Contribution of Agriculture to Economic Growth in Nigeria[1]

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To be presented at:

The 18th Annual Conference of the African Econometric Society (AES) Accra, Ghana at the session organized by the Association for the Advancement of African Women Economists (AAAWE), 22nd and 23rd July, 2013.

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[1] A work in progress

Abstract

This paper investigates the contribution of the agriculture sector to economic growth in Nigeria using the growth accounting framework and time series data from 1960 to 2011. We find that the agriculture sector has contributed positively and consistently to economic growth in Nigeria, reaffirming the sector's importance in the economy. The contribution of agriculture to economic growth is further affirmed from a causality test which showed that agriculture growth Granger-causes GDP growth, however no reverse relationship was found. The resilient nature of the sector is evident in its ability to recover more quickly than other sectors from shocks resulting from disruptive events e.g. civil war (1967-70) and economic recession (1981-85) periods. We also find that the crop production subsector contributes the most to agriculture sector growth and that growth in the agriculture sector is overly dependent on growth of the crop production subsector. This indicates the importance of this subsector and probably, lack of attention or investment to the other subsectors. Therefore, increased efforts in developing the livestock, fisheries and forestry subsectors will foster the contributions of agriculture sector to the Nigerian economy.

Key words: Agriculture, Economic Growth, GDP, Nigeria, Growth Accounting, Granger causality tests.

JEL Classification: Q1, O4, O55

1. Introduction

The relationship between agriculture and development, especially in Sub-Saharan Africa, cannot be overemphasized. As a roadmap to attaining development, the Millennium Development Goals (MDGs) [2] was adopted in year 2000 and in Africa, 70% of the development target group live in rural areas and are dependent on agriculture for a living (IFPRI, 2004). Invariably, reducing poverty, improving nutrition and general well-being of the population would imply improving the livelihood of this majority and this hinges critically on the performance of the agriculture sector. For example, using World Development Indicator (WDI) data from Nigeria for selected periods, we find a strong positive correlation between food production and primary school enrollment ratio and gender equality while there is a strong negative correlation between food production and child mortality rates[3]. This gives some evidence on the importance of agriculture in economic development.

However, sustained economic development cannot be achieved without economic growth. As expressed by the World Bank (2006), high poverty level will lead to low growth and low growth will lead to high poverty level. Thus, economic growth is necessary for sustained economic development (Akanbi & Du Toit, 2011; World Bank, 2006). This paper investigates the contribution of agriculture to aggregate economic growth in Nigeria. The fact that economic growth is necessary for sustained development, coupled with data limitation, informs our focus on investigating the contributions of agriculture to economic growth, as measured by Gross Domestic Product (GDP), in Nigeria.

The literature has established a relationship between agriculture sector and economic growth (Gallup et al., 1997; Thirtle, Lin & Piesse, 2003; Awokuse, 2008; Irz et al., 2001). We contribute to this literature using Solow's growth accounting framework and estimate our model with time series data on the Nigerian economy from 1960 to 2011. Similar to Collins & Bosworth (1996) and Iyoha & Oriakhi (2002), we consider the contributions of agriculture sector as a source of growth in the economy. In our model, aggregate output growth is conceptualized as the sum of growth contributions from each sector of the economy. We further modify the model to provide evidence on the importance of the agriculture subsectors in the growth of the sector. In this

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[2] MDG goal 1 is to eradicate poverty and extreme hunger. This is directly linked to agriculture through availability and access to food. Increased food production can only be achieved through agricultural growth.
[3] See correlation results in appendix.

second model, growth in the agriculture sector is taken to be the weighted sum of the growth in the sub-sectors of the agriculture sector – namely, crop production, livestock production, fisheries and forestry. We also expect that disaggregating the agriculture sector will provide clearer evidence on how agriculture contributes to economic growth by highlighting the sources of growth in the agriculture sector. Furthermore, we conduct Granger causality test to investigate a bidirectional causality relationship between GDP growth and agricultural growth. This will give additional evidence on the contribution of agriculture to economic growth on Nigeria.

The importance of this study stems from the role of agriculture in Nigerian economy based on its size, potential and prospects. In Nigeria, because 70% of the population is employed in the agriculture sector, economic growth will be almost impossible to achieve without developing the sector. Furthermore, the importance of agriculture to the Nigerian economy is evident in the nation's natural endowments in production factors – extensive arable land, water, human resources, and capital. Exploring the nation's productive advantage in this sector is the fastest way to stimulate growth in the economy. Research on this issue is therefore important to help inform policy decisions regarding resource allocation in agricultural growth and development to achieve rapid economic growth.

The literature is replete with studies that analyze the agriculture sector of the Nigerian economy. It gives evidence of a positive relationship between agriculture sector investment and GDP growth. Iganiga and Unemhilin (2011) and Oji-Okoro (2011) found that agricultural output is significantly influenced by government capital expenditure. Iyoha and Oriakhi, (2002) identified the sources of economic growth in Nigeria using the growth accounting model and found that agriculture contributes more than expected to GDP growth. According to the paper, this indicates a lag in the nation's industrialization process. They also find that the share of labour involved in agriculture is too high and suggest that labour be reallocated to other sectors to accelerate economic growth. Recently, Olajide et al. (2012) used Ordinary Least Squares (OLS) regression method to analyse the relationship between agricultural resource and economic growth in Nigeria between 1970 and 2010. They found a positive causal relationship between GDP and agricultural output in Nigeria, however their study was limited to showing only that agriculture and GDP growth rate are related.

Our study makes some contributions to this growing literature. First, we provide a basis for comparison between the agriculture sector's contribution to growth and those of other sectors in Nigeria by including other secors namely – industy, wholesale and retail trade, building and contruction and services – as other sources of economic growth in our model. Second, we do not merely consider the share of agriculture in GDP but the weighted growth rate (growth rate weighted by size of sector) of the agriculture sector on economic growth. Finally, we give evidence of the impact of growth in each subsector of the agriculture sector will have on growth in the sector as further evidence on the source of economic growth.

The rest of the paper is organized as follows. Section 2 reviews the literature on the economy of Nigeria, the agriculture sector, its potentials, importance and role in economic growth and development. The estimation model, data and estimation methodology are discussed in section 3. The result, interpretations and implications of the empirical analysis are discussed in section 4 while section 5 concludes the paper.

2. Literature review

2.1 Nigeria's agriculture sector

Originally an agriculture dependent country, Nigeria shifted focus to oil exports in the 1970s and decades of slow economic growth later; there is a need to refocus on agriculture. With the pressure to attain the MGDs, it is important to investigate the contribution of the sector to Nigeria's economic growth. Agriculture contributes 40% of the Gross Domestic Product (GDP) and employs about 70% of the working population in Nigeria (CIA, 2012). Agriculture is also the largest economic activity in the rural area where almost 50% of the population lives.

Nigeria suffers from the resource curse[4] (Aluko, 2004; Otaha, 2012). Given the enormous resource endowment both in human capital and natural resources, the performance of the economy has been far below expectation. The most populous nation in Africa, with a population of over 150million and a labour force of 53.83million (2012 estimates; CIA, 2012), Nigeria is blessed with ample source of labour to fuel economic growth. Besides being Africa's largest producer of oil, Nigeria's gas reserves ranks 6th globally and it has the 8th largest crude oil reserve in the world (Sanusi, 2010). About 31 million hectares of the land area is under

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[4] Coexistence of vast wealth in natural resources and extreme personal poverty

cultivation and the diverse climate makes production of a variety of products, from tropical and semitropical areas of the world possible (Chauvin, Mulangu and Porto, 2012). Despite these endowments, the nation ranks among the world's poorest economies.

The agriculture sector has been the mainstay of the economy since independence and despite several bottlenecks; it remains a resilient sustainer of the populace. In the 1960s, Nigeria was the world's largest exporter of groundnut, the second largest exporter of cocoa and palm produce and an important exporter of rubber, cotton (Sekunmade, 2009). More recently, agriculture employs about two-thirds of Nigeria's labour force, contributes significantly to the GDP and provides a large proportion of non-oil earnings (CIA, 2013, Sekunmade, 2009).

The sector has several untapped potential for growth and development in the availability of land, water, labour and its large internal markets. It is estimated that about 84 million hectares of Nigeria's total land area has potential for agriculture; however, only about 40% of this is under cultivation (FMARD, 2012). Productivity in the cultivated lands is also low due to small farm holdings and primitive farming methods. Nigeria has therefore become heavily dependent on food imports. In addition to diverse and rich vegetation that can support heavy livestock population, it also has potential for irrigation with a surface and underground water of about 267.7 billion cubic meters and 57.9 billion cubic meters respectively (Chauvin, Mulangu and Porto, 2012; Lipton 2012). Nigeria's large and growing population provides a potential for a vibrant internal market for increased agricultural productivity.

In spite of these opportunities, the state of agriculture in Nigeria remains poor and largely underdeveloped. The sector continues to rely on primitive methods to sustain a growing population without efforts to add value. This has reflected negatively on the productivity of the sector, its contributions to economic growth as well as its ability to perform its traditional role of food production among others. This state of the sector has been blamed on oil glut and its consequences on several occasions (Falola & Haton, 2008). In 1960, petroleum contributed 0.6% to GDP while agriculture's contribution stood at 67%. However by 1974, shares of petroleum had increased to 45.5% almost doubling that of agriculture which had decreased to 23.4% (Yakub, 2008). It should be clarified that this pattern was not an outcome of increased productivity in the non-agricultural sectors as expected of the industrialization process

(Christaensen & Demery, 2007); rather it was the result of low productivity due to negligence of the agriculture sector.

Furthermore, the nation was self-sufficient in food production and exports of major crops accounted for over 70% of total exports in 1960. However, due to fall in local production among other things, importation of food began to increase and food items like bread made from imported wheat flour began to replace cheap staple foods. In 2012 alone, importation of wheat was valued at $1billion (Nzeka, 2013). Largely due to significant fall in the output of export products like cocoa, palm oil rubber and groundnuts, the share of agricultural products in total exports decreased to less than 2% in the 1990s (Olajide, Akinlabi & Tijani, 2012).

The subsectors of the agriculture sector in Nigeria have potentials that give the sector opportunity for growth. According to CBN (2012), between 1960 and 2011, an average of 83.5% of agriculture GDP was contributed by the crops production subsector making it the key source of agriculture sector growth. The food production role of the agriculture sector depends largely on this subsector as all the staples consumed in the nation comes from crop production, 90% of which is accounted for by small-scale, subsistent farmers. The major crops cultivated include yam, cassava, sorghum, millet, rice, maize, beans, dried cowpea, groundnut, cocoyam and sweet potato. The second largest is the livestock subsector contributing an average of 9.2% between 1960 and 2011. This sector is the largest source of animal protein including dairy and poultry products. The economic importance of the subsector is therefore evident through food supply, job and income creation as well as provision of hide as raw material. Despite this, the sub-sector has been declining in its contribution to economic growth, according to Ojiako and Olayode (2008). Between 1983 and 1984, the share of livestock in agricultural GDP was about 19% but this dropped as low as 6% between 2004 and 2005. In the fishery subsector, local production is inadequate for domestic demand and consumption. Nigeria imports 700,000MT of fish annually which is 60,000 MT more than total domestic production (Ibru, 2005 in Essien & Effiong, 2010). However, the subsector has recorded the highest average growth rate of 10.3% (1961-2011) compared to the 6% recorded in crop production in the same period (CBN, 2012). With an average contribution of 4.3% to total agriculture GDP between 1960 and 2011 and provision of at least 50% animal protein, fisheries contributes to economic growth by enhancing food security and improving livelihood of fish farmers and their households (Gabriel et al., 2007; Essien & Effiong, 2010). Forestry is the smallest sub-sector in Nigerian agriculture

7

contributing only 3.0% (between 1960 & 2011); however, the subsector plays a major role in providing industrial raw materials (timber), providing incomes as well as preserving biodiversity.

In these subsectors, productivity is low and contributions to the economy are below expectation. Among other constraints, low productivity has been identified as a major contribution to the declining growth rate in Nigerian agriculture sector. Iyoha and Oriakhi (2002) find that slow growth in capital per worker and not slow Total Factor Productivity (TFP) is responsible for slow growth in the agriculture sector. This was further explained to be due to inadequate capital investment and rapid growth of the population and labour force. Also, Muhammad-Lawal and Atte (2006) recommends increase in per-capita productivity through the introduction of improved technology in agricultural production. They also indicated a positive and consistent relationship between GDP growth rate, population growth rate, and the Consumer Price Index as factors affecting domestic agricultural production in Nigeria. However, it is estimated based on the prospects of the sector that by 2015, it is possible to provide 3.5 million jobs within the agriculture value chain, increase farmers' incomes by $2 billion and also reduce food insecurity by 20 million metric tons (MT) increase in food supply (FMARD, 2012). This can only be achieved by intensified efforts in increasing productivity and developing the agriculture value chain.

2.2 Agriculture Sector and Economic Growth

Several studies have focused on understanding the association between agriculture and economic growth, yet there is some disagreement. While some researchers have argued that agriculture should be the foundation of economic growth (Gollin, Parente & Rogerson, 2002; Thirtle, Lin & Piesse, 2003), others claim that the linkages agriculture has with other sectors are too weak and its innovative structures inadequate for promoting economic growth (Ranis and Fei, 1961; Jorgenson, 1961).

However, the relationship between the agriculture sector and other sectors should not be a competition but rather be viewed as interdependent where supply and demand in sectors can be accommodated through strengthened linkages (Adelman, 1984; Sabry, 2009). For instance, industry is an important sector and every economy that strives for development should work

toward strengthening its industries (Lewis, 1954). Nonetheless, the position of agriculture in the strive for industrialization should not be ignored as the case has been in Nigeria. As argued by advocates of agriculture-led growth (ALG), development of the agriculture sector is a prerequisite for industrialization through increase in rural incomes and provision of industrial raw materials, provision of a domestic market for industry and above all the release of resources to support the industry (Schultz, 1964; Timmer, 2004). Neglect of the agriculture sector in favour of the industrial sector will only lead to slow economic growth and inequality in income distribution. Therefore, despite the fact that agriculture may be unable to single-handedly transform an economy, it is a necessary and sufficient condition in kick-starting industrialization in the early stages of development (Byerlee, Diao, & Jackson, 2005).

The contributions of agriculture to economic growth can be examined through the roles of the sector in the economy. Johnston and Mellor (1961) summarized these roles in five inter-sectoral linkages; food, labour, market, domestic savings and foreign exchange. The most basic of these roles is, perhaps the supply of food for both domestic consumption and export. Direct contributions of food production can be through income generated from sales of farm produce and returns from economic activities related to production; or indirectly from increased capacity to partake in any form of economic activity through improved diet. Anyawu, Ibekwe and Adesope (2010) using correlation matrix find that production of major staples in Nigeria contributed significantly to GDP growth (except wheat) between 1990 and 2001. Also, as observed by Timmer (1995), the agriculture sector contributes to economic growth through provision of better caloric intake and food availability. The attainment of global food security and reduction of hunger hinges largely on this singular role. According to FAO (2005), agriculture can facilitate the attainment of all 8 MDGs through the direct or indirect linkages to food availability and poverty reduction. In 2008, UNDP reported that the 12.6% reduction recorded in the proportion of underweight children between 1990 and 2008 can be attributed largely to growth in the agriculture sector in Nigeria (UNDP, 2008). Furthermore, as population increases, failure to increase food supply in proportion to increased demand has negative effects on industrial profits, investment and economic growth (Johnston & Mellor, 1961).

Hazell and Roell (1983) assert that in the early stages of development, rising incomes of rural/farming households is essential to providing market for domestically produced goods and services via strengthened purchasing power. The most direct contribution of agriculture to

economic growth, according to Irz et al. (2001), is increase in incomes of farmers and therefore their purchasing power. Results of several studies, including Gallup et al. (1997), Irz et al. (2001) and Thirtle et al. (2001), show that an increase in agriculture growth results in an increase in the income level of the poorest of the population. Also results from cross-country regressions among developing countries show that $1 increase in GDP results in significantly more poverty reduction when the growth is in agriculture rather than other sectors (Lipton, 2012). This sectoral growth increases the incomes and therefore purchasing power of farmers resulting in a vibrant domestic market for other sectors, hence growth in the economy.

An offshoot of income growth is increased domestic savings, both at micro and macro levels as observed in developed economies like Japan, Taiwan, South Korea, Hong Kong and recently, China (Harbaugh, 2004). Agriculture therefore contributes to economic growth by increasing the incomes of majority of the population thereby strengthening their saving capacity. Results from an IFPRI publication on Ethiopia's growth and transformation plan shows that increased domestic savings is imperative to the achievement of higher Total Productivity (GTP) (Engida et al., 2011). Using Tobit regression model on multi-stage data from Kwara state, Nigeria, Obayelu (2012) finds that domestic saving is low among rural dwellers/farmers in Nigeria. He highlights the effect of high expenditure on food, which is a consequence of low income due to low productivity, on saving capacities of the farming households in the study. This implies that domestic savings largely influences the growth path of the economy.

The sector is also in a position of making surplus labour available to industries. As productivity in the agriculture sector increases, surplus labour and capital is created and diverted to investment in industrial sector resulting in economic growth (Ike, 1982). This facilitates the industrialization process and eventually the transformation of the economy as postulated by the structural development advocates (Awokuse, 2008).

Having argued that economic growth in Nigeria depends to a large extent on growth in the agriculture sector, empirically investigating the sector's contributions to growth is important both to assess past efforts and justify future investment. Our empirical analysis in the next sections will be aimed at providing evidence on the sources of growth in the Nigerian economy. To further do justice to this, we will evaluate the agriculture sector by investigating the sources

of its growth and the subsectors that require further attention based on already highlighted potentials relative to their past contributions.

3. Methodology

In this section, we briefly describe the study area - Nigeria, and discuss the model, data and estimation method.

Study Area: Nigeria

The Federal Republic of Nigeria is located in West Africa between latitude 4^0-14^0N and longitude 3^0-15^0E. It is bordered by the Gulf of Guinea to the south, Benin to the West, Niger to the North and Cameroon and Chad to the East. Nigeria comprises of 36 states and its Federal Capital Territory, Abuja. There are over 250 ethnic groups in Nigeria; the major ones being Hausa/Fulani, Igbo, and Yoruba who predominantly live in the northern, eastern and western parts of the country, respectively. These regions were amalgamated as the Colony and Protectorate of Nigeria in 1914. In 1960, Nigeria got its independence from Britain.

Nigeria has a total land area of 923,768sqkm including 13,000sqkm of water, a border length of 4,047km and a coastline of 853km. The highest point in Nigeria is Chappal Waddi at 2,419m (7,936ft) and the lowest is the Atlantic Ocean (0m). The main rivers in Nigeria, River Niger and River Benue, converge in Lokoja (Kogi State) and empty into the Niger Delta, the location of a large area of Central African Mangroves. The climate and vegetation of Nigeria is equatorial in the south, tropical in the center, and arid in the north. There are two distinct seasons in the country: the rainy season and the dry season.

Nigeria is the most populous country in Africa and the second largest economy in the continent. Lagos and Kano are its largest cities. Nigeria has huge reserves of natural gas and crude oil and is the eight largest exporter of the resource in the world. Oil export accounts for about 95 percent of foreign exchange earnings and 80 percent of budgetary revenues in the country. However, recent growth in the domestic economy was driven by the agricultural sector which contributed 41 percent of Nigeria's GDP in 2011; employs over 60 percent of the workforce and is a major means of livelihood for most of the rural dwellers (50 percent of the population). Other indicators of the state of the Nigerian economy are provided in table 1.

Table 1: Nigeria's Economic Indicators

Indicator	Statistic	World Rank
Population	174,507,539 (July 2013 est.)	7
Population growth rate	2.55%	28
GDP (official exchange rate)	$272.6 billion (2012 est.)	
GDP - real growth rate	7.1% (2012 est.)	27
GDP - per capita (PPP)	$2,700 (2012 est.)	180
Labor force	53.83 million (2012 est.)	11
Unemployment rate	23.9% (2011 est.)	171
Population below poverty	70% (2010 est.)	
Budget - Revenues	$23.48 billion	
Budget - Expenditure	$31.61 billion (2012 est.)	
Taxes and other revenues	8.6% of GDP (2012 est.)	212
Public debt	18.8% of GDP (2012 est.)	128
Ination rate (consumer prices)	12.1% (2012 est.)	205
Exports	$97.46 billion (2012 est.)	41
Imports	$70.58 billion (2012 est.)	43
Reserves of foreign exchange and gold	$42.8 billion (2012 est.)	44
Debt - external	$10.1 billion (2012 est.)	92

Source: CIA Factbook, 2013

Growth Accounting Framework

In the previous sections, we discussed how agriculture contributes to economic growth and development. We highlighted the following contributions of agriculture: provision of food for household consumption, export of agricultural produce and products and consequent earnings of foreign exchange, employment opportunities, provision of market for industrial products and the flow of money into capital formation. To fully understand how these contributions impact on the economy, we employ the growth accounting framework.

Growth accounting is used to determine the sources of economic growth. In neo-classical growth theory, it measures aggregate output (Y_t) in period t as a function of capital (K_t), labor (L_t) and total factor productivity (A_t) assuming that $0 < \alpha < 1$ and $\mu > 0$: $Y_t = Y_t = A_t^{\mu} f(K_t^{\alpha}, L_t^{1-\alpha})$.

However, because of our interest in the value added by agriculture to the economy and the value added by agriculture sub-sectors to agriculture, we conceptualize aggregate output (Y_t) as the sum of the contributions of each sector of the economy. Aggregate output of the economy (Y_t) embodies sectoral outputs, and each sectoral output is assumed to be the sum of outputs of its sub-sectors.

Formally, we specify the aggregate output and the sectoral output as:

$$Y_t = \sum_t^T Y_{it} \qquad (1.1)$$

$$Y_{it} = \sum_t^T Y_{ijt} \qquad (1.2)$$

where (Y_t) is the aggregate output of an economy in period t, Y_{it} is the output of sector in period t, and Y_{ijt} is the output of sub-sector j in period t. We assume that all the outputs of the sectors and the sub-sectors make a positive contribution to aggregate output. It is possible that growth in each sector of an economy impacts growth in aggregate output. Likewise, growth in a sub-sector can be the source of growth in a sector. Hence we specify the growth in aggregate output and growth in sectoral output as the first derivative of equations (1.1) and (1.2) as follows:

$$\frac{\partial Y_t}{Y_t} = \sum_t^T \frac{\partial Y_{it}}{Y_{it}} \qquad (1.3)$$

$$\frac{\partial Y_{it}}{Y_{it}} = \sum_t^T \frac{\partial Y_{ijt}}{Y_{ijt}} \qquad (1.4)$$

Where $\frac{\partial Y_t}{Y_t}$ is the growth in aggregate output economy in period t, $\frac{\partial Y_{it}}{Y_{it}}$ is the growth in the output of sector in period t, and $\frac{\partial Y_{ijt}}{Y_{ijt}}$ is the output of sub-sector j in period t. We expect that the growth in all the sectors and sub-sectors make a positive contribution to growth in aggregate output. It is also possible that the share (weight) of a sector in the economy, and a sub-sector in a sector, is an important determinant of the contribution of a sector to aggregate growth or a sub-sector to sectoral growth. Thus we formally specify growth in aggregate and sectoral output as expressed below:

$$\frac{\partial Y_t}{Y_t} = \Sigma_t^T \frac{Y_{it}}{Y_t} . \frac{\partial Y_{it}}{Y_{it}} \tag{1.5}$$

$$\frac{\partial Y_{it}}{Y_{it}} = \Sigma_t^T \frac{Y_{ijt}}{Y_{it}} . \frac{\partial Y_{ijt}}{Y_{ijt}} \tag{1.6}$$

where $\frac{Y_{it}}{Y_t}$ is the share of the output of sector in aggregate output in period t, $\frac{Y_{ijt}}{Y_{it}}$ is the share of the output of sub-sector j in the sectoral output in period t, and the other variables are as previously defined. The weighted growths of the sectors and sub-sectors are expected to contribute positively to growth in the aggregate output.

To estimate equations (1.5) and (1.6), we first specify the variables. The sectors of the Nigerian economy as defined by the Central Bank of Nigeria and the National Bureau of Statistics are agriculture, industry, wholesale and retail trade, building and construction, and services. The sub-sectors of the agriculture sector are categorized into crop production, livestock production, fisheries and forestry. We include the value added by these sectors and sub-sectors and estimate them as:

gdpgrow = wagrgrow + windgrow + wtragrow + wbcgrow + wsergrow + e$_i$ (1.7)

agrgrow = wcrpgrow + wlivgrow + wfisgrow + wforgrow + e$_i$ (1.8)

where *gdpgrow* is the growth in real GDP in period t, *wagrgrow* is the weighted growth rate of agriculture in period t, *windgrow* is the weighted growth rate of industry in period t, *wtragrow* is the weighted growth rate of building and construction to in period t, *wbsgrow* is the wighted growth rate of wholesale and retail trade in period t, and *wsergrow* is the weighted growth rate of services in period t; *wcrgrow* is the weighted growth rate of crop production in period t, *wlivgrow* is the weighted growth in livestock production in period t, *wfisgrow* is the weighted growth rate of fisheries in period t and *wforgrow* is the weighted growth rate of forestry in period t. We expect all the sectors and sub-sectors of the Nigerian economy to make a positive contribution to real GDP growth in period t.

Granger Causality test

We are also interested in the significance of agriculture as a cause of economic growth in Nigeria; we therefore perform a Granger causality test, following Granger (1969) to examine this causal relationship. This approach can be used to determine whether or not one economic

variable can help determine another. In time series data, variable *X* is said to Granger-cause variable *Y*, if the current value of *Y* (*yt*) is conditional on the past values of *X* (*x*t-1, *x t*-2, ... , *x*0) and thus the history of *X* is likely to help predict *Y* (Konya, 2004).

Focusing on agriculture as an engine of economic growth, we are interested in the bidirectional causal relationship to provide evidence on if growth in the agriculture sector has caused economic growth and also if economic growth has caused agriculture sector growth between 1961 and 2011. We therefore consider two hypotheses:

    i.   Agriculture growth, *wagrgrow* does not Granger-cause GDP growth, *gdpgrow*

    ii.   GDP growth, *gdpgrow* does not Granger-cause agriculture growth, *wagrgrow*

The VAR equations are hence specified as follows:

$$(wagrgrow)_t = \propto \; + \sum_{i=1}^{m} \beta_\gamma \, (wagrgrow)_{t-i} + \sum_{j=1}^{n} \gamma_j (gdpgrow)_{t-j} + \mu_t \qquad (1.9)$$

$$(gdpgrow)_t = \theta \; + \sum_{i=1}^{\rho} \beta_\gamma \, (wagrgrow)_{t-i} + \sum_{j=1}^{\sigma} \gamma_j (gdpgrow)_{t-j} + \omega_t \qquad (2.0)$$

μ_t and ω_t are the error terms of equations 1.9 and 2.0 respectively.

Data

In the previous section, we developed frameworks for analyzing economic and sectoral growth which recognizes that economic growth is dependent on growth in the sectors of an economy and that sectoral growth is dependent on growth in the sub-sectors of the sector. We explain the variables included in the frameworks and the data source in this sub-section.

First, for the equation (1.7), the dependent variable is the real GDP growth rate *(gdpgrow),* which we measure as a proxy for economic growth. The independent variables include weighted agriculture growth rate *(wagrgrow)*, weighted industry growth rate *(windgrow)*, weighted wholesale and retail trade growth rate *(wtragrow),* weighted building and construction *(wbcgrow)* and weighted growth rate of services *(wsergrow)*.

Dependent variable for the second equation (1.8) is agriculture growth rate (*agrgrow*). Other independent variables include weighted growth rate of crop production *(wcrpgrow),* weighted growth rate of livestock production *(wlivgrow),* weighted growth rate of fisheries *(wfisgrow)* and

weighted growth rate of forestry (*wforgrow*). Definitions and summary statistics of these variables are provided in table 2.

Data for this study were obtained from the 2011 Central Bank of Nigeria (CBN) statistical bulletin, which comes from the National Bureau of Statistics. The data set is available at *http://www.cenbank.org/documents/Statbulletin.asp* (as at 15th May 2013). The data are contained in section C (sheet C1.2) of the bulletin. The data are the real GDP of Nigeria from 1960 to 2011 and its components. The components include the value added by the five sectors of the Nigeria economy and their sub-sectors. The sum of the value added by each sub-sector yields the sectoral value added, that are in turn summed to obtain the aggregate GDP. The data are in segments: data from 1960 to 1973 were calculated using the 1962/63 constant basic prices; 1974 to 1980 using 1977/78 constant basic prices; and 1981 to 2011 using 1990 constant basic prices.

Table 2: Summary Statistics of Selected Variables, from 1960-2011.

Variable	Mean	Std. Dev.	Min	Max
gdp (billion naira)	264.84	203.88	45.14	834.16
gdpgrow (%)	6.48	12.56	-16.36	74.53
agr (billion naira)	100.36	85.24	24.11	335.39
agrgrow (%)	5.98	17.79	-14.15	108.82
wagrgrow (%)	47.18	98.52	-219.37	328.29
wcrpgrow (%)	94.79	23.65	-44.39	137.82
wlivgrow (%)	-2.70	19.51	-117.44	18.57
wforgrow (%)	4.70	24.97	-14.15	176.91
wfisgrow (%)	3.20	12.80	-16.99	84.93

N = 52 for the real values and N = 51 for growth rates.

4. Result and Discussion

In this section, we present and discuss our empirical findings and their implications. The results of the growth accounting exercise are discussed first and then the causality tests. Both give evidence on the contribution of agriculture to economic growth in Nigeria.

Sources of Economic Growth

The results from the growth accounting developed in equation (1.7) are presented in table 3 and 4. Table 3 presents the contributions of the sectors of the economy to GDP growth while table 4 presents the contributions of the agriculture subsectors to agriculture growth. The contributions are reported in periods, from 1961-65 to 2006-11.

While the contributions of agriculture sector to the economy is our focus in this paper, the other sectors of the economy and the part they play in economic growth warrant some discussion. This gives us a basis for comparison and helps inform our evaluation of the agriculture sector. Initial results from the data show that the pattern of growth of the Nigerian economy is unstable, consistent with that of a developing economy. The trend of GDP growth in Nigeria reflects the economic consequences of various events experienced both in the country and globally. Instances highlighted from our data include the post oil boom era, the 1976-1980 period, where economic growth fell from 23.68% in the previous period to 3.19%. Also the 1981-1985 period, characterized by economic recession in the nation recorded a growth rate of -0.33%. This implies that the Nigerian economy has little ability to absorb shocks from economic and political crisis which could be a result of low national savings, as suggested by Aportela (2008).

Consistent with the literature, we find that the agriculture sector and industry are the largest contributors to economic growth in Nigeria. Without considering the size of contribution per period, the results show that from 1961 to 2011, the agriculture sector contributed most consistently to economic growth relative to the other sectors of the economy. Also, we observe that the trend in the contribution of the building and construction, trade and service sector are more similar to that of the industry sector than the agricultural sector. This suggests that the industry may have stronger linkages to other sectors relative to agriculture and other sectors.

Table 3: Contributions of sectors to GDP growth, 1961 – 2011

Period	gdpgrow	(%) Contributions of:				
		wagrgrow	windgrow	wbcgrow	wtragrow	wsergrow
1961-65	4.84	1.09 (20.59)	1.98 (37.21)	0.41 (7.66)	0.83 (15.71)	1.00 (18.83)
1966-70	7.60	0.82 (8.90)	4.43 (48.00)	0.48 (5.19)	0.64 (6.96)	2.86 (30.95)
1971-75	23.68	7.36 (26.30)	10.83 (38.69)	1.77 (6.31)	4.69 (16.75)	3.35 (11.96)
1976-80	3.19	-0.62 (308.31)	-1.2 (640.07)	0.94(-469.38)	0.55 (-275.04)	0.21 (-103.95)
1981-85	-0.33	1.17 (742.79)	-0.14 (-91.21)	-0.51(-325.96)	-0.08 (-51.04)	-0.27(-174.58)
1986-90	5.99	1.80 (28.74)	2.81 (45.04)	0.10 (1.60)	0.76 (12.18)	0.78 (12.44)
1991-95	1.02	0.89 (81.86)	-0.52 (-47.27)	0.07 (6.06)	0.26 (24.23)	0.38 (35.11)
1996-00	3.20	1.47 (44.55)	0.99 (30.20)	0.08 (2.48)	0.25 (7.68)	0.50 (15.08)
2001-05	11.40	6.80 (52.30)	1.87 (14.40)	0.11 (0.85)	1.64 (12.62)	2.58 (19.83)
2006-11	6.81	2.65 (37.64)	0.00 (0.03)	0.23 (3.31)	2.26 (32.13)	1.89 (26.89)

*Point contributions, percentage contributions in parenthesis

In comparison with the industrial sector, we observe some characteristics of the agriculture sector that underscore its importance to economic growth in Nigeria. First, observation from the oil boom period (1971-1975), when attention shifted from the agriculture sector to industry; show that the contribution of agriculture sector in this period was impressive despite the shift. Comparing the oil boom period with the preceding period, the agriculture sector grew even more than the industrial sector at 6.54% and 6.4% respectively. Although the growth of the agriculture sector during the period can be attributed to an influx investment from the oil exports into agriculture, it highlights the responsive nature of agriculture to investment.

The nation experienced an economic collapse in the 1981-1985 period. During this period, economic growth rate fell from 3.19% in the previous period to -0.33%. All the sectors of the economy contributed negatively to growth except the agricultural sector, contributing 1.17% despite the general economic crisis. This observation emphasizes the buffer role of agriculture in the economy, implying the sector's ability to provide temporary source for cushion in a period of economic crisis (Shovan, 2004).

Finally, we observe the resilient nature of the agriculture sector in the economy, described as the ability of the sector to recover more quickly from shocks especially when compared with other sectors. This is highlighted in the 1976-1980 period when contributions to the economic growth fell across the sectors due to oil price crash. Comparing the industry and agriculture sector in the next period (1981-1985), agriculture increased from -0.62% in the previous period to 1.17% making a recovery of 1.79%, while contributions from the industrial sector recovered by 1.51%, still making a negative contribution in the 1981-1985 period.

Therefore, we infer from our discussion in this section that based on past performance of agriculture in Nigeria, the sector has the ability to contribute to economic growth by its observed tendency to respond positively to investment be it in the form of progressive policies or funds. Also, the sector is able to serve as a buffer in the event of economic crisis; the strength of the buffer however depends on how strong the sector is. Finally, we observe the resilient nature of agriculture which emphasizes sector's ability to recover more quickly from shock than other sectors.

Sources of Agriculture Growth

Similar to the section above, we accounted for the sources of growth of the agriculture sector by considering the four subsectors, namely; crop production, livestock, forestry and fisheries. Our findings, consistent with the literature, show that growth in the crop production sector has impacted the most on agriculture sector growth. The livestock production sector according to literature is the second largest subsector; however our results show that in terms of weighted growth rates, the fisheries sector contributes more than the livestock production sector.

Agriculture growth in Nigeria relies heavily on the crop production subsector suggesting that increased productivity in the other subsectors will lead to increase in the contributions of the agriculture sector to GDP growth.

Table 4: Contribution of agriculture subsector to agriculture sector growth, 1961-2011

Period	agrgrow	(%) Contributions of:			
		wcrpgrow	wlivgrow	wforgrow	wfisgrow
1961-65	1.79	1.10 (55.12)	0.23 (11.71)	0.17 (8.38)	0.49 (24.79)
1966-70	2.58	1.53 (42.81)	-0.18 (-5.01)	0.49 (13.75)	1.73 (48.45)
1971-75	26.23	15.40 (52.70)	1.86 (6.36)	1.00 (3.44)	10.96 (37.50)
1976-80	-2.78	-2.27 (154.01)	2.00 (-135.23)	-0.13 (9.02)	-1.07 (72.19)
1981-85	3.53	3.85 (92.75)	0.79 (19.00)	0.01 (0.13)	-0.49 (-11.88)
1986-90	5.23	4.46 (79.53)	0.19 (3.33)	0.02 (0.30)	0.94 (16.84)
1991-95	2.67	2.79 (100.72)	0.11 (3.82)	0.06 (2.22)	-0.19 (-6.75)
1996-00	4.16	3.38 (80.46)	0.26 (6.29)	0.02 (0.58)	0.53 (12.67)
2001-05	15.88	15.91 (96.17)	0.34 (2.06)	0.05 (0.28)	0.24 (1.48)
2006-11	6.38	5.68 (89.01)	0.42 (6.58)	0.08 (1.19)	0.21 (3.23)

*Point contributions, percentage contributions in parenthesis

Agriculture Growth and GDP Growth: Causal Relationship

Using augmented Dickey-fuller unit root test, we examined the data for univariate time series properties. ADF tested for the null hypothesis of non-stationarity among the variables and the results showed that at 1%, 5% and 10% critical values, the variables had unit roots. However, after the second differencing, non-stationarity was confirmed across the data. The results for unit root test are presented in table 5. We confirm that the variables are not co-integrated then conducted Granger causality test as specified in equations (1.8) and (1.9) to examine the variables for bidirectional causality tests. Using lag length 4 we tested two hypotheses: (a) Agriculture growth does not Granger-cause GDP growth and (b) GDP growth does not Ganger-cause Agricultural sector growth. It is important to explore this two way relationship because, according to literature, agriculture growth may lead to GDP growth through its roles in the economy and GDP growth, through the influx of investment into agriculture may cause growth in the sector.

Summarized results for the tests showing the F-statistics and corresponding probability values are presented in table 6.

Table 5: Augmented Dickey-Fuller test for Unit root

Variables	t-statistics		Critical values (1%)		probability	
	t (D0)	t (D1)	D0	D1	D0	D1
gdpgrow	-1.980*	-3.968	-3.614	-3.621	0.2953	0.0016
wagrgrow	-2.634*	-4.633	-3.614	-3.621	0.0862	0.0001

The symbol * indicate the rejection of null hypothesis of unit root at 1% level of significance. Lag length is 5 for all the variables. D0 = no differencing, D1 = first differencing.

We find that agriculture growth Granger-causes GDP growth but GDP growth does not Granger-cause agriculture growth. This empirical evidence suggests that in Nigeria, the agriculture sector contributes significantly to economic growth. This is consistent with the results summarized previously; growth in agriculture has resulted in economic growth. However, there is no evidence for reverse causal flow from GDP growth to agriculture suggesting that even though resources from the agriculture are utilized for economic growth there is little or no effort to add value to the sector from the returns of economic growth. This is consistent with literature that highlights the lack of attention and investment in the agriculture sector in spite of its proven potentials. Awokuse (2008) made similar observations in three oil producing countries including Nigeria and concluded that this trend might be a reflection of the 'Dutch disease' which is characterized by the draining of resources from the agriculture sector into the industrial sector.

Table 6: Granger causality test between Economic growth and Agricultural growth

Hypothesis	F Value		Decision
	F stat.	F critical	
wagrgrow does not Granger cause gdpgrow	0.9612	0.15 (4, 37)	Reject the null hypothesis
gdpgrow does not Granger-cause wagrgrow	0.2842	1.3 (4, 37)	Do not reject null hypothesis

Values in brackets are lower and upper degrees of freedom (df) respectively.

These findings give strong evidence that support the need for increased investment in the agriculture sector. Nigerian agriculture has been typified as primitive and undeveloped, yet growth in the sector has been identified as an engine of economic growth. This implies that developing the sector will result in more profound contributions to the nation's economic growth. Development of the agriculture sector invariably will require more investment as we have repeatedly mentioned in this study. However, the aim of these investments should be clear and disbursement strategic. From the literature, we established five inter-sectoral linkages through which agriculture contributes to economic growth: provision of food, labour, market, domestic saving and foreign exchange. These linkages can serve as reference points through which the government can target development policies and disburse investment funds, tactically ensuring agriculture development. Focusing on crop production alone may result in lopsided contributions, neglecting the potentials of other subsectors of agriculture as we have seen in our study. Thus, the emphasis should be on developing all the subsectors- including livestock production, fishery and forestry; and strengthening their linkages to other sectors of the economy through value-chain development. This will create more employment opportunities and generate additional income, enhancing the industrialization process.

Furthermore, the lack of reverse causal flow from economic growth to agriculture strengthens the claim that agriculture sector has been neglected in Nigeria. Nigeria cannot achieve either economic growth or development without a developed agriculture sector. Our point of view on this subject is strengthened by our brief examination of the relationship between agriculture and development which emphasizes the linear relationship (see appendix). With evidence that agriculture has the potential to cause economic growth, spur industrialization as well as to enhance the living condition of the nation's majority, increased investment in the development of the sector is justified.

5. Conclusion

In recent times, there has been increasing pressure to increase investment in agriculture due to the need to attain the MGDs among other things. The importance of agriculture development in ensuring poverty reduction and the economic growth hinges on the fact that 70% of the population is employed in the agriculture sector. The sector's role of food production, provision

of resources for other sectors, creation of viable market and domestic savings gives credence to its importance in economic growth. Also, Nigeria's natural endowments in agricultural production factors – extensive arable land, water, human resources, and capital highlight the potential of agriculture in economic transformation.

In view of the existing controversy among development economists on the role of agriculture as a precondition for industrialization and economic growth, we explored the contributions of agriculture to economic growth. This study provides evidence that agriculture contributes significantly to GDP growth in Nigeria. The trend of contributions observed also highlights the responsive nature, the buffer role and the resilient nature of agriculture; we consider these as nature of agriculture that could be leveraged upon. Finally we find that economic growth does not impact on agriculture growth. This supports the notion that lack of investment in the sector may be responsible for the slow growth experienced in Nigerian agriculture.

We therefore reaffirm that agriculture is an engine of economic growth in Nigeria and efforts should be made to add value to the sector through increased investment. Based on the evidence from this study, we also recommend that the linkages between agriculture and other sectors be strengthened to increase the effect of agriculture growth on growth across the sectors. This can be achieved through increased productivity and the development of agriculture value chain.

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Appendix

Agriculture and economic development – Correlation

	gdpgrwrat	foodprod	pryedu	mortrate	gendeqlt
gdpgrwrat	1.0000				
foodprod	0.0089 (0.974)	1.0000			
pryedu	-0.3617 (0.169)	0.8733(0.0000)*	1.0000		
mortrate	0.2741 (0.3043)	-0.8983(0.000)*	-0.9693(0.0000)*	1.0000	
gendeqlt	-0.5427 (0.298)	0.7157(0.0018)*	0.9392(0.0000)*	-0.8968(0.000)*	1.0000

p in parenthesis, * correlation is significant at .05 level. N= 16

Data: World Bank's World Development Indicators (WDI), available at *http://data.worldbank.org/country/nigeria*. Reference years are; 1970-1973, 1980-1983, 1990-1993 and 2004-2007.

Variables: GDP Growth rate (***gdpgrwrat***), food production index (*foodprod*), primary education (*pryedu*), infant mortality rate (*mortrate*) and ratio of female to male primary school enrollment (*gendeqlt*).