

AGRICULTURAL PRODUCTIVITY AND ECONOMIC GROWTH: IMPACT ANALYSIS FROM NIGERIA

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Abstract: This study examined the impact of agricultural productivity on economic growth in Nigeria between the periods of 1981 to 2015. The Johansen cointegration test was employed to determine the existence of long run relationship between agricultural productivity and economic growth. Error Correction Model (ECM) was employed to determine the short run impact of agricultural productivity on economic growth. From the results, it was found that the agricultural labour productivity and agricultural value added were the positive determinants of economic growth. The study concluded that improvement in the performance of the agricultural sector has a significant effect on economic growth in Nigeria. Therefore, the government should encourage labour force participation in the agricultural sector by increasing investment in the agricultural sector.

Index Terms: Agricultural Value Added, Labour and Capital Productivity, Error Correction Model (ECM), Economic growth, Nigeria.

I. INTRODUCTION

Agriculture is the bedrock of economic growth, development and poverty eradication in the developing countries. Agriculture has been regarded as the engine and panacea to economic prosperity. Gunner Myrdal, (1984) explained that the battle for long-term economic growth will be won or lost in the agricultural sector. However, how this route leads to economic growth is still under debate among researchers. The question as to whether agriculture is a viable engine of economic growth issues have been raised. In response to this question, Lavorel et al. (2013) investigated the relationship between agricultural productivity and economic growth in 85 countries that comprises developed and developing countries, using agricultural value added per worker and gross domestic product (GDP) per capita as key variables. The findings revealed a relationship between agricultural valued added and economic growth only in the developing countries, while the results for the developed countries remain ambiguous. According to Kuznetz 1973; Abayomi 1997, agricultural sector has four major contributions to the development of an economy; product contribution, factor contribution, market contribution and foreign exchange contribution. Agriculture is a source of food and raw materials in the industrial sector, it provides raw materials for industrial use for speeding up industrialization. It involves production of crops, livestock and forestry, fishery, for man's consumption and use; processing and marketing of the agricultural products. These contributions in effect have been the source of gainful employment opportunity with attendant implications for poverty alleviation and improvement of income distribution. Also, foreign earnings from exportation of agricultural local materials, has played a significant role in reducing the pressure on balance of payment in most African nations. Based on these contributions, agriculture is regarded as the fundamental to the socioeconomic development of a nation (Ahmed, 1993).

In most low and middle-income countries, the agricultural sector remains, the largest contributor providing inputs, food, employment opportunities, raw materials for other industries, provision of foreign earnings from the exportation of the surpluses, and more importantly the enormous advantage of the value added in the various production process (Izuchukwu, 2011). Thus, the role of agriculture in transmuting both the social and economic structures of an economy cannot be over-emphasized. Rostow (1960) argued that in the process of economic development, nations pass through several stages, namely: traditional stage, the precondition for take-off, the take off stage, drive to maturity and the high mass consumption stage. Agriculture played crucial roles in the first three stages (Traditional society, pre-conditions for take-off and take-off stages). The agricultural sector has the potential to be the industrial and economic springboard from which a country's development can take off. Indeed, more often than not, agricultural activities are usually

concentrated in the less- developed rural areas where there is a critical need for rural transformation, redistribution, poverty alleviation and socioeconomic development. Based on the historical experience of Western countries, economic development was seen as requiring a rapid structural transformation of the economy focused on agricultural activities to a more complex modern industrial and service society. As a result, agriculture's primary role is to provide food and manpower to the expanding industrial economy. Reynolds (1975) revealed that agricultural development can promote the economic development by increasing the supply of food available for domestic consumption and releasing the labour needed for industrial employment. According to him, agricultural development can promote economic development of underdeveloped countries in four distinct ways: by increasing the supply of food available for domestic consumption and releasing labour needed for industrial employment; by enlarging the size of the domestic market for the manufacturing sector; by increasing the supply of domestic savings and by providing foreign exchange earned by the agricultural exports. Omawale and Rodriguez (1980) opined that for most developing countries, agriculture has been assigned an important role in national development. This is because, agriculture has been seen as a means of reducing dependence on certain importations, containing food price increases, earning foreign exchange, absorbing many new entrants to the labour market and increasing farm incomes in times of severe unemployment.

Nigerian economy in past decades was reputed as the mainstay of the economy, especially in the in the early 1960's. It was seen as the key driver for growth and development. Agriculture was the backbone of the Nigerian economy at independence in 1960 as it accounted for over half of the Gross Domestic Product (GDP) (Olagunju, 2007). The sector contributes about 55% of gainful employment and almost 40 % of the share of GDP, before the discovery of oil. This GDP share of agriculture sector is quite high when compare with the average of 27% for low income nations in Sub-Sahara Africa (WDI, 2010). But with the oil boom in the early 1970s, successive governments abandoned and neglected the agricultural sector completely and since then poor performance characterized the Nigerian agricultural sector. The role agricultural sector plays in the region and economic development of the country have diminished over the years. In spite of this, the sector still accounts for about 40 percent of GDP and provides employment, both formal and informal, for about 60 percent of Nigerians 144 millions of people (Olagunju, 2007 and Odoemelam, 2011). The growth rates of agricultural productivity usually calculated as the difference between output growth and the growth of labour and capital weighted by their share have been increasing at a decreasing rate. One of the reasons for this poor performance of the agricultural sector is that majority of farmers in Nigeria are still engaged in primitive and traditional methods of agricultural production. Farming machinery everywhere is very primitive.

According to Akintola, (2017), the main tools are the hoe to work the land, small knives and sickles used for reaping rice and cutting of reed. This problem disincentives farmers and lead to massive migration of people from rural to urban areas. Less than 50% of the Nigeria's arable agricultural land are still under cultivation and smallholder and traditional farmers who use rudimentary production techniques, with resultant low productivity, cultivate most of this land. The smallholder farmers are constrained by many problems, including those of poor access to modern inputs and credit, poor infrastructure, inadequate access to markets, environmental degradation, and inadequate research and extension services. Hence, they cannot produce in large quantity for commercial purpose, this inefficiency of the agricultural inputs have been identified to retard growth in the agricultural sector (Olajide et al., 2012).

The majority of the government policies on agriculture are characterized by backward flip, lip service, inconsistencies, poor implementations and mismanagement of funds. The Federal government and state government of Nigeria and other multinational organizations, like the World Bank, have spent in the agricultural sector a huge sum of money (David et al, 2013). This monetary commitments was done with the belief that agricultural sector will be transformed, but corruption or mismanagement of funds has eroded the effectiveness of enormous spending in the agricultural sector. It also contributed to the poor performance of the agricultural sector. This situation discourages investments in the agricultural sector; decrease country's food production; increase unemployment rates and retard industrialization in Nigeria. Considering the role that the agricultural productivity play in the development of a nation, it is important to examine the extent of the effect of agricultural productivity on economic growth in consonance with the available agricultural inputs in Nigeria. On this note, this study examined the effect of agricultural productivity in Nigeria

II. PRODUCTIVITY AND GROWTH

The Measures of Productivity

Productivity is commonly defined as a ratio of a volume measure of output to a volume measure of inputs (OECD, 2001). While there is no divergence on this general view, a look at the various applications of productivity in the literature shows that there are various diverse productivity measures. The choice between them depends on the purpose of productivity measurement and, in several cases, on the data accessibility. Generally, productivity measures can be classified as single factor productivity measures (relating a measure of output to a single measure of input) or multifactor productivity measures. Under the single factor productivity measure, there are labour and capital productivity based on gross output or value added. Labour productivity shows how productive labour is used to generate output and it only partially reflects the productivity of labour in terms of the capacities of labors or the intensity of their efforts. The ratio between output and labour input depends to a large degree on the presence of other inputs (Growth, Promoting Pro-Poor, 2006). Like labour productivity, capital productivity measures can be based on a gross-output or a value-added concept. When capital input is measured as a flow of services adjusted for changes in the quality of investment goods, the capital measure translates

embodied technical change into a larger or smaller flow of constant-quality capital services (OECD, 2001). Thus, rising quality of capital goods implies a larger amount of capital services. Capital-labour multifactor productivity indices show the time profile of how productively combined labour and capital inputs are used to generate value added. (OECD, 2001). The multifactor productivity measures link a measure of output to a bundle of inputs. Labour-capital productivity is categorized under this measure.

Agricultural Labour and Capital Productivity Measure

Agricultural productivity refers to the rise in per capita output of agricultural produce within an economy during a given period of time. The period of time can be monthly, quarterly or annually. However, the annual period of time is usually adopted by most researchers in the field of economists and statistics due to the accurate and coherent information it tends to offer. Agricultural productivity refers to the output produced by a given level of inputs in the agricultural sector of a given economy (Amire, 2016). More formally, it can be defined as the ratio of the value of total farms outputs to the value of total inputs used in farm production (Iwala 2013). Agricultural productivity is measured as the ratio of final output, in appropriate units to some measure of inputs. Singh and Dhillon (2000) suggested that yield per unit should be considered to indicate agricultural productivity. Many scholars criticized this suggestion while pointing out that the approach only considered land as the factor of production. Several researchers were of the opinion that agricultural productivity should contain all the factor of production such as: labor, farming experiences, fertilizers, availability and management of water and other biological factors. Also, agricultural productivity can be measured by total factor productivity (TFP). This method of calculating agricultural productivity compares an index of agricultural inputs to an index of outputs. Increase in TFP is usually attributed to technological progress. Agricultural productivity is very significant, because it increases food production and farmer's prospects for growth and competitiveness in the agricultural market. As farmers adopt new techniques and differences, the most productive farmers benefit from an increase in their welfare while farmers who are not productive enough will exit the market to seek success elsewhere (Yair, 2007). Agricultural productivity is becoming increasingly important as the world population continues to grow. It is not only the people employed in agriculture who benefit from increases in agricultural productivity. Those employed in other sectors also enjoy lower food prices and a more stable food supply.

Agricultural productivity consists of all the factors of production such as: labor, capital, farming experiences, availability and management of water and other biological factors. Capital refers to cash and other man-made farm assets that are required to carry out production. Capital is usually accumulated through saving and investment. But, in developing countries where national income is generally low, investment and saving are also low. This explains the low productivity, output and income in developing countries. According to Phillip et al, (2008), the transformation of smallholder agriculture in Nigeria from subsistence to market orientation requires the injection of more capital. This is true because farmers need capital to acquire, machineries and seeds and fertilizers among others. Where financial capital is inadequate farmers resort to borrowing from financial institutions for running of the farms. Labour is the center piece of the whole process of production. It is the human physical effort required to undertake production. Capital accumulation makes the labour better equipped and delays setting in of the law of diminishing returns in agricultural systems. Labour is measured in man-days in relation to the number of hours spent on the farm. In some developing countries, sources of labour could be family, hired or both family and hired. Although, labour is a critical productive input in small scale farming (Ibana, 2009), asserted that hired labour can be exorbitant and so recommended that farmers combine family and hired labour. Ogbanje (2017) noted that, given the ageing trend of farmers and high rate of rural-urban migration, labour in Nigeria is expensive and many labors are unwilling to engage in agriculture. This factor also contributed to the low agricultural productivity in Nigeria.

III. CONNECTING THEORY WITH EMPIRICAL FINDINGS

Development economists have focused on how agricultural productivity can best contribute to overall economic growth and modernization. From this perspective, the development of an economy depends on the growth of the agricultural sector. The physiocrats believe that the fortune of the economy is structured by productivity in agriculture and its surplus is dispersed throughout the system in a network of transactions. Tombofa (2004), explained that agriculture provides the basis for the world's great civilization in the past decades and supports that the state of agriculture is of utmost importance to the development process. He pointed to the increase in agricultural productivity in England as the basis for his assertion. Similarly, Todaro and Smith (2003) assumed that the underdeveloped economies consist of two sectors; the traditional agricultural sector characterized by zero marginal labour productivity and the modern industrial sector, while looking at Lewis theory of development. The agricultural sector is known to employ over 75 percent of the labour force in developing countries and provide the purchasing power over industrial goods. In Nigeria, Olajide et al, (2012), analyzed the relationship between Agricultural resource and economic growth in Nigeria using Ordinary Least Square (OLS). The results revealed a positive relationship between gross domestic product (GDP) and agricultural output in Nigeria. Agricultural sector was estimated to contribute 34.4 percent variation in gross domestic product (GDP) between 1970 and 2010 in Nigeria. On this basis, the study suggested that increasing capital inputs by giving special incentives to farmers and providing adequate funding, as well as infrastructural facilities such as good roads, pipe borne water and electricity.

Moreover, Atte and Lawal (2006) examined agricultural productivity and its determinants in Nigeria. From the findings, it was revealed that the major factors affecting agricultural productivity in Nigeria are GDP growth rate, population growth rate and consumer

price index. Similarly, using numbers and volume of guaranteed loan by ACGSF as a capital input, Oguntade and Mafimisebi (2008) found a long-run relationship agricultural capital input and the agricultural output. This indicated that capital input is quantum of contribution to agricultural productivity in Nigeria. Adebite et al, (2008) argued that lack of credit facilities has always been a major problem of small scale farmers and other micro-entrepreneurs in Nigeria and in most developing countries worldwide. This condition has been attributed to the non-availability of collateral securities and inadequate capital that prevented this category of people from accessing credit facilities.

Furthermore, Omorogiuwa et al, (2014) analyzed the historical and current perspective about the development of agriculture in Nigeria, in light of its productivity. The findings of the study proved that an in-depth research on the development of the agricultural sector is essential to its productivity, therefore the agricultural development should start with the empowerment of the poor farmers financially. Equally, Anyanwu (1997), explained that the role of agriculture in transforming both the social and economic framework of an economy cannot be over-emphasized. This is because, agriculture remains the source of food and raw materials for the industrial sector for speeding up industrialization by providing the nation's industries with local raw materials and as a source of reliable source of government revenue. In the same vein, Izuchukwu (2011) in examining the contribution of the agricultural sector in the Nigerian economic growth, found that a positive relationship existed between Gross Domestic Product (GDP) Vis-a-Vis domestic saving, government expenditure on agriculture and foreign direct investment.

Moreover, Echevarria, (1998) focused on the case study of Canada, where agriculture is less labour intensive than the service and industrial sectors. The findings of this study show that the sector that uses less labour intensive and more capital intensive the most is the agricultural sector, while both service and industrial sectors use more of labour intensive than capital intensive. This implies that both in the industrial and service sectors, there is more employment and more job opportunities than the agricultural sector. However in Nigeria, the reverse is the case as the agricultural sector employed a large percentage of the labour force in Nigeria. Using social accounting matrices, Vogel (1994) examined the agriculture as a determinant of growth in 27 countries. The study discovered that agriculture through its linkages in all 27 countries, leads to positive integration of the sector to the broader economy, it also served as a viable source of economic growth in the primary stages of development and its importance diminish with industrialization. According to Onunze (2012) in his work titled the impact of agricultural development on Nigeria economic growth found that agricultural productivity impacted positively on economic growth. Similarly, (Olajide et al, (2012) explained that increases in agricultural productivity can help to alleviate poverty in poor and developing countries, especially where agriculture is labour intensive. According to Anyanwu (1997), agricultural sector has been the source of gainful employment from which the nation can feed its teeming population and reduction of poverty because the sector is less labour intensive therefore employing more manpower and less machineries that is capital intensive. Overall, the reviews have shown the significant impact of agricultural productivity on economic growth relative to agricultural labour and capital inputs.

IV. METHODOLOGY

This study examined the long and short run effects of agricultural productivity on economic growth in Nigeria. The agricultural productivity was measured by Agricultural value added (AGVADD) Agricultural labour productivity (AGLP), Agricultural capital productivity (AGKP), while Real Gross Domestic Product (RGDP) proxy economic growth. Inflation rate (INFR) was included as a control variable. Secondary data were sourced from the Central Bank of Nigeria and the World Bank Database (WDI, 2016). The major method of analysis employed in this study is the regression analysis. However, since time series variables are used, it is essential to examine their properties so as not to end up with a spurious regression. Therefore, all variables were examined through unit root tests. To examine the long run relationship among the variables, Johansen cointegration test was conducted while the short run analysis was done via error correction model (ECM). Following the Solow growth model, the key variables are labor productivity, which is output per worker, it measures how much the average worker in the economy is able to produce. The output per worker is calculated by simply taking the economy's level of real GDP or output Y, and dividing it by the economy's labor force L. This quantity, output per worker, Y/L, is a proxy for agricultural labour productivity, while output per capital is taking as the agricultural output divided by the capital to yield agricultural capital productivity. The functional relationship between agricultural productivity and economic growth was expressed as;

$$\Delta \ln RGDP_t = \alpha_0 + \sum_{i=0}^p \gamma_i \Delta \ln RGDP_{t-i} + \delta \Delta \ln AGVADD_t + \varphi \Delta \ln AGLP_t + \tau \Delta \ln AGKP_t + \vartheta \Delta \ln INFR_t + \sum_{i=0}^{q_1} \delta_i \Delta \ln AGVADD_{t-i} + \sum_{i=0}^{q_2} \varphi_i \Delta \ln AGLP_{t-i} + \sum_{i=0}^{q_3} \tau_i \Delta \ln AGKP_{t-i} + \sum_{i=0}^{q_4} \vartheta_i \Delta \ln INFR_{t-i} + \rho ECM_{t-1} + \varepsilon_t$$

The structural lags length was established by using minimum Akaike's information criteria (AIC). The a priori expectation are $\delta, \varphi, \tau, \vartheta > 0$, indicating that all coefficients are positively related to RGDP

V. RESULTS AND DISCUSSION OF FINDINGS

Table 1. Stationary Test Results

Variables	ADF @ Level				ADF @ 1 st Difference				Decision
	Test Stat	Test Critical Value at 5%	Prob.	Remark	Test Stat	Test Critical Value at 5%	Prob.	Remark	
LOG(RGDP)	-2.240	-3.548	0.453	NS	-4.383	-3.553	0.008	S	I(1)
LOG(AGVADD)	-2.041	-3.548	0.559	NS	-5.316	-3.553	0.001	S	I(1)
LOG(AGKP)	-2.889	-3.548	0.178	NS	-5.997	-3.553	0.000	S	I(1)
LOG(AGLP)	-2.021	-3.548	0.569	NS	-5.279	-3.553	0.001	S	I(1)
INFR	-3.061	-3.581	0.135	NS	-5.449	-3.568	0.001	S	I(1)

Source: Author's Computation, underlying data from Central bank of Nigeria Statistical Bulletin and World Development Indicator (WDI) Database, 2016.

The time series behaviour of each of the series is presented in Tables 1, using the ADF tests at both level and first difference of the series. The result depicts that all the variables are integrated of order one (i.e. I(1)). Therefore, they are made stationary by first difference prior to subsequent estimations to forestall spurious regressions.

Cointegration Test for Long run Relationship

The test statistics indicate that the hypothesis of no cointegration, H0, among the variables can be rejected. The results reveal three cointegrating vectors exist among the variables of interest. Since the variables are cointegrated, there is, therefore, a long run relationship among the variables. It also means that the study can proceed to estimating the Error Correction Model.

Table 2: Summary Result on Co-integration Test

No. of CE(s)	Eigen Value	Trace Statistic	Critical Value	Prob.**	Eigen value	Max_Eigen Statistic	Critical Value	Prob.**
None *	0.644	96.152	84.378	0.013	0.644	33.088	35.581	0.177
At most 1 *	0.633	63.064	60.086	0.058	0.633	32.051	29.540	0.051
At most 2	0.408	31.013	39.755	0.443	0.408	16.797	23.441	0.475
At most 3	0.270	14.216	23.342	0.640	0.270	10.080	17.234	0.610
At most 4	0.121	4.136	10.666	0.722	0.121	4.136	10.666	0.722

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level, * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values.

The error correction results shown in table 3, R2 value of 0.641 shows that all the variables explain about 64.1% of RGDP. F-statistic of 5.129 (P<0.05) shows that they are jointly significant and the Durbin Watson value of 1.804 implies that the model does not suffer from autocorrelation problem. In terms of the significance of the individual variables, it is observed that current AGLP and past value of AGVADD as well as inflation rate are the three significant determinants of RGDP in Nigeria for the period of analysis. Specifically, current value of AGLP and past value of AGVADD increases the current RGDP at 0.01 and 0.10 levels of significance respectively. On the other hand, current INFR is a negative and significant determinant of RGDP in Nigeria for the period of study. This implies that the current value of INFR reduces the current GDP at 0.10 levels of significance. Most of the other variables are correctly signed, although not significant. For instance, it is shown that past AGVADD and RGDP increase current RGDP. The negative and significant coefficient of ECT at lag 1 provides the evidence about its convergence from the long run equilibrium point.

This means that about 35.9% of the errors are corrected yearly. The results imply that increase in agricultural productivity has a positive impact on economic growth in Nigeria.

Table 4.3: Error Correction Model (ECM)

Variable	Coefficient
C	0.010(0.016)
D(LOG(RGDP(-1)))	0.127(0.138)
D(LOG(AGVADD(-1)))	8.921(5.526)
D(LOG(AGLP))	0.355***(0.115)
D(INFR)	-0.001*(0.001)
D(LOG(AGLP(-1)))	-9.052(5.462)
D(LOG(AGVADD(-2)))	0.384*(0.149)
D(LOG(AGKP(-2)))	-0.014(0.022)
ECT(-1)	-0.359*(0.179)
R-squared	0.641
Adjusted R-squared	0.516
F-statistic	5.129
Prob(F-statistic)	0.001
Durbin-Watson stat	1.804

*Note: *, ** and *** represents significance level of 10%, 5% and 1% respectively. Standard error in parenthesis*

VI. CONCLUSION AND RECOMMENDATIONS

Agricultural productivity as measured by labour and capital productivity as well as agricultural value added has been verified to have significant effects on the economic growth in Nigeria. From the results obtained from this study, agricultural output and labour productivity have a positive impact on the economic growth in the short run. This analysis brings evidence of the active role of agricultural sector as a catalyst to fostering economic growth in Nigeria under a controlled inflation rate. Having seen that agricultural productivity has a significant impact on economic growth in Nigeria, this study concludes that policies that will improve the performance of the agricultural sector, especially in the area of manpower are needed to foster economic growth in Nigeria. Based on the results and the conclusion drawn from this study, the Nigerian government should encourage labour force participation in the agricultural sector by increasing investment in the agricultural sectors. Since increase labour force participation has a positive feedback effect on economic growth, the government should enable accessibility to agricultural machineries at affordable prices and subsidize the costs of accessing and acquiring the modern agricultural machineries through improved extension and adequate incentives. This will encourage large scale farming for commercialization purposes in Nigeria with the use of modern inputs.

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