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An Empirical Analysis of Agricultural Production: The Sway of Economic Growth in Nigeria

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I. Introduction

a) Background to the Study

The agricultural sector is considered as one of the most important sectors of an economy, and this sector is particularly important in terms of its employment generation, contribution to the gross domestic product (GDP) and export revenue earnings as well as sustenance of live and machinery. How important is this sector in Nigeria which is generally agreed to be the giant and largest country in Africa, with a total land area of 923,768 square kilometres and has an estimated population of about 126 million in 2006 (2006 census). This nation lies wholly within the tropics along the Gulf of Guinea on the western coast of Africa. Nigeria is a nation with highly diversified agro ecological vegetation, which makes possible the production of a wide range of agricultural products throughout the year for food and lubrication.

Despite Nigeria's rich agricultural resource endowments, the agricultural sector is seen to be growing at a very low pace; and less than 50% of the country's cultivable agricultural land is under-cultivated (CBN 2008). The country is found to be bedevilled will small-scale peasants and traditional farmers who use rudimentary production techniques and tools, with resultant low yields. The small- scale farmers are constantly constrained by many problems including those of poor access to modern inputs of farm implements, poor access to credit facilities, poor infrastructure, inadequate access to markets, land and environmental degradation, and inadequate research and extension services.

Moreover, with the collapse of the oil boom of the 1970s (CBN 2000), there has been a dramatic increase in the incidence and severity of poverty in Nigeria, arising in part from the dwindling performance of the agricultural sector where a greater majority of the poor are employed. Furthermore, poverty in Nigeria has been assuming wider dimensions including household income poverty, food poverty, poor access to public services and infrastructure, unsanitary environment, illiteracy and ignorance, insecurity of life and property, and poor governance.

In response to the dwindling performance of agriculture sector in the country, various governments have, over the decades, initiated copious policies and programs aimed at restoring the agricultural sector to its place of pride in the economy of our nation have not yielded much fruit; no significant success has been achieved due to the several persistent constraints inhibiting the performance of the sector. From all indications irrespective of the sustainable agricultural growth and development plans put in place in Nigeria, yet, the most fundamental constraint found is the peasant nature of the production system, with its low productivity, poor response to technological adoption strategies, and poor returns on investment. However, it is recognized that agricultural commercialization and

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investment are the key strategies for promoting accelerated modernization, sustainable growth and development and, hence, poverty reduction in the sector. Real investment in agriculture is vital so that those constraints inhibiting the performance of the sector are identified with a view to unleashing them and creating a good and conducive atmosphere for investment in the sector.

One of the important objectives of macroeconomic policy has been the rapid economic growth of an economy. Economic growth being considered as the process whereby the real per capita income of a country over a long period of time is achieved; and is measured by the increase in the number of goods and services produced in a country. A growing economy produces more goods and services in each successive period of time. Therefore, growth occurs when an economy's productive capacity increases which in turn is used to produce more goods and services. In its wider spectrum, economic growth implies raising the standard of living of the people and reducing Inequalities of the income distribution. Economic growth is a desirable goal for a country; but, there is no agreement over the annual growth rate which an economy should attain (Jhingan, 2005).

Economists generally believed in the possibility of continual growth. This belief is based on the presumption that innovations tend to increase productive technologies of both capital and labour over time, and there is every possibility that an economy may not grow despite technological innovations. Production might not increase further due to lack of demand which may retard the growth of the productive capacity of the economy. The economy may not also grow further than it is if there is no improvement in the quality of labour in keeping with the new technologies.

Economic growth is, as a matter of fact, usually measured in terms of an increase in real gross national product (GNP) or gross domestic product (GDP) over time or by an increase in income per head over time. GDP measures increase in total output to a change in population. Thus, if total output rises higher as compared to population, then there's an improvement in the average living standards. Growth is desirable because it enables the community to consume more private goods and services and the provision of a greater quantity of social goods and services such as health, education, etc. thereby improving living standards. The government can also stimulate economic growth by increasing its current spending, and through tax cuts (fiscal policy), and by increasing the money supply and reducing interest rates (monetary policy). Principally, there are three main determinants of economic growth, which are; the growth of its labour force, the growth of its capital stock, and technical progress.

Nigeria used to be heavily dependent on the agricultural sector prior to the oil boom. In the early 1950's up to the early 1970's before the discovery of crude oil, agriculture was the mainstay of the economy, employing about 70 percent of the total population (CBN, 2000). Although subsistence farming was predominant, it was a major revenue earner for the country. In the early 1980's, it became more apparent that the agricultural sector could no longer perform its traditional role of meeting domestic food supply, providing raw materials for industries and major foreign exchange earner through exports for obvious reasons.

Nigeria's soil and climate allow cultivation of a wide variety of food crops, including cassava (of which Nigeria is the largest world producer), millet, sorghum, and maize. Agriculture is Nigeria's biggest employer of labour, accounting for about 60 percent of the workforce, working mainly in small- holdings using basic tools. Together with livestock rising, it provides a third of gross domestic product.

Growth in agricultural output is higher than the population growth rate, as it averaged 3.5 percent over the 1993-1997 period, and 4.0 percent, 5.2 percent, 5.1 percent from 1998-2000 respectively (CBN, 2000). This compares with a period of stagnation in the first half of the 1980's when growth averaged just 0.5 percent, due to low producer prices, marketing restrictions and a drought (CBN, 2007). Agriculture picked up after the economic reforms introduced in 1986, which included trade liberalization, dissolution of price-fixing marketing boards and improved producer prices facilitated by the devaluation of the naira. Growth in the sector averaged 3.8 percent in 1986-92, and there was a boost of activity in the cash crop sector, with many farmers returning to previously abandoned fields. However, the renewed interest was not sustained, nor did it result in increased investment in cash crop production, mostly carried out by smallholders. Improved food crop production contributed to a sharp fall in food imports, from 19.3 percent of total imports in 1983 to 7.1 percent in 1991, although this crept back up to 13.1 percent in 1996 (CBN, 2000). Much of the increase in agricultural output in recent years has resulted from the expansion of the area under cultivation, rather from increased productivity. The sector has been hampered by lack of investment in improved farming techniques. There has also been the case of over-farming of fragile soil which has worsened over the years.

The share of agricultural products in total exports has dropped from over 70 percent in 1960 to less than 2 percent in the present time. The decline was largely due to the phenomenal rise of oil shipments, but also reflected the fall in the output of products like cocoa, palm oil, rubber, and groundnuts, of which Nigeria was once a leading world producer. For example, production of cocoa, currently Nigeria's

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biggest non-oil export earner, has remained around 160,000 tons per year since 1995, compared with an annual average of 400,000 tons at its peak before the oil boom. The government has made some effort to encourage private investment in agriculture and agro-industries by providing incentives, including tax breaks, finance credit and extension services, but without much success.

In response to the dwindling performance of agriculture in the country, governments have, over the decades, initiated numerous policies and programs aimed at restoring the agricultural sector to its pride of place in the economy. But, as will be evident from analyses in subsequent chapters, no significant success has been achieved, due to the several persistent constraints inhibiting the performance of the sector.

From the perspective of sustainable agricultural growth and development in Nigeria, the most fundamental constraint is the peasant nature of the production system, with its low productivity, poor response to technology adoption strategies and poor returns on investment. It is recognized that agricultural commercialization and investment are the key strategies for promoting accelerated modernization, sustainable growth and development and, hence, poverty reduction in the sector. However, to attract investment into agriculture, it is imperative that those constraints inhibiting the performance of the sector are first identified with a view to unlocking them and creating a conducive investment climate in the sector. The development challenges of Nigeria's agriculture are, therefore, those of properly identifying and classifying the growth and development constraints of the sector, unlocking them and then evolving appropriate strategies for promoting accelerated commercialization and investment in the sector such that, in the final analysis, agriculture will become one of the most important growth points in the economy.

b) Statement of the Problem

Agriculture is a major source of food, clothing, and shelter, but the literature has reported that in spite of Nigeria's rich agricultural resource endowment, there has been a gradual decline in agriculture's contributions to the nation's economy (Manyong et al., 2005). In the 1960s, agriculture accounted for 65-70% of total exports; it fell to about 40% in the 1970s and crashed to less than 2% in the late 1990s. The decline in the agricultural sector was largely due to rising in crude oil revenue in the early 1970s. Less than 50% of Nigeria's cultivable agricultural land is under cultivation. Even then, smallholder and traditional farmers who use rudimentary production techniques, with resultant low yields, 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, land, and environmental degradation, and inadequate research and extension services. The inability to capture the financial services requirements of farmers and agribusiness owners who constitute about 70 percent of the population is inclusive (Lawal, 2011). Low agricultural output has a negative effect on the Nigerian economy as a whole. Several factors have been identified to enhance or retard growth in the agricultural sector. These factors include education, infrastructure, and inflation. (Yee et al. 2000).

c) Objectives of the Study

The main objective of this study is to examine the impact of agricultural output on the growth in Nigerian. Specifically, other objectives are:

i. To examine the relationship between agricultural output and economic growth in Nigeria;
ii. To examine the relationship between commercial bank's credit to the agricultural sector and economic growth in Nigeria; and
iii. To examine the relationship between interest rate and economic growth in Nigeria.

d) Statement of the Hypotheses

In an attempt to achieve the above objectives, the research work is guided by the following null and alternative hypotheses:

Ho1: There is no significant relationship between agricultural output and economic growth in Nigeria.
$H_1$1: There is a significant relationship between agricultural output and economic growth in Nigeria.
Ho2: There is no significant relationship between commercial bank's credit to the agricultural sector and economic growth in Nigeria.
$H_1$2: There is a significant relationship between commercial bank's credit to the agricultural sector and economic growth in Nigeria.
Ho3: There is no significant relationship between interest rates and economic growth in Nigeria
$H_1$3: There is a significant relationship between interest rates and economic growth in Nigeria.

e) Definition of Terms

Agriculture: Agriculture or farming is the cultivation and breeding of animals, plants, and fungi for food, fibre, bio fuel, medicinal plants and other products used to sustain and enhance human life. Agriculture was the key development in the rise of sedentary human civilization, whereby farming of domesticated species created food surpluses that nurtured the development of civilization. The study of agriculture is known as agricultural science.

Agriculture Productivity: Agriculture productivity is a measure of the amount of agricultural output produced for a given amount of inputs, such as an index of multiple outputs divided by an index of multiple inputs (e.g., the value of all farm outputs divided by the value of all farm inputs). The index-number approach to

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studying productivity estimates total factor productivity (TFP), which measures levels and changes in agricultural output relative to changes in an aggregated index of multiple inputs. Agricultural productivity is measured as the ratio of agricultural outputs to agricultural inputs. While individual products are usually measured by weight, their varying densities make measuring overall agricultural output difficult. Therefore, the output is usually measured as the market value of final output, which excludes intermediate products

Economic Growth: Economic growth is defined as the achievement of yearly increases in both the total and per capita output of goods and services in a country (Akpakpan 1987).

Economic Development: Economic development is defined quantitatively as a process of improvement in the general welfare of the entire society usually manifested in desirable changes in various aspects of the society such as; reduction in the level of unemployment, regional inequalities, absolute poverty; rise in real output of goods and services and improvement in the technique of production; improvement in literacy, housing condition, health and government services; improvement in the level of social and political consciousness of the people; greater ability to draw on local resources both human and materials to meet local needs(self-reliance) and a reduction in pollution and or environmental degradation (Akpakpan, 1999).

Gross Domestic Product: Gross domestic product (GDP) is a monetary measure of the market value of all final goods and services produced in a period (quarterly or yearly). The gross domestic product is the best way to measure a country's economy. GDP is the total value of everything produced by all the people and companies in the country. It doesn't matter if they are citizens or foreign-owned companies. If they are located within the country's boundaries, the government counts their production as GDP.

Interest Rate: It is defined as the proportion of an amount loaned which a lender charges as interest to the borrower, normally expressed as an annual percentage. It is the rate a bank or other lender charges to borrow its money or the rate a bank pays its savers for keeping money in an account. An interest rate, is the amount of interest due per period, as a proportion of the amount lent, deposited or borrowed (called the principal sum). The total interest on an amount lent or borrowed depends on the principal sum, the interest rate, the compounding frequency, and the length of time over which it is lent deposited or borrowed.

Commercial Banks: A commercial bank is a type of financial institution that provides services such as accepting deposits, making business loans, and offering basic investment products. A commercial bank can also refer to a bank, or a division of a large bank, which more specifically deals with deposit and loan services provided to corporations or large/middle-sized business - as opposed to individual members of the public/small business - retail banking, or merchant

II. Literature Review and Theoretical Framework

The study reviewed some relevant literature that relates to the subject matter of this research work. For a clearer overview of the various kinds of literature on the study, this chapter discussed the conceptual framework, theoretical framework, empirical literature and summary of the literature reviewed.

a) Conceptual Framework

i. *The Concept of Agriculture*

The term Agriculture is derived from two Latin words 'ager' or 'agri' meaning soil and 'cultura' meaning cultivation. Agriculture is an applied science which encompasses all aspects of crop production including horticulture, livestock rearing, fisheries, forestry, etc. Agriculture is defined as an art, science, and business of producing crops and livestock for economic purposes. As an art, it embraces the knowledge of the way to perform the operations of the farm in a skilful manner but does not necessarily include an understanding of the principles underlying the farm practices. As a science, it utilizes all technologies developed on scientific principles such as crop breeding, production techniques, crop protection, and economics etc. to maximize the yield and profit. As long as agriculture is the way of life of the rural population, production is ultimately bound to consumption. But agriculture as a business aims at maximum net return through the management of land, labour, water, and capital, employing the knowledge of various sciences for production of food, feeds, and fuel. In recent years, agriculture is commercialized to run as a business through mechanization.

Agriculture is defined in the Agriculture Act (1947), as including 'horticulture, fruit growing, seed growing, dairy farming and livestock breeding and keeping, the use of land as grazing land, meadow land, osier land, market gardens and nursery grounds, and the use of land for woodlands where that use ancillary to the farming of land for Agricultural purposes". Agriculture has seven branches viz; Agronomy which deals with the production of various crops which includes food crops, fodder crops, fibre crops, sugar, oilseeds, etc.; Horticulture which Deals with the production of fruits, vegetables, flowers, ornamental plants, spices, condiments and beverages; Forestry which deals with production of large scale cultivation of perennial trees for supplying wood, timber, rubber, etc. and also raw materials for industries; Animal husbandry

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which deals with agricultural practice of breeding and raising livestock in order to provide food for humans and to provide power (draught) and manure for crops; Fishery science which deals with practice of breeding and rearing fishes including marine and inland fishes, shrimps, prawns etc. in order to provide food, feed and manure; Agricultural Engineering which deals with farm machinery for filed preparation, inter-cultivation, harvesting and post-harvest processing including soil and water conservation engineering and bio- energy; and Home science which deals with application and utilization of agricultural produces in a better manner in order to provide nutritional security, including value addition and food preparation.

ii. *Types of Agriculture*

Since the development of agriculture, many different types of production have been implemented. Currently, agriculture is divided into two different types, including industrialized agriculture and subsistence agriculture.

Industrialized (commercial) Agriculture: Industrialized agriculture is the type of agriculture where large quantities of crops and livestock are produced through industrialized techniques for the purpose of sale. The goal of industrialized agriculture is to increase crop yield, which is the amount of food that is produced for each unit of land. Crops and livestock made through this type of agriculture are produced to feed the masses and the products are sold worldwide. Industrialized agriculture is able to produce large quantities of food due to the farming methods used. Instead of using animal and manpower to work the fields, industrialized agriculture utilizes large machines, which are more powerful and can work faster and harder. The shift towards machines has increased the use of fossil fuels on industrial farms, and, therefore, the price of food can fluctuate as the price of oil changes. Industrialized agriculture also increases crop yield by investing in large irrigation systems and by using chemical fertilizers and pesticides. The chemical fertilizers that are used in industrialized agriculture often add inorganic nutrients to the soil to increase yield and plant size. The use of pesticides is also common in industrialized agriculture, and most pesticides help increase yield by killing pests that are harming or consuming the crops. Another farming technique that is used in industrialized agriculture is the method of growing monocultures, which is when a single crop is planted on a large scale. Although planting monocultures can increase overall yield, this method of farming is also more susceptible to disease and causes a reduction in the dietary variation of consumers.

Subsistence Agriculture: Subsistence agriculture is when a farmer lives on a small amount of land and produces enough food to feed his or her household and have a small cash crop. The goal of subsistence agriculture is to produce enough food to ensure the survival of the individual family. If there is excess food produced, it is sold locally to other families or individuals. Subsistence agriculture varies a great deal from industrialized agriculture in terms of the farming methods used. This type of agriculture is labour-intensive because all of the work is done by humans and animals and only hand tools and simple machines are used to work the land. Subsistence agriculture does not rely on chemical fertilizers or pesticides and instead utilizes more natural techniques. Most farmers have animals, including chickens, goats, and cows, and the manure from these animals is used to fertilize the plants. The crops produced are then consumed or sold, and the inedible parts of the plants are used to feed the livestock. This creates a closed circuit within the farm where nothing goes to waste. Instead of using chemical pesticides, subsistence farmers rely on natural predators of pests to control the pest population. Subsistence agriculture is often divided into three different types, including intensive subsistence, which is the traditional method, shifting cultivation, which relies on clearing forest to create new farm plots every few years and pastoral nomadism, which relies on traveling with herds of animals.

iii. *Importance of Agriculture*

The following facts clearly highlight the importance of agriculture in this country.

Source of Livelihood: The main occupation of Nigerian population is agriculture. About 65 percent of our population is directly engaged in agriculture. In advanced countries, this ratio is very small being 5 percent in U.K., 4 percent in USA., 16 percent in Australia, 14 percent in France, 21 percent in Japan, and 32 percent in USSR. Whereas, 70 percent of India's population like Nigeria is engaged in agriculture.

Contribution to National Income: Agriculture is the premier source of our national income. According to the National Income Committee and C.S.O., in 1960-61, 52 percent of national income was contributed by agriculture and allied occupations. In 1976-1977, this sector alone contributed 42.2per cent while in 1981-1982, its contribution was to the tune of 41.8 per cent. In 2001-2002, it contributed around 32.4 percent of national income. This was further reduced to 28 percent in 1999-2000. (CBN 2000)

Supply of Food and Fodder: Agriculture sector also provides fodder for livestock. Cow and buffalo provide protective food in the form of milk and they also provide draught power for farm operations. Moreover, it also meets the food requirements of the people. Import of food grains has been very small in recent years, rather export avenues are being sourced and utilized.

Importance in International Trade: The agricultural sector is another area or source of feeds for the country's

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trade. If the development process of agriculture is smooth, export increases and imports are reduced considerably. Thus, it helps to reduce the adverse balance of payments and save our foreign exchange. This amount can be well utilized to import other necessary inputs, raw- materials, machinery and other infrastructure which is otherwise useful for the promotion of economic development of the country.

Marketable Surplus: The development of the agricultural sector leads to a marketable surplus for the country. As a country develops more and more people are to be engaged in mining, manufacturing, and other non-agricultural sectors. All these working populace depend upon the food production which they can meet from the marketable surplus. As agricultural development takes place, output increases and marketable surplus expands and keep on increasing.

Source of Raw Material: Agriculture has been the potential source of raw materials to our industries like cotton and jute textiles, sugar, tobacco, edible and non-edible oils etc. We also have many other industries like processing of fruits and vegetables, milling, rice husking, fur making depending on agriculture for their raw materials.

Feeding of the Transport Sector: Agriculture is the main support for railways and roadways which transport the bulk of agricultural produce from the farms especially those in the hinterlands to the factories in Townships. Internal trade and transportation is mostly in agricultural products.

Contribution to Foreign Exchange Resources: Agricultural sector occupies an important place in the country's export trade. Agricultural commodities like tobacco, oil bean seeds, raw cotton, cocoa, groundnut, hides and skins accounted for about 20 percent of the total value of Nigeria's exports. This shows that agriculture products still continue to be a significant source of earning foreign exchange.

Vast Employment Opportunities: The agricultural sector is significant as it provides greater employment opportunities. With the fast-growing population and high incidence of disguised unemployment in Nigeria, it is only the agriculture sector which provides more employment chances to the labour force, hence, the significance of agricultural sector. In terms of economic development, agriculture employs majority of our population; meaning that, agricultural section has raised the level of the national income and standard of living. The rapid" rate of growth in agriculture sector is a source of motivation for development; it helps to create the enabling atmosphere for the general economic development of the economy. Thus, indicating that economic development highly depends on the rate at which agriculture sector grows.

Therefore, agriculture occupies an important place in the development of an economy and in fact, a pre-condition for economic development.

b) Agricultural Development in Nigeria

Agricultural development is an aspect of development that is related to agrarian reforms being an integral part of national development. A lot of scholars have postulated theories linking agriculture with national development as a result of its contribution towards the socio-economic development of many countries. Development paradigms postulated in the field of agriculture, communication, sociology, and economics have ample evidence to show that changes are taking place in the agricultural sector across the globe; which changes can be viewed from contributions of agriculture to the national economies of various countries in form of Gross Domestic Product (GDP). The broad-spectrum goal of development initiatives is a total transformation of the quality of life of the people or the targeted beneficiaries of the development program.

According to Olawoye and Ogunfiditimi (1989), people are not only the most important means transforming process of development but also the ultimate end of development. Agricultural development can therefore be viewed as another arm of development, which connotes improvement in the principles, and practices of agriculture given both human and material resources that will result in a maximum output from a combination of minimum inputs.

Development is a multi-dimensional perspective paradigm that is related to politics, economics, and psychology, socio-cultural and ecological phenomena at all levels of human endeavours. Hence, Chauvin (1993) has stated that several schools of thought have continued to view development from the economic, social or modernization and technological perspective. Thus, development should be defined in relation to sustainability and of course its relevance to the socio-cultural circumstances of the people affected by changes inherent in the process. It is sad to note that in Nigeria, the rural sector suffers more neglect and under development with ever increasing cases of population growth, unabated rural migration of able- bodied youths, malnutrition, lack of basic necessities of life (health care centres, schools, good roads, portable and safe drinking water, electricity, irrigation), total marginalization, etc. Consequently, what we're left are multiple negative forces in the social system such as armed robbery, advanced fee fraud (419) and general dishonesty, cheating and stealing. This justifies the need for urgent actions and interventions to address the myriads of problems of the rural areas and set the nation on the path to glory and excuse a larger proportion of the nation's population from inhuman living circumstances in order achieve greatness.

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Successive governments of Nigeria have executed several agricultural development programmes aimed at improving the level of agricultural production that will ensure self-sufficiency in food production. These intervention programmes can be viewed from two perspectives that are based on Policy and Nature of the Agency. Some of these programmes are as enumerated below:

i. *Policy-Based Intervention Programs*

National Accelerated Food Production Program (NAFPP): This program was designed in the early 60s by both the Federal and state governments to accelerate the production of grains (maize, rice, guinea corn, millet, wheat, cassava, and cowpeas). It was the opinion of the initiators of this program that target crops for accelerated production are major staple foods of Nigerians and if produced in abundance, by introducing high yielding variety seeds, applying appropriate fertilizers, agrochemicals, and providing good storage and processing facilities, with the provision of credit as well as marketing outlets will reduce hunger and related food crisis to the barest minimum. In addition, several research institutes were set-up with a mandate to develop improved crop varieties through research and development.

Operation Feed the Nation (OFN) was introduced in 1976 by the Obasanjo administration to address the problem of rising food crisis, rural-urban migration and escalating food import bills. The OFN program attempted to mobilize the general public to participate actively in agricultural production and ensure self- sufficiency in food production. The program actually aroused the interest of Nigerians to farm through various strategies. Some of these strategies included subsidized production inputs, increased bank credit to farmers, the establishment of commodity boards and fixing of attractive prices for agricultural produce but, with less success.

Green Revolution Program (GR): The Green Revolution Program replaced the Operation Feed the Nation of the Federal Military Government by the civilian government in 1979 by the Shehu Shagari administration. This was an attempt to bring about radical changes in Nigerian Agricultural production and eliminate inherited food problems of successive governments. Large, medium and small- scale farmers received a number of incentives to boost their production level during the implementation of the program. Livestock and crop components were introduced while the research institutes were re-organized to make them more responsive to the needs of the program (Williams, 1981).
Agency-Based Intervention Programs

National Agricultural Land Development Authority (NALDA): This development authority executed a national agricultural land development program aimed at moderating the problems of low utilization of abundant farmland, thereby increasing food production level of farmers through expansion of farmers' farmlands. A survey conducted by the Central Bank of Nigeria in 1998 indicated that the agency was able to develop 16,000 hectares of land. Out of this, 12,984 (81.1%) was cultivated with various crops. It also provided extension services to farmers at project sites. The overall goal of NALDA was to encourage farmers to plant above what they can consume so that the surpluses can be sold at the local markets or exported to other countries for foreign exchange earnings.

River Basin Development Authority (RBDA): The existing abundant water resources in the country and its potential for increasing agricultural production prompted the establishment of River Basin Development Authority (RBDA). The scheme became necessary because of persistent short rainy seasons in many parts of the country which has continued to restrict cultivation to single cropping pattern the year round. However, the establishment of various large-scale irrigation facilities the country witnessed unprecedented multiple cropping patterns. In addition, larger areas were put into cultivation, while livestock and fisheries production were intensified. Available statistics from eight River Basin Development Authorities showed that there was an increase in the tempo of activities in 1998 when the total land area developed by the authorities rose from 30.3 thousand hectares in 1994 to 47.7 thousand hectares in 1998.

Agricultural Development Programs (ADPs): The Agricultural Development Programs is a concept of integrated agricultural and rural development. It started in 1972 in Northern Nigerian towns of Gombe and Gusau with two pilot projects assisted by the World Bank. This became necessary because of the need for the application of knowledge and skills in all the relevant areas of agriculture. This concept involves the provision of Infrastructural facilities such as roads, schools, water supply in the rural areas at the right times in required quantity to farmers. The ADP is the implementation organ of the state ministry of agriculture and natural resources. It is semi-autonomous and focuses on the small farmer. It adopts the integrated rural development strategy in its operations (Jibowo, 2005). The success of the Gombe and Gusau projects encouraged other state governments to embark on more of such projects with the assistance of the World Bank. Since then, Nigeria has continued to witness agricultural development programs of various dimensions. It is against this background that effective extension services have been established. The closest assistance ever realized by farmers in Nigeria have come from contact with various Agricultural Development Programs (ADPs) and the extension agents working under the Training and Visit (T and V) system. The Activities of ADPs in Nigeria spread over three thematic areas; provision of infrastructural

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rural facilities, conducting worthwhile training on improved agricultural technologies and supply of farm inputs.

Directorate of Food, Road and Rural Infrastructure (DFRRI): Trends in the transformation of the rural sector shows that despite the huge investment in the agricultural sector, which was assumed will automatically bring about the eradication of rural poverty and isolation has not been achieved. This is partly due to the deplorable conditions of rural areas, enormous size and dwindling economic resources to address the problem of rural underdevelopment in Nigeria. In 1987, the Babangida administration established the Directorate of Foods, Road and Rural Infrastructure (DFRRI) to open up the rural areas through the construction of access roads, and provision of basic amenities of modern living. This is inevitable because it has long been realized according to Otubanjo (1992) that the economic future of Nigeria depends on the development of rural areas. Therefore, the potentials of rural areas were seen to be both immediate and long-term. The idea of opening up of rural areas with feeder roads and integrating it with other parts of the country provide the basis for food that could be evacuated to enhance the quantity of food and raw materials consumption. Consequently, there will be more food at a cheaper rate. On the other hand, the improved rural condition will stem the rate of rural-urban migration; improve quality of rural life and by implication, its productive capacity that would ensure a greater exploitation of the potentials of rural areas. The problem of DFRRI was hardly one of enthusiasm and relevance but of variation between the enormity of rural underdevelopment and the quantum of resources available to subdue the problem.

ii. *Development Challenges in Nigerian Agriculture*

Identification of the development constraints in the agricultural sector is a necessary step to unlock the factors inhibiting performance of the sector toward designing policy strategies that would create a conducive climate for promoting accelerated commercialization and growth of the sector. In this connection, the following factors are very important.

Storage and Processing: The traditional storage facilities is what was commonly found in Nigeria which have certain deficiencies, including a low elevated base giving easy access to rodents, wooden floors that termites could attack, weak supporting structures that are not moisture-proof, and inadequate loading and unloading facilities. The lack of adequate storage and processing facilities accounts for the divergence between national food security and household food security. At the aggregate level, there happens to be inadequate production of food which brings no significant improvement in food security and there is that need to provide food for consumption at the right time and in the right form. However, a common sight is the perishing of harvested products due to lack of storage and processing facilities. Simple, efficient, and cost-effective technologies for perishables, such as roots, tubers, fruits, and vegetables, are not as highly developed in the country compared to the storage technologies for cereal grains and legumes.

Infrastructural Inadequacies: The Low level of development of infrastructure has greatly affected agricultural performance in Nigeria. Inadequate infrastructure constitutes a major constraint to agricultural investment, and production as well as trade. In many parts of the country physical and marketing infrastructure is poorly developed, storage facilities are primary and access to information and markets is highly restricted. The situation represents the urban bias in the pattern of development in the country. Infrastructure inadequacy is mirrored by restricted access to the markets, which limit the availability of agricultural products in many areas, and reduces farmers' income. The Infrastructural constraints have continued due to government neglect, poor governance, poor political leadership, poor maintenance culture, and poor funding.

Unstable Input and Output Prices: The rising prices of inputs leading to instability in macroeconomic policy actions have led to inflationary pressures, high-interest rates, and volatile exchange rate. Invariably, the deficiency in the macroeconomic policy environment constituted a major constraint to the growth of investment in the production of agricultural products. This has a tendency to cause high factor cost to the farmers cultivating agricultural crops. The rising costs of farm inputs combined with a dearth of investible funds pose a serious constraint to investment in agriculture. This could lead to a reduction in production and domestic supplies of agricultural products. The prices of many commodities also increased due to wide fluctuations which can cause persistent rise in the profitability of farm enterprises.

Agricultural Labour: Availability of labour affects the use of farmland in the traditional farming system. Since agriculture in Nigeria is not virtually mechanized, human labour becomes vital in all production systems, accounting for about 90 percent of all farm operations. Although farming is largely labour- intensive, farmers, generally often experience seasonal labour shortages. The supply of labour is affected by the unending migration of able-bodied youths from the rural to urban areas creating labour shortages, especially at peak periods when labour is required for land preparation, weeding, and harvesting. Hired labour shortages have driven up the cost of labour making such labour unprofitable to the average smallholder.

Technical Constraint: Technical constraint in Nigeria affects both the upstream and the downstream segments of agriculture. The constraint manifests in

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poor technology, poor quality of raw materials and inadequate supply of modern inputs. The main causes of the constraint include low support from the government, poor government policy, poverty, low level of awareness, lack of adequate research and increases in the prices of inputs. Poor government support and policy prevents the emergence of innovations from research institutes, thereby curtailing the level of available technically feasible and efficient agricultural practices. There are also communication gaps existing between farmers (end-users of research efforts) and the researchers. Furthermore poor coordination is divergent between researchers, extension agents, and farmers. Thus, farmers are unable to take up new innovations aimed at boosting their productivity and, by extension, their output. The low level of productivity translates to a vicious cycle of poverty, thereby leading to a low level of production. The technical constraint is further sustained by high input prices, which are a consequence of inflation in the economy as well as the dependence of the agricultural economy on foreign inputs.

c) Historical Background of Agriculture in Nigeria

Nigeria as a country, shifted focus from agriculture-dependent to oil exports in the 1970s and thereabout, came into slow economic growth. There is therefore, a need to refocus on agriculture if our economy shall have a steady growth rate. With the pressure to attain the MDGs, 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.

Given the enormous resource endowment both in human capital and natural resources, the performance of the Nigerian economy has been far below expectation and in-fact suffers from resource curse according to Aluko (2004) and Otaha (2012). Nigeria being the most populous nation in Africa, with a population of over 150 million and a labour force of 53.83million (2012 estimates; CIA, 2012), is blessed with ample resource 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 cultivated.

Coexistence of vast wealth in natural resources and extreme personal poverty cultivation and the diverse climates makes the production of a variety of products, from tropical and semitropical areas of the world possible (Chauvin, Mulangu and Porto, 2012). Yet, besides these natural endowments, the nation ranks one 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, CIA, 2013, and Sekunmade, 2009 stated that agriculture employs about two-thirds of Nigeria's labour force, contributes significantly to the GDP and provides a large proportion of non-oil earnings.

The agricultural sector irrespective of the abundant resources, yet has several untapped potentials for growth and development in terms of availability of land, water, labour, and its large internal markets. It is estimated that about 84 million hectares of Nigeria's total land area have the 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 importation. In addition to diverse and rich vegetation that can support heavy livestock population, it also has the 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 the negligence of the agriculture sector.

Furthermore, the nation was self-sufficient in food production and exports major crops which accounted for over 70% of total exports in 1960. However, due to a 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, the 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

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groundnuts, and 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 an opportunity for growth. According to CBN (2012), between 1960 and 2011, an average of 83.5% of agriculture in 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 the 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 contribution to GDP was about 19% but this dropped as low as 6% between 2004 and 2005 (CBN 2009). In the fishery subsector, local production is inadequate for domestic demand and consumption. Nigeria imports 700,000 MT 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% between 1961 and 2011 as compared to the 6% recorded in crop production in the same period (CBN, 2012). Gabriel et al., 2007; Essien & Effiong, 2010 went on to say that, with an average contribution of 4.3% to total agriculture GDP between 1960 and 2011 and provision of at least 50% animal protein, fisheries contribute to economic growth by enhancing food security and improving the livelihood of fish farmers and their households. Forestry is the smallest sub-sector in Nigerian agriculture, contributing only 3.0% between 1960 & 2011; and 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 the Nigerian agriculture sector. Iyoha and Oriakhi (2002) findings revealed 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.

Muhammad-Lawal and Atte (2006) recommends an 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 was possible to provide 3.5 million jobs within the agricultural value chain, increase farmers" incomes by $2 billion and also reduce food insecurity by 20 million metric tons (MT), with an increase in food supply (FMARD, 2012). This can only be achieved by intensified efforts in increasing productivity and developing the agriculture value chain.

III. Theoretical Literature

a) *Boserup Theory of Agricultural Development*

Boserup theory of agricultural development was developed as a concept by a female Danish economist named Ester Boserup in 1965 in Denmark. Boserup occupies the place of pride in the task of discussing the problems and processes of agricultural development. Boserup attributed agricultural development to the factor which so far has been described as irrelevant but it demolished a theory propounded by the classical economist Malthus.

Boserup in her attempt tried to probe into the causes of agricultural development. She maintained the view that agricultural development is due to some kind of compulsion. This compulsion relates to the rising trend of the population. It means the basic force behind agricultural development is the pressure of population; and the development of patterns and techniques of cultivation is governed by the population growth.

According to the Malthusian theory of population, if at any time food supply increases, population will increase and a new equilibrium will be established between population and food supply. In a sense, if the population is less than the existing food supply, the population will increase and wipe out the excess food supply. But, if the population is already beyond the means of subsistence, the population will itself come down to reach equilibrium through the positive checks instituted.

Boserup has tried to refute these aspects of the Malthusian theory. She criticized first part of the theory on the ground that few observers would like to suggest that the tremendous increase in the rates of population growth witnessed throughout the underdeveloped world in the two post-war decades could be explained as a result of changes in the conditions for food production.

It is reasonably clear that the population explosion is a change in basic conditions which must be regarded as autonomous in the sense that the

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explanation is to be sought not in the improved conditions of food production but in medical inventions and some other factors which the student of agricultural development would regard as independent variables.

As regards the second part of the Malthusian theory, the refutation is more direct and emphatic. Thus her theory of agricultural development cannot be sustained so long as Malthusian contention holds. Prof. Boserup contends that, "whenever, there is a population pressure, the population does not go down. It rather leads to various technical and other changes which result in agricultural growth and an increase in food supply."

b) Criticisms of Boserup's Theory of Agricultural Development

Unlike other agricultural development models, Boserup theory of agricultural development is also not free from criticism. The main points of criticism are understated:

i. The major criticism levelled against Boserup theory is that it is not applicable to those economies where the urban industrial sector is less developed.

ii. Though, Boserup has attempted to show that cultivation becomes more intensive when population increases and becomes extensive in character when population falls; but, this assertion is not fully convincing. It is due to the reason that the sequence of intensification of cultivation and accompanying technical, institutional and social set up enumerated by her is not fully reversible.

iii. Boserup has absolutely ignored the unfavourable effects of growing population on agriculture. In backward economies where land frontiers have already been reached, the sub-division and fragmentation of holdings must follow. Thus, small farmers, in turn, will obstruct the use of improved technology and the growing population may adversely affect the process of capital formation.

iv. Finally, Boserup model is said to only have an academic value; and that its applicability to the modern day world is completely uncertain. The various stages of intensification of cultivation are only a matter of history and it is a history which is not likely to repeat itself.

Despite these criticisms, the Boserup's theory is important because it reveals that necessity is the mother of invention because people only made advances when they realized they needed to, yet, the theory describes how increased food supply can come after a high population growth, and with an increased technological advances. Being optimistic about the future of agricultural and population development, the theory shows how the rate of food supply may vary but never reach its carrying capacity because every time it gets near, a new advancement causes supplies to increase.

c) Lewis Theory of Agriculture

The Lewis theory of agriculture explains the growth of a developing economy in terms of a labour transition between two sectors, the capitalist sector and the subsistence sector. The dual-sector model is a model in developmental economics commonly known as the Lewis model which was named after its inventor W. Arthur Lewis. The model assumes that a developing economy, there shall be a surplus unproductive labour in the agricultural sector; and these workers are attracted to the growing manufacturing sector where higher wages are offered. It also assumes that the wages in the manufacturing sector are more or less fixed; and that, Entrepreneurs in the manufacturing sector makes profits because they charge a price above the fixed wage rate. The model assumes that these profits will be reinvested in the business in the form of fixed capital. An advanced manufacturing sector means an economy has moved from a traditional to an industrialized one.

W. A. Lewis divided the economy of an underdeveloped country into 2 sectors: The capitalist sector was defined as "that part of the economy which made use of reproducible capital and pays capitalists thereof". The use of capital is controlled by the capitalists, who hire the services of labour in manufacturing, plantation farms, mines etc. The capitalist sector may be either private or public which sector is "that part of the economy which is not using a reproducible capital". It can also be said to be the indigenous traditional sector or the "self-employed sector". The output per head is comparatively lower in this sector which is not fructified with capital. The other sector being the "Dual Sector Model" which is a theory of development in which surplus labour from the traditional agricultural sector is transferred to the modern industrial sector whose growth over time absorbs the surplus labour, promotes industrialization and stimulates sustained development.

In the model, the subsistence agricultural sector is typically characterized by low wages, an abundance of labour, and low productivity through a labour-intensive production process. In contrast, the capitalist manufacturing sector is defined by higher wage rates, higher marginal productivity, and a demand for more workers. Also, the capitalist sector is assumed to use a production process that is capital intensive, so investment and capital formation in the manufacturing sector are possible over time as capitalists' profits are reinvested in the capital stock. Improvement in the marginal productivity of labour in the agricultural sector is assumed to be a low priority as the hypothetical developing nation's investment is going towards the physical capital stock in the manufacturing sector.

d) Relationship between the Two Sectors

The primary relationship between the two sectors is that when the capitalist sector expands, it

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extracts or draws labour from the subsistence sector to the capitalist sector. Lewis assumes that the supply of unskilled labour to the capitalist sector is unlimited as a result of the overpopulated surplus labour; giving rise to the possibility of creating new industries and expanding existing ones at the existing wage rate. A large portion of the unlimited supply of labour consists of those who are in disguised unemployment in agriculture and in other over-manned occupations such as domestic services, casual jobs, petty retail trading, etc. Lewis went further to say that two other factors also causes an increase in the supply of unskilled labour, that is to say women in the household and population growth.

The agricultural sector has a limited amount of land to cultivate, so, the marginal product of an additional farmer is assumed to be zero as a result of the law of diminishing marginal returns which has a fixed input i.e. land. However, the agricultural sector has a good number of farm workers that are not contributing to agricultural output since their marginal productivities are zero; and termed surplus labour who could move to other sectors with no effect on agricultural output. Surplus labour is not used in the Marxist context but only refers to the unproductive workers in the agricultural sector. Due to wage differentials, workers will tend to transit from the agricultural to the manufacturing sector over time to reap the reward of higher wages even though; the marginal product of labour is zero. No matter the quantity of workers who moves from the subsistence to the capitalist sector as surplus labour, the general welfare and productivity will rather improve; the total agricultural product will remain unchanged while total industrial product will increase as a result of the additional labour, even though marginal productivity and wages in the manufacturing sector will decline. However, at the long run, as this transition continues to take place and investment results in increases in the capital stock, the marginal productivity of workers in the manufacturing sector will be driven up by capital formation and driven down by additional workers entering the manufacturing sector. Eventually, the wage rates of the agricultural and manufacturing sectors will equalize as workers leave the agriculture sector for the manufacturing sector, increasing marginal productivity and wages in agriculture sector, whilst driving down productivity and wages in te manufacturing sector. The final result of this transition process is that the agricultural wage will equal the manufacturing wage, and the agricultural marginal product of labour will also equal the manufacturing marginal product of labour; and with no further manufacturing sector enlargement taking place, workers will no longer have a monetary incentive in transition. Although Lewis model has provided a deep and perceptive analysis of the various problems of underdeveloped countries yet it is not free from criticism.

e) The criticism levelled against Lewis model on theoretical and practical grounds are as follows:

i. Limited Supply of Skilled Labour: One of the limitations of this model is that if we assume an unlimited supply of unskilled labour, then, the supply of skilled labour is definitely limited in underdeveloped countries. This will create difficulties in carrying out programs of industrialization and economic development. However, the truth is that the problems of skill labour are not easily overcome especially in backward and underdeveloped economies.

ii. Unrealistic Assumption: The theory assumes a constant wage rate in the capitalist sector until the supply of labour from subsistence sector is exhausted. This is unrealistic as the wage rate rises continuously over time in the industrial sector of an underdeveloped economy.

iii. One-Sided Theory: Prof. Lewis theory is a one-sided theory as it does not consider the possibility of progress in the agricultural sector, but the industrial sector which develops with the transfer of surplus labour, thereby making demand for food and raw materials to rise, which will ultimately lead to growth in the agricultural sector.

iv. Neglects of Aggregate Demand: Prof. Lewis neglects the problem of aggregate demand, as he thinks that whatever that is produced in the capitalist sector is consumed by itself or is exported. Hence, he fails to consider the demand for products of the capitalist sector by the subsistence sector; and if there is a shortage of demand for the products of the capitalist sector, the growth process may come to a halt.

v. Lack of Entrepreneurs: Lewis theory of unlimited supply of labour is based on the assumption that a capitalist class exists in underdeveloped countries; and that the entire process of growth depends upon the resistance of such a class which has the necessary skill to accumulate capital. In reality, the rising level of profits in underdeveloped countries does not necessarily induce a rising level of reinvestment. However, speculative activities where a large number of existing entrepreneurs may turn to speculators to reap extra gains from the emerging shortage in the economy may exist.

vi. Less Developed Countries hardly experience Multiplier Effect: For the fact that, this model assumes that capital accumulation takes place when the capitalist class reinvests profits meaning that a presupposition of investment multiplier which is not applicable for UDC has taken place. The Prof. Lewis does not take cognizance of the fact that, if the profits are reduced or the price of wage goods rises, the process of capital formation will stop before the entire surplus labour is absorbed.

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IV. Empirical Literature

To keep abreast of our dynamic world as regards existing literature and breakthroughs in every field of endeavours, we need to see works of other eminent researchers and the various methods and approaches these scholars have employed and various findings.

Titus (2008) Taking advantage of recent developments in time series econometric methods, re-examined the question of whether agriculture could serve as an engine of growth. Results from the empirical analysis provided strong evidence indicating that agriculture is an engine of economic growth. Furthermore, the study discovered that trade openness has a positive effect on GDP growth.

Matthew and Adegboye, (2010) examined the role of the Agricultural sector in Economic Development. The empirical data used for the study was from 1970 to 2008, the Johansen Co-integration technique of regression was used to analyse the data. The results showed that there is no significant impact of the agricultural sector on economic development in Nigeria. The study recommended that research and technology would drive agricultural development and increase agricultural productivity and that the Government should establish an agricultural fund to finance and facilitate medium/large-scale agricultural production, to enhance employment, production for local consumption and for export. The study concluded that any policy thrust that addresses poverty would inevitably focus on agriculture, by increasing rural opportunities that could generate agricultural induced development. Hence, the development of agriculture is a sine qua non for the alleviation of poverty and the achievement of sustainable development.

Enoma (2010), presented the study on an empirical analysis of the impact of agriculture credit on economic growth in Nigeria. The study highlighted the problems of agricultural production in Nigeria and the strategies for agricultural transformation of the economy after review of the various policies of the government. His findings revealed that agricultural variables have an impact on economic growth and their contribution to export growth has been encouraging.

Using time series data, Lawal (2011) attempted to verify the amount of federal government expenditure on Agriculture in the thirty-year period 1979 – 2007. Significant statistical evidence obtained from the analysis showed that government spending does not follow a regular pattern and that the contribution of the agricultural sector to the GDP is in direct relationship with government funding of the sector.

Iganiga and Unemhilin (2011) studied the effect of federal government agricultural expenditure and other determinants of agricultural output on the value of agricultural output in Nigeria. A Cobb Douglas Growth Model was specified and the variables used included commercial credits to agriculture, consumer price index, annual average rainfall, population growth rate, food importation and GDP growth rate. The study performed a comprehensive analysis of data and estimated the Vector Error Correction model. Their results showed that federal government capital expenditure was found to be positively related to agricultural output.

Jadalla, et. al (2013) studied the impact of independent variables on the performance of agricultural extension management in eastern Libya: toward reorganization for sustainable agricultural development. A questionnaire was used to collect the data and analysed using descriptive statistics. The result showed the implications for sustainable agricultural development which were categorized into two groups consisting of: (a) The Decentralization (b) The Pluralism. The results of the multiple correlation coefficient measures indicated that the relationship between decentralization and continuous independent variables is moderate and positive. The study recommended that to achieve this participation, extension organizations would need to formally take off decentralization and Pluralism or transfer the control of specific program planning and management functions to the system levels of local Agricultural extension, Private sector organizations, Farmers organizations and Education organizations where extension programs are actually implemented.

Oni (2013) studied the Challenges and Prospects of Agriculture in Nigeria: The Way Forward. The paper identified the constraints and proffered policy prescriptions to be implemented to remove them so as to fast-track the attainment of poverty reduction and rapid economic development in the country. The identified constraints included a marketing problem, infrastructure inadequacies, and unstable input and output prices. Policy actions for removing the constraints include improvement in downstream commodity activities, environmental management, increased funding and efficiency in agricultural spending. The study recommended that government must invest heavily in rural infrastructure and such investment must ensure the development of infrastructure in the rural area.

Oyinbo and Rekwot (2014) carried out research to provide empirical information on the relationship between agricultural production and the growth of the Nigerian economy with a focus on poverty reduction. The study employed Time series data in the research and the analyses of the data were done using unit root tests and the bounds (ARDL) testing approach to cointegration. The result of the data analysis indicated that agricultural production was significant in influencing the favourable trend of economic growth in Nigeria. They also discovered that despite the growth of the Nigerian economy, poverty is still on the increase and

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this calls for a shift from monolithic oil-based economy to a more plural one with agriculture being the lead sector. The study recommended that pro-poor policies should be designed for alleviating rural poverty through increased investments in agricultural development by the public and private sectors.

Ihegboro (2014), analysed the impact of agricultural credit on agricultural productivity in Nigeria. The ex-post facto research design was adopted to enable the researcher to make use of secondary data and determine cause-effect relationship during the period, 1978-2008. The Ordinary Least Square (OLS) estimation technique was adopted, using SPSS statistical software to test the hypotheses, where Total Agricultural Credit Guarantee Scheme Fund (TACGSF), Agricultural Credit Guarantee Scheme Fund to crop production (ACGSFCP), Agricultural Credit Guarantee Scheme Fund to livestock (ACGSFLSP) and Agricultural Credit Guarantee Scheme Fund to fisheries (ACGSFP) were used as the independent variables while Agricultural Production (AP), Gross Domestic Product Agricultural Crop Production (GDPACP), Gross Domestic Product Agricultural Livestock Production (GDPALS) and Gross Domestic Product Agricultural Fisheries Production (GDPAFP) were used as the dependent variables. The study found that Agricultural Credit guarantee scheme fund for crop production, livestock production and fisheries had a significant positive impact on crop, livestock and fisheries productivity in Nigeria for the period of the study and also, the total agricultural credit guarantee scheme fund had a significant positive impact on agricultural output in Nigeria. The study, therefore, recommended that stakeholders in the scheme (the farmers, lending institutions and government) must show greater commitment and dedication for the scheme to achieve its laudable objectives.

Nnamocha and Charles (2015), studied Bank Credit and Agricultural Output in Nigeria from 1970 – 2013; using an Error Correction Model (ECM) Approach. This work investigated the effect of Bank Credit on Agricultural Output in Nigeria using the Error Correction Mode (ECM). A yearly data (1970- 2013) obtained from the Central Bank of Nigeria was used for the analysis. The analysis showed that all the variables were integrated of order one I (1) and long-run relationship existed among them. However, the empirical findings of the study revealed that in the long-run bank credit and industrial output contributed a lot to agricultural output in Nigeria, while; only industrial output influenced agricultural output in the short-run.

Ojeka et. al (2016), studied the constraints to agricultural development in Nigeria. The study investigated the constraints to agricultural development in Nigeria using time series data spanning the period 1970 – 2010 and contemporary econometric methods of unit root test, co-integration an error-correction mechanism. The Empirical findings revealed that rainfall, exchange rate and food export (lag one) are the most significant positive determinants of agricultural output in Nigeria. However, food imports, diversion of funds meant for agricultural purposes and low technology diffusion in agriculture are among the factors identified as constraints to agricultural development in Nigeria. The study recommended, maintenance of stable and favourable exchange rate regime, and the pursuance of programs that will bolster partnerships between research institutions and other stakeholders in agriculture as a route to facilitating agricultural development and hence, economic development in Nigeria.

V. Summary of Literature Reviewed

Agriculture has been identified as an important sector of the Nigerian economy and a number of studies have been carried out on different aspects of this subject; all pointing to the fact that agricultural output could be stimulated if adequate funding of the sector by other sources and that of the government. Irrespective of these studies, the problem of inadequate agricultural output still persists and economic growth has not accelerated at the rate needed to reduce poverty and unemployment in Nigeria. However, in as much as the above studies carried out by some other scholars are commendable; yet the basic questions remain as:

1. What is the relationship between agricultural output and economic growth in Nigeria?
2. What are the relationship between commercial banks' credit to the agricultural sector and economic growth in Nigeria?

Answers to these questions are the major concern of this research work. In addition, none of the scholars examines the agricultural output and economic growth in Nigeria from 1985 to 2015 using OLS, Co-integration and Granger causality methods of econometrics. This study therefore, stands out to fill in this gap by employing OLS, Co-integration and Granger causality methods of econometrics to showcase the impact of agricultural output on economic growth in Nigeria from 1985 to 2015.

VI. Method of Study

The method of study adopted in this research, comprises of research design, model specification, data collection and sources, types and data analysis technique.

a) Research Design

A research design according to Onwumere (2005), is a kind of blueprint that guides the researcher in his or her investigation and analyses. The research design adopted for this research is the ex-post facto research design. This is because according to Kerlinger (1970), the ex-post facto research design also called

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causal- comparative research is used when the researcher intends to determine a cause- effect relationship between the independent and dependent variables with a view to establishing a causal link between them. As a fact-finding study, we focused on reporting economic growth as a result of agricultural output, interest rate and commercial banks credit to agriculture.

b) Model Specification

This section specifies the econometric model that was used in this study. The econometric model aimed at capturing the relationship between agricultural output and economic growth in Nigeria in line with the conceptual, theoretical and empirical literature reviewed was developed being guided by the model of Oyinbo and Rekwot (2014) with slight modifications. The model for this study is presented thus:

GDP= f (AGO, CBCA INR)

GDP= a0+ a1AGO+ a2CBCA+a3INR+ ux

a0 = Constant

a1, a2, a3 = Coefficient of the Independent variables ux = Error Term

Where;

GDP = Real Gross Domestic Product AGO= Agricultural Output

INR = Interest Rate

CBCA= Commercial Banks' Credit to Agriculture

Therefore, in line with the model specification above;

GDP =a0 + a1 AGO + a2INR + a3CBCA + μ

a0, a1-a3- parameters to be estimated

c) Apriori Expectation

On the apriori;

a1 is expected to have a positive sign because in macroeconomic theory, the higher the level of agricultural output, the higher the level of economic growth and development in the economy. (i.e. a1 > 0).

a2 is expected to have a negative sign because in macroeconomic theory, the larger the interest rate, the lesser would be the demand for credit. (i.e. a2< 0).

a3 is expected to have a positive sign because when commercial bank's credit to agricultural sector increases, investment into the agricultural sector is also increased thereby stimulating economic growth. (a3 > 0).

i. *Explanation of variables in the model*

Dependent Variable: The dependent variable in this study is economic growth and it is measured with GDP. The dependent variable is subject to change as a result of a change in any of the independent variables in the model. GDP is expected to be positively influenced by agricultural output and commercial bank's credit to the agricultural sector.

Independent variables used in this study are agricultural output, interest rate and commercial bank credit to the agricultural sector. Agricultural output is measured as the ratio of agricultural outputs to agricultural inputs. The interest rate is the amount gained for parting with liquidity for a period of time; while commercial banks' credit is the amount given to the agricultural sector for investments in order to facilitate productivity. These variables will cause a change in the economic growth.

ii. *Data Required*

The data required for the study are the various values of agricultural output, interest rates, and commercial banks credit to agriculture sector from the period of 1985-2015.

iii. *Data Collection and Sources*

The study employed the use of secondary data obtained from the Central Bank of Nigeria statistical bulletin of various issues. The study was designed to cover a period of 30 years (1985-2015).

iv. *Method of Data Analysis*

In order to investigate the relationship that exists between the dependent variable and independent variables, this research adopted the Ordinary Least Squares, Co- integration and Granger Causality methods of econometrics to analyse the data.

v. *Unit Root Test*

The study conducted the unit root test on the variables by employing the Augmented Dickey-Fuller (ADF) statistics to test the characteristics of the variables with a view to determining the order of integration.

vi. *Granger Causality Test*

Granger causality test shows the direction of effect between two-time series; which effect could be bilateral, bidirectional, unidirectional and independence causality.

vii. *Co-integration Test*

In order to ascertain if there was a long-term relationship existing among these variables, a co-Integration test was carried out using the Johansen co-integration test.

viii. *Regression Analysis*

This was used to determine factors influencing agricultural output in Nigeria. However, all the above-mentioned techniques were analysed using E-view version 8.0 for the data spanning from 1985 to 2015.

VII. Data Presentation and Analysis of Results

The study on the impact of agricultural output on economic growth in Nigeria from 1985-2015 is very important; as we present the explanation of the data used in carrying out the study as well as the presentation of analysis of regression results. Thus, this section begins with the data presentation and thereafter analysis of the results.

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a) Data Presentation

The main objective of this study is to examine the impact of agricultural output on economic growth in Nigeria from 1985 to 2015. The study made use of data on the gross domestic product (GDP) as the dependent variable while agricultural output (AGO), commercial bank's loan to agricultural sector (CBCA) and interest rate (INR) are the independent variables. The data for the analysis are attached in the first appendix.

b) Unit Root Test (Test for Stationarity)

A test of stationarity which has become widely popular over the past several years is the unit root test (Gujarati, 2007). The assumption of stationarity of dependent and independent variables is crucial for the properties of the OLS estimators. In this case, the usual statistical results for the linear regression model showed consistency of estimators. You may know that, when variables are non-stationary, then the usual statistical results may not hold sway. In other words, the test for stationarity is the very foundation for co-integration test to be carried out. Also, Granger (1969) opined that most time series variables are non-stationary and using a non-stationary variable in the model might lead to spurious regression. Stationary test is therefore a must if we do not want spurious answer.

Table 4.1: Unit Root Test (Augmented Dickey-Fuller)

Variables	ADF Test	Critical Value			Order of integrat ion
		1% critical value	5%critical value	10%critical value	
GDP	-4.849536	-3.689194	-2.971853	-2.625121	1(2)
AGO	-5.040088	-3.670170	-2.963972	-2.621007	1(0)
CBCA	4.409101	-4.416345	-3.622033	-3.248592	1(0)
INR	-6.830144	-3.769597	-3.004861	-2.642242	1(1)

Source: Authors' Computed Result from (E-views 8)

The stationarity test result presented in Table 4.1 above shows that at various levels of significance (1%, 5% and 10%), the variables were stationary. AGO and CBCA were stationary at level (integrated of order zero). However, GDP was stationary at the second difference (integrated of order two). While INR was stationary at first difference (integrated of order one). Hence, the entire variables in this study are stationary. The test for the long-run relationship between the variables was conducted using the Johansen co-integration framework. For detail result of the Johansen co-integration, see the table 4.2 below.

Table 4.2: Johansen Co-integration Test

Eigen value	Trace Statistic	5% critical value	Prob. **	Hypothesis of CE(s)
0.759522	81.82081	47.85613	0.0000	None *
0.516335	40.49216	29.79707	0.0020	At most 1 *
0.389396	19.42762	15.49471	0.0121	At most 2 *
0.161894	5.121723	3.841466	0.0236	At most 3 *

Source: Computed Result Using (E-Views 8)

Table 4.3 reveals that there are four cointegrating equations at 5% level of significance. This is because the Trace Statistic is greater than critical values at 5%. Therefore, there exists a long-run relationship or equilibrium between the variables (GDP, AGO, CBCA and INR).

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Table 4.3: Short Run Result: GDP = f (AGO, CBCA and INR)

Variable	Coefficient	t-Statistic	Prob.
C	790274.2	6.448715	0.0000
AGO	0.187661	1.759288	0.0899
CBCA	0.427653	2.703614	0.0117
INR	-31578.78	-3.726324	0.0009
R^2=0.540882, F-Statistic= 10.60281, DW=0.774510, Prob.(F- stat=0.000000)			

Source: Authors' Computed Result from (E-view 8)

The short-run result as reported in Table 4.3 reveals that the coefficient of determination - R2 is 0.54, indicating that the variation in the gross domestic product (GDP) was explained by the agricultural output (AGO), commercial banks' loan to agricultural sector (CBCA) and interest rate (INR) is 54 percent. Therefore, the explanatory power of the model estimated is 54 percent.

Moreover, the coefficient of agricultural output (AGO) is positively signed and this conforms to apriori expectation; meaning that an increase in agricultural output or productivity (AGO) will lead to 0.187661 million increases in economic growth. Moreover, the absolute value of the t-statistic for the slope in coefficient is not significant at 5% level. This is because the t-calculated value of 1.759288 is less than the t-table of 2.045. Thus, we accept the null hypothesis which states that "there is no significant relationship between agricultural output and economic growth in Nigeria". The implication of this result is that agricultural output has impacted on economic growth of Nigeria during the period of study but not significantly; meaning that agricultural productivity has the ability to increase economic growth in Nigeria if it is well managed.

Furthermore, the coefficient of commercial banks' loan to the agricultural sector (CBCA) is positively signed and this conforms to our apriori expectation; meaning that an increase in commercial banks' loan to the agricultural sector (CBCA) will lead to 0.427653 million increases in economic growth. Moreover, the absolute value of the t-statistic for the slope's coefficient is significant at the conventional level (i.e., 5%). This is because the t-calculated of 2.703614 is greater than the t- table of 2.045. Thus, we reject the null hypothesis and accept the alternative hypothesis which states that "there is a significant relationship between commercial banks' loan to the agricultural sector and economic growth in Nigeria". The implication of this result is that commercial banks' loan to the agricultural sector has significantly impacted on economic growth of Nigeria during the period under study.

At the same time, the coefficient of interest rate (INR) has a negative sign implying a negative relationship between interest rate and economic growth. This also conforms to our apriori expectation; meaning that a percentage increase in interest rate (INR) will decrease economic growth. Moreover, the absolute value of the t-statistic for the slope's coefficient is significant. This is because the t- calculated of 3.726324 is greater than the t-table of 2.045. Thus, we reject the null hypothesis and accept the alternative hypothesis which states that "there is a significant relationship between interest rate and economic growth in Nigeria". The implication of this result is that interest rate variable has significantly impacted on economic growth of Nigeria during the period under study.

The entire regression model is significant given the f-value of 10.60281 with the probability (F-stat=0.000088). The Durbin Watson value of 0.774510 depicts the presence of serial autocorrelation.

Table 4.4: Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.
AGO does not Granger Cause GDP	30	1.02336	0.3207
GDP does not Granger Cause AGO		1.63507	0.2119
CBCA does not Granger Cause GDP	30	12.9860	0.0013
GDP does not Granger Cause CBCA		5.50629	0.0265
INR does not Granger Cause GDP	30	0.10661	0.7465
GDP does not Granger Cause INR_	_	5.90150	0.0221

Note: AGO, GDP, CBCA and INR as earlier defined.
Source: Computed Result Using (E-Views 8)

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Granger causality test which reveals the direction of causality between agricultural output and economic growth in Nigeria was conducted. The results of Table 4.4 revealed that there exists independence in causality between AGO and GDP. There is a unidirectional causality between CBCA and GDP; but, there is bidirectional causality between INR and GDP. This also reveals that the variables such as banks' credit to the agricultural sector (CBCA) and interest rate (INR) used in this study are necessary variables for achieving an increase in economic growth in Nigeria.

VIII. Summary

This study empirically examined the impact of agricultural output on economic growth in Nigeria from 1985-2015. Therefore, the broad objective of the research is to ascertain the impact of agricultural output on the economic growth of Nigeria from 1985 to 2015.

Furthermore, to achieve our objectives, we utilized data collected from secondary sources, particularly the CBN Statistical Bulletin on agricultural output, gross domestic product, interest rate, and commercial bank's credit to agriculture sector. The study adopted the ordinary least square (OLS), Co-integration, and Granger Causality methods of econometrics to analyse the data and showcase the relationship that exists between the variables.

The major findings in the study include:

1. There is no significant relationship between agricultural output and economic growth in Nigeria.
2. There is a significant relationship between interest rate and economic growth in Nigeria.
3. There is a significant relationship between commercial banks' loan to the agricultural sector and economic growth in Nigeria.
4. The long-run dynamic result (co-integration result) demonstrates that there is a long-run relationship or equilibrium between the variables.
5. The Granger result also revealed that there exists a unidirectional causality between CBCA and GDP, bidirectional causality between INR and GDP and independence Causality between AGO and GDP.

Policy Implication

The policy implication of the results of the research includes:

1. That, agricultural output has not contributed significantly to enhance the economic growth from 1985-2015 but has a tendency to do so. Hence, effective agricultural output enhancement policy should be put in place by the Government.
2. That, interest rate policy has enhanced economic growth from 1985-2015 meaning that interest rate has the potential to stabilize economic growth if it is properly managed by the monetary authorities.
3. Furthermore, we found yet another policy implication revealing that commercial banks' credit to the agricultural sector has been well enunciated and harmonized towards raising the economic growth of the country from 1985 to 2015 meaning that with the emphasis on funding; agriculture can bring about the desirable economic growth and eventually economic development.

IX. Conclusion

This study on the impact of agricultural output on economic growth in Nigeria from 1985-2015 is an important study as we examined empirically the degree to which agricultural output influenced economic growth in Nigeria from 1985 to 2015. With the utilization of data on GDP, AGO, INR and CBCA from CBN Statistical Bulletin and we use ordinary least square (OLS), Co-Integration, Granger Causality methods of econometrics to analyse the data so as to find out the relationship that exists between the variables. The regression results revealed that there is no significant relationship between agricultural output and economic growth in Nigeria; but rather, there is a significant relationship between interest rate and economic growth in Nigeria. There is also a significant relationship between commercial banks' credit to the agricultural sector and economic growth in Nigeria. The long-run dynamic result (co-integration result) also demonstrated that there is a long-run relationship or equilibrium between the variables. The study, therefore, concludes that suitable or effective agricultural output enhancement policy should be put in place by the Government. There should be appropriate interest rate policies that would bring about the stability of the economy and economic growth. Moreover, concerted efforts should be made by the monetary authorities with the emphasis on funding agriculture in order to increase economic growth in Nigeria.

X. Recommendations

It is necessary to provide a set of policy recommendations that would be applicable to the economy of Nigeria, hence, the following recommendations are postulated:

1. That, the agriculture sector of Nigeria should be paid more attention in order to increase the agricultural output which will lead to increased consumption (demand), investment, employment and eventually economic growth.
2. That, the monetary authority should re-evaluate her interest rate policies to stimulate investment and increase economic growth.
3. It is our recommendation that there should be a conscious effort by the monetary authorities to develop policies that would maintain and stimulate commercial banks' credit to the agricultural sector in order to further increase economic growth.

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4. The government should partner with the private sector carry out industrialized farming by intentionally shifting away from subsistence farming.
5. The Government of Nigeria should make consorted efforts to acquired farming implements, tractors; harvesters etc. and distribute to farmers at a subsidized rate.
6. The Government of Nigeria should increase output of agricultural products and make them available in the local market which will in turn reduce prices of these goods when purchased, so as to improve the standard of living of the populace.

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Appendix: I

Table 4.1: Data on AGO, CBCA, INR and GDP

YEAR	AGO(₦'M)	CBCA(₦'M)	INR%	GDP (₦ million)
1985	65748.40	1310.2	10	201036.3
1986	72135.20	1830.3	10	205971.4
1987	69608.10	2427.1	12.8	204804.5
1988	76753.70	3066.7	12.75	219875.6
1989	80878.00	3470.5	18.5	236729.6
1990	84344.60	4221.4	18.5	267550
1991	87503.50	5012.7	14.5	265379.1
1992	89345.40	6978.9	17.5	271365.5
1993	90596.50	10753.0	26	274833.3
1994	92833.00	17888.8	13.5	275450.6
1995	96220.70	25278.7	13.5	281407.4
1996	100216.2	33364.1	13.5	293745.4
1997	104514.0	27939.3	13.5	302022.5
1998	108814.1	27180.7	14.31	310890
1999	114570.7	118518.3	18	312183.5
2000	117945.1	146504.5	13.5	329178.7
2001	122522.3	200856.2	14.31	356994.3
2002	1901334.	227617.6	19	433203.5
2003	203409.9	242185.7	15.75	477533
2004	216208.5	261558.6	15	527576
2005	231463.6	262005.5	13	561931.4
2006	248599.0	239752.3	12.25	595821.6
2007	266477.2	149578.9	8.75	634251.1
2008	283175.4	106151.8	9.81	672202.6
2009	299823.9	165161	7.44	718977.3
2010	317281.7	140297.2	6.13	776332.2
2011	335180.1	137203.3	9.19	834161.9
2012	348490.8	147553.8	12	902794
2013	348600.4	97418.1	9.12	964184
2014	365332.8	127391.7	10.1	969969.1
2015	354141.3	1241212	10.41	945,649.00

Source: *CBN Statistical Bulletin (Various Issues)*

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Appendix II: Regression Result

Dependent Variable: GDP

Method: Least Squares

Date: 18/07/18 Time: 20:05

Sample: 1985 2015

Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	790274.2	122547.6	6.448715	0.0000
AGO	0.187661	0.106669	1.759288	0.0899
CBCA	0.427653	0.158178	2.703614	0.0117
INR	-31578.78	8474.514	-3.726324	0.0009
R-squared	0.540882	Mean dependent var		471742.1
Adjusted R-squared	0.489869	S.D. dependent var		258085.4
S.E. of regression	184333.5	Akaike info criterion		27.20680
Sum squared resid	9.17E+11	Schwarz criterion		27.39183
Log likelihood	-417.7053	Hannan-Quinn criter.		27.26711
F-statistic	10.60281	Durbin-Watson stat		0.774510
Prob(F-statistic)	0.000088			

Appendix III: Unit Root Test GDP @ level

Null Hypothesis: GDP has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.019106	0.7328
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GDP)

Method: Least Squares

Date: 18/07/18 Time: 20:06

Sample (adjusted): 1987 2015

Included observations: 29 after adjustments

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Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.019682	0.019313	-1.019106	0.3175
D(GDP(-1))	0.879523	0.202796	4.336992	0.0002
C	11332.43	7416.455	1.528011	0.1386
R-squared	0.499660	Mean dependent var		25506.12
Adjusted R-squared	0.461173	S.D. dependent var		24997.98
S.E. of regression	18349.73	Akaike info criterion		22.57031
Sum squared resid	8.75E+09	Schwarz criterion		22.71176
Log likelihood	-324.2696	Hannan-Quinn criter.		22.61461
F-statistic	12.98235	Durbin-Watson stat		1.930220
Prob(F-statistic)	0.000123			

GDP @ 1ST DIFF.

Null Hypothesis: D(GDP) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.770787	0.3868
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GDP,2)

Method: Least Squares

Date: 18/07/18 Time: 20:08

Sample (adjusted): 1987 2015

Included observations: 29 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-0.261957	0.147933	-1.770787	0.0879
C	5936.978	5197.382	1.142302	0.2634
R-squared	0.104052	Mean dependent var		-1008.800
Adjusted R-squared	0.070869	S.D. dependent var		19050.27
S.E. of regression	18362.83	Akaike info criterion		22.54052
Sum squared resid	9.10E+09	Schwarz criterion		22.63481
Log likelihood	-324.8375	Hannan-Quinn criter.		22.57005
F-statistic	3.135686	Durbin-Watson stat		1.661326

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Prob(F-statistic)	0.087887

GDP @ 2ND DIFF.

Null Hypothesis: D(GDP,2) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.849536	0.0006
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GDP,3)

Method: Least Squares

Date: 18/07/18 Time: 20:08

Sample (adjusted): 1988 2015

Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1),2)	-0.993634	0.204892	-4.849536	0.0000
C	-827.0933	3731.060	-0.221678	0.8263
R-squared	0.474938	Mean dependent var		-857.2571
Adjusted R-squared	0.454744	S.D. dependent var		26736.85
S.E. of regression	19742.88	Akaike info criterion		22.68772
Sum squared resid	1.01E+10	Schwarz criterion		22.78288
Log likelihood	-315.6281	Hannan-Quinn criter.		22.71681
F-statistic	23.51800	Durbin-Watson stat		1.872261
Prob(F-statistic)	0.000050			

AGO @ LEVEL

Null Hypothesis: AGO has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.040088	0.0003
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	

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	10% level	-2.621007

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(AGO)
Method: Least Squares
Date: 18/07/18 Time: 20:09
Sample (adjusted): 1986 2015
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGO(-1)	-0.948989	0.188288	-5.040088	0.0000
C	229143.6	75312.21	3.042582	0.0051

R-squared	0.475680	Mean dependent var	9613.097
Adjusted R-squared	0.456954	S.D. dependent var	456651.8
S.E. of regression	336514.2	Akaike info criterion	28.35501
Sum squared resid	3.17E+12	Schwarz criterion	28.44842
Log likelihood	-423.3251	Hannan-Quinn criter.	28.38489
F-statistic	25.40249	Durbin-Watson stat	2.010607
Prob(F-statistic)	0.000025		

CBCA @ LEVEL

Null Hypothesis: CBCA has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 7 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.409101	0.0102
Test critical values:	1% level	-4.416345	
	5% level	-3.622033	
	10% level	-3.248592	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CBCA)
Method: Least Squares
Date: 18/07/18 Time: 20:10
Sample (adjusted): 1993 2015
Included observations: 23 after adjustments

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Variable	Coefficient	Std. Error	t-Statistic	Prob.
CBCA(-1)	-5.980302	1.356354	-4.409101	0.0007
D(CBCA(-1))	4.716814	1.228746	3.838721	0.0021
D(CBCA(-2))	3.014632	1.287082	2.342222	0.0357
D(CBCA(-3))	3.720849	1.172000	3.174787	0.0073
D(CBCA(-4))	3.507607	1.213083	2.891480	0.0126
D(CBCA(-5))	2.217474	1.241579	1.786012	0.0974
D(CBCA(-6))	5.620902	1.117489	5.029941	0.0002
D(CBCA(-7))	2.738219	1.689949	1.620296	0.1292
C	-729524.5	173250.0	-4.210819	0.0010
@TREND("1985")	73443.82	15604.78	4.706495	0.0004
R-squared	0.799723	Mean dependent var		53662.31
Adjusted R-squared	0.661069	S.D. dependent var		234142.9
S.E. of regression	136312.8	Akaike info criterion		26.78231
Sum squared resid	2.42E+11	Schwarz criterion		27.27601
Log likelihood	-297.9966	Hannan-Quinn criter.		26.90647
F-statistic	5.767780	Durbin-Watson stat		1.626864
Prob(F-statistic)	0.002479			

INR @ LEVEL

Null Hypothesis: INR has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.766854	0.0751
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(INR)

Method: Least Squares

Date: 18/07/18 Time: 20:11

Sample (adjusted): 1986 2015

Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INR(-1)	-0.426701	0.154219	-2.766854	0.0099

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C	5.735154	2.159425	2.655871	0.0129
R-squared	0.214707	Mean dependent var		0.013667
Adjusted R-squared	0.186661	S.D. dependent var		3.778357
S.E. of regression	3.407523	Akaike info criterion		5.354189
Sum squared resid	325.1140	Schwarz criterion		5.447602
Log likelihood	-78.31284	Hannan-Quinn criter.		5.384073
F-statistic	7.655482	Durbin-Watson stat		2.124008
Prob(F-statistic)	0.009914			

INR @ 1ST DIFF.

Null Hypothesis: D(INR) has a unit root

Exogenous: Constant

Lag Length: 7 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.830144	0.0000
Test critical values:	1% level	-3.769597	
	5% level	-3.004861	
	10% level	-2.642242	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(INR,2)

Method: Least Squares

Date: 18/07/18 Time: 20:11

Sample (adjusted): 1994 2015

Included observations: 22 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INR(-1))	-4.243304	0.621261	-6.830144	0.0000
D(INR(-1),2)	2.620777	0.561206	4.669898	0.0004
D(INR(-2),2)	2.231555	0.508428	4.389124	0.0007
D(INR(-3),2)	1.876144	0.428113	4.382357	0.0007
D(INR(-4),2)	1.654110	0.357419	4.627926	0.0005
D(INR(-5),2)	1.196410	0.290492	4.118561	0.0012
D(INR(-6),2)	0.896085	0.202056	4.434846	0.0007
D(INR(-7),2)	0.490427	0.127922	3.833792	0.0021
C	-1.455488	0.456223	-3.190298	0.0071
R-squared	0.943110	Mean dependent var		-0.372273

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Adjusted R-squared	0.908101	S.D. dependent var	6.524771
S.E. of regression	1.977975	Akaike info criterion	4.494113
Sum squared resid	50.86102	Schwarz criterion	4.940449
Log likelihood	-40.43525	Hannan-Quinn criter.	4.599256
F-statistic	26.93894	Durbin-Watson stat	1.014766
Prob(F-statistic)	0.000001		

Appendix IV: Johansen Cointegration Test Result

Date: 18/07/18 Time: 20:12

Sample (adjusted): 1987 2015

Included observations: 29 after adjustments

Trend assumption: Linear deterministic trend

Series: GDP AGO CBCA INR

Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.759522	81.82081	47.85613	0.0000
At most 1 *	0.516335	40.49216	29.79707	0.0020
At most 2 *	0.389396	19.42762	15.49471	0.0121
0.161894	5.121723		3.841466	0.0236

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.759522	41.32866	27.58434	0.0005
At most 1	0.516335	21.06453	21.13162	0.0511
At most 2 *	0.389396	14.30590	14.26460	0.0492
At most 3 *	0.161894	5.121723	3.841466	0.0236

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

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Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

GDP	AGO	CBCA	INR
-4.87E-06	-3.76E-06	1.33E-07	-0.005775
-4.95E-06	4.30E-06	-2.34E-06	-0.282663
-1.13E-06	-2.21E-06	8.53E-06	-0.261526
1.87E-06	-3.64E-07	-1.56E-05	-0.062900

Unrestricted Adjustment Coefficients (alpha):

D(GDP)	5674.056	2981.818	7009.430	-3779.062
D(AGO)	117422.2	-137052.1	188969.9	17301.67
D(CBCA)	-160454.9	-27839.50	21821.11	21542.72
D(INR)	0.350857	1.384327	1.249937	0.885862

1 Cointegrating Equation(s):	Log likelihood	-1180.005

Normalized cointegrating coefficients (standard error in parentheses)

GDP	AGO	CBCA	INR
1.000000	0.772764	-0.027235	1186.563
	(0.14795)	(0.42201)	(7762.28)

Adjustment coefficients (standard error in parentheses)

D(GDP)	-0.027613
	(0.01578)
D(AGO)	-0.571447
	(0.37187)
D(CBCA)	0.780870
	(0.11896)
D(INR)	-1.71E-06
	(3.6E-06)

2 Cointegrating Equation(s):	Log likelihood	-1169.473

Normalized cointegrating coefficients (standard error in parentheses)

GDP	AGO	CBCA	INR
1.000000	0.000000	0.208262	27514.95
		(0.39300)	(7120.91)
0.000000	1.000000	-0.304746	-34070.43
		(0.49184)	(8911.73)

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Adjustment coefficients (standard error in parentheses)		
D(GDP)	-0.042360	-0.008509
	(0.02208)	(0.01818)
D(AGO)	0.106351	-1.031256
	(0.49172)	(0.40497)
D(CBCA)	0.918552	0.483649
	(0.16475)	(0.13568)
D(INR)	-8.55E-06	4.64E-06
	(4.7E-06)	(3.9E-06)

3 Cointegrating Equation(s):	Log likelihood	-1162.320

Normalized cointegrating coefficients (standard error in parentheses)

GDP	AGO	CBCA	INR
1.000000	0.000000	0.000000	35382.88
			(7442.73)
0.000000	1.000000	0.000000	-45583.43
			(9996.22)
0.000000	0.000000	1.000000	-37779.00
			(10198.8)

Adjustment coefficients (standard error in parentheses)

D(GDP)	-0.050279	-0.024023	0.053595
	(0.01987)	(0.01732)	(0.02502)
D(AGO)	-0.107135	-1.449480	1.949242
	(0.41409)	(0.36097)	(0.52137)
D(CBCA)	0.893900	0.435355	0.230148
	(0.16382)	(0.14281)	(0.20627)
D(INR)	-9.97E-06	1.87E-06	7.47E-06
	(4.4E-06)	(3.9E-06)	(5.6E-06)

Pairwise Granger Causality Tests
Date: 18/07/18 Time: 20:16
Sample: 1985 2015
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
AGO does not Granger Cause GDP	30	1.02336	0.3207
GDP does not Granger Cause AGO		1.63507	0.2119
CBCA does not Granger Cause GDP	30	12.9860	0.0013
GDP does not Granger Cause CBCA		5.50629	0.0265

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INR does not Granger Cause GDP	30	0.10661	0.7465
GDP does not Granger Cause INR		5.90150	0.0221
CBCA does not Granger Cause AGO	30	6.40261	0.0175
AGO does not Granger Cause CBCA		0.12959	0.7217
INR does not Granger Cause AGO	30	0.56743	0.4578
AGO does not Granger Cause INR		0.75673	0.3920
INR does not Granger Cause CBCA	30	0.40868	0.5280
CBCA does not Granger Cause INR		2.40960	0.1322

	GDP	AGO	CBCA	INR
Mean	471742.1	235292.5	134893.2	13.31194
Median	329178.7	117945.1	106151.8	13.50000
Maximum	969969.1	1901334.	1241212.	26.00000
Minimum	201036.3	65748.40	1310.200	6.130000
Std. Dev.	258085.4	327046.7	224212.3	4.069842
Skewness	0.746080	4.438162	4.013573	0.863025
Kurtosis	2.121989	23.22242	20.47466	4.356925
Jarque-Bera	3.871704	629.9916	477.6569	6.226477
Probability	0.144301	0.000000	0.000000	0.044457
Sum	14624004	7294068.	4181689.	412.6700
Sum Sq. Dev.	2.00E+12	3.21E+12	1.51E+12	496.9085
Observations	31	31	31	31

	GDP	AGO	CBCA	INR
GDP	1.000000	0.297001	0.523076	-0.554079
AGO	0.297001	1.000000	0.240209	0.060337
CBCA	0.523076	0.240209	1.000000	-0.189624
INR	-0.554079	0.060337	-0.189624	1.000000

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