The Effects of Capital Accumulation on Crop Production Output in Nigeria

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ABSTRACT
This study was aimed at investigating the effects of capital accumulation on crop production output in Nigeria. The study covered a period of 1980-2013. The objective is; to examine the effect of capital accumulation (Net National Savings (NNS), Gross Capital Formation (GCF), Human Capital Formation (HCF)) on crop production output (CRP) in Nigeria. The study employed the Ordinary Least Squares (OLS) and the Co-integration/Error Correction method (ECM) as the main analytical tools. One model was developed (Crop Production Output). The result of the Crop Production Output model revealed that the coefficient of ECM appeared with the right sign and statistically not significant at the 5% level. The Durbin Watson value of 2.2 suggests a lesser level of autocorrelation. The overall fit was satisfactory with an R-squared of 0.53 The F-statistic of 2.19 is significant at the 5% level. The result showed that all the variables used in the model had positive impact on crop production output but the impacts were not significant hence, the null hypotheses was accepted which states that capital accumulation (NNS, GCF, HCF) does not significantly affect crop. The results showed that capital accumulation has positive implications for crop production output in Nigeria. Policies on National savings should be reviewed and strengthened. This is because net national savings is abysmally low in Nigeria hence it is not impacting significantly on growths especially growth in the crop sector. Government policies on capital Investment in the crop sector should be increased and monitored to ensure that the target groups use the funds for the development of the crop sector.

Keywords: *Production, Capital Accumulation, Crop, Savings, Investments*

Introduction

Improving the production capacity of agriculture in developing countries through productivity increases is an important policy goal where agriculture represents an important sector in the economy. Agriculture comprises the main fields of human activity concerning the primary production of food and cash crops, livestock, fishing, forestry and marketing of the products. The Nigerian economy during the first decade after independence could be described as an agrarian economy because agriculture served as the engine of growth of the overall economy (Ogen, 2003). From the stand point of occupational distribution and contribution to GDP, agriculture was the leading sector. In the early 60's, contribution from this sector accounted for about 70% of the Gross Domestic Product (GDP). This was a period when we were not only virtually self-sufficient in production of food crops to feed ourselves but also provided raw materials for industries and major crops for export (Ekerete, 2000). Indeed, agriculture provided the main stimulus

to our national economic growth despite the small farm holdings and primitive productive systems. The role of agriculture in any economy is very well articulated in the relevant literature. Therefore, agriculture contributes greatly to government revenue, employment and the general economic performance – the higher the agricultural output, the higher will be the overall expenditure, savings and, ultimately, investment in the economy. Consequently, any activity that will boost agriculture will be expected to result in increased savings and investment. This will, in the long run, stimulate economic growth and reduce poverty. Unfortunately, Nigeria's agricultural sector suffers from extremely low productivity, largely due to its peasant nature. The sector has also suffered from unstable and often inappropriate economic policies (of pricing, trade and exchange rate), the relative neglect of the sector, the negative impact of oil boom era (NBS, 2014), a land tenure system that does not encourage long-term investment in technology or modern production methods and a severe shortage of rural credit (FAO, 2006). Given the central role of agriculture in Nigeria's economy, this situation does not augur well for savings and investment. So, the need for agricultural growth–driven government policy is inevitable for sustained economic growth in Nigeria. There is growing concern among researchers and policy makers over the declining trend in saving rates and its substantial divergence among countries. This is due to the critical importance of savings for the maintenance of strong and sustainable growth in the world economy.

The crucial role of capital in economic growth and development process has been recognized since the pre Keynesian era when the classical ideology monopolized economic thinking and policy formulation. Without doubt every nation in the world today still lays tremendous emphasis on capital accumulation by stressing the need for raising the level of investment in relation to output. This emphasis is traceable to the short term fiscal policies and national development plans of both the developed and the developing economies over the Past four decades. One important trend in development process which has remained consistent since civilization is that all developed nations are industrialized. Industrialization is associated with heavy investment financed through capital accumulation.

Capital accumulation as a component of economic growth and development in any society is the process of acquiring additional capital stock which is used in productive process. The foundation of capital accumulation is savings and it results when some portion of present income is saved and invested in order to augment future output and incomes. The extent to which the level of savings can affect capital accumulation and growth largely depends on the capacity of the economy to channel the savings into productive use. Higher savings then implies higher capital accumulation and hence, growth in the agricultural sector of the economy and in indeed the general economy. Many attempts are being made on a regular basis to study the relationship between capital accumulation and economic growth in less developing countries like Nigeria. It is believed that the people of LDCs are incapable of high level of individual savings for reasons like; low level of per capital income, indulgence in luxurious and conspicuous consumption by the few who could afford to save. According to Sims (2004), it may seem that given higher level of savings and investment, the capital stock will grow faster and a higher growth of income will result.

Statement of the Problem

Inadequate funding of the agricultural sector has been re-echoed by several experts as an obstacle to increased agricultural output (CBN 2007). However, from a nominal point of view, it is evident that in Nigeria, government spending on agriculture continues to increase over the years while empirical evidence have revealed that the performance of the agricultural sector has been inadequate (CBN, 2000). Two decades ago, Nigeria policy makers pursued a structural adjustment programme which shifted emphasis from the public sectors to the private sector. The goal was to encourage private domestic savings, private domestic investment and capital formation in order to enhance economic growth. In an attempt to achieve this goal, resources were diverted from current consumption and were invested in capital formation through privatization and commercialization of state enterprises. Unfortunately, the initial optimism expressed about public sector reforms has not been met. The growing demand for food in

both rural and urban areas requires that agricultural productivity must increase. However, population growth and pressure in Nigeria have affected the supply of productive land negatively in the country (Nwagbo and Achoja, 2001).

A trend analysis of the ratio of total savings to GDP in Nigeria showed that the saving rate has been fluctuating over time. The savings/GDP ratio was 2% in 1960. It increased to 7.8% and 11.6% in 1970 and 1980, respectively. In 1990 and 2000, it declined to 11.1% and 8.4% respectively. In 2011, the savings/GDP ratio in Nigeria stood at17.4% (CBN, 2011). Clearly, the relatively poor rates at which domestic savings in Nigeria is growing is a source of worry to agricultural growth and production in Nigeria. Investment is also of a special interest as a limiting factor to agricultural production capacity and production because an alarming trend is being observed: public and private investment in agriculture has been declining (FAO 2006). Meanwhile, Agriculture sector contribution to GDP fell from 48 per cent in 1970 to 20.6 per cent in 1980 and was only 23.3 per cent of GDP in 2005. With much focus on oil sector, the average contribution of agricultural sector output to GDP is about 13 percent (CBN, 2007; Obayori, 2014). Also, when agricultural production continued to be denied of the requisite manpower and the expected gross public and private investment, its productive capacity has continued to fall short of domestic consumption and as a major source of export earnings for the country. Therefore, growth in the various sectors of the economy like the agricultural sector and indeed the general economy is slowed down and economic activities neglected. The decline in public investment is of particular concern because public investment in basic infrastructure, human capital formation and research and development (R&D) are also necessary conditions for private investment in the agricultural sector. It is based on the above that answers would be provided to the following research questions. What are the impacts of gross domestic investments on crop production in Nigeria? What are the impacts of gross national savings on crop production in Nigeria? and does human capital formation have effects on crop production output in Nigeria?

LITERATURE REVIEW

Agricultural products are usually measured by weight or volume. An immediate question arises as to how to best combine different agricultural products since summing over weights or volumes is not very meaningful. One approach when dealing with crops is to convert them to a common physical unit, such as wheat units (Adelakun, 2011). More commonly, *aggregate* output in agriculture is measured in monetary units as the sum of the value of all production in the agricultural sector minus the value of intermediate inputs originating within the agricultural sector. Both cash and non-cash (barter, trade and self-consumption) transactions of final products should be included. This is referred to as "final output" and differs from agricultural GDP by not subtracting out the value of non-agricultural inputs. In other words, final output is the amount of agricultural output available for the rest of the economy, while agricultural GDP measures the net contribution of agriculture to the GDP of a country. Productivity measures are subdivided into partial or total measures. Partial measures are the amount of output per unit of a particular input. Commonly used partial measures are yield (output per unit of land), labour productivity (output per economically active person (EAP) or per agricultural person-hour). Yield is commonly used to assess the success of new production practices or technology. Labour productivity is often used as a means of comparing the productivity of sectors within or across economies. It is also used as an indicator of rural welfare or living standards since it reflects the ability to acquire income through sale of agricultural goods or agricultural production (Boldizzoni, 2008).

According to Lawanson (2009) Capital accumulation or formation refers to the process of amassing or stocking of assets of value, the increase in wealth or the creation of further wealth. Capital formation can be differentiated from savings because accumulation deals with the increase in stock of needed real investments and not all savings are necessarily invested. Recent literature has confused investment with capital formation. Investment can be in financial assets, human (capital) development, real assets that can be productive or unproductive. The increase in investment through non-financial assets has been held to

increase value to the economy and the increase in the gross domestic product through further increase in employment (Adekunle and Aderemi, 2012). The Central Bank of Nigeria (2007), defines capital formation as the total change in the value of fixed assets in the economy in addition to fixed assets either for replacing or adding to the stocks, it refers to the increase in the fixed capital stocks of the capital formed. Governments by their autonomous investment influence the direction of other investment by crowding in other investment as desired.

National Savings thus represents resources available to government and businesses for investment in infrastructure, purchase of capital goods, human capital growth among other uses. Higher savings and investment in a nation's capital stock contribute to increased productivity and stronger economic growth and sectoral growth like agriculture over long term. That is, savings today increases a nation's capacity to produce goods and services in the future. Production often brings about an increase in income either of individuals (businesses) or government and invariably a corresponding propensity to save from the additional income. Gollin (2002) defined savings as the residue of income of a government, a firm or a household after all their expenditures have been incurred. In national accounts terminology, savings is the net surplus of income over consumption or, stated differently, the amount of resources or income produced in the economy in a given period that is not consumed immediately but put to use in a way that will provide returns to the economy in future (Bakare, 2009). Saving, therefore, means forgoing consumption today so as to enjoy a better standard of living in the future while national saving, on the other hand, is the sum of saving by households, businesses, and all levels of government.

According to Ajie (2008) Human Capital is the skill, knowledge or abilities acquired by labour or a stock of assets in a country which allows an individual to receive a flow of income, which could be likened to interest earned in physical capital (Ajao 2011). Income of individuals is a function of human capital possessed by the workforce (Yesufu, 2000). From the view point of job performance, there may be substitution or complementary relationship between experience and training or education (Ogbuagu and Ewubare, 2014). Human Capital is a widely used concept with varying definitions which is sometimes taken to include only schooling (i.e. acquired formal education). In other circumstances, it is defined as wide set of investment that influences well-being and productivity of people, firms and nations like investments in health and nutrition, as well as vocational training (Akpokoje, 1998). Human Capital Formation on the other hand, is the process of acquiring and increasing the number of persons who have the skills, education and experience which are critical for the economic and political development of a country (Yesufu, 2000). Human Capital Formation is associated with investment in man and his development as a creative and productive person. There are different ways of acquiring and developing human capital. These various ways called human capital investment include investment in education, training, health promotion, as well as "investment in all social services that could influence man's productive capacities especially transport and housing (Okojie, 1995). Education is identified in most human capital studies as the most important component of human capital.

According to Ajie and Ewubare (2013) Gross Fixed Capital Formation can be classified into gross private domestic investment and gross public domestic investment. The gross public investment includes investment by government and public enterprises. Gross domestic investment is equivalent to gross fixed capital formation plus net changes in the level of inventories. Economic theories have shown that capital formation plays a crucial role in the models of sectoral growth in particular and economic growth in general. It is clear that even mildly robust growth rates can be sustained over long periods only when countries are able to maintain capital formation at a sizeable proportion of GDP
This phenomenon justifies the strong linkage between capital formation and economic growth. In order to trace the linkage between the capital formation and growth, the gross capital formation of each year is normally scaled to the gross domestic product (GDP). Thus, fluctuations in capital formation is said to have considerable effect on economic growth. However, the proportion of capital formation to GDP that can sustain a robust economic growth must not be less than 27 percent and in some cases, it must go as

high as 37 percent. The public sector reforms were expected to ensure that interest rates were positive in real terms and to encourage savings, thereby ensuring that investment funds would be readily available to the real sector. Besides this, the reforms were expected to lead to efficiency and productivity of labor; efficient utilization of economic resources, increase aggregate supply, reduces unemployment and generate low inflation rate. The decline in capital formation can be as a result of macro-economic imbalances such as deteriorating foreign exchange rate and corruption in public sector. The inadequacy in economic infrastructure such as poor power supply, bad road network as well as poor health facilities were equally responsible for the decline in capital formation over time.

Anyanwu (2009) applying Ordinary Least Squares technique, studied the determinants of aggregate agricultural productivity among small holder farmers in Rivers State, Nigeria. Cross- sectional data generated from 288 food crop farmers randomly selected from 5 out of the 23 Local Government Areas were used. Results of the analysis showed that farm land, labour input, planting materials, age of the farmers, farming experience, and level of education are the main significant determinants of aggregate agricultural productivity in the State. Lawal (2011) examined the factors that drive Nigeria's agricultural growth. Using hypothesized traditional factor inputs, he estimated a global agricultural production function for Nigeria based on the Cobb-Douglas model, assuming Hicks-neutral technological progress and they estimated an econometric model of total factor productivity (TFP) based on 'Solow Residual'. The analysis showed that Nigerian agricultural sector is characterized by increasing returns to scale, which implies that farmers are operating at the low end of the production function. The relatively more important factors that were found to influence Nigeria's agricultural value added include rainfall, technology (efficiency parameter) and fertilizer use; land area is the least important factor. Capital expenditure on agriculture, price of agricultural commodities, per capita income and investment rate in agriculture, human capital and access to credit are positive influences on total factor productivity. On the other hand, agricultural trade (openness), environmental degradation and agricultural output variability have negative influences.
Anyanwu (2009) used a profit function to econometrically estimate determinants of agricultural production in the country. The study indicated the importance of state marketing infrastructure and increased credit availability in stimulating crop production. He also found out that R&D had insignificant effect on crop production. A study undertaken in southern Ethiopia with the objective of assessing productivity and technical efficiency of small holder farmers, based on the data collected from 385 randomly selected farmers, showed that there was significant level of inefficiency among maize producing farmers. They used a two stage estimation technique, translog production function to determine the levels of TE followed by Tobit regression model to identify factors influencing technical efficiency. The model result depicted that productivity of maize was significantly influenced by the use of labor, fertilizer, and oxen power. The mean technical efficiency was found to be 40 percent and important factors that significantly affected the technical efficiency were agro-ecology, oxen holding, farm size and use of high yielding maize varieties.

Shumet (2011) used survey data collected by Tigray Microfinance in the year 2009 to estimate small holder farmers' technical efficiency and its principal determinants. He used both descriptive and econometric methods of analysis. In his study, he has tested the functional form, existence of inefficiency, and the joint statistical significance of inefficiency effects. The maximum likelihood parameter estimates showed that except labour all input variables have positive and significant effect on production. According to the study, the mean technical efficiency of farmers was 60.38 percent implying that output in the study area can be enhanced by 39.62 percent using same level of input and the current technology. The estimated stochastic frontier production function revealed that education of household heads, family literacy, family size, share cropping, credit access, crop diversification, and land fertility were found to have a positive and significant effect on efficiency. In contrast, Households' age, dependency ratio, livestock size, and off-farm activity affect efficiency negatively and significantly.

Kiani (2008) measured total factor productivity in the crops sub-sector and analyzed the relationship between productivity and agricultural research expenditures during 1970-2004 in Pakistan. They used Tornqvist-Theil index method for measuring total factor productivity using outputs and inputs for 24 fields and horticulture crops. Results indicated that total factor productivity index for crops sub-sector improved over time, at an average annual growth rate of 2.2%. Velazco (2001) examined trends in agricultural production growth for the period 1950-1995, identified factors that affect agricultural growth and investigated any underlying constraints. The study used a Cobb-Douglas production function and supply function to analyze data. The study looked at how changes in land, labour and fertilizer, the role of public and private investment, technological change, policy and political violence influenced Peru's agricultural sector. A specific outcome of the agricultural growth estimation of the aggregate production function for 1970-1995 indicated that increasing agricultural employment would have the greatest impact on the output, followed by land, fertilizer and tractors.

Tripathi (2008), however, argued that an improvement in not only labour but also capital and land productivity can improve agricultural productivity. They studied agricultural productivity growth in India and the impact of labour, capital and land on agricultural productivity growth from 1967-70 to 2005-06. A Cobb-Douglas production function was used to analyze data and the results indicated that output elasticity of land was 1.98, labour 1.06 and capital 0.15 and when added up they gave a sum greater than one. This meant all inputs had positive and significant influence on agricultural productivity growth. Zepeda (2001) examined agricultural investment and productivity in the context of developing countries. The study used number of models of production growth (index numbers or growth accounting techniques, econometric estimation of production relationships and nonparametric approaches) to measure the change in output, to identity the relative contribution of different inputs to output growth and to identify the Solow residual or output growth not due to increases in inputs. Results showed a relatively weak relationship between physical capital and growth, as compared to investment in technology and human capital. Other factors found to be stimulants to growth included; the policy environment, political stability and natural resources degradation.

Wiebeet (2001) indicated that an expected increase in output from improved infrastructure and price policies were difficult to quantify, but such improvements were probably prerequisites to make possible the increases in output productivity from the use of conventional inputs and research. Other important constraints to agricultural productivity were the quality and availability of education, research and extension services, as well as institutional uncertainties that weaken incentives to invest in the maintenance or improved of land quality. The study concluded that education of rural labour force and agricultural research is needed to improve the future prospects for productivity growth in SSA.

Several studies have been conducted to show the significance of public financing and investments in the agricultural sector in Nigeria. (Lawal, 2011) employed trend analysis and simple linear regression to examine the level of government spending in the agricultural sector and the consequential effect on GDP. The result of the study showed that public spending does not follow a regular pattern and the contribution of agricultural sector to GDP is in direct consonance with government funding to the sector. Bakare (2009) Studies applied the Cobb-Douglas production function to establish the relationship between credit and agricultural output. In general, there is consensus that credit influences agricultural output and its coefficient is positive. The other variables included in the agricultural production function are land, rainfall and capital. Kelly (2006) have argued that improved seeds and other inputs like tractors, fertilizer and biocides that may be purchased using credit money play an important role in agricultural production and these can be directly influenced by the availability of credit. Osei (2011) argues that credit affects production in the agricultural sector in three ways: (i) it encourages efficient resources allocation by overcoming constraints to purchase inputs and use them optimally. This sort of effect would shift the farmer along a given production surface to a more intensive and more remunerative input combination"; (ii) if the credit is used to buy a new package of technology, say high-yielding seed and other unaffordable expensive inputs, it would help farmers to move not only closer to the production frontier but also shift the entire input-output surface. In this regard, it embodies technological change and a

tendency to increase technical efficiency of the farmers, and (iii) credit can also increase the use intensity of fixed inputs like land and family labour, and management persuaded by the 'nutrition-productivity link of credit raises family consumption and productivity. Carter's reasoning implies that agricultural credit not only improves management efficiency but also affects the resource allocation and profitability. Okojie (1995) examined the role of public expenditures in agricultural research and extension on agricultural output. They show that between 1990 and 1994, real spending on research and extension programs increased by factors of four to seven and that research intensities more than tripled for the lowest income developing countries.

Ajao (2011) in his study concludes that long-term capital formation in Nigeria were not majorly sourced from the capital market as the above result shows the marginal contribution of Market Capitalization and New Issues to Gross Fixed Capital Formation. Though, it is unarguable that when investors take position for profit, it can affect the level of wealth which can then be used to build private capital. This result is in line with the findings of Gollin (2002) where he concludes that there exist no meaningful relationship between stock market capitalization and gross fixed capital formation. Orji and Mba (2010) in their study looked at relationship between FPI, Capital Formation and Growth, in Nigeria using the two-stage least squares (2SLS) method of estimation. The study finds that the long run impact of capital formation and foreign private investment on economic growth is larger than their short-run impact. There is thus, a long-run equilibrium relationship among the variables as the error correction term is significant, but the speed of adjustment is small in both models. In their result, the two stage least squares estimates are very close to the OLS estimates suggesting that OLS estimates are consistent and unbiased. Hence, endogeneity was not a problem in the estimated models. There is therefore no simultaneity between GDP growth and capital formation model.
Adekunle and Aderemi (2012) examined the relationship between Domestic Investment, Capital Formation and Growth in Nigeria. He used Secondary data from the Central Bank of Nigerian, for capacity utilization, capital expenditure, bank credit and capital formation while growth and investment rates from World Economic Information database were also used. His result shows that the rate of investment does not assist the rate of growth of per capital GDP in Nigeria. The study tests on the curve estimation regression models confirm that growth is in existence but is found to be insignificant. The linear result indicates the importance of government expenditure, capacity utilization and bank credit in increasing the income of Nigerians.

Using Vector Auto Regressive (VAR) and Vector Error Correction (VEC) model, Adelakun (2011) empirically investigated the relationship between savings and growth. Their findings rejected the Solow's hypothesis that saving precedes economic growth, and accept the Keynesian theory that postulated that it is economic growth that leads to higher savings. Bankole and Basiru (2013), focusing on the cause and effect relationship between domestic savings and growth in Nigeria for the period of 1980-2010. While employing Granger-Causality and Engle-Granger co-integration, he found that causality runs from savings to growth by accepting the Solow's hypothesis. Osei (2011) employed ARDL co-integration approach to determine the long run relationship among savings, investment and GDP for the period 1950-1951 to April 2003 and supported that the labor force and human capital have the most important effect on long-run growth in the sector. Adefeso and Mobolaji (2010) examined empirical determinants of private savings for a sample of economies in the Middle East and North Africa over a period of 1981 to 1994. Using lifecycles hypothesis and panel estimation techniques, he investigated the relationship between private saving rates and several macroeconomic policy and non-policy variables. He reported that per capita income has a positive coefficient and was significant. It was also revealed by the author that the young dependency ratio, the old dependency ratio and urbanization turned out statistically insignificant. The results indicated a negative and significant impact of government savings while inflation rates and terms of trade showed a positive and significant impact. The effect of interest rate on savings was not found to be statistically significant. Kanu., Ozurumba & Anyanwu (2014), on the other

hand, discussed the design of the research projects on saving in developing countries and its core database. They summarized the main projects and placed the results of the projects in the context of the literature on saving. The results showed that variables which are statistically significant included the terms of trade, foreign borrowing constraints, fiscal policy variables and pension system variables. They also stated that the influence of income is greater in developing than in industrial countries. They also found that growth rate increases the private saving rates. Anyanwu (2009) analyzed the determinants of private saving in sub-Sahara Africa. The study attempted to explain the region's dismal performance and identify policies that could help to reverse the decline in saving in the region. Empirical analysis showed that in sub-Sahara Africa, causality runs from growth to investment, whereas a rise in the saving rate Granger-causes an increase in investment. The empirical analysis was done on sub-Sahara Africa over 1970 – 1995. The result of the analysis revealed that Africa lags behind other regions (most notably, the high performing Asian economies) in its private saving. This is because of the region's low per capita income, high young–age dependency ratio, and high dependence on aid. The combined effects of these factors substantially outweigh Africa's advantage from its public saving and higher government consumption.

Nwachukwu and Odigie (2011) studied the determinants of private saving in Nigeria between1970-2007 using the ECM model. The finding of the analysis showed that the saving rate rises with both the growth rate of disposable income and the real interest rate on bank deposits; while public savings seems not to crowd out private saving, suggesting that government policies aimed at improving the fiscal balance have the potential of bringing about a substantial increase in the national saving rate. Also, the degree of financial depth has a negative but in significant impact on savings behavior in Nigeria and that agricultural production has a direct relationship with national savings. Adelakun (2011) employed two-stage least squares method of simultaneous equation modeling to examine the factors that determine household saving of rural agro-based firm workers in the south-south region of Nigeria. The results indicate that income, tax, job experience, education, family size and membership of a social group influence saving attitude of workers. Bankole and Basiru (2013) employed econometric model to examine financial system regulation, deregulation and savings mobilization in Nigeria by adopting an ex-post analysis of the Nigerian banking system. The results indicate that ex-post real interest rate is a significant determinant of both savings and real stock of money demand in Nigeria and that the higher the rate of savings the greater the output of agro based production. Temidayo and Taiwo (2011) examined the determinants of saving among cooperative farmers in Ondo State, South-western Nigeria. They obtained data from 15 cooperative farmers using structured copies of questionnaire. The results of their study indicate that household size, years of cooperative membership, interest rate on loan, gender and the amount of money borrowed are the significant determinants of savings among the cooperative farmers.

Nwachukwu and Odigie (2011) studied the determinants of private saving in Nigeria by comparing the estimation results of the ECM model with those of partial-adjustment, growth rate and static models. They found that real interest rate on bank deposits has a significant negative impact while external terms of trade, inflation rate and external debt service ratio have positive impact on private savings. They also found that savings rate rises with the level of disposable income; and that the ECM performed better than the other models and that agro production can only increase through increased private and public savings. Osei (2011) examined the functional relationships between financial savings and macroeconomic variables in Ghana using trend analysis and ECM methodology. The study found that level of investment, deposit rate, and level of income has significant positive impact on savings. Igbatayo and Agbada (2012) investigated the relationship between inflation, savings and output in Nigeria, employing Vector Auto regression (VAR) approach. The results indicate that inflation tends to reduce Output while savings actually stimulates output in Nigeria. Temidayo and Taiwo (2011) adopted descriptive statistics in carrying out a qualitative analysis of the relationship between domestic savings and agricultural production in Nigeria, using annual secondary data obtained from World Data Indicator (WDI), World Bank publication and Statistical Bulletin of the Central Bank of Nigeria for the period of 1970 to 2006.

The study concluded that the problem with agricultural production is not that of mobilizing domestic savings but that of intermediation; and thus recommended that government should adopt policy enhancing intermediation between savings and investment in the economy by providing regulating and coordinating role to ensure effective intermediation between savings and growth in the economy. Eregha and Irughe (2009) examined the impact of foreign aid inflow on domestic savings in Nigeria using an OLS methodology. The results indicate that both the short run and steady state foreign aid inflow to Nigeria have positive effect on domestic savings and invariably affect agricultural production. Ogwumike and Ofoegbu (2012) used an ARDL estimation technique to examine the impact of financial liberalization on Nigeria's domestic savings on 1970-2009. The study concluded that interest on deposit induced by liberalization was not the major determinant of savings.
Sarkar (2006) studied the relationship between domestic savings and agricultural growth for various economies with different income levels using the Granger causality test. He adopted the time series annual data from 1960 to 2001. His empirical results indicated unidirectional and bi-directional Granger causality from economic growth rate to growth rate of savings in thirteen countries and five countries respectively.

Human capital directly influences agricultural productivity by affecting the way in which inputs are used and combined by farmers. Improvements in human capital affect acquisition, assimilation and implementation of information and technology. Nkamleu (2007) used a stochastic frontier production (Maximum Likelihood Estimation, MLE) methodology to estimate the food production in Oyo State, Nigeria. The estimated mean level food production was 70 percent, ranging between 18 percent and 93 percent, indicating that with the present technology there is still room for a 30 percent increase in food production. Based on the result, age of farmers affects food production positively and significantly whereas farming experience and level of education have negative and significant influence on the level of food production.
Human capital also affects one's ability to adapt technology to a particular situation or to changing needs. Schultz (1963) attributed between 21 to 23 percent of the growth in U.S. income, between 1929 and 1957, to education of the labour force. Contemporaneously, Schutz (1963) focused on minimizing the unexplained portion of growth in U.S. agriculture by adjusting labour for quality, using education. When he included research and extension expenditure as an input to production, he found that virtually all the "unexplained" growth could be explained by economies of scale, R&D and labour quality changes. Farrell (1957) explored the role of farmer education and extension on farm efficiency. They found that farmer education and extension were not only important to enhancing production on Thai, Korean and Malaysian farms, but that there was an interaction effect between education and extension. In contrast, they found physical capital had an insignificant impact on production and profits.
On the other hand, some researchers are finding evidence that returns to education are low, especially for those who stay in agriculture. In their summary of the findings on the determinants of rural poverty for six country studies based on econometrically estimated income equations, Lopez and Valdes (2000) conclude that the return to education in farming is surprisingly small in most cases. An increase in one year in the average level of schooling raises per capita annual income of the family by less than US$ 20 per person in most cases. The main contribution of education in rural areas appears to be to prepare young people to migrate to urban areas and towns. Using an econometric approach, Okojie, (1995) examined sources of TFP growth in 83 industrial and developing countries for the period 1960-1990. They found that human capital formation was three to four times more important than raw labour in explaining output growth. Using human capital as a separate variable, they found that the countries with the fastest growing economies have based their growth on factor accumulation (human capital, labour and physical capital), not growth in efficiency or technology.

This study is unique in its form. This is because no study from empirical studies disaggregated capital accumulation into Net National Savings, Gross Fixed Capital Formation and Human Capital Formation as

explanatory variables to determine variations in crop productivity as a component of total economic growth in Nigeria. Also, this study seeks to determine both the short and long run impact of capital accumulation on crop production in Nigeria using OLS and cointegration/ECM methods. Also, the time frame of the current work is extended to 2013 to capture the resent reality in the Nigerian economy. These are the gaps the study identified to be filled.

METHODOLOGY

The research design employed for this study is quasi-experimental and explanatory in nature. The ordinary least squares regression analysis (OLS) and the co-integration/error correction mechanism were employed as the main analytical tools. The Ordinary Least Squares was adopted because of its desirable properties of best, linear, unbiased estimates (BLUE). The co-integration technique was employed to determine the long run equilibrium relationship between the variables in the models developed as well as establish the speed of adjustment of short run dynamics to long run equilibrium.

Model Specification

Both linear and nonlinear specifications were tried on the argument on equations

The specifications are as follows:

Model : Crop Production Output Model

$$CRP = f(NNS, GCF, HCF) \quad (1)$$

$$CRP_t = a_0 + a_1NNS_t + a_2GCF_t + a_3HCF + U_t \quad \text{(Linear)} \quad (2)$$

$$LogCRP_t = Loga_0 + Loga_1NNS_t + Loga_2GCF_t + Loga_3HCF + U_t \quad \text{(Nonlinear)} \quad (3)$$

Where:

a_0 = Intercept Parameter

a_1-a_3 = slopes Parameter

CRP = Output of crop Production

NNS = Net national savings

GCF= Gross capital formation

HCF= Human capital formation

All at time t.

***A priori* expectations**

On the apriori; $a_1 > 0$, $a_2 > 0$ and $a_3 > 0$

Data Collection Methods and Sources

The data for this study was time series data at the macro level spanning from 1980 to 2013. The data were largely sourced from National Bureau of Statistics Bulletin, Federal Ministry of Agriculture annual issues and Central Bank of Nigeria (CBN) statistical bulletin. The data include Crop Production output as dependent variable and Capital Accumulation as disaggregated into Net National Savings, Gross Fixed Capital Formation and Human Capital Formation as independent variable.

Techniques of Data Analysis

The statistical tool to be employed in analyzing the data of this study are; Ordinary Least Square method (OLS), the Error Correction Method of Co-integration based on Engle-Granger (1987) co-integration theorem and the Granger Causality test. The choice of these econometric approaches is premised on the fact that time series data are sometimes pronged to fluctuation that may cumulate into spurious regression result.

Ordinary Least Squares Regression Analysis

This test is employed to investigate the relationship that exists between the dependent and independent variables. The OLS method is chosen because of the considerable advantages associated with it (Wallace and Silver, 1988). These advantages include; Best Linear Unbiasedness (BLU), minimum variable, efficiency, least mean square (MSE) and sufficiency.

Unit Root Tests

The first stage of co-integrated technique is the unit root test, otherwise called test of 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 regressors and regressands is crucial for the properties of the OLS estimators. In this case, the usual statistical results for the linear regression model and consistency of estimators hold. But when variables are non-stationary, then the usual statistical results may not hold. Also Granger (1986) opined that most time series variables are non-stationary and using non-stationary variable in model might lead to spurious regression. Therefore a preliminary investigation into the analysis commenced with confirmation of the order of integration of the series, where the series is confirmed to be order 1, then, co-integration can then be performed. Time series analysis involving stochastic trends, Augmented Dickey-Fuller unit root tests was calculated for individual series to provide evidence as to whether the variables are integrated. This was followed by a co-integration analysis. Augmented Dickey-Fuller (ADF) test involved the estimation of one of the following equations respectively: The unit root model is presented thus:

$$\Delta Y_1 = \alpha Y_{t-1} + \sum_{i=1}^{m} \beta \Delta Y_{t-1} + \delta + Y_{1+} \varepsilon_1 \quad (3.4) \quad \text{for levels}$$

$$\Delta\Delta Y_1 = \alpha \Delta Y_{t-1} + \sum_{i=1}^{m} \beta \Delta\Delta Y_{t-1} + \delta + Y_1 + \varepsilon_1 \quad (3.5) \quad \text{for first difference}$$

The Co-integration Technique
The study adopted the co-integration estimation technique in analyzing our data. Co-integration is an econometric technique used for testing the correlation between non-stationary time series data. Usually time series data are non-stationary due to fluctuations that do characterize such information. Two variables are said to be co-integrated if they have a long run or equilibrium relationship between them or share a common stochastic drift (Gujarati, 2007). Hence co-integration technique has been developed to address the problem of spurious correlation often associated with some time series data.

Johansen's Test for Co-Integration: The basic argument of Johansen's procedure is that the rank of matrix of variables can be used to determine whether or not the two variables are co-integrated.
Suppose two variables X (human capital formation) and Y(net national savings), used in our analysis are integrated of order 1 and we are interested in finding out the equilibrium relationship between the two variables, then this method suggests a straight forward test whether two variables are co-integrated of order l(I) or not.

The Error Correction Model (ECM)
According to Iyoha and Ekanem (2011), error correction model (ECM) involves using lagged residual to correct for deviations of actual values from the long-run equilibrium. The error correction model (ECMs) parameter λ, which shall be negative, in general measured the speed of adjustment towards the long run equilibrium relationship between the variables.). The Error Correction Method is used to correct the inconsistencies in time series data for this study as well as provide short-run and long-run relationship amongst the variables.

Other Tests
Also to be tested in this research work are the following:

- Test for the co-efficient of determination (R^2) as test to know the explanatory power of the variables in the models (goodness of fit of the variables).
- Test of significance (T-test) of each of the parameter estimates.
- Overall significance (F-test) of the explanatory variables in the model.
- Durbin Watson test for serial autocorrelation.

RESULTS AND DISCUSSION

Table 1 Crop Output Net National Savings, Gross Fixed Capital Formation and Human Capital Formation, 1980-2013 (in million naira)

YEAR	CRP	NNS	GCF	HCF
1980	51.11000	5769.900	10841.20	
1981	52.00000	6562.600	12215.00	1852.300
1982	53.17000	7514.400	10922.00	1232.800
1983	50.28000	9443.900	8135.000	1421.100
1984	55.56000	10988.10	5417.000	1247.000
1985	57.50000	12521.80	5573.000	1051.400
1986	61.78000	13934.10	7323.000	1073.700
1987	49.60000	18676.30	10661.10	1455.200
1988	52.35000	23249.00	12383.70	889.9000
1989	94.35000	23801.30	18414.10	1527.300
1990	100.0000	29651.20	30626.80	2394.400
1991	118.0400	37738.20	35423.90	2952.400
1992	129.5900	55116.80	58640.30	2311.700
1993	133.8900	85027.90	80948.10	10683.60
1994	138.5100	108460.5	85021.90	13311.60
1995	141.9300	108490.3	114476.3	17580.20
1996	149.9700	134503.2	172105.7	20412.70
1997	154.8200	177648.7	205553.2	21747.00
1998	159.9600	200065.1	192984.4	38705.60
1999	165.4500	277667.5	175735.8	47743.80
2000	171.0100	385190.9	268894.5	85749.90
2001	143.4000	488045.4	371897.9	104396.1
2002	149.3000	592094.0	438114.9	172626.4
2003	196.1800	655739.7	429230.0	119121.6
2004	169.9000	797517.2	456970.0	153555.3
2005	181.5000	1316957.	472140.4	191720.9
2006	206.2000	1739637.	479243.6	270803.7
2007	195.1600	2693554.	492421.2	308171.8
2008	194.3000	4118173.	512438.4	256898.8
2009	198.5000	5763511.	494701.1	278624.7
2010	196.0000	5954261.	499853.5	281231.8
2011	196.3000	6531913.	502331.0	272251.7
2012	196.9000	6083228.	498961.9	277369.4
2013	196.4000	6189801.	500382.1	276951.0

Source: *CBN Statistical Bulletin (Various Issues)*

Trend Analysis of the Variables in the Models

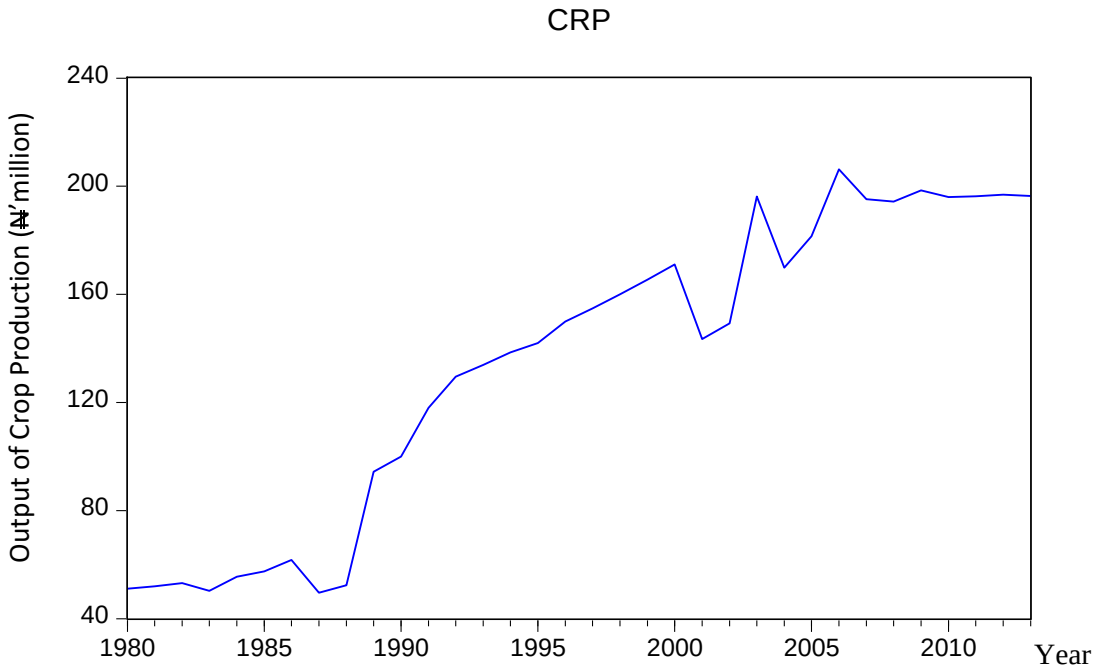

Figure 1 Trend of Output of Crop Production

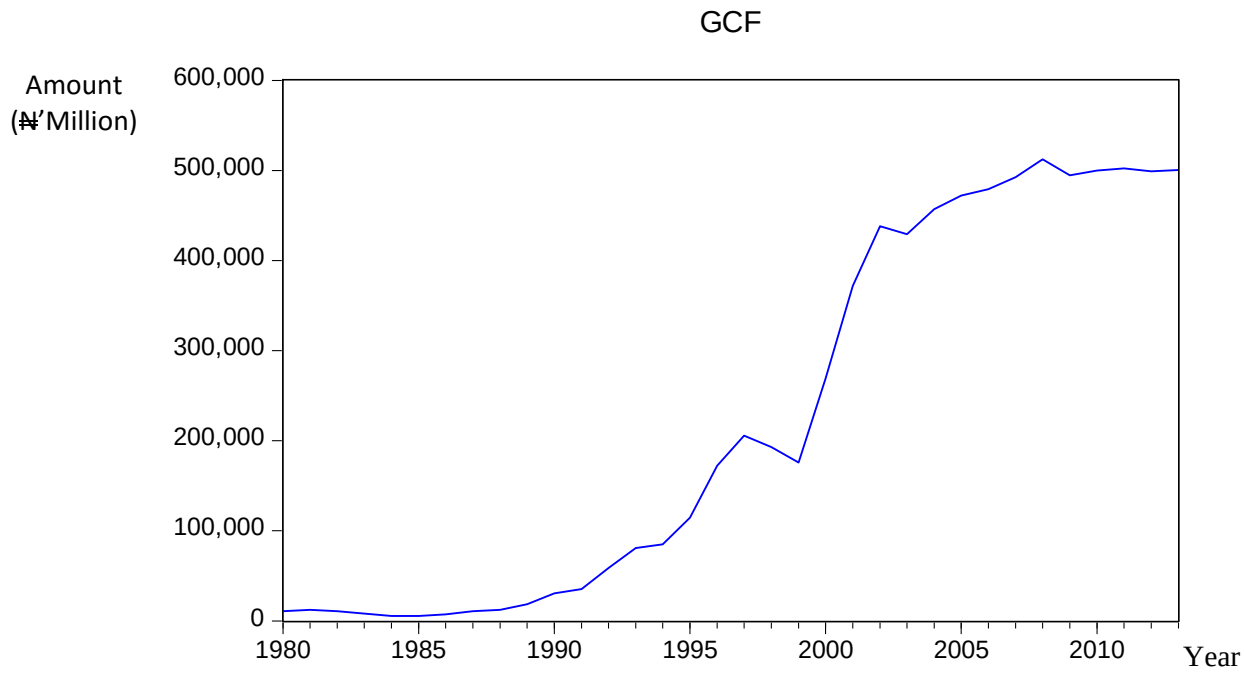

Figure 2 Trend of Gross Capital Formation

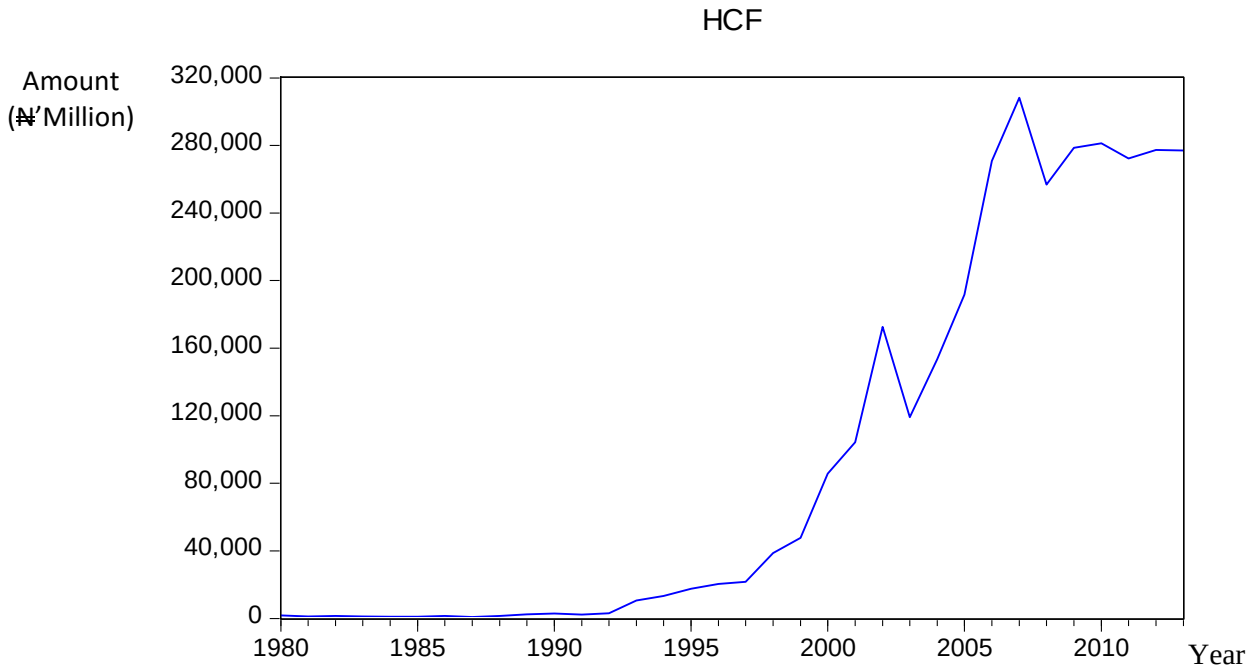

Figure 3 Trend of Human Capital Formation

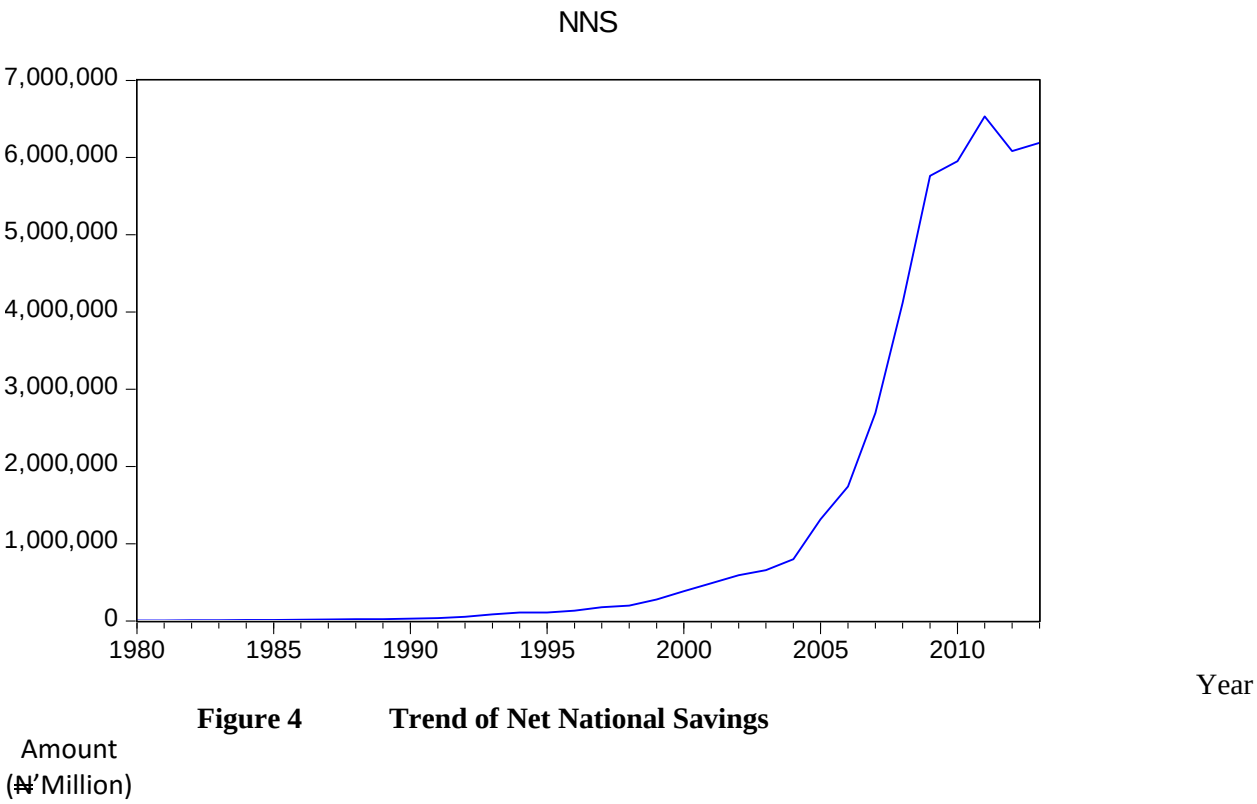

Figure 4 Trend of Net National Savings

Table 2 Analysis of Regression Result for Crop Production Output Model

Dependent Variable: LOG(CRP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.773279	0.309578	2.497848	0.0182
LOG(NNS)	0.070498	0.042115	1.673939	0.1045
LOG(GCF)	0.415264	0.064553	6.432960	0.0000
LOG(HCF)	-0.160428	0.066967	-2.395619	0.0230
R-squared	0.933970	Mean dependent var		4.783840
Adjusted R-squared	0.927367	S.D. dependent var		0.524357
S.E. of regression	0.141317	Akaike info criterion		-0.965495
Sum squared resid	0.599113	Schwarz criterion		-0.785923
Log likelihood	20.41342	Hannan-Quinn criter.		-0.904256
F-statistic	141.4468	Durbin-Watson stat		1.384375
Prob(F-statistic)	0.000000			

Source: *Computed Result from (E-View 7.1)*

Table 2 shows that the coefficient of determination (R^2) is 0.933 indicating that the variation in Crop Production Output explained by Net National Savings, Gross Capital Formation and Human Capital Formation is 93 percent. The Durbin-Watson value of 1.3 depicted the presence of serial auto-correlation. The regression result is spurious. This may be attributed to non-stationarity of time series data that was used for the study. Hence, the need to conduct stationarity test.

Table 3 Result of Unit Root (Stationarity) Test on Variables (1980-2013)

Variables	ADF Test	Critical Value			Order of integration
		1% critical value value	5% Critical value	10% critical	
CRP	-6.797855	-3.653730	-2.957110	-2.617434	I(1)= 1st Diff.
NNS	4.790816	-3.711457	-2.981038	-2.629906	I(0)=At Level.
GCF	-4.068590	-3.661661	-2.960411	-2.619160	I(1)= 1st Diff.
HCF	-5.765974	-3.653730	-2.957110	-2.617434	I(1)= 1st Diff.

Source: *Computed Result (E-view 7.1)*

Johansen Test for Co-integration

Co-integration is conducted based on the test proposed by Johansen. According to Iyoha and Ekanem, (2002) co-integration deals with the methodology of modeling non-stationary time series variables. For detail result of the Johansen co-integration.

Table 4 Johansen Co-integration Test Result for CRP Model

Eigen value	Max-Eigen Statistic	5% critical value	Prob. **	Hypothesized N0 of CE(s)
0.913386	70.94258	27.58434	0.0000	None *
0.828374	51.11065	21.13162	0.0000	At most 1 *
0.572326	24.63242	14.26460	0.0008	At most 2 *
0.099954	3.053975	3.841466	0.0805	At most 3

Source: *Computed Result (E-view 7.1) from Appendix IV*

Note: * denote rejection of the hypothesis at the 0.05 level. **Mackinnon-Haug-Michelis (1999) p-values. Max-eigenvalue test indicate 3 co-integrating eqn(s) at 0.05 level. Since there three co-integrating equations, the requirement for fitting in an Error Correction Model is fulfilled.

Error Correction Model (ECM)

Error correction model (ECM) is a means of integrating the short-run behaviour of an economic variable with its long-run behaviour (Gujarati and Sangeetha, 2008). One implication of Granger representation theorem is that if two variables are co-integrated, an Error Correction Term (ECT) is required to be included (Granger, 1988). The table below shows an inference error correction test conducted:

Table 5 Over Parameterized Error Correction Mechanism for CRP Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.803820	5.242890	0.916254	0.3762
D(CRP(-1))	0.245601	0.303290	0.809791	0.4326
D(CRP(-2))	-0.224723	0.241595	-0.930162	0.3692
D(CRP(-3))	0.164518	0.286076	0.575084	0.5751
D(NNS)	5.47E-05	3.37E-05	1.625447	0.1281
D(NNS(-1))	-1.10E-05	1.37E-05	-0.804932	0.4353
D(NNS(-2))	-3.90E-05	2.37E-05	-1.641340	0.1247
D(NNS(-3))	2.34E-05	1.83E-05	1.283090	0.2219
D(GCF)	0.000218	0.000202	1.074558	0.3021
D(GCF(-1))	-0.000229	0.000178	-1.290324	0.2194

D(GCF(-2))	0.000493	0.000287	1.719792	0.1092
D(GCF(-3))	-9.17E-05	0.000160	-0.572588	0.5767
D(HCF)	-0.000248	0.000129	-1.913399	0.0780
D(HCF(-1))	2.55E-05	0.000125	0.204294	0.8413
D(HCF(-2))	-0.000712	0.000382	-1.865833	0.0848
D(HCF(-3))	-0.000343	0.000253	-1.356655	0.1980
ECM(-1)	-49.14218	28.27676	-1.737900	0.1058
R-squared	0.661862	Mean dependent var		4.870667
Adjusted R-squared	0.245691	S.D. dependent var		15.03268
S.E. of regression	13.05603	Akaike info criterion		8.273462
Sum squared resid	2215.978	Schwarz criterion		9.067474
Log likelihood	-107.1019	Hannan-Quinn criter.		8.527473
F-statistic	1.590363	Durbin-Watson stat		2.330909
Prob(F-statistic)	0.201928			

Source: *Computed Result (E-view 7.1)*

Table 5 above shows the results of the over-parameterized error correction model CRP model. The reason for the over-parameterized specification is to show the main dynamic processes in the model and as well sets the lag length such that the dynamic processes would not be constrained by too long a lag length.
The over-parameterized is the transform in order to achieve the parsimonious ECM to make it more interpretable for policy implementation.

Table 6Parsimonious Error Correction Model for CRP Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.296850	4.036944	1.559806	0.1353
D(CRP(-1))	0.136830	0.239104	0.572263	0.5739
D(CRP(-2))	-0.043326	0.200726	-0.215846	0.8314
D(CRP(-3))	0.469274	0.186972	2.509861	0.0213
D(NNS)	-4.12E-06	7.12E-06	-0.578148	0.5700
D(NNS(-1))	-4.33E-06	7.14E-06	-0.607211	0.5509
D(GCF)	9.30E-05	0.000106	-0.877037	0.3914
D(GCF(-1))	4.72E-05	0.000105	-0.447721	0.6594
D(HCF)	9.77E-05	9.63E-05	-1.014744	0.3230
D(HCF(-1))	0.000168	9.57E-05	1.759115	0.0947
ECM(-1)	-4.924764	26.23700	-2.877031	0.0760
R-squared	0.534931	Mean dependent var		4.870667
Adjusted R-squared	0.290158	S.D. dependent var		15.03268
S.E. of regression	12.66535	Akaike info criterion		8.192192
Sum squared resid	3047.812	Schwarz criterion		8.705965
Log likelihood	-111.8829	Hannan-Quinn criter.		8.356553
F-statistic	2.185416	Durbin-Watson stat		2.217279
Prob(F-statistic)	0.068396			

Source: *Computed Result (E-view 7.1)*

CONCLUSION AND RECOMMENDATIONS

Inadequate funding of the crop sector has been identified by several experts as an obstacle to increased crop output in Nigeria. However, from a nominal point of view, it is evident that in Nigeria, government spending on crop continued to increase over the years while empirical evidence have revealed that the performance of the crop sector has been inadequate. Table 6 of the model showed that the coefficient of

ECM appeared with the right sign and statistically significant at the 5% level. Moreover, the current and lag one forms of the independent variables (GCF and HCF) were positively signed. While the current and lag one forms of the independent variable (NNS) are negatively signed. All these conform to apriority expectation. But for the one period, the independent variables were not statistically significant at 5 percent level. With these results, we accept the null hypotheses of the analysis which state that there is no significant relationship between capital accumulation and crop production output. In model two, the current and lags forms (i.e lag one and two) of the independent variables (GCF and HCF) were positively signed. While the current and lags forms of the independent variable (NNS) are negatively signed except lag one form that is positively signed. But for the one period, the independent variables were not statistically significant at 5 percent level. Table ECM appeared with the right sign but statistically not significant at the 5% level. Meanwhile, the lag one and three forms of the independent variables (HCF) are positively signed. But only the lag three form is statistically significant. Also, the lag one and three forms of the independent variable (GCF) are positively signed but not statistically significant. But for the independent variable (NNS), only the lag one period are statistically not significant while the lag three period is negative and statistically not significant. With these results, we accept the null hypothesis of the model which state that there is no significant relationship between capital accumulation and crop production output in Nigeria. Meaning that capital accumulation (proxied by net national savings, gross capital formation and human capital formation) alone does not spur crop output in Nigeria during the period under review. From this, it is obvious that the government has not done much to make capital accumulation impact significantly crop production output.

Policies on National savings should be reviewed and strengthened. This is because net national savings is abysmally low in Nigeria hence it is not impacting significantly on growths especially growth in the crop sector.

Government policies on capital Investment in the crop sector should be increased and monitored to ensure that the target groups use the funds for the development of the crop sector.

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