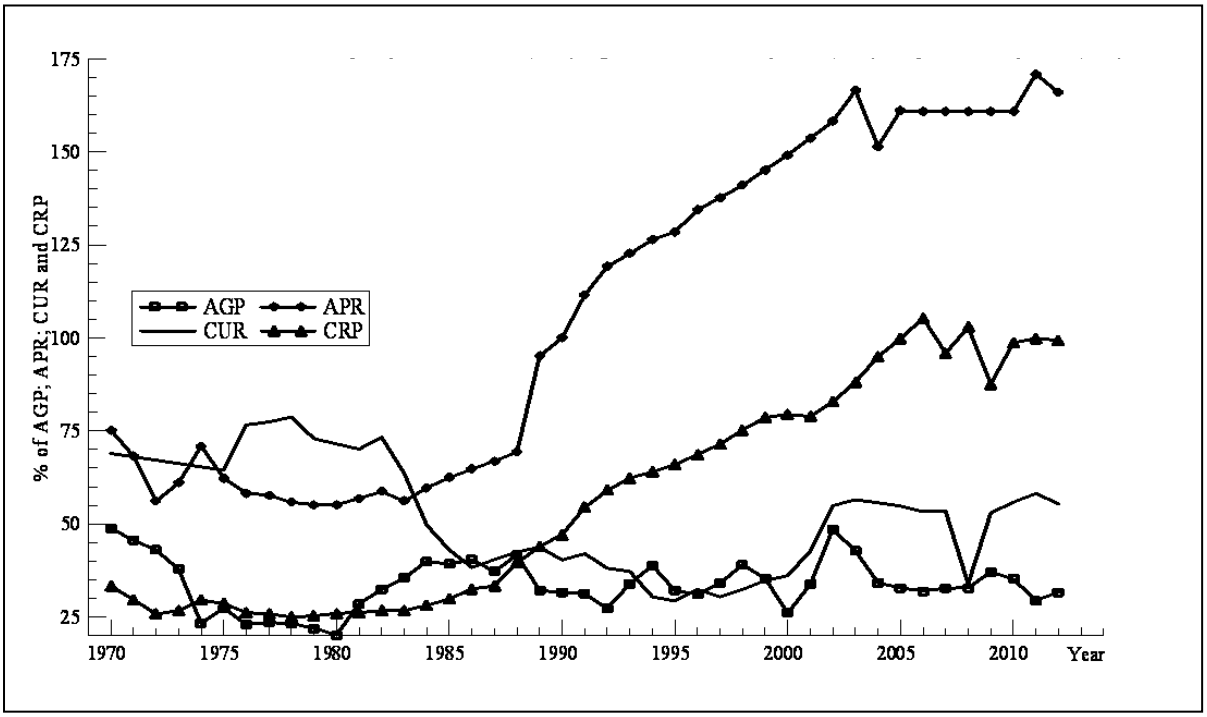
The industrial capacity utilization rate (CURt) has significant negative relationship with time as shown in Table 3. This indicates that, CURt declines with time. The result also revealed that the trends in the crop productivity index, agricultural GDP and agricultural productivity index reacted positively to time in the period under consideration in Nigeria. This implies that, these variables on average increase over time. From 1970 to 2012, we discovered positive exponential growth rates of about 3.3% in agricultural productivity indices (APR), and 4.16% in crop productivity indices (CRPt) and 0.23% in agricultural GDP; while CURt had negative exponential growth rate of -1.13%. However, AGPt, APRt, and CRPt had decelerated growth rates over time. This means that, these variables have positive growth rates that were inconsistently trended in the long run period. In other words, it means that, growth rates in AGPt, APRt, and CRPt increase marginally at increasing rates (but insignificant increasing rates) over time. On the other hand, the growth rate in the industrial capacity utilization rates had positive marginal relationship with increased time. This means that, the trend in the industrial capacity utilization rate over time assumes marginal accelerated pattern. This indicates that, at the long run, the trend in the industrial capacity utilization rate increases at marginal or minimal increasing rate.

Figure 1 shows the graphical representation of the linear trend in crop productivity index, industrial capacity utilization rate, agricultural GDP and agricultural productivity index in Nigeria. From 1970 to 1987, trend in AGPt, CURt, APR_t, and CRP_t witnessed general declined. From 1988, period of Structural Adjustment Programme (SAP), APR_t and CRP_t witnessed dramatic upsurge till 2003. However, CUR_t and AGP_t had undulated trend that averaged around 25% from 1988 to 2003.

Table 3. Exponential Trend Analysis of Industrial Capacity Utilization Rates and Agricultural productivity Indicators in Nigeria

Variables	CUR	AGP	APR	CRP
Constant	4.17(50.34)***	3.44 (52.06)***	3.87 (70.71)***	3.01(55.75)***
Time	-0.011(-3.45)***	0.0023 (0.38)	0.032 (14.94)***	0.04 (19.10)***
F- cal.	11.91***	0.803	223.23***	364.99***
R-square	0.225	0.019	0.845	0.899
Exponential GR (%)	-1.13	0.23	3.29	4.16
Nature of Growth Rate				
Constant	4.58 (46.92)***	3.47 (33.55)***	3.93 (46.45)***	3.09 (37.68)***
Time (b_1)	-0.066 (-6.46)***	-8.0e-04 (-0.08)	0.024 (2.71)***	0.029 (3.31)***
Time (b_2)	0.001 (5.52)***	7.33e-05 (0.31)	1.87e-04(0.96)	2.8e-04 (1.46)
F- cal.	25.46***	0.439	111.86***	188.58***
R-square	0.56	0.02	0.85	0.90
Inference	Accelerated GR	Insignificant GR	Insignificant GR	Insignificant GR

Note: Values in bracket represent t-values. The asterisks * and *** represent 10% and 1% significance levels respectively. Variables are as defined in equation 3.



Source: Graph plotted by authors and data from Central Bank of Nigeria (CBN) and FAO.

Figure 1: Trend in Industrial Capacity Utilization Rate (CUR); Agricultural Productivity Index (APR); Crop Productivity Index (CRP) and Agricultural GDP (AGP) in Nigeria**.**

3.4. Bilateral Granger Causality Test for Industrial Capacity Utilization and Agricultural Policy Output in Nigeria

The long run causality relationship between industrial capacity utilization rate (CURt) and indicators of agricultural productivity was investigated. The result of the analysis is presented in Table 5. The result in Table 4 shows the optimal lag period needed in the causality equation specified in equations 4 to 9. The asterisks

below indicate the best (that is, minimized) values of the respective information criteria, AIC = Akaike criterion, BIC = Schwarz Bayesian criterion and HQC = Hannan-Quinn criterion.

Table 4. The optimal Lag length for the causality equation

Lag	Loglikelihood	P(LR)	AIC	BIC	HQC
1	163.37	-	-7.147*	-6.124*	-6.780*
2	173.74	0.189	-6.858	-5.152	-6.246
3	181.41	0.499	-6.431	-4.043	-5.574

The corresponding lag length indicates the best lag length for generating a more parsimonious causality equation for the specify series. The result of the exercise indicated that lag 1 was more appropriate for the causality equations. This implies that the causality equations generated were done by using one period lagged of the variables involved. The estimated results are presented in Table 5.

Table 5. The vector autoregressive regression Granger causality test for logged variables

Hypotheses	Lag	Sample size	F-Statistic	Prob.	Decision
$\Delta LnCUR_t$ does not Granger Cause $\Delta LnAPI_t$	1	41	0.2860	0.7529	Accepted
$\Delta LnAPI_t$ does not Granger Cause $\Delta LnCUR_t$	1	41	0.3395	0.7142	Accepted
$\Delta LnCUR_t$ does not Granger Cause $\Delta LnCRP_t$	1	41	4.3851	0.0193**	Rejected
$\Delta LnCRP_t$ does not Granger Cause $\Delta LnCUR_t$	1	41	0.2211	0.8027	Accepted
$\Delta LnCUR_t$ does not Granger Cause $\Delta LnAGP_t$	1	41	0.1238	0.8839	Accepted
$\Delta LnAGP_t$ does not Granger Cause $\Delta LnCUR_t$	1	41	0.0845	0.9191	Accepted

Note: Variables are as defined in equation 1, 2 and 3.

The result in Table 5 suggests that there is evidence of one-directional Granger causality between CRPt and CURt (at 5% probability level) from 1970 to 2012 in Nigeria. The result shows that, the causality runs from CUR_t to CRP_t. Alternatively, the result revealed that, CURt impact significantly on the CRPt. The result could also be seen this way, that the previous value of industrial capacity utilization rate (CURt) significantly predicted the current value of the crop productivity index (CRPt) in Nigeria. The result further revealed that, there is no significant impact of the backward integration policy of the Agricultural sector in Nigeria. The industrial activities influence the crop sub-sector of the agricultural sector, while the crop sector does not contribute significantly to the development of the industrial sector. The result provided the fact that, the crop sub sector if properly harnessed could trigger growth in the industrial sector; but there is no evidence of the reverse action in Nigeria.

Table 6. The Vector autoregressive regression Granger causality test for growth rates of logged variables

Hypotheses	Lag	Sample size	F-Statistic	Prob	Decision
$GRCUR_t$ does not Granger Cause GRAPI_t	1	41	0.4066	0.6687	Accepted
$GRAPI_t$ does not Granger Cause GRCUR_t	1	41	0.3396	0.7142	Accepted
$GRCUR_t$ does not Granger Cause GRCRP_t	1	41	4.1841	0.0226**	Rejected
$GRCRP_t$ does not Granger Cause GRCUR_t	1	41	0.1558	0.8562	Accepted
$GRCUR_t$ does not Granger Cause GRAGP_t	1	41	0.1057	0.8999	Accepted
$GRAGP_t$ does not Granger Cause GRCUR_t	1	41	0.1285	0.8798	Accepted

Note: Variables are as defined in equation 1, 2 and 3 but are used as growth rates.

Similar results were obtained for the same variables expressed in growth rates. Table 6 shows the Granger Causality relationship between growth rate of industrial activities and growth rates of indicators of agricultural productivity in Nigeria. The result confirms that, a unidirectional causality run from industrial activities to the crop sector. This means that, changes in growth rates of industrial outputs affect changes in growth rates of crop production and not vice versa.

3.5. Impact of Agricultural Production Index on Industrial Capacity Utilization Rate in Nigeria (1979 - 2012)

Result in Table 7 shows the regression relationship between industrial capacity utilization rate and agricultural productivity index in Nigeria. The empirical result revealed that, there is no significant correlation or relationships among the industrial capacity utilization rate, agricultural productivity indices and the period of liberalization period from 1970 to 2012 in Nigeria. This implies that, activities in the industrial sector were not significantly influenced by activities in the agricultural sector as a whole in the period under consideration in Nigeria.

Table 7. Industrial Capacity Utilization Versus Agriculture production index equation in Nigeria

Variable	Coefficient	Standard error	t-value
Constant	-0.0324	0.0356	-0.9083
ΔLnAGP	-0.07314	0.29082	-0.2515
Policy Dummy	0.04444	0.04642	0.9564

Note: Variables are as defined in equation 1 to 3. $R^2 = 0.023$ DW = 2.192

3.6. Impact of Crop Productivity Index on Industrial Capacity Utilization Rate in Nigeria (1970 -2012)

Selected areas in agricultural sector were isolated and tested for empirical relationship with industrial capacity utilization rate in Nigeria. The diagnostic statistics for the estimated equation 11 revealed that, about 17.9% variability in industrial capacity utilization rate (CURt) was attributed to the activities of crop sub-sector of agricultural sector in Nigeria. The autocorrelation among series was not a serious problem as shown in Table 8. The result indicated that, crop productivity indices (CRP_t), had significant (at 1% probability level) negative relationship with the industrial capacity utilization rate (CURt) in Nigeria. This implies that increase activities in the crop sub-sector significantly decreases the industrial activities in the country. The plausible reason for the result is the facts that, the domestic price for most of the agro-based industrial raw materials (i.e. crops) were lower than the international price. Hence, there were more incentives to farmers from exportation than domestic consumption. Also, the policy dummy (period of liberalization) had a positive significant relationship with the industrial capacity utilization rate in Nigeria. This means that, the liberalization policies that were targeted at promoting crop production had positive impact on the industrial activities in Nigeria.

Table 8. Industrial Capacity Utilization Versus Crop productivity index equation in **Nigeria**

Variable	Coefficient	Standard error	t-value
Constant	-0.03752	0.03258	-1.152
ΔLnCRP	-0.82984	0.30367	-2.733***
Policy Dummy	0.08391	0.04349	1.929*

Note: Asterisks *, and *** represent 10% and 1% significance level respectively. Variables are as defined in equation 1 to 3. $R^2 = 0.179$; DW = 1.852

3.7. Impact of Agricultural GDP on Industrial Capacity Utilization Rate in Nigeria

Result in Table 9 indicates the relationship between industrial capacity utilization rate and agricultural GDP in Nigeria. The empirical result revealed that, there is no significant relationship among the industrial capacity utilization rate, agricultural GDP and the period of liberalization period from 1970 to 2012 in Nigeria. This implies that, the activities in the industrial sector were not significantly influenced by the contribution of agricultural GDP in the total GDP in Nigeria.

Table 9. Industrial Capacity Utilization Versus AGP in total GDP equation in Nigeria

Variable	Coefficient	Standard error	t-value
Constant	-0.03053	0.03542	-0.8620
LnΔAGP	0.06368	0.12813	0.4970
Policy Dummy	0.04042	0.04412	0.9161

Note: Variables are as defined in equation 1 to 3. $R^2 = 0.0275$; DW = 2.1625.

4. Conclusion

The study investigated empirical relationships between the agricultural productivity indicators (agricultural productivity index, agricultural GDP and crop productivity index) and industrial capacity utilization rates in the Nigeria's economy. Since industrial development is an integral part of economic development, the improvement in industrial activities will trigger economic development as a whole. The trend analyses of the variables used in the study revealed that, agricultural GDP, agricultural productivity index, crop production index and industrial capacity utilization rate had exponential growth rates of 0.2%, 3.3%, 4.2% and -1.1% respectively. The empirical result revealed that, a unidirectional Granger causality runs from industrial activities to crop productivity index and not vice versa in Nigeria. Also, it was discovered that, the industrial activities has insignificant relationship with agricultural productivity indices in Nigeria. The same result was also obtained for industrial activities and agricultural GDP. However, the result further revealed that, the industrial activity has significant negative correlation with the crop productivity index in Nigeria. These imply that, agricultural production had not played significant role in revolutionizing industrial activities in Nigeria. This result suggests that, there is no significant impact of the backward integration policy of the agricultural sector on industrial sector in Nigeria. The result further validated the fact that, agricultural policies during liberalization era shifted the coefficient of the industrial activities positively; which means that, the liberalization policies meant to increase crop production contributed to increase in the industrial activities. Therefore, it is recommended that the agricultural production should be boosted so as to generate sufficient demand and raw materials for the industrial sector. Agricultural policy of the liberalization period should be promoted and strengthen as an alternative way to induce positive growth in industrial activities and hence economic development in Nigeria.

References

Adelman, I. (1984). Beyond Export-Led growth, *World development*, 12(9), 937-49.

Akpan, S. B., Ini-mfon V., Glory E., & Daniel E., (2012). Agricultural Productivity and Macro-Economic Variable Fluctuation in Nigeria. *International Journal of Economics and Finance,* 4(8), 114 –125.

Business Day Report (2012). "Strengthening agriculture to drive industrial development" Available at http://www.businessdayonline.com/NG/index.php/markets/agribusiness/34342strengtheningagriculture -to-drive-industrial-development.

CBN, (2005). *Statistical Bulletin of Central Bank of Nigeria*. Available at http/www.cbn.org/out/publications.

CIA, World Fact book, on Nigeria, 2013.

Eicher, C., & Witt, L. (Eds.) (1964). *Agriculture in Economic Development*. New York: Mcgraw Hill.

Food and Agricultural Organization Reports, 2012.

Gollin D., Parente S. & Rogerson, R. (2002). The Role of Agriculture in Development, *American Economic Review*, 92(2), 160-164.

Granger, C. W. J. (1969). Investigating Causal Relations by Econometric Models and Cross spectral Methods". *Econometrica* 37 (3), 424–438.

Gujarati, D. N., & Dawn C. P. (2009). Basic Econometric, 5th edition. McGraw-Hill International, New York, USA.

Jones, E.I., & Woolf, S.S. (Eds.) (1969). *Agrarian Change and Economic Development: The Historical Problems* London: Methuen.

Koo, W. W., & Jianqiang L., (1997). The Relationship between the Agricultural and Industrial sectors in Chinese Economic Development. Agricultural Economics Report No. 368.

Murphy K., Shleifer A. & Vishny, R., (1989). Industrialization and the Big Push, *Journal of Political Economy*, 97(5), 1003-1026.

National Population Commission (NPC) (2006). National Census Data. Available at www.population.gov.ng/. Retrieved 25-1-2013.

Nurkse, R. (1953). Problems of Capital Formation in Underdeveloped Countries, Oxford University Press, New York.

Nwosu, A. C. (1992). Structural Adjustment and Nigerian Agriculture. United State Department of Agricultural Economic Research Service. Agriculture and Trade Analysis Division.

Ogen, O., (2007). The Agricultural Sector and Nigeria's Development: Comparative Perspectives from the Brazilian Agro-Industrial Economy, 1960-1995. *Nubula,* 4.1, 184-194.

Ogun, O. (1987). Nigeria's Trade Policy During and After the Oil Boom: An Appraisal, University of Ibadan, 1987.

Oji-Okoro, I. (2011). Analysis of the contribution of agricultural sector on the Nigerian economic development. *World Review of Business Research*, 1(1), 191 – 200.

Oluwasanmi, H.A. (1966). *Agriculture and Nigeria's Economic Development* Ibadan: Ibadan University Press.

Ranis, G (1984). "Typology in Development Theory: Retrospective and Prospects", *In* M. Syrquin, L. Taylor and L. Westphal (Eds). *Economic Structure and Performance: Essays in Honor of Hollis B. Chenery,* New York, Academic Press.

Rostow, W., (1960). *The Stages of Economic Growth: A Non Communist Manifesto*, Cambridge University Press, London.

Saikia, D. (2011). Agriculture-Industry Interlinkages: Some Theoretical and Methodological Issues in the Indian Context. MPRA Paper No. 27820. Available at http://mpra.ub.uni-muenchen.de/27820/.

Stewart, R. (2000). "Welcome Address". *Proceedings of the 7th World Sugar Farmers Conference*. Durban. Available at www.sugaronline.com/sugarindustry/index.htm.

Udoh E., & Elias A. U. (2011). Ten Years of Industrial Policies under Democratic Governance in Nigeria: "New Wine in Old Bottle", *European Journal of Social Sciences*, 20(2), 248- 258.