IMPACT OF SELECTED MACROECONOMIC VARIABLES ON AGRICULTURAL OUTPUT IN NIGERIA (1981 – 2017).

BY

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P15SSEC8005

A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES AHMADU BELLO UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTER DEGREE IN ECONOMICS

APRIL, 2021

DECLARATION

I, Simon, Ibrahim Achihereby declare that this research work is the result of my efforts which has been carried out under the supervision of Dr. Taofik M. Ibrahim and Dr. Damian Bernsah Lawong and has not been presented for the award of a master's degree in any place. All resources in the work have been duly acknowledged.

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CERTIFICATION

This is to certify that this research work titled **“Impact of Selected Macroeconomic Variables on Agricultural Output in Nigeria (1981 – 2017)”**by Simon Ibrahim Achimeets the regulations governing the award of Master of Science Degree in the department of Economics, Postgraduate School, Ahmadu Bello University, Zaria. This dissertation is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This dissertation is dedicated to my beloved mother, wife, siblings,and loved ones for their prayers and support to me during this Programme. I also want to use this medium to dedicate this research work to the Federal Ministry of Agriculture and Rural Development (FMARD) and all the International Agricultural Organisations for their efforts in seeing that the Nigerian populace have quality, affordable and sufficient food to eat in all the states of the country. Thank you for the efforts thus far.

ACKNOWLEDGEMENTS

In the name of the Almighty God, all praise be to Him, Master of the universe for the wisdom and understanding to carried out this research. It is vital to start by expressing my gratitude to Almighty God for granting me the strength and most of all the living opportunity to complete this study successfully.

I am delighted by the immeasurable efforts of my supervisors, Dr. Taofik M. Ibrahimand Dr.Damian B. Lawong for their immense contribution – patience, tolerance, advice and suggestions which have been of great importance to me in the course of this study. I sincerely appreciate your efforts and I say ‘thank you very much Sirs’, may the blessings of the Almighty God be with you and may He rewards you accordingly.Also worthy of commendation are all my lecturers in the Department for their efforts inequipping me with sound knowledge in different areas of economics. I am very grateful to you all.

I would like to appreciate the support and prayers of my beloved mother- Mrs. Laraba Simon Achi; my wife Alheri Ibrahim, my dear uncle – Professor Duniya G. Gambo; my siblings- Mr. Ezekiel, Mrs. Abigail L., Corporal. Nehemiah; Mr. Yohana and all my extended family members for all their enormous supports to me in the course of this study.

ABSTRACT

In the past 3 decades (1981-2017), the Nigerian government has set out various policies targeted at stimulating the macroeconomic variables and consequently affecting the agricultural outputs positively in the economy, but have inadequately achieved these goals. This is evidenced in the annual agricultural outputs which are always insufficient to cater to the rising population of the country. Hence, this study examined the impact of selected macroeconomic variables onNigeria's agricultural outputs (aggregate and dis-aggregated) over the time under review(1981-2017). The Cobb-Douglas Production theory formed the theoretical framework for the study. After reviewing relevant works of literature, the suitable analytical techniques (Johansen cointegration(long-run relationship), Fully Modified OLS(FMOLS(long-run impacts) and Error Correction Model (ECM)(short-run impact)) were chosen and employed. The five (One aggregate and four disaggregated) estimated Johansen results all indicated a long-run equilibrium relationship. Furthermore, the coefficients of the FMOLS results for aggregate agricultural output, in the long run, reveals that credit and Non-oil importsaresuitable macroeconomic variables that can be used to positively and negatively impact the aggregate agricultural outputs in Nigeria respectively. In the short run, non-oil exports impact much positively with a 24.6% increase for any 10% increase. While Non-Oil Imports impact much negatively to aggregate agricultural output with -20.6% for any 10% increase. For the sub-sectors, the FMOLS results for crop production suggested credit to be a more suitable variable to use to rapidly increase the sub-sector's outputs with a 2.07% increase to the output for a 10% increase; while Non-Oil imports can impose the most negative impact with -0.41% reduction the sub-sector's output for any 10% increase. And in the short run, Non-oil exports impact much positively with 0.804% for any 10% increase; while non-oil imports impact much negatively to the sub-sector with -0. 8.15% for any 10% increase. Again for a quick and much positive response in fish production, in the long run, the result suggests credit be the most suitable variable with a 2.323% increase in fish output for any 10% increase; while Non-Oil exports can impose the most negative impact with -1.996% reduction of fish output for any 10% increase. And in the short run, Non-oil imports impact much positively with a 0.990% increase in fish output for any 10% increase. While non-oil export impacts much negatively with -1.013%. reduction for any 10% increase. Considering the result obtained from the FMOLS estimation for the forestry sub-sector, to achieve the quickest and positive response in forestry production, in the long run, the result suggests Non-Oil export as the most suitable variable with a 0.616% increase to the forestry output for any 10% increase; while credit can impose the most negative impact with -0.716% reduction of forestry output for any 10% increase. In the short run, Non-oil exports impact much positively with a 0.322% increase in forest output for any 10% increase; while Non-Oil imports impact much negatively with a -0.255% reduction for any 10% increase. Finally, to achieve a fast and much positive response in livestock production, in the long run, the FMOLS result suggests labour as the most suitable variable with a 0.514% increase to the livestock output for any 10% increase; while public debt servicing can impose a quick and more negative impact on livestock output with -0.140% reduction in the output for any 10% increase. In the short run, labour impacts more positively with a 0.307% increase in the output for any 10% increase. Thus, the results obtained suggest that macroeconomic variables still affect the sector's outputs; and practical policy recommendations by policymakers to help and rapidly boost the sector output's growth is by helping farmers via the good provision of credit and helping them to market their produce at the international markets which can help them earn foreign currencies and thus, stimulate them to produce more and consequently lead to expansion of the whole sector vis-à-vis the Nigerian economy.

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LIST OF ABBREVIATIONS AND ACRONYMS

ACGSF	Agricultural Credit Guaranteed Scheme Funds
AU	African Union
CAADP	Comprehensive Africa Agriculture Development Programme
CBN	Central Bank of Nigeria
ECM	Error Correction Model
FMARD	Federal Ministry of Agriculture and Rural Development
FMOLS	Fully Modified Ordinary Least Squares
FAO	Food and Agricultural Organisation
IFAD	International Fund for Agricultural Development
NAB	National Agricultural Bank
NAIC	Nigerian Agricultural Insurance Corporation
NBS	National Bureau of Statistics
SAP	Structural Adjustment Programme
USD	United State Dollar
WFP	World Food Programme

CHAPTER ONE

INTRODUCTION

1.1 General Background of the Study:

Macroeconomic goals in every country are to increase the general output level with a minimal level of idle labour, a constant favourable balance of payments, price stability and a good standard of living of her citizens. For any economy to achieve these goals, it must be actively involved in the high production of its basic primary and secondary needs via a good relationship between macroeconomic fundamentals and real sectors of the economy (Sloman and Wride, 2009). Sometimes this relationship can be indirect; for instance, macroeconomic variables like interest rate and investment are capable of boosting the output level of an economy by linking the money and goods markets together. Again this indirect link may take a longer time, as several channels exist through which these variables have to penetrate and adjust for the markets to arrive at equilibrium level; thereby leading to positive output growth in the economy. At equilibrium, a high possibility for positive output growth is experienced, and this affects the volume of external trades (exports and imports) whose proceeds are used for continuous increase in growth and development of other sectors' capacity (McConnell & Brue, 2005). The World Food Programme (WFP) understood this in 2008, as it kicked against imposing export prohibitions or restrictions on agricultural foodstuffs purchased for non-commercial purposes, with the aim of achieving zero hunger by 2030 (Action Against Hunger, 2018).

Regionally, within the Sub-Saharan countries, the report by the Food and Agricultural Organization (FAO) revealed how agricultural output has helped the countries in the region to reduce the level of poverty and food insecurity (FAO, 2009). Despite the commendation by the FAO, most countries in the region to date have not reached the desired level of food production.

Hence, they cannot depend much on agriculture for products and export returns. This is because of poor management of some macroeconomic variables, combined with inconsistency in maintaining and adhering to good agricultural policies by some regional countries.

In Asia, available information revealed that China with 35 percent of its labour force in agriculture (425million agricultural farmers), can feed 22 percent of the world's population based on its different agricultural produce and products which are outcomes of modern technology and good management of some macroeconomic variables[1]. China was able to achieve this feat because the government played a major role in building and developing the sector to its present level via sound macroeconomic policies. For instance, the government raised loan balance from $43 billion to $ 127 billion from 2002 to 2005, adopted the use of micro-loans and joint guarantee group lending programme and practiced the land leasing method of agriculture which involves giving farmers land for as long as 30 years without any product nor financial costs (Hay, 2008 and Gale & Collander, 2006). Apart from China, some other countries(the United States of America(U.S.A); in the world are economically buoyant and rich in agricultural output not based on the large labour force, but rather, they invest massively in the sector through capital and labour, and shield the sector from the negative impacts of some macroeconomic variables.

In Nigeria, for the past two decades, the agricultural sector's output and value addition per capita have not adequately satisfied the demands of the people and the domestic industries; despite the large labour force which the sector accommodates. This could be attributed to the fast annual growth in the population of the country, while research works that have been carried out revealed

[1] Agriculture is a major source of income to most Chinese, as it was stated by Lauren Keane in Washington post, China has a long standing policy of food – self – sufficiency, growing about 95% of the grains required to feed its people. Any lower output can have a negative impact on the world food supply.

some factors like change in climate condition, other(Eyo (2008); Adama and Bobai (2010); Rebecca and Ogunbadejo (2014) among others) were of the views that macroeconomic variables like inflation, interest rate and lack of credit have been the major cause inhibiting the output growth in the agricultural sector over the years also play some part in the sector's inadequate outputs growth, while other studies' results revealed lack of public investment in the sectors as a challenge (Abel and Anoriode, 2015; Rebecca and Ogunbadejo, 2014; Sunday, Ini-Mfon, Glory, & Daniel, 2012 among others).

A report by the FAO through the Ministry of Agriculture and Rural Development (FMARD) in 2008 revealed that Nigeria lost an estimated 10 billion USD for the past 20 years due to poor post-harvest storage and inadequate value addition to produce. Furthermore, other studies by Adeoti and Sinh (2009), Anyawu and Adesope (2010) and Adesope and Okoruwa (2013) argued, that the poor performance of the agricultural sector can partly be attributed to the poor application of modern technology by most farmers which helps in adding value to the raw produce and low amount of expenditure (less than 4%) sunk into the sector which was evidenced from the National Bureau of Statistics (2018). Whereas Eyo(2008); Adama and Bobai (2010); Rebecca and Ogunbadejo (2014) among others revealed that some macroeconomic variables like inflation, interest rate and lack of credit have been the major cause inhibiting the output growth in the agricultural sector over the years(p 5,7 & 8).

Finally, Nigeria with its large heterogeneous population and abundance of fertile arable land that is suitable for the cultivation of different crops, ought to have lead other African countries if not compete at the global level in terms of good agricultural output. However, the negative effects of some macroeconomic variables (monetary and fiscal) may have deprived the country of this feat.

Hence, there is a need to examine some of these macroeconomic variables (inflation rate, interest rate, public debts servicing, total non-oil exports and imports) to determine the nature of their impacts to correct the negative effects they may have caused in the agricultural sector. (World Bank, 2016 and Abel & Onoriode, 2015)

1.2 Problem Of The Study:

The agricultural sector in Nigeria had the largest share of the labour force and output; and was massively engaged before the discovery and exploration of oil in 1956 and 1958 respectively (Olarinde and Abdullahi, 2014). After the discovery of crude oil, the sector was relegated to the background which led to some technical challenges especially in boosting its output capacity. Thus, making the impact of government policies on the sector to be ineffective coupled with the negative impact of some macroeconomic variables as identified and empirically proven by Adama and Bobai (2010); Okidim and Albert (2012); Ajudua, Davis, & Osmond, (2015); Oyetade, Shri and Abdulrazak (2016); among others that some macroeconomic variables like money supply, savings, inflation rate, unemployment rate, exchange rate, among others have affected the output rate of this sector in time past and probably till now.

Furthermore, some previous studies(Adama and Bobai(2010, Olarinde and Abdullahi, 2014 among others) and national statistical publications revealed and relate the problem to the meager amount of the total government expenditure injected into the sector compared to other sectors of the economy. For instance, the 2016 annual report by the Central Bank of Nigeria (CBN) revealed that for the past 7 years (2010 – 2016), the budgetary allocation to the sector has not exceeded 2%. For instance, in 2010, the budgeted figure stood at 1.32%, it increased to 1.47% in 2011; 1.67% in 2012 and 2013. The figure then reduced to 1.43% in 2014 and 0.90% in 2015 (CBN, 2016).

Furthermore, official data analyzed and presented in 2018 by the Nigerian Ministry of Budget and Planning, revealed that the central and state governments only budgeted 360.1 billion for agriculture. This represents only 2% of the 17.5trillion of Nigeria's cumulative spending of these two tiers of government in 2018; N254 billion (1.8%) in 2017 out of the cumulative spending of N13.5 trillion and N196.3 billion (1.6%) in 2016 out of the total budget of N12.5 trillion). This contradicts the 2003 Maputo African Union (AU) agreement which Nigeria is a signatory for because these figures do not show a substantial move by the Federal government to diversify the economy by moving away from the oil sector to a sector like agriculture. Considering the 2003 Maputo Declaration on Comprehensive Africa Agriculture Development Programme (CAADP), which requires all African Union member countries to allocate at least 10% of their National annual budgets to the Agricultural sector, in which some African countries like Burkina Faso (18%), Niger and Mali (15%) Malawi (13.8%), Ethiopia (11.9%), Senegal (10.8%) and Zambia (11.5%) have complied. However, the Nigerian government over the years has not implemented the terms of this agreement (CAADP, 2003).

In terms of good management of macroeconomic variables and policies consistency and Programmes in the economy, Nigeria has witnessed series of economic retardation because of some incompetency in line with these. Evidenced from the macroeconomic literature like Akpan (2015), Oyakhilomen and Rekwot (2014) and Udeaja and Elijah (2014), the inflation rate is still a variable of concern in Nigeria. For instance, from November 2014 to the third quarter of 2016 the inflation rate rose increasingly from 8% to more than 16.54% respectively. However, the Federal Ministry of Finance attributed the hike to be an exchange rate pass-through due to our import dependency, while the Central Bank viewed it as an outcome of the fall in global crude oil price and depletion of the foreign reserve that contributed to the high demand of foreign currencies, which brought about the rise in inflation. This showed how porous and weak the Nigerian foreign exchange system is, which allows for many fluctuations in the market. During those periods, the exchange rate (Naira to U.S. Dollar) appreciated from N188.45 (0.8%) per Dollar as of December 2014 to N366.19 (41.1%) per Dollar in 2016. Hence, the effect of this problem can spread, affecting other macroeconomic variables like real government expenditures, inflation rate, real money supply, public debt servicing, Unemployment rate, interest rate, external sector and the general output growth in the economy (Ibrahim, 2018).

Furthermore, the poor management of some macroeconomic variables and inconsistency in the implementation of national policies have also affected the agricultural output (Adama & Bobai, 2010; Rebecca & Ogunbaejo, 2014; Olarinde & Abdullahi (2014). For instance, policies ranging from the fourth National Development Plan (1981 – 1985) to policy on trade like the export boom (1984 – 1990). Furthermore, policy on foreign direct investment, which contributed to about 49.6% of the economy's growth in Nigeria in the early 1980s; to policy on structural development – Structural Adjustment Policy (SAP) introduced in the Mid –1980s, the Green Revolution Programme (1979 – 1983). Other policies include National Agricultural Land Development Authority (1992), National Fadama Development Project (1992), Roots and Tuber Expansion Programme (2003), the Agricultural Transformation Agenda (2016); export diversification in 2016 and most other reforms were not effectively implemented. The effects of these policies do not mirror agricultural output based on poor policy implementations. That may be the reason for the poor output growth in the sector for some time now especially from 2013 to 2016 as the 2016 World Bank Survey's report revealed. The report showed the average growth rate of the agricultural sector from 2006 to 2016 stood at 5.20%, which is not a good output rating for a country whose population is acutely rising daily.

This report (2016 World Bank Survey) and other evidence from the literature revealed the instability of the sector's output, which is worthy of note that, some macroeconomic variables can still affect the agricultural sector positively or negatively. Thus, there is a need for the investigation of the impact of other macroeconomic variables (Inflation rate, Interest rate, Public debts servicing, non-oil exports and imports) on the aggregate and disaggregated agricultural sector outputs, to proffer proper policy guides for the growth and development of the sector and its sub-sectors, vis-à-vis the Nigerian Economy. Hence, to address these problems, these questions were asked:

1.3 Research Questions:

a. What has been the trend of agricultural output and these selected Macroeconomic variables (inflation rate, interest rate, public debt servicing and non-oil external trade) in Nigeria?
b. What is the impact (long and short-run) of these selected macroeconomic variables (inflation rate, interest rate, public debt servicing and non-oil external trade) on the aggregate agricultural output in Nigeria?
c. What is the impact (long and short-run) of these selected macroeconomic variables (Inflation rate, Interest rate, public debt servicing and non-oil external trade) on the disaggregated agricultural output (Crop, Fisheries, Forestry and Livestock) in Nigeria?

1.4 Research Objectives:

The research questions stated above outlined the ways on how to achieve the objectives of the study, which are:

a. To examine the trend of agricultural output and some selected macroeconomic variables in Nigeria.
b. To determine the impact (long and short-run) of some selected macroeconomic variables (inflation rate, interest rate, public debt servicing and non-oil exports and imports) on aggregate agricultural output in Nigeria.
c. To investigate the impacts (long and short-run) of some selected macroeconomic variables (inflation rate, interest rate, public debt servicing and non-oil exports and imports) on disaggregated (Crop, Fishery, Forestry and Livestock) agricultural output in Nigeria.

1.5 Justification for the Study.

The justification for this study is underpinned by the observed gaps in the literature. These gaps are two folds: Empirical and methodological. First, is the measurement of the dependent variable (agricultural output), unlike Eyo (2008); Olarinde and Abdullahi (2014); Oyetade, et al. (2016) among others that considered the absolute monetary value, agricultural growth rate and index of agricultural production to measure agricultural sector's output in their models, this study considered both the disaggregated sub-sectors output (Crop Production, fishery, Forestry and livestock and Poultry) and the real aggregate share of agricultural sector's output (in relative terms) to Nigeria's real GDP.

The motivation for dis-aggregating the sector is for policy purpose. That is, to determine which of the macroeconomic variables in terms of government policy implementation can be used to yield greater growth in any of the sub-sector. In other words, if the government wants to encourage the cultivation of fish within the sector, which of these macroeconomic variables(inflation rate, interest rate, public debt servicing and non-oil exports and imports) would she stimulate more to achieve more output of fish. While the justification for using the relative share of real agricultural output and not absolute monetary value nor growth rate nor index of agricultural production is because there exists some degree of positive correlation between the real share of agricultural output to human lives in Nigeria. Unlike the absolute monetary value(share of nominal agricultural output) which measures agricultural outputs at current market prices without considering inflation, the real share of agricultural output considers the effect of inflation since it is measured at constant prices. Thus the more it increases the more it affects people's lives positively and vice-versa. Furthermore, works like Oyakhilomen and Rekwot (2014) and Akpaeti (2015) attempted to maintain only the fiscal and monetary variables impact on agricultural output in Nigeria respectively, however, this work will combine both monetary (Credit, inflation rate and interest rate) and fiscal (Non-Oil External Trade and Public debt services) variables to determine their impacts on the agricultural Output.

Second, the selected variables that were chosen and included in the model of this study and analyzed are much more different from previous studies. For instance, only Sunday, et al. (2012); Okoye and Clement (2015) and Lawrence and Clement (2017) had attempted to include and investigate the impact of external but not public debts servicing (domestic and foreign) on agricultural output and they used annual and not quarterly data. Hence, this study used quarterly data of public debt servicing as one of its variables to ascertain the impact of the agricultural sacrifice that is made when the government services public debts. Furthermore, this study includes a more related agricultural variable known as Non-oil trade (non-oil imports and exports) into its estimation model and investigate its impact on the agricultural sector’s output in the Nigerian economy as most of the reviewed studies did not incorporate the variable into their model. Since previous studies did not attempt to adequately investigate the impact of these selected macroeconomic variables on the real agricultural output in Nigeria thus, this study will add to the existing works of literature differently by including these variables. No doubt, these variables also may have positive or negative effects on the sector's output.

On methodology, most of the previous studies used descriptive statistics, Ordinary Least Squares (OLS) (Multivariate and Two-Stage), seemingly unrelated regression, VAR and one-step dynamic forecasting. Few works like Olarinde and Abdullahi (2014); Udeaja and Elijah (2014); Oyakhilomen and Rekwot (2014); Oyetade, et al. (2016); Aniekan (2015); Eze (2017) among others have reported this subject matter via the use of VAR and cointegration. These estimation techniques were used by these studies without correcting for the serial correlation, endogeneity and low convergence of large finite samples. Thus, the coefficients from such estimations may not be biased, but the t-statistics used to make inference may not be consistent and a type 1 error may be made (Kao 1999, as cited in Studenmund, 2016). It is on these notes that the researcher opted to exploit the fully modified Ordinary Least Squares (FMOLS) for long-run impact coefficients and the Error Correction Model (ECM) for short-run impact and to determine the speed of adjustment to equilibrium using quarterly data. The choice for the use of quarterly data is because annual data does not give a good account of lead/lag relationships; furthermore, quarterly data gives a quick reaction to level shifts and changes in trends more than annual data since it is modeled quarterly and not annually (Tom, 2018).

1.6 Scope Of The Study:

The study empirically determined the impact of selected macroeconomic variables (inflation, interest rate, public debt servicing, non-oil exports and non-oil imports) on agricultural output in

Nigeria using quarterly Nigerian time-series data from 1981 to 2017. The selection of the period in question (1981 – 2017) is to determine the extent to which some macroeconomic variables affect the agricultural sector's output despite several attempts by the government to boost the sector's output via different policy reforms. Furthermore, the period culminates in the vast accumulation of external reserves and the Structural Adjustment Policy, which comes with the abolition of the agricultural marketing board, and several other institutional and pricing policies. Finally, this is a period where some financial reforms with the view of stimulating the agricultural sector were initiated and implemented. For instance, the early initiation of the Agricultural Credit Guarantee Scheme Fund(ACGSF) that was established by Decree number 20 of 1977, and fully started in 1978 is one among many policies that we need to determine its impacts on Nigeria's real agricultural output. Besides, the 1994 – adoption of pegged exchange rate system, 1996- the liberation of the utilization and disbursement of exports proceeds by exporters, the creation of risk department for a micro guideline for farmers in 2010 and other financial policy reforms (Ajibola, Udoette, Omotosho, & Rabia, 2015 and Alex, 2012).

1.7 Organisation of the Study:

The study was structured into five chapters; Chapter 1 contains the general introduction, which comprises the background of the study, the research problem, research questions, research objectives, justification for the study, the scope of the study and organization of the study. Chapter 2 has the review of related works of literature by presenting the conceptual, theoretical and empirical issues and stylized facts. While chapter 3 has the theoretical framework and methodology of the study; Chapter 4 focused on the trend analysis, estimations, presentation and interpretation of empirical results and key findings; and finally chapter 5 encompasses the summary, conclusion and policy recommendations of the study.

CHAPTER TWO

2.0 LITERATURE REVIEW

This chapter contains a detailed explanation of reviewed concepts, reviewed theories, with the exposition of more stylized facts and empirical review and gaps found in the literature.

2.1 CONCEPTUAL LITERATURE:

2.1.1 Agricultural Output:

For a good and general understanding of the term agricultural output, it is important to understand first the term agriculture. "Ager" or "Agri" is the Latin word for Agriculture, which means "Soil" and "Cultura" meaning cultivation. Hence, in simple form agriculture is the cultivation of the soil. Nevertheless, this is just a peripheral view because agriculture goes beyond this level. As defined by Agrislide, 2017 as "a branch of science and art of farming including the work of cultivating the soil, producing crops, planting forest plants/trees, raising livestock and rearing fishes. Also defined by Monteith (1958), "Agriculture is an exploitation of solar energy made possible by an adequate supply of water and nutrients to maintain plant growth." It has three scope branches – Aeroponic (plantation horticulture, forestry) Geoponic (pomology, floriculture and arboriculture) and hydroponic. In Nigeria, these three branches are further divided into four areas by the national system of accounting and it is generally acceptable- Crop Production: (Which deal with the cultivation of different species of crops for man and animal use.) Forestry: (This area takes care of the cultivation of trees for domestic and industrial use such as firewoods, furniture building constructions and even in medical lines such as pharmacognosy.) Livestock and Poultry: (This section of agricultural production involves the raising of farm animals for meat consumption. These farm animals include dairy cattle, pigs and poultry -the production of birds and their produce e.g. Eggs; Genetic mutation research takes place in this area). (Monteith, 1958). All these outputs put together accounted for the agricultural output of every economy.

In the area of literature, various previous studies conceptualized this term differently. Studies like Eyo (2008); Okidim and Albert (2012) and Olarinde and Abdullahi (2014) were the few among other studies that conceptualized agricultural output as the combination of all the outputs that are harnessed from the different fields of agriculture; and these outputs are usually measured in tons with the value of currency tag to it. Different scholars viewed and conceptualized Agricultural output based on the context of what they are investigating. Hanumanthappa (2014) conceptualized agricultural output in India as the total value of agricultural productivity which every household was able to produce within a farming season. The outcomes can be in money terms and non-money terms. While Farm Business Survey (FBS) (2005), conceptualized agricultural output in England as the main measure of total individual crop and livestock output which encompasses Crop enterprise output, Livestock enterprise output, By-products output, forage and cultivations- which cover the value of the output of the by-products of agricultural activity, sales of fodder and valuation changes for fodder. It also covers revenue from the letting of bare land or forages on a short-term lease), and Miscellaneous output.

In Nigeria, studies like Olarinde and Abdullahi (2014); Obi and Obayori (2016) and Ekine and Nwaokedibe (2018) viewed Agricultural output to be the total monetary value realized from the sale of all the volume and tons of crop production, forestry, fishery, livestock and poultry produced in the country within an annual season. In this study, we conceptualized agricultural output to be the total annual farm outputs (Crop, fishery, forestry and livestock) that are consumed and traded locally and internationally and that are measured in real monetary terms which is capable of improving the living standard of Nigerians.

2.1.2 Macroeconomic Variables:

Macroeconomics variables are the group of economic variables that deal with the overall functioning and wellbeing of any economy. Economically, the proper management of these variables can lead to the general improvement in the general output in the economy and the living standards of the citizens as well (Mankiw, 2010). Thus, they are constantly considered, targeted and used when implementing an economic policy, because they have the power to affect every economic agent in the economy (Oyakhilomen and Rekwot 2014; Akpan 2015). Thus, they influence the two main markets of the economy: The Factor and products markets as they are always used alongside economic policies that are implemented via two channels namely: The monetary and fiscal channels. The monetary channel includes the control of money and other monetary assets for the growth and development of the economy; through the control of cash liquidities or non-cash liquidity. The fiscal channel deals with government spending, borrowing, taxes, exchange rate determinants, credit rules, etc. The impact of these variables through these two channels in any economy can be positive or negative depending on the time of introduction of the policy and the kind of variables that were employed. Hence Macroeconomic variables are used to pursued and bring about the proper functioning of the economy and stability with policy objectives focus on: full employment, price stability, economic growth and balance of payment deficits. (World Bank, 2018)[2].

Different scholars have conceptualized macroeconomic variables over the years differently. In Ghana, Patrick and Prudence (2013) conceptualized macroeconomic variables to be Labour force, Inflation, exchange rate and real GDP, while Barros (2015) and Dlamini (2015), in Mozambique and Swaziland respective conceptualized macroeconomic variables to be Exchange Rate, inflation, Official Development Assistance. (ODA) interest rate, government expenditure,

[2] (www.worldbank.org/topic/macroeconomics/brief/macroeconomic-policy

government expenditure in agriculture, money supply exports and real GDP. In Malaysia, Shariff and Zainab (2015) viewed it to be exchange Rate, Net Exports, government expenditure, inflation rates, money supply and interest rate. While in Iran, Karbasi, Sabohi and Tavana (2008) conceptualized it to be exchange rate, net exports, government expenditure, inflation rates, money supply and interest rate. In Nigeria, some scholars also have conceptualized this concept differently depending on what they want to achieve. For instance, some earlier reviewed studies before 2013 like Eyo (2008); Adama and Bobai (2010) and Okidim, (2012) all have majorly considered exchange rate and inflation in conceptualizing this concept.

In 2015, Aniekan (2015) conceptualized it to be total savings, private sector, real GDP, agricultural investment, interest rate and Exchange Rate. While Okoye and Clement (2015) viewed it to be Exchange rate, interest rate, inflation rate, external debt, terms of trade and trade openness. Okoye and Clement's (2015) conceptualization was different from Aniekan, (2015) by introducing Inflation, debt and trade into his model which gives the view that external trade can impact agricultural output in Nigeria. He considered oil included trade and failed to restrict to Non-oil trade. Thus, the Inflation rate proxy by Consumer Price Index, interest rate, public debt servicing and external trade is the main macroeconomic variables that are considered in this study.

The difference between some of the variables used in this study and the previous studies are in public debt servicing, as we considered not only external or domestic debt alone but both every quarter for 37 years, another difference is non-oil external trade: which we considered as it is void of crude oil influence and more related to the agricultural outputs we produced and the inputs we used in farming activities. These also may have an impact on the agricultural sector’s output. Besides, one of the selected macroeconomic variables that are most concerned by every economy is inflation. Inflation is an economic situation in which general prices of goods and services arise rapidly and continuously causing a corresponding fall in the volume of money. Inflation in Nigeria over the years has been a macroeconomic variables issue that the Nigerian monetary authorities have always try to bring the rate to a one-digit figure but it is still not achievable, this has affected the agricultural output in different ways (Oyakhilomen and Rekwot 2014).

Another macroeconomic variable of concern that affects most real sectors in any economy is the rate of interest and Public debt servicing. As defined by the Cambridge School- Alfred Marshall, "It is the rate that is paid as a return on capital in any market." In other words, it is the reward for the use of capital (money or assets terms). The Keynesians defined it as "the reward for parting with liquidity for a certain period." Paid either in Net or in Gross. It is paid in the net when it is paid purely for the use of money, which is usually determined by the forces of demand and supply. One of the rules applied in the determination of interest rate is Taylor's rule, which is segmented into three: Contemporaneous Taylor's rule, Backward- Looking Taylor's rule and finally the forward-looking Taylor's rule (Handan, 2009 and CBN, 2016). While public debt is defined by Arnone, Bandiera and Presbiterio (2005), "as that portion of a country's resources that are acquired from foreign and local sources by the government of that country with the consent of paying back in future time.

2.2 Theoretical Literature Review.

This section gives an account of some reviewed relevant literature that related to this study. This gives the study a good theoretical perspective and exposes it to a suitable theory that best suits the subject matter.

Table. 2.2 List of some earlier studies and their theoretical framework.

S / N	Topic	Author /year	Country	Theory / Framework Employed
1	Macroeconomic Policies and Agricultural Development in Developing Countries: Lessons from Emerging Economies.	Obasaju B.O, Oloni F.E Obadiara E.D & Rotimi M.E (2014)	Nigeria	General Equilibrium
2	Impact of Macroeconomic policy on agricultural growth in Nigeria.	Ariode, Ojiyyovwi Rebecca & Ogunbadejo H. Kehinde (2014)	Nigeria.	John Hick – General Theory of IS-LM
3	The Determinants of Agricultural Productivity in Kenya	Anders Ekbom (1998)	Kenya	Cobb-Douglass Production Function
4	Which Macro Factor influence agricultural production in Ghana	Patrick Enu & Attah – Obeng (2013)	Ghana	Cobb-Douglass Production Function
5	Macroeconomic Factors and Agricultural Sector in Nigeria.	Oyetade P. Oluwatoyese, Shri Dewi & Nor Azam Abdul Razak (2016)	Nigeria	Production Function.
6	Response of Nigeria's Agricultural Sector to Selected Macroeconomic Policy Variables.	Pius Chinwuba Ike & Abel Ejiroghene Onoriode (2015)	Nigeria	Stimulus-Response and Production Function
7	Institutions, Macroeconomic policy and the growth of the agricultural sector in Nigeria (2012)	Benson U. Omjimite (2012)	Nigeria	Endogenous Growth Theory/model
8	Macroeconomic Policy and Agricultural Output Implications for Food Security.	Muftaudeen Olarinde O. & Hussainatu Abdullahi (2014)	Nigeria	Endogenous Growth Theory/model
9	Influence of Finance and Macroeconomic Variables on Manufacturing Capacity Utilisation in Nigeria. (2015)	Okoye Lawrence Uchenna & Clement Nwakoby (2015)	Nigeria	Dependency Theory of Development
10	Macroeconomic Environment and Agricultural Sector in Nigeria.	Emmanuel O.Eyo (2008)	Nigeria	Theories Of Agricultural Development- The High - Pay-Off- Input theory.

Source: Author's Compilation from previous studies.

The earlier research works have attempted to establish some theoretical linkages between some macroeconomic variables and agricultural output. Some studies revealed that some of the theories are more microeconomic than macroeconomic; an example is the theory of production function. While others have a view that some theories are more of macroeconomic than microeconomic example is the John Hick IS-LM, the Endogenous growth theory and the general equilibrium theory. To have good insights into the previous studies' theories and frameworks, a list of some literature among other reviewed literature is drafted in table 2.2. From table 2.2 above, it is obvious that different studies employed different theoretical frameworks to explain the link between macroeconomic variables and agricultural output in Nigeria and other African countries. Obasaju, Oloni, Obadiara, and Rotimi (2014) opined that the neoclassical General Equilibrium theory is good when explaining a macroeconomic study like this as they employed it to explain the determinants of agricultural productivity in Nigeria.

Walras (1955) first initiated and explained this theory. He asserts that the general equilibrium theory is a general interconnectedness of all economic markets that establish a uniform price, demand and supply. He stated that the business firms are the buyers in the product market as well the same sellers in the same market. The subset of the general equilibrium is the partial equilibrium that considers one market and one price that regulate the demand and the supply. Moreover, as explained by Levin (2006), general equilibrium is one of the recurrent themes of economic analysis which has a remarkable degree of coherence among the vast numbers of individual and seemingly separate market decisions about the buying and selling of commodities which determine the general price. This is true in application to the Nigerian economy; as there is always a need for balancing between the total amount of goods and services supply and the amounts that other different individual groups want to sell. The buyers would ordinarily count correctly on being able to carry out their intentions, and would there be sellers who do not ordinarily find themselves producing great amounts of goods that they cannot sell. Some of these questions still beckon for answers in Nigeria.

Another similar theory that incorporates some number of markets that may lead to economic activities and growth in the economy is the Hicks and Keynes Model of IS-LM model (Rebecca

& Ogunbadejo, (2014)). The IS-LM is a model that revealed the rate of interest and money supply that is capable of rebalancing and achieving a better national output. Some scholars like Mankiw (2010) opined that the model gives the good direction of how every economy ought to work, because of its synthesis of savings, Interest rate and money which gives more opportunity for investment and also money supply which influences the demand for money in the economy, however, few among many works of literature employed this macroeconomic model. It may be due to its long mechanism channels of implementation, which always involves the products and money markets. The critique about this theory is the assumption of the constant price level that does make its application difficult and cumbersome.

Further, studies like Ekbom (1998); Patrick and Prudence (2013); Oluwatoyese, Dewi, & Azam, (2015) and Pius & Abel (2015) employed the Production theory- Cobb- Douglas Function. Since agriculture is a production activity that cannot be restricted to microeconomic activity, then it needs a good and favourable combination of Macro-inputs to make it yield the utmost output. However, some scholars criticized the use of the theory in Macroeconomic studies because of its microeconomic origin and managerial nature, which emphasized the correlation of physical inputs (capital and labour) and outputs only. However, its theoretical technique was later adapted and employed in a macroscopic study through what is known as the "Aggregate Production theory" and it was valid. Since then it is at times used in macro studies. (Sloman and Wride, 2009; Koutsoyiannis, 1979).

Some other studies like Benson (2012), Olarinde, and Abdullahi (2014) employed the Endogenous growth theory, which is a slight opposite of some growth theories. These studies employed this theory because the major goal of an economic growth theory is to explain the persistent rise in the standard of living of the people via boosting growth through some sectors' output like agriculture. Other theory like the neoclassical theory by Solow – Swan Theory shows that for economic growth to be persistent in an economy, it must come from technological progress, which is exogenously determined but this is not so with Endogenous growth model; the endogenous growth model looks at the major factors that affect economic growth from within the model. Noticeably, the theory is suitable for developing countries but again the theory rejected the assumptions of exogenous determination of technological change (Mankiw, 2011 and Romer, 2012).

Other literature like Okoye and Clement (2015) showed how the dependency theory of development was applied to form the basis of their analysis. The theory argues that the development process in the less developed economy is linked to their dependency on the developed economy who use the privileged for their benefits using different macroeconomic policies that are detrimental to the development process of the less developed economies. (Horwite, 2002 and Vincent Ferraro, 1996). Some other literature like Eyo (2008) adopted the High-Payoff-Input theory of agricultural development. Though one may say the theory involves a traditional agricultural sector; however, the components of the model are variables that promote economic growth. The model sensitizes the role of investment in promoting the growth of the agricultural sector's output by making modern pay-off inputs available to farmers, especially in poor countries. The theory also reveals why the traditional farmers cannot increase their agricultural returns due to the use of limited technical equipment and limited economic opportunities to which they could respond.

All the above theories tried to establish the way(s) which an economy can increase the agricultural output. Given these theories used by various studies, we cannot say that taking a single theory and applying it to the Nigerian economy will automatically yield a perfect and desired outcome, this is due to some assumptions that are inherent in most conventional theories (Garba, 2014). Again, the cultural and economic composition of the economy that the theory is applied to has some roles to play. In Nigeria, many of these factors have some influence to play. Nevertheless, so far, one can choose one of these theories that may best describe the nature of the economy and the sector that the theory seeks to address the most. In this study, we choose to use the Cobb Douglass Production Function, which is a production theory that states the relationship between two main variables (capital and Labour) concerning any output in a micro or macro perspective. This is further elaborated in the theoretical model in section four, also studies like Berth and George, (2017); Okoh (2015); Kwanashie, Garba and Ajilima (1997) among others have employed the theory in investigating the impact of some macroeconomic variables on agricultural output. Besides the theory is suitably linked to macroeconomic studies like this.

2.2.1 Stylised Facts: General outlook of the Agricultural sector's output and selected macroeconomic variables in Nigeria.

Agriculture in Nigeria as revealed by Babajide (2017) and Ogbalubi and Wokocha (2013) accounted for the largest proportion (70%) of the Nigerian labour force. Also, like other countries globally, the sector is largely focused on food crops, livestock, fishery and forestry. The food crop production averages about 85.01% of the total sector's output from 1981 to 2016 (CBN Statistical bulletin, 2016). Whereas the remaining 15% is shared between livestock, fishery and forestry. The reason being that food crop sales faster both in the domestic and international market; hence, it brings higher income. However, we chose to consider all the four sub-sectors and not only the crop production mainly because of government policy targets. That is, to determine which macroeconomic variable(s) the government can use when boosting any of the four sub-sectors.

Besides in Nigeria, despite the presence of a large number of farmers, the country remains a net importer of foods like rice, maize and fish. This is because the large proportion of the proceeds that the country realized comes from the sale of petroleum and related products. At some point, this takes away the focus of government from other sectors like agriculture thereby leading to under-investment in the Agricultural sector by not only the government but private sector, bilateral and multilateral agencies inclusive (NBS, 2016).

2.2.1.1 Why Nigeria Needs to Focus More on Agricultural Sector.

The Nigerian agricultural sector is one of the sectors with potential growth prospects compared to other sectors of the economy (NBS, 2010). The higher growth prospect can be achieved with good investment and proper monitoring of policy implementation in the sector; particularly by expanding the products' value chain; boosting more supply of varieties of farm products for domestic consumption and export, which will have an inverse effect on the volume of food and commodities imported, and consequently lead to an adjustment in the country's balance of payment. Furthermore, NBS (2017) and World Development Indicator (2017) attested that formally, the sector accumulates the largest proportion of Nigeria's labour force (37%) in 2017. However, despite the large proportion of the workforce, the sector is dominated by unskilled and semi-skilled farmers. The effect(s) of these make farming operations by these farmers to be in small-scale, because of their limited knowledge in modern agricultural science in areas of modern crop and animals' genetic, modern inputs, modern method of harvesting, processing and distributions.

All these make it difficult for the farmers to cultivate large land areas and rear large livestock, hence, leading to a loss in volume of food outputs, meats, fish, eggs, hides and so on that ought to be produced locally. In addition to the provision of food and raw materials, agriculture is a good source of foreign exchange. Some developing countries like Malaysia, Taiwan, Egypt, Kenya, Ethiopia and South Africa, have used this sector greatly to earn a good proportion of foreign exchange earnings. Indeed, before the discovery and exploration of crude oil in the 20th century in Nigeria, agriculture was the main contributor of Nigeria's foreign exchange earnings contributing to over half of our GDP (Mohammed, 2017). The situation changed after oil exploration started in the 1970s. The discovery and exploration of oil tilted the attention of the Nigerian government to the industrial sector thereby, making agricultural practices look non-lucrative and unattractive for not only the existing farmers but also for young Nigerian youths who would have ventured into the sector. Thus, the shift of attention to crude oil has continued to affect the contribution of agriculture to real Gross Domestic Products for almost two decades (1980 to 1996) (CBN Statistical Bulletin, 2016).

Still on why Nigeria needs to focus on agriculture in another perspective other than food, raw materials and money, is because of environmental/ecological balancing. Since human health is tied to the consumption of quality good air and the aesthetics environment, he lives in; Agricultural practices especially crop production and Forestry (Horticulture and Floriculture) can help in mental and ecological balancing for the people of any society. This can assist in preventing some environmental hazards like wind erosion, help in wildlife keeping, recreation and help moderate the rate of temperature for the inhabitants of that environment and help them with the source of herbs. This is obvious that areas without active agricultural activities especially forestry (floriculture and horticulture) are liable to face some environmental and health hazards. For instance, in February 2017, the Nigerian Youth Service Corps (N.Y.S.C) in Sokoto State knew how imperative this is as they went on planting about 1 million trees in the state. (Sokoto State Ministry of Agriculture, 2017). Also, other foreign studies showed that the reason why most residents in Florida, Alaska and Alabama in the United States like to plant trees than the residents of New York because the trees help in reducing the effect of carbon monoxide and the danger of hurricane which once struck the areas in 2005 aside from the economic gains. (The U.S. Forest Facts and historical trends, 2016)

2.2.1.2 Why Nigeria's Agricultural Sector is not Yielding Optimum Output.

Despite the number of reforms experienced in the agricultural sector over the years, the sector is still lagging because of inadequate application of quality modern inputs. This has largely affected the sector. The reason why countries like China, the United States, Brazil and other recognized agricultural countries are doing well in the world is the availability and application of modern inputs apart from the availability of labour, these combined to bring about great output. In late 2016, NOI polls limited carried out a survey in Nigeria and a greater percentage of the interviewees (61%) reported that lack of adequate fertilizer especially urea base and some other farm chemicals and farm hybrid seeds were not transported to areas with high needs. These made their prices dearer to purchase. In addition, most farmers did not employ adequate modern mechanical tools. This may have been the reason why Nigerian score was below average in 2016 by the World Bank Survey of the business climate for agriculture (World Bank Survey of Business climate for agricultural business, 2016)

Apart from taking into consideration the poor and inadequate farm inputs, the poor market climate is another reason. The report by the World Bank Survey of the business climate in 2016 revealed how poor market climate environments do inhibit the proper output growth in the sector. This poor market climate environment does not restrict to poor power supply alone, but also includes poor road networks, poor transport mediums, and poor irrigation channels for dry season farming, some security challenges that are found while transporting these produce to their desired destinations and overcrowded ports. (World Bank Business Survey, 2016). For instance, some of the farms produce like onions, garden eggs and fish transported from states like Kebbi to the South-West, and Southeast zones do get deteriorated before reaching their destinations due to bad roads and security challenges. This often discourages farmers to farm more, hence, restricting them to their nearby small local markets, consequently dis-improving their income status and standard of living. This challenge has robed the sector of what it would have been enjoying and contributes to a hike in some food commodities in some parts of the country. Evidence in 2016, the procurement specialist of the World Food Programme (WFP) compared the cost of 1 metric ton of rice which cost $1,100 in some parts of Nigeria compared to Cameroon which is less than $ 500 (Richard, 2017).

Apart from this challenge that farmers in Nigeria face with regards to the poor market environment, they also faced uneasy access to the market and poor market structure for their farm produce. There are a lot of instances where farmers have to take a small quantity of their produce to the market for sale because of poor roads. While others have to stop the cultivation of some crops because the value chain for their products cannot exceed the raw stage; hence, cannot be processed to compete in the global markets. This challenge encompasses the poor processing facilities which are affecting the value chain of agricultural produce in the country. Also, good storage facilities which were found around some markets some decades ago are nowhere to be found, and if found, they are in shambles and cannot accommodate the tones of agricultural produce presently cultivated by farmers. This was revealed in the report by the Agricultural Promotion Policy (APP) in 2016, where Nigeria's estimated demand for tomatoes is 2.2million tons annually, but its annual production has been less than 1.5 million tons losing 0.7 million tons to post-harvest. Hence, this amount is imported due to post-harvest loss as a result of poor storage that has made some farmers restrict themselves to little pieces of land which give them the chance to farm a sizeable quantity that they can adequately store. (Agriculture Promotion Policy, 2016).

The unfavorable and uneasy access to credit facilities may have been another factor worthy of note in the Agricultural sector. An unfavorable credit term has been a challenge to the sector hence and may have been causing a negative indirect effect on the sector's output for a long time. Despite the establishment of the Agricultural Credit Guaranteed Scheme Funds (ACGSF) in 1977, the establishment of the Nigerian Agricultural Bank (NAB) in 1978, the Nigerian Agricultural Co-operative Bank Limited (NACB) in 2001 and the establishment of the Bank of Agriculture Limited (BOA) in October 2010; and other credit and financials Scheme Programmes, Nigerian farmers are still not optimizing the credit funds available to them may be due to fear of high collateral demand and interest rate. The reports by NOI polls in 2016 showed that 35% of farmers revealed access to credit as the main barrier to some of their operations. In the South-South region, the percentage was as high as 59%. This might be the reason why loans to agriculture by commercial banks in that year were less than 4% of the total lending amount. (NOI Polls, 2016 and CBN Statistical Bulletin, 2016).

Lastly, the Nigerian agricultural system has not received adequate research grants at the federal and states level as it ought to receive, coupled with the low budgetary allocation (National Bureau of Statistics, 2017**).** This is another factor inhibiting the growth of the sector. Thus to meet up with the world's standard, the sector needs to invest considerably in research in some of its institutions like the National Agricultural and Production Research Institutes (NAPRI), National Agricultural Extension Research and Liaison Services(NAERLS) and so on which will help unraveled other important areas that need to be explored and hence, boost the output growth of the sector. Records have shown that over $60.5 million grants Programmes and interventions have been carried out by the United State Agency for International Development (USAID) on food production research from 2008-2016; and other available research grants by other International Agricultural Organizations like World Food Programme and the International Fund for Agriculture Development (IFAD), Nigeria agricultural sector has not to manifest much of the impact of these agencies' interventions in the sector in the area of research viz-a-viz total outputs. (The International Fund for Agricultural Development (IFAD), 2017)

2.2.1.3 Review Of Some Previous Reforms in the Sector (1981– 2020)

Given figure 1 below, Nigeria's agricultural output in the past 3 decades has been sectionalized into four phases. (1, 2, 3 and 4) this is done to assess the impact of some of the past reforms in the sector.

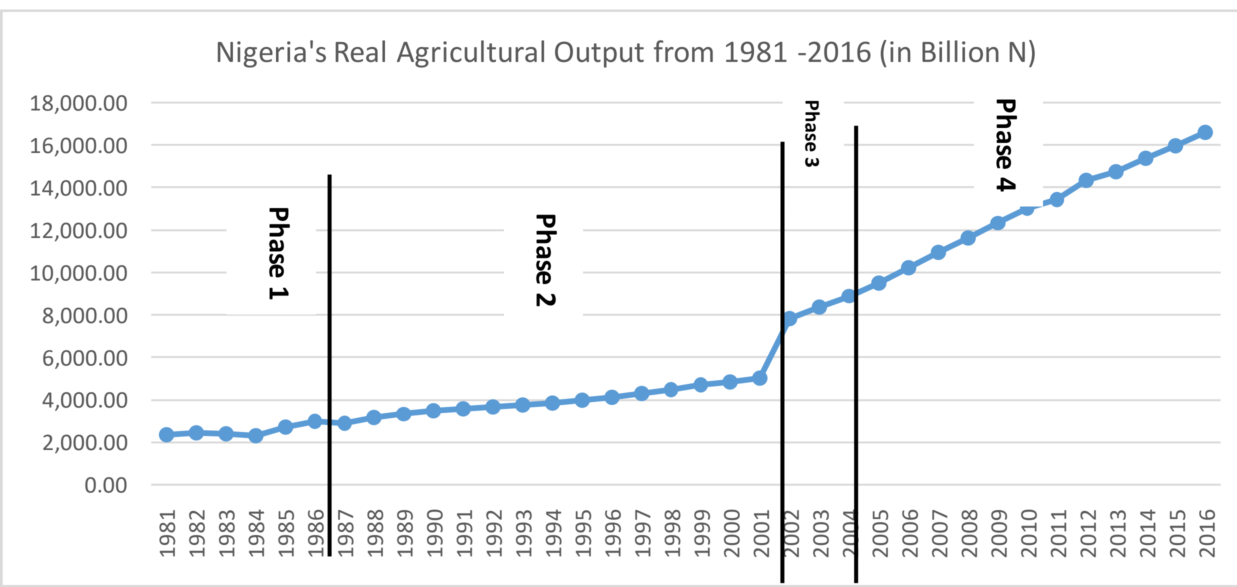


Figure 2.2.4. Total Agricultural Output in Nigeria from 1981-2016; In Billion Naira.

Source: Author Computation with Data from CBN statistical Bulletin, 2016.

1st phase takes account of the agricultural reforms that were introduced between 1981 - 1985, phase 2 revealed the reforms that were introduced between 1985-2000, phase 3 which is the shortage time frame, account for the reform between 2000-2003 (4 years) and the last phase (phase 4) is from 2003 to 2016 (14years). Witnessed quite some reforms, which at some point bred good outcomes, while others do not. The noticeable trait with every reform is that from the initial introductions, there seems to be an improvement in the sector's output, but as time goes on, its efficacy fades away, leading to the introduction of another reform(s). Besides that, successive government regimes do come with their reforms, pushing the previous government's own. Some reforms like the Green Revolution Programme, which falls within phase 1, were introduced in the second republic (1979 -1983) and were anchored by the National Council on Green Revolution. The reform when announced brought a quite great quantum of hope to the agriculturalist and most farmers nationwide as of that year. The major aim of the Programme was to make Nigeria achieve self-sufficiency in agriculture based on the increased population of 2,097,740 people from 1978 to 1979 (total population was 71,391,290 as of December 1979) (National Population Commission (NPC), 2018)

Phase 2 (1985-2000) witnessed a good number of reforms which led to the rise in the total agricultural output (from 2000.00 - 5000 Billion Naira) these policies include "Go back to Land (1983-1985), Agricultural Technical Assistance Project (ATAP) (1980-1990), Directorates of Foods, Roads and Rural Infrastructure (DFRRI) (1986), Nigerian Agricultural Insurance Corporation (NAIC) (1987), the program was meant to provide insurance for all types of agricultural activities especially, farming-related activities, National Agricultural Land Development Authority (NALDA) initiated in 1991 to give assist farmers with credit alongside opening up more areas for agricultural production. The program goes along with the Community Banking Programme which was established also in 1991 to give room for the establishment of community banks with a focus on rural banking operations. It was intended to provide the needs of the rural communities in terms of cheaper farm inputs. Due to the improper implementation of some of the Programmes like the National Agricultural Land Development Authority, the National Fadama Development Projects was introduced in 1993 by the then Head of state, via the support of the World Bank.

Phase 3 (2000- 2003) With the weakness of the Fadama projects, one of the first-millennium programs on Agriculture was launched in April 2002 which was the Root Tuber Expansion Programme (RTEP). It covers 36 states and was designed to address the problem of not only food production but also rural poverty and cheaper staple foods production like cassava and yam. At the local farmers' level, the Programme was meant to achieve economic growth, improve access to social services by the poor and carry out intervention measures to protect poor and financially weak groups (Presidential Research and Communications Unit, 2003). This led to a tremendous increase in the sector's output. Raising the total output from 5024.54210729881 to 8364.83210282782 Billion Naira between 2001 to 2003 making an average relative contribution of 24.42% to real GDP (CBN Statistical Bulletin, 2016). Indeed, the program together with other Programmes like the National Special Programme on Food Security (NSPFS) led to the growth in the total output of the sector. This output continues to increase till 2016 which is the fourth phase (2003-2016) and this period encompasses some programs like the food security (2008-2011), the agricultural transformation agenda(2011-2015), later adapted in 2016 by the government to maintain some of the achievements made by the previous government in the sector, to increase the income of smaller holders' farmers and rural entrepreneurs that are actively engaged in agricultural production, processing, storage and marketing of selected commodity value chain (Agricultural Transformation Agenda, 2016).

Another reform that is recent in the sector is the Agricultural Promotion Policy (APP) which was introduced in June 2016 to directs the activities of agriculture in the country from 2016 to 2020 by the Federal Ministry of Agriculture and Rural Development (FMARD). The Agriculture Promotion Policy (APP) directly gives importance to pursuing and building upon the efforts of the past governments' policies on agriculture especially in adding more value to agricultural products and promoting and rebranding them into a global market standard. Issues addressed by the policy also involved how farmers' productivity can be increased, how to access fertile land and how to manage them, improving soil fertility, access to information and knowledge, access to farm inputs, storage and a host of other agricultural issues were outlined to be addressed by the policy. (Agricultural Promotion Policy Guideline, 2016.)

2.3 Empirical Literature:

Evidence from the summary of the review of empirical literature in the appendix section, a good number of studies on this subject matter has been carried out to investigate the impact of some macroeconomic variables on Nigeria's agricultural sector. However, these studies have analyzed the subject matter based on the objectives they are set to achieve, the nature, size and behavior of the data sets of their variables (dependent and independent variables) and the techniques and analytical tools employed that best suit their data behavior was directed by their objectives. Therefore, from the empirical review, works like Mustapha and Nishat (2004); Omojimite and Akpokodje (2010); Yakub (2010); Nessabien and Naghizadeh (2012); Yanikkaya, Kaya and Kocturk (2013); Aroriode and Ogunbadejo (2014); and Gatawa and Mahmud (2017) all discovered a negative relationship between exchange rate and agricultural outputs from the demand side and that exchange rate had a significant contractionary effect on agricultural output. In other studies, carried out by Colacelli (2008); Essien, Akpan and Sunay (2011); Okputu, Opue and Bankong (2012) and Umaru, Sa'idu and Salihu (2013) further stated that unanticipated appreciation of domestic currency increased agricultural output from the supply side, though it depends on the combined effect of elasticities of demand and supply.

Abdullahi (2009) and Essien, et al. (2011) as cited in Mbutor and Uba (2013) stated that a low-interest rate enables farmers to acquire loans and purchase the required inputs and machinery for carrying out farm operations and increasing production. While other works like Kwanashie, et al. (1997); Garba (2000) and Akpokodje (2000); Benson (2012); Onwumere and Onyike, (2012); Patrick and Prudence (2013); Ernest, (2014) and Pius and Abel (2015), all tried to investigate the impact of macroeconomic policies on agriculture with various period and techniques. Though they had different findings and had contributed to the existing works of literature. Significantly, works like Aniekan (2015); Ernest, (2014) and Muftaudeen et al. (2014) established empirical linkages between macroeconomic growth and agricultural productivity in Nigeria and confirmed that major macroeconomic variables like interest rates and inflation rate affect agricultural output in the country negatively. These studies differ from Oyetade et al. (2016) which found out that the inflation rate is insignificant in affecting the agricultural sector's output in Nigeria. This may be because of the different measures and methods of estimation used in estimating agricultural productivity.

The review of the literature also exposed some conflicting results on the impact of external debt on domestic real sector productivity in the economy. The literature revealed that external debt exposure impedes productive capacity in an economy as studied by, Clement, Bhattacharya and Nguyen (2003); Arnone, et al. (2005); Ayadi (2008); Edo (2012); and Ajayi and Oke (2012) showed this. However, studies like Suleiman and Azeez (2012), Oke and Sulaiman, (2012) produced evidence that external borrowing enhances the productive capacity of the economy, but didn't consider the impact of servicing public debts on the Nigerian economy.

Zepda (2001), examined agricultural investment and productivity in the context of developing countries using econometrics models to measure the changes in output and relative contribution of various outputs. His study reveals that there is a strong relationship between investment in technology and human capital compared to that of physical capital and growth that was found to be weak. Furthermore, other researchers have also attempted to investigate the relationship between agricultural output growth and macroeconomic variables through the test of causality with mixed results. Their results suggested the macroeconomic linkages of agriculture, which involve the relationship between the general domestic economy and the agricultural sector, and the world economy (Knutson, Penn and Barry, (2000)). Looking at the causality between exports and agricultural output in Pakistan using the Auto Regression Distributed Lags (ARDL), Memon, Beig and Ali (2008) found a bi-directional Granger causality relationship between total exports and agricultural GDP; while Salih (2006), present empirical evidence showing a significant long-run relationship between agricultural output growth and economic growth (income) that assumes bi-directional causation.

Relating to Nigeria, Sunday et. al, (2012) investigated the relationship between the value of agricultural GDP as a ratio of total GDP and some selected macroeconomic variables. Estimating the chain of causality using the F-statistic for both short and long-run period the test result revealed there exist a unidirectional relationship running from macroeconomic variables to agricultural productivity. He concludes that total variation in agricultural productivity is induced by changes in macroeconomic variables. From the above, one can conclude that the role of agriculture as a source of achieving sustainable food supply, eradication of poverty and improved welfare in the country is largely hinged on the stability of some selected macroeconomic fundamentals. More insights can be deduced from the summary of the empirical literature table in the appendix section.

2.3.1 Gaps identified from the literature reviewed.

From the related studies reviewed, it is clear to note some differences in merging quite a several macroeconomic variables and testing their impact on Nigeria's agricultural sector output. While some works choose to look at the impact of monetary variables on Agriculture (Oloyede, 2014; Udeaja, et al. 2014; Christopher, and Akorah, 2012 among others), other works tried to maintain only the impact of fiscal variables on agriculture (Okoh, 2015; Oyetade et al. 2016 among others). However, this study includes monetary and fiscal variables (debt servicing and variables of external trade) into its estimation model to determine their impact on the agricultural sector in Nigeria.

Similarly, most of the estimation techniques of previous studies that were reviewed (see empirical table in the appendix section) were descriptive statistics, Multivariate and Two-stage OLS, seemingly unrelated regression, one-step dynamic forecasting and VAR. However, this study deployed the use of Fully Modified OLS to determine the coefficient of the long-run impact in the existence of a long-run equilibrium relationship. Furthermore, this work will expand the scope of most previous studies in terms of the time frame to 2017. Furthermore, none of the literature reviewed has attempted to use quarterly data of relative share of agricultural output to Real GDP.

Lastly, most previous works considered using one of the disaggregated sub-sectors output and not all the sub-sectors; for instance, works like Eyo (2008); Okidim and Albert (2012) and

Oluwatoyese (2016). However, this study uses the aggregated as well as the disaggregated (Crop Production, Fishery, Forestry and Livestock) output in its analysis. We consider these two sets of variables (Aggregate and Disaggregate) so that we can examine the impact of macroeconomic variables not at the general level of agriculture output but also the sub-sector level, to determine which macroeconomic variables should be given more concern if any of the sub- sector's output is to be improved.

CHAPTER THREE

3.0 THEORETICAL FRAMEWORK AND METHODOLOGY

Introduction.

In this study, this chapter helps to reveal what is the most effective way of achieving the research objectives. Thus, the section encompasses the theoretical framework, empirical framework or model specification, the estimation techniques, sources of data and the anticipated results from the variables.

3.1 Theoretical Framework:

The Cobb-Douglass Production function formed the basis for this study's theoretical framework. However, the study also identified three macroeconomic channels through which the agricultural output can be affected apart from the mainstream classical production function channels of capital and labour. These Macroeconomic channels are the Trade channel (dependency theory), Interest rate channel (Interest Rate theory) and Public Expenditure (fiscal policy) channel (Kwanashie, et al. 1997; Knutson, et al. 2000 and Mankiw, 2011). From the typical production function, the study considered two variables (Capital and Labour) with the addition of other macroeconomic policy variables, which also affect the agricultural sector endogenously in the model. Based on this theoretical exposition, the study adopted the functional Cobb-Douglass production model specification as adapted in studies like Ekbom, (1998); Herzer and Nowak-Lehmann, (2006); Okidim and Albert (2012); Patrick and Prudence (2013); Pius and Abel (2015); Oyetade, et al. (2016); Ibrahim, (2018); among others. Though these studies adapted the Cobb Douglass production equation, the basis of the equation is from the classical production function which has been adapted and used in both micro and macro studies. The theoretical production function states that “the total output or total production of any sector or firm is a function of labour and capital before any other variables (Sloman & Wride, 2009). Adopting the Cobb-Douglas production function, which is the framework for our analysis we have:

$$\boldsymbol{Y_t = F\,(K_t\,,\,L_t)} \qquad 3.1$$

Thus, to achieve the objectives of this study, the Cobb-Douglass production function equation (equation 3.1) is adapted. This is experienced in Ibrahim (2018) and Herzer and Nowak-Lehmann (2006). Thus, equation 3.1 is augmented by incorporating other selected macroeconomic variables to determine their impact on the agricultural sector’s output (aggregate and disaggregated) in Nigeria. The effect of these variables can be either negative or positive, significant or insignificant. Thus, the equation is expressed as:

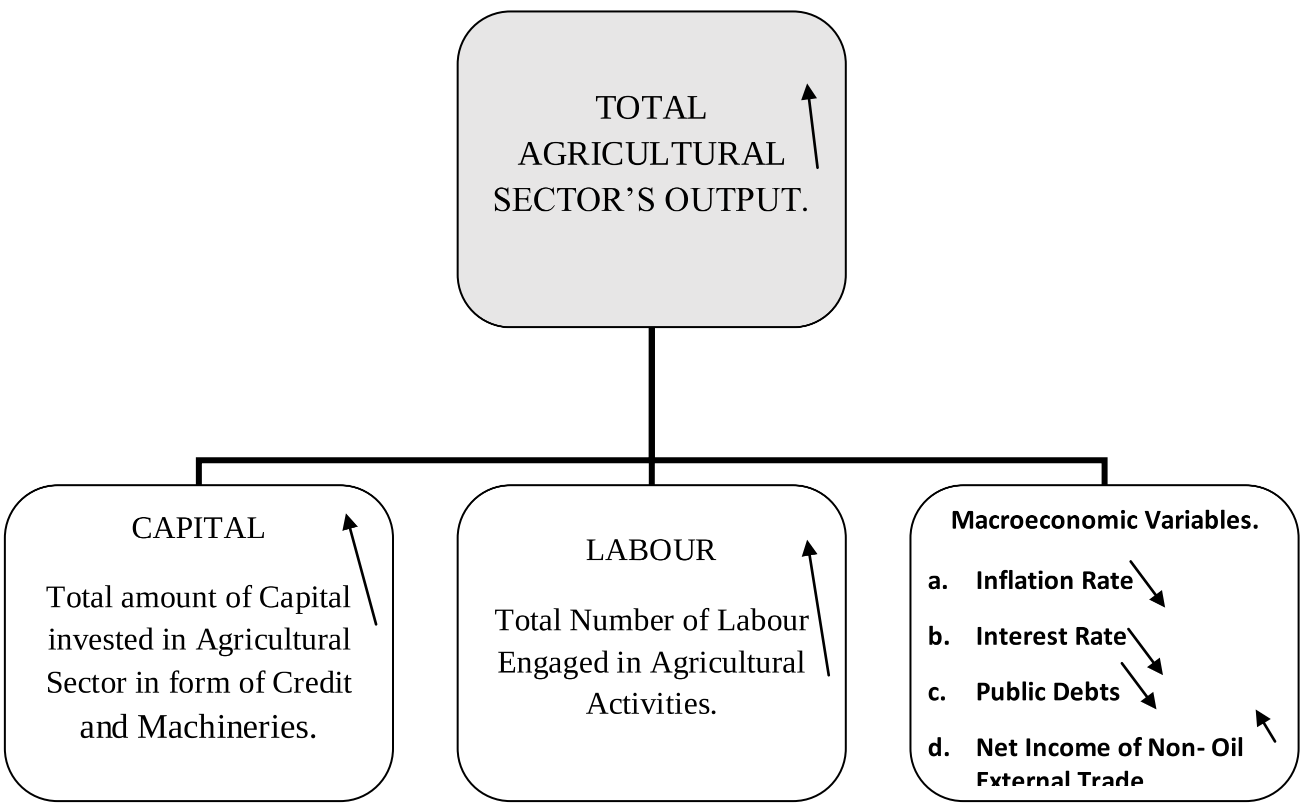
$$\mathbf{Y_t = F\,(}K_t\,,\,L_t\,,\,\mathbf{INF_t\,,\,INTR_t\,,\,PDBTS_t\,,\,NOE_t\,,\,NOI_t)} \qquad 3.2$$

Where **Y** is the Total output, **K** and **L** are capital and labour employed in the sector as inputs respectively, **INF** =Inflation proxied by Consumer Price Index, **INTR**= Interest Rate, **PDBTS** = Public Debts Servicing, **NOE** = Non-Oil Exports and **NOI** = Non- Oil Imports.

3.1b Schematic Diagram of how the Macroeconomic Variables In Equation 3.2 Can Affect Agricultural Output in Nigeria.

The Agricultural Transformation Agenda (ATA) (2016) and Agricultural Promotion Policy (APP) (2016), also adapted and established the relationship between the macroeconomic environment and agricultural output through sector-specific measures in which the government influences agricultural output directly through capital and labour. These policies suggest measures like fewer tariffs to farm inputs, grants, Credit availability with less interest rate, farm input used, soft price controls, quantitative restrictions, government expenditures and taxes. On the other side, some government policies in managing the agricultural sector's output had indirect and unintended effects. Policies such as industrial protection, interest rate reductions, management of exchange rate and employment creation may have unintentional consequences on the sector and other linked agricultural sectors in the economy. This was pictured when industrial protection penalizes agriculture because its term of trade with industry was negatively affected in the 1980s. Also, overvalued exchange rate penalized agricultural output because some agricultural goods were tradable in the foreign market while some were not. For many developing countries, before making policy adjustments, a combination of industrial protectionism and exchange rate overvaluation was a common challenge and this scenario of [illegible]s against sectors like agriculture (Agricultural Transformation Agenda, 2016).

Fig.3.1 shows how the Variables in equation 3.1 can affect the Total Agricultural Output in Nigeria



Key: The $\uparrow$ Arrow Signifies Increase and $\downarrow$ Signifies Decrease. **Source:** Author's Composition.

3.2 Empirical Model Specification:

The structural form or empirical specification for this study is deduced from the production function as outlined in the theoretical framework and as used by studies like Patrick and Prudence (2013); Oyetade, et al. (2016) among others. This framework is adapted because of the relationship that is established between output (dependent) and other factors (Capital and Labour) (Mankiw, 2010). However, the framework is augmented to achieve the objectives of the study. To achieve the objectives of the study, the following five estimable equations are specified from equation 3.2 on page 36 after taking the natural log. This is symbolically stated in stochastic form as:

Estimable Equation for Aggregate Agricultural output.

$$Y_t = \alpha_0 + \alpha_1 LNACGSF_t + \alpha_2 LNLEAG_t + \alpha_3 CPI_t + \alpha_4 INTR_t + \alpha_5 LNPDBTS_t + \alpha_6 LNNOE_t + \alpha_7 LNNOI_t + U_t \qquad 3.3$$

While the estimable equations for the disaggregated Agricultural sector's outputs (Crop Production (CPY), Fishery (FHY), Forestry (FTRY) and Livestock (LVKY)) equation are as follows:

$$CPY_t = \mho_0 + \mho_1 \ln ACGSF_t + \mho_2 \ln LEAG_t + \mho_3 CPI_t + \mho_4 INTR_t + \mho_5 \ln PDBTS_t + \mho_6 \ln NOE_t + \mho_7 \ln NOI_t + \varepsilon_{t1} \qquad 3.4$$

$$FHY_t = \beta_0 + \beta_1 \ln ACGSF_t + \beta_2 \ln LEAG_t + \beta_3 CPI_t + \beta_4 INTR_t + \beta_5 \ln PDBTS_t + \beta_6 \ln NOE_t + \beta_7 \ln NOI_t + \mu_{t2} \qquad 3.5$$

$$FTRY_t = \psi_0 + \psi_1 \ln ACGSF_t + \psi_2 \ln LEAG_t + \psi_3 CPI_t + \psi_4 INTR_t + \psi_5 \ln PDBTS_t + \psi_6 \ln NOE_t + \psi_7 \ln NOI_t + \lambda_t \qquad 3.6$$

$$LVKY_t = \phi_0 + \phi_1 \ln ACGSF_t + \phi_2 \ln LEAG_t + \phi_3 CPI_t + \phi_4 INTR_t + \phi_5 \ln PDBTS_t + \phi_6 \ln NOE_t + \phi_7 \ln NOI_t + v_{t4} \quad 3.7$$

Where; Y=Relative share of Real Agricultural output to Real GDP (RACG);

ACGSF= Agricultural Guaranteed Credit Scheme Fund; LEAG= Labour Employed in the Agric Sector; CPI= Consumer Price Index; INTR=Interest Rate; PDBTS= Public Debt servicing; NOE= Non-Oil Export; NOI = Non-Oil Imports;

CPY = Proportion of Crop production output in aggregate agricultural output;

FHY = Proportion of Fishery production output in aggregate agricultural output;

FTRY = Proportion of Forestry production output in aggregate agricultural output;

LVKY = Proportion of Livestock production output in aggregate agricultural output and

υ, ε, μ, λ and v = error term for each equation.

Any variable with the symbol "LN" signifies that the natural log had been taken. Taking the natural log of the variable is to strengthen out exponential growth, reduce heteroscedasticity (i.e. stabilizes the variance) and have efficient results because a log-linear specification, compared to simple specifications, provides more efficient estimates (Kowalski, 2007).

3.3 A Priori Expectation:

The Classical and the Neo-Keynesian theory of inflation and economic growth as further explained in studies like Barro, (1995); Max, Harris and Matyas (2009); Khayroollo, (2011) and Oyakhilomen and Rekwot (2014) assisted in revealing the effects of inflation on the general output of the economy. Also, the classical theory of interest rate and loanable funds' impacts on economic growth guides this study in deciding the possible effect of interest rates; this is further considered by Le, (2012). While for external trade, the New Growth theory as explained in Terry and Hammid (1999) revealed its effect on the economy. Finally, the Theory of Debt-Cum-growth and the Buffer Stock Model were significant in helping the researcher to understand the possible impact of Debts on the general performance of the economy in terms of outputs.

Table 3.3. A priori expectations.

S / N	MACROECONOMIC VARIABLES	Expected Impact on Agricultural Output.
1	AGRICULTURAL CREDIT GUARANTEED SCHEME FUND (ACGSF) α_1, $\mho_1$, β_1, Ψ_1, ϕ_1	POSITIVE
2	LABOUR EMPLOYED IN THE AGRIC SECTOR α_2, $\mho_2$, β_2, Ψ_2, ϕ_2	POSITIVE
3	CONSUMER PRICE INDEX (CPI) α_3, $\mho_3$, β_3, Ψ_3, ϕ_3	NEGATIVE
4	INTEREST RATE (INTR) α_4, $\mho_4$, β_4, Ψ_4, ϕ_4	NEGATIVE
5	PUBLIC DEBT SERVICING (PDBTS) α_5, $\mho_5$, β_5, Ψ_5, ϕ_5	NEGATIVE
6	NON-OIL EXPORTS (NOE) α_6, $\mho_6$, β_6, Ψ_6, ϕ_6	POSITIVE
7	NON-OIL IMPORTS (NOI) α_7, $\mho_7$, β_7, Ψ_7, ϕ_7	NEGATIVE

Source: Author's Compilation after reviewing relevant theories.

3.4 Estimation Techniques:

To empirically estimate the result based on the stated objectives, the variables were subjected to these lines of estimation techniques. First, the stationarity test- (Augmented Dickey-Fuller Test (ADF) and Philip and Perron (PP)), followed by the Johansen cointegration test, the Fully Modified Ordinary Least Squares (FMOLS), the Error Correction Model (ECM) and finally some diagnostics tests.

3.4.1 Stationarity (Unit Root) Test

Since the Classical assumptions on the regression model required that both the dependent and independent variables are to be unit root free, the errors should have a zero mean and constant variance; we employed the Philip Perron (PP) in testing for the stationarity of all the twelve variables. This is because the estimation of non-stationary macroeconomic variables gives a spurious and unreliable regression result. According to Granger and Newbold, (1974), non-stationary variables are characterized by a high R^2 and a low Durbin-Watson (DW) statistic, t- and F-statistics which appear to be significant, but the results derive give no any economic sense (Granger & Newbold, 1974, p.18; Enders, 1995 and Verbeek, 2000).

3.4.1.1 The Phillip Perron (PP):

The PP tests correctly for any serial correlation and heteroskedasticity in the errors ε_t non-parametrically by modifying the Dickey-Fuller test statistics. Phillips and Perron's test statistics can be viewed as Dickey-Fuller statistics that have been made robust to serial correlation by using the Newey–West (1987) heteroskedasticity-and autocorrelation-consistent covariance matrix estimator. Under the null hypothesis that $\rho = 0$, the PP, Z_τ and Z_π statistics have the same asymptotic distributions as the ADF t-statistic and normalized bias statistics. One advantage of the PP tests over the ADF tests is that the PP tests are robust to general forms of heteroskedasticity in the error term ε_t. Another advantage is that the user does not have to specify a lag length for the test regression (Phillip & Perron,1988). Thus, the PP unit root is specified as:

$$\Delta Y_t = \mu + \alpha_{t-1} t + \sum_{i=1}^{p} \beta i \, \Delta\beta_{t-1} + \varepsilon_t \qquad 3.8$$

3.4.1.2 The Johansen (1991) Cointegration Test

The Johansen (1991) cointegration is the test for the long-run equilibrium relationship among the variables. It is measured by the rank of α_1 in any estimable equation which is often denoted by r under the null hypothesis that there are or there are no cointegrating vectors against the alternative that the number of vectors is less than or equal to r. This is specified as:

$$Y_t = \alpha + A_1\, y_{1-t,} +_{,} \ldots, + A_p\, y_{t-p} + \varepsilon_t \qquad 3.9$$

Where: y_{1t} denote an (n×1) vector of I (1) time series, Y_t is cointegrated if there exists an (n×1) vector $\beta = (\beta_1, \ldots, \beta n)'$ such that

$$\beta' Y_t = \beta_1 y_{1t} + \cdots + \beta_n y_{nt} \sim I(0) \qquad 3.10.$$

In other words, the non-stationary time series in Y_t are cointegrated if there is a linear combination of them that is stationary or I (0). If some elements of β are equal to zero, then only the subset of the time series in Y_t with non-zero coefficients is cointegrated. As stated by Johansen, et at. (1990), the linear combination $\beta' Y_t$ is often motivated by economic theory and thus referred to as a long-run equilibrium relationship; though this is mostly applicable to bivariate equations. The intuition is that I (1) time series with a long-run equilibrium relationship cannot drift too far apart from the equilibrium because economic forces will act to restore the equilibrium relationship to its starting point (Johansen, et al. 1990). Therefore, the long-run equilibrium relationship among the variables is determined by the rank of β_1, often denoted by r under the null hypothesis that there are at most Cointegrating vectors against the alternative that the number of vectors is less than or equal to r. The test of the null hypothesis of cointegrating equations was conducted based on the trace and maximum Eigenvalue statistics as specify as: λ trace = $-\left(\frac{T}{2}\right)\sum_{i=r+1}^{n}\left(1 - \hat{\lambda}_i\right)$ 3.11

$$\lambda \text{ max Eigen} = -T \text{ Log } \left(1 - \hat{\lambda}_{r+1}\right) \quad 3.12$$

(Johansen, et al. 1990)

3.4.1.3 Fully Modified Ordinary least Squares (FMOLS).

This FMOLS estimation technique guides us in achieving the second and third objectives of this study. This technique involves a three-stage procedure (Unit Roots, Johansen Cointegration and the FMOLS test). The first stage involves Stationary test for unit roots, using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) test proposed by Phillips and Perron (1988) with intercept or Intercept and trend which we opted for the latter; and both estimations (ADF and PP) are carried out at level and first difference. Secondly, the Johansen Cointegration test is conducted to ascertain the long- relationship between macroeconomic variables and the share of agricultural output to Real GDP. Finally, the FMOLS and ECM estimations are used to quantify the long and short-run effect of macroeconomic variables on the share of agricultural output to Real GDP in Nigeria.

The superiority of the FMOLS model as first introduced by Philips and Hansen (1990) over other cointegration tests (Johansen, 1991 and Engel Granger, 1987) is that it is suitable for determining long-run relationship among variables, produces reliable estimates for small and medium sample size and provides a check for robustness of the results. The FMOLS method also has some characteristics which make it better than other estimations like the ordinary least squares (OLS), the Johansen cointegration and the Engel Granger cointegration techniques by introducing appropriate correction to overcome the inference problem in terms of the t-test and probability values for long-run estimates which are most valid (Al-Abdulrazag & Amani, (2014)). Furthermore, the Fully Modified Ordinary Least Squares (FMOLS) method utilizes "Kernal estimators of the Nuisance parameters that affect the asymptotic distribution of the OLS estimator, this also helps in accounting for serial correlation, correcting for simultaneity effects and test for the endogeneity which do come when estimating a model. To achieve the asymptotic efficiency, this technique modifies least squares as stated and used in some studies (Shahbaz, Rukhsana, & Amir 2008 and Babajide, 2016).

3.4.1.4 ECM model for short-run analysis.

After determining the Long run coefficients and impacts via the FMOLS test, then the Ericson and Hendry (1991) method of Error Correction Model (ECM) for each equation was further estimated where the residuals obtained from the OLS estimation is used to generate the over parameterized model and after the removal of all insignificant variables in the model, the parsimonious ECM was obtained. This is done to measures the short-run behaviours of the variables with regards to equilibrium as a result of changes in one of the variables (Ericson & Hendry, 1991). Thus the ECM model is specified as:

$$\Delta(y_t) = \mu + \alpha_1 \Delta(y_{t-1}) + \alpha_2 \Delta(y_{t-2}), ---, + \alpha_p \Delta y_{t-p} + e_t \qquad 3.13$$

Where Δy_t and Δy_{t-1} are I (1) variables at present and lag periods respectively.

Where Y_t is n x 1 vector of variables that are integrated of the same order - I (1), e_t is n x1 vector of innovation at time t. Equation 3.14 can also be written as:

$$\Delta (y_t) = \mu + \alpha_1 \Delta (y_{t-1}) + \sum_{i=1}^{p-1} \beta_i \Delta(y_{t-i}) + e_t \qquad 3.14$$

The Error Correction Model (ECM) can also take this form:

$$\boldsymbol{\Delta Y_1 = a_0 + \sum_{i=1}^{i} a_{1i} \Delta Y_{t-i} + \sum_{i-1}^{j} a_{2i} \Delta X_{it-i} +. \, . \, . + a_n ect_{t-1} + u_t} \qquad 3.15$$

Where the long-run properties are derived from the proportionality between Y_t and Xit. The above specification relates the short-run change in the dependent variable ΔY_t to the short-run change in the explanatory variable. This is called the impact effect (a_{2i}) but ties the change to the long-run impact through a feedback mechanism. From equation (3.16), the estimable error correction model for aggregate agricultural output is given as:

$$\boldsymbol{\Delta RACG_1 = a_0 + \sum_{i=1}^{j} a_{1i}\, \Delta RACG_{t-1} + \sum_{i-1}^{i} a_{2i}\, \Delta LNACGSF_{t-1} + \sum_{i-1}^{j} a_{3i}\, \Delta LNLEAG_{t-1} + \sum_{i-1}^{j} a_{4i}\, \Delta CPI_{t-1} + \sum_{j-1}^{j} a_{5i}\, INTR_{t-1} + \sum_{i-1}^{j}} a6i\, \boldsymbol{\Delta LNPDBTS_{t-1} + \sum_{i-1}^{j} a_{7i}\, \Delta LNNOE_{t-1} + \sum_{i-1}^{j} a8i\, \Delta LNNOI_{t-1} + a_{\partial} ect_{t-1} + u_{t9}} \quad 3.16$$

Equation 3.16 is also estimated for every disaggregated sub-sector equation.

3.5 SOURCES OF DATA:

Table 3.5. Variables Definition, Description, Measurement and Sources.

S / N	VARIABLE'S DEFINATION	VARIABLE DESCRIPTION	VARIABLE MEASUREMENT	SOURCE(S)
1	RACG	Relative Agricultural share To Real GDP.	Percentage Of Real GDP (Real Agric. Output/ Real GDP) * 100.	2017 CBN Annual Statistical Bulletin.
2	CP	Real Crop Production	Relative Value In thousand Naira	2017 CBN Annual Statistical Bulletin
3	FH	Real Fishery Production	Relative Value In thousand Naira	2017 CBN Annual Statistical Bulletin
4	FTR	Real Forestry Production	Relative Value In thousand Naira	2017 CBN Annual Statistical Bulletin
5	LVK	Real livestock Production	Relative Value In thousand Naira	2017 CBN Annual Statistical Bulletin
6	ACGSF	Agricultural Credit Guarantee Scheme Fund	Relative Value in thousand Naira.	2017 CBN Annual Statistical Bulletin
7	LEAG	Total Labour that used the Capital provided in the Sector.	Whole Value in thousand	2017 CBN Annual Statistical Bulletin
8	CPI	Consumer Price Index.	Percentage	https://knoema.com/atlas/Nigeria/topics/Economy/Inflation-and-Prices/Consumer-price-index#
9	INTR	Interest Rate	Maximum Lending Rate in percentage.	2017 CBN Annual Statistical Bulletin
10	PDBTS	Public Debts Servicing	Relative Value In thousand Naira	2017 CBN Annual Statistical Bulletin
11	NOE	Non-Oil Exports	Relative Value In thousand Naira	2017 CBN Annual Statistical Bulletin
12	NOI	Non-Oil Imports	Relative Value In thousand Naira	2017 CBN Annual Statistical Bulletin

Source: Compiled by the author from the sources indicated.

This study used Quarterly data covering $Q_1$1981 – 2017Q_4. The sources of the data are shown in table 3.5 above. The choice of the period was dictated by the availability of data, also the real GDP rebasing of 2010 constant prices by the NBS and CBN, which started from 1981. The table above (table 3.5) contains the variable's definition, description, measurement and sources of the data used in carrying out the analyses of this study.

CHAPTER FOUR.

4.0 DATA PRESENTATION, INTERPRETATION AND ANALYSES OF RESULTS.

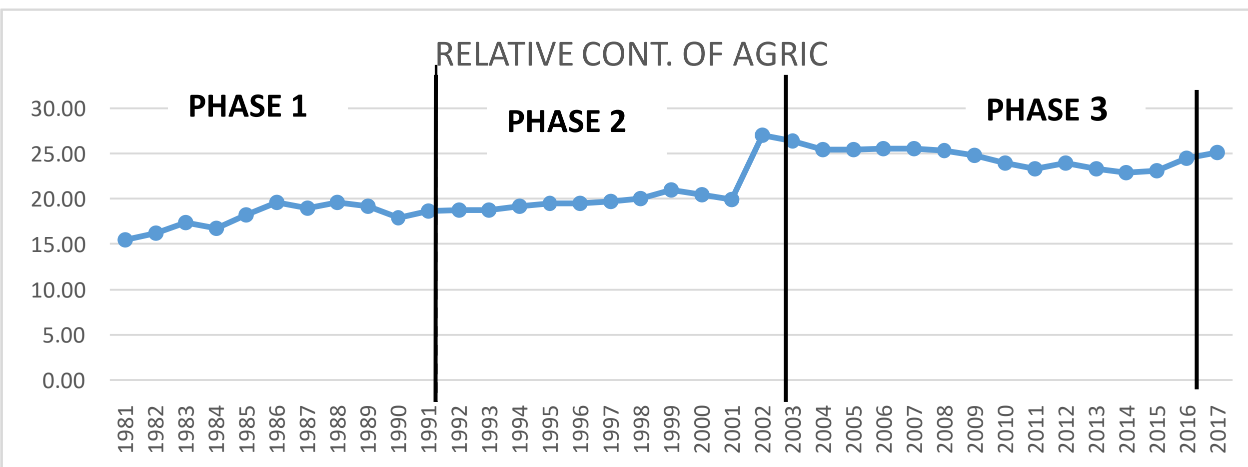
The previous chapter of this study attempted to present the methods adopted for this work. This chapter encompasses the analysis of the trend of the Agricultural sector's output and selected macroeconomic variables in Nigeria as it seeks to address the first objective and the application of the methods as identified in chapter three base on the stated objectives. Hence, this section account for the trend of the agricultural sector's output and the selected macroeconomic variables in Nigeria, the summary of descriptive statistics of all the variables (Aggregate and Disaggregated) which can be used for further statistical analysis. The chapter also includes the Unit root test of all the variables, the Johansen cointegration tests for a long-run relationship, the FMOLS tests for the long-run coefficients, the Parsimonious ECM for short-run impact and finally the diagnostic test for each equation, which was started in the previous chapter (equation 3.3 to 3.7). After the estimations and analyses, then the key findings were identified and noted.

4.1 The trend of Agricultural Sector's Output and the selected Macroeconomic Variables in Nigeria.

4.1.1 The Relative Share of Agricultural Output in the Nigerian Economy.

The agricultural output no doubt is contributing to the growth of the Nigerian economy. Though the attention that was given to the sector in the 1960s, 1970s and 1980s is different from the attention been received in recent years. From the figure below – fig 2. The relative contribution of agriculture was below 20% from 1981 until 1998 when the rate rises from19.76% in 1997 to 20.03% in 1998; then it was maintained that position until 2001 when it drops from 20.95% in 2000 to 19.89% in 2001. Afterward, it moved fast from 19.89% in 2001 to 26.99% in 2002 and has never been below 25% since then until 2008. On an average level, agricultural output has contributed 21.4% to the real GDP of Nigeria from 1981 to 2017. The maximum contribution was made in 2002 (26.99%), while the least contribution was experienced in 1981 (15.5%). Measurable to the amount both in money and non-money terms that have been invested in the sector by both domestic government and local and international Organizations. From the graph above, we can see that from 2001 to date the sector has contributed more to the real GDP of Nigeria compared to the period before 2001.

Fig. 4.1.1 The Relative Share Of Agricultural Output To Nigeria's Real GDP From 1981 – 2017.



Source: Author with Data obtained from CBN Statistical Bulletin, 2017.

Though the sector has been contributing to the growth of the Nigerian economy, the contribution, however, is not progressive. The reason for the increase in the relative contribution of the Agricultural sector's output in phase 2 and 3 (2001 – 2017) was due to the series of agricultural reforms which the sector had witnessed within that period, which initially started with the introduction, of Fadama project phase 3, National Special Programme on Food Security (NSPFS), Root Tuber Expansion Programme (RTEP), National Economic Empowerment and Development Strategy (NEEDS) and (SEEDS). These Programmes led to an increase in the output of the sector with an average of 24.42% contribution to Nigeria's real GDP from 2001 to 2017 (CBN Statistical Bulletin, 2017).

4.1.2 Share of Agricultural output and Inflation.

The relationship between the Agricultural sector and inflation is guided by the law of demand and supply. When there is a high supply, there is a tendency for lower prices. And when there is lower supply, higher prices are bound to occur which can lead to inflation in the general prices of agricultural products. On a general note, when there is inflation outside the sector, say from foreign exchange, it can also affect the sector's output negatively. Inflation is undeniable one of the leading and dynamic macroeconomic issues confronting most economies of the world and has become a leading topic of discussion in Nigeria as its effects penetrate more deeply into the nation's economic life due to prevailing increase in prices (Olatunji, Omotesho, Ayinde, & Ayinde, 2010).

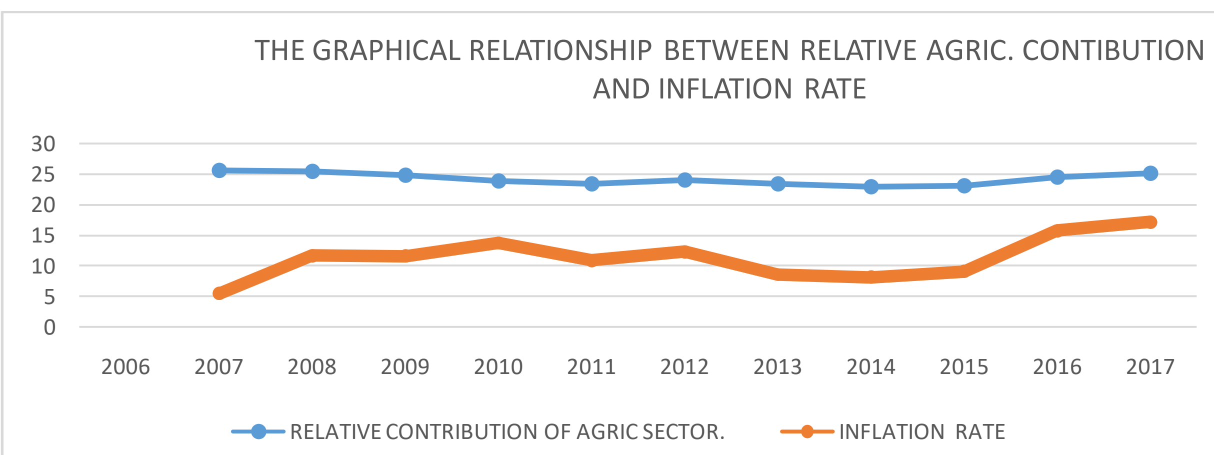


Figure 4.1.2. Showing the graphical representation of Relative Agricultural Output Share and Inflation Rate in Nigeria from 2007 to 2017. Data obtained from CBN Statistical Bulletin, 2017. **Source:** Author Initiative with the use of excel,

The consumer price index for food over the years in Nigeria constituted a larger proportion of the composite consumer price index and as noted by Oppedah (2009), households in developing countries spend more on food relative to overall spending and therefore, food price inflation had played a bigger role in overall inflation. Theoretically, inflation hurts any economy and as for Nigeria, the inflation rate has affected the agricultural sector (Oyakhilomen & Rekwot, 2014).

The World Bank fact figure on average shows that Nigeria's inflation rate is 11.24% while the CPI is 128.21% for the past one decade (2007 to 2017) as the rate increase from 5.40% in 2007 to 17.1% in 2017 while CPI also increases from 70.70 in 2007 to 241.2 in 2017. The Federal Ministry of Finance asserted that it's imported inflation caused by the overdependence on foreign goods as Non-oil imports increase from 3143.73 (In Billion Naira) in 2007 to 8189.3915 (Billion Naira) in 2017. However, the Central Bank of Nigeria stated that it was caused by the volatility of global crude oil prices which has a direct link to Nigeria's foreign reserves; consequently, leading to depletion of the reserve as a result of the high demand for foreign exchange currencies. From the figure below, it is obvious that the fluctuations in the Inflation rate trend (thick line trend), and a stable trend for Agric. This depicts that the inflation rate may be dictated by some external forces other than domestic factors. If not the trend would have also been stable like the Agricultural trend. This depicts that the relationship between agricultural output and inflation is negative as revealed from the graph. The graph from 2006 to 2017 inflation rate also showed inflation rate averaged 10.98, while relative agricultural contribution to real GDP averaged 24.26 (CBN Statistical Bulletin, 2017).

4.1.3 Share of Agricultural Output and Interest Rate(Maximum Lending rates).

Omojimite (2012), Anyawu and Asesope (2010), and so on observed that rising agricultural interest rate in the economy in the short run can affect agricultural output negatively, while in the long-run it can affect the sector’s output more negatively as farmers would not desire to take any loan again, even when they need to expand land areas. Hence, making agricultural output decline. Nigeria's interest rate (lending rate) over the years has not been friendly to most farmers in the country, as the rate has always been above 20%. Though the reason as stated in the CBN 40th anniversary bullion was a result of underdeveloped money and capital markets and the existence of inflationary pressure. On average, the figure for the interest rate for the last decade (2007 to 2017) was 24%. From the figure below (Fig 4.1.3), it can be seen that before 2012, the relative contribution of agricultural output has always exceeded the interest rate. However, after 2012, the interest rate has always been higher than the relative contribution to agriculture, hence making borrowing difficult to pay back and that has been discouraging farmers from borrowing to expand their agricultural activities. Thereby affecting the agricultural sector’s output. The graph also shows that the agricultural output movement has not been positive like the interest rate, with the Interest rate averaging 26.5% from 2012 to 2017, while agricultural output averaged 23.8%.

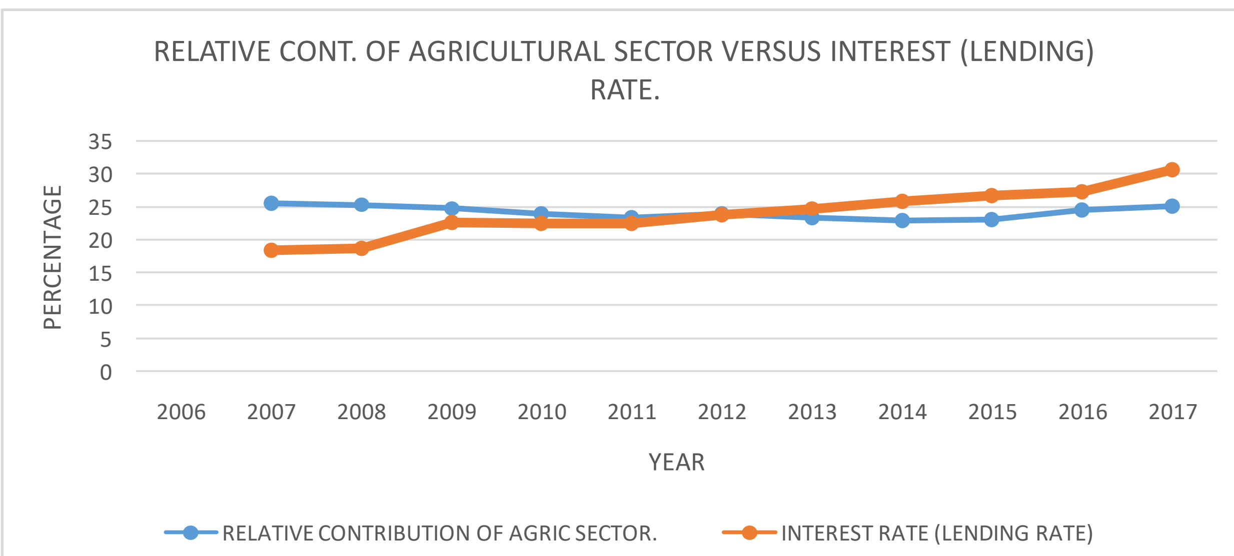


Figure4.1.3. Relative Contribution of Agricultural Sector’s Output versus Interest rate.

Source: Author Initiative with the use of excel, 2013 with Data from CBN Statistical Bulletin, 2017

4.1.4 Agriculture and Public debts

Public debt, according to Abula (2016); Tajudeen (2012) and Oyejide (2004), is the resource or money used in an organization that is not contributed by its owner and does not in any other way belong to them. It is a liability represented by a financial instrument or other formal equivalents. Public debt is the total amount of money that is borrowed by the government of a country. It can be domestic or external borrowing (Abula, 2016). The cost of servicing these debts is called public debt servicing and this can be done monthly, quarterly, or annually. The cost of servicing debt in Nigeria had been on an increase every year. For the past 17 years (2000-2017), the total amount spent on servicing debt amounted to N10.41233 trillion. That is N578.46 billion on average (CBN Bulletin, 2017). This amount is good enough to make the budget of the agricultural sector for at least 4years. The opportunity cost of servicing debt in Nigeria is the volume of agricultural output that the country has forgone simply to service the debt the country has incurred in the past. This is affecting not only the agricultural sector but the economy as a whole. A good example is the N1.69 trillion naira budgeted in 2017 to service public debt. This money would be of great use if being a channel to some sectors of the economy. To give more visual insight to this, below is the figure showing the trend of public debt servicing in Billion Naira in Nigeria for the past decade.

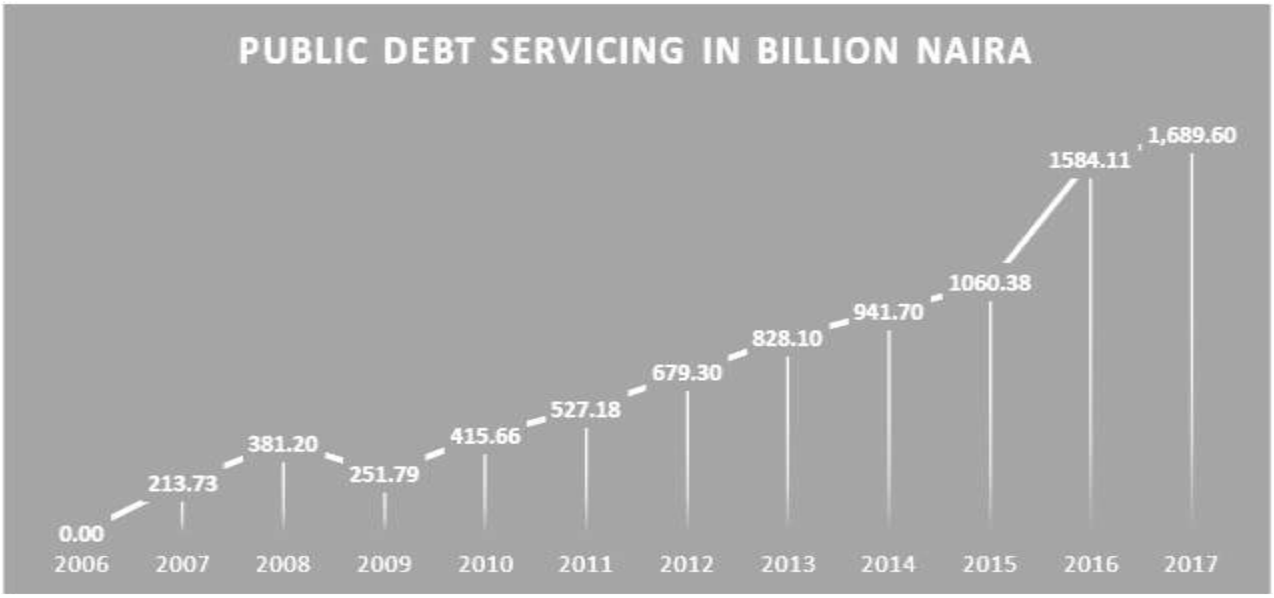


Figure 4.1.4. Showing the graphical representation of Public Debt Servicing in Nigeria from 2007 to 2017. Data obtained from CBN Statistical Bulletin, 2017. **Source:** Author Initiative with the use of excel, 2016

From the trend above, it is clear to see the rise in public debt servicing. However, there was a decrease in 2009, and after 2009 the debt servicing figure has to be on increase reaching up to N1.69 trillion in 2017. This accounted for an average of over N700 billion Naira annually for the past decade (NBS, 2017).

4.1.5 Agriculture and credit availability(ACGFS)

Again in the aspect of agriculture and credit availability, an increase in the amount of credit available to the agricultural sector in the economy has the power to influence more output in the sector; but the output may not be obtained in long run due to the law of diminishing returns which can affect the agricultural output rate (Jhinghan, 2003). However, in the case of Nigeria, there is always fertile land to expand to and cultivate which may contradict this law. In this study, the Agricultural Credit Guaranteed Scheme Fund is the Credit institution dedicated solely to the assistance of the sector via soft loans and an expedient payment system. From its establishment in 1978 the credit scheme had assisted more than 844,486 farmers in all 36 States.

And the average loan from 1981 to date stands at N 3.27 billion. With the total value of the loan stands at N 121.037 billion. (CBN Statistical Bulletin, 2017)

4.2. Descriptive Statistics based on Endogenous and Exogenous Variables.

From the descriptive statistics for the dependent variables in Table 4.2a, The mean of the relative share of the agricultural sector's output is 21.36%. This implies that the share of agriculture contributed about 21.36% of the real GDP in Nigeria from 1981Q1 to 2017Q4 despite the application of crude farming techniques and tools and the large unskilled and semi-skilled labour that takes a larger proportion of the sector; the sector averagely supports Nigeria's GDP with 21.36% annually. This simply depicts that agricultural sector practices are not restricted to the lower-income class of the economy only; as the sector is large and comprises a good number of Nigerians who may also belong to other sectors of the economy. Thus, if more investment and good management of some macroeconomic factors will be well taken care of, the sector can contribute more than what it is recording.

Table 4.2a Descriptive Statistics for the Endogenous Variables.

	RACG	**CPy**	**FHy**	**FTRy**	**LVKy**
Mean	21.3578	22.3433	18.7068	18.4016	20.2269
Median	20.0400	22.0968	18.6685	18.2882	20.1090
Maximum	26.9900	23.4600	19.7042	18.9935	20.9091
Minimum	15.5000	21.2881	17.5205	18.0248	19.6486
Std. Dev.	3.2010	0.7225	0.6200	0.2834	0.3749
Skewness	0.1085	0.1737	0.0182	0.8193	0.4535
Kurtosis	1.7416	1.5141	2.0040	2.2748	1.8533
Jarque-Bera	10.0570	14.3595	6.1256	19.8006	13.1808
Probability	0.0065	0.0008	0.0468	0.0001	0.0014

Observations	148	148	148	148	148

Source: Author Computation.

For the Crop production, it has a mean output of 22. 34%, Fishery had 18.70%, Forestry has 18.40% and livestock had a mean output of 20.23%. with maximum and Minimum output value of 23.46% and 21.29%; 19.70% and 17.52%; 18.99% and 18.02% and 20.91% and 19.65% respectively. Thus, this shows that crop production is the most common and largest contributor in the agricultural sector followed by livestock output within the period under review. More statistics details for the other variables can be seen from the two tables.

The skewness measures the symmetrical nature of the distribution of the series around the mean. For a distribution to be considered symmetric it should have a zero skewness value. Thus, by observing the row of skewness from the above tables all variables seem to have symmetric distribution because their values are not far from zero. The row under kurtosis in the above tables measures the flatness and Preakness of the distribution. For a distribution to be considered normally distributed, it should have a kurtosis value of 2 and hence some of our variables under study have 2 digits as kurtosis.

Table 4.2b Descriptive Statistics for all Exogenous Variables.

	ACGSF	**LEAG**	**CPI**	**INTR**	**PDBTS**	**NOE**	**NOI**
Mean	3185633.	30257.30	51.1919	21.6237	2.95E+08	2.42E+08	2.36E+09
Median	242028.3	23681.00	27.9000	21.3375	81081580	28008600	6.79E+08
Maximum	12456251	72322.00	214.2000	36.0900	1.69E+09	1.13E+09	9.35E+09
Minimum	24654.90	1076.000	0.5000	10.0000	1007078.	203200.0	5069700.
Std. Dev.	4171502.	21008.52	58.0979	5.9125	4.24E+08	3.61E+08	3.02E+09
Skewness	0.1614	-1.25139	1.1684	-0.0172	-0.53123	-0.22952	-0.40895
Kurtosis	1.436941	3.685744	3.3991	2.9380	2.156381	1.843636	1.740067
Jarque-Bera	15.70868	41.52748	34.6547	0.0310	11.34973	9.545392	13.91442
Probality	0.000388	0.000000	0.0000	0.9846	0.003431	0.008458	0.000952

Observations	148	148	148	148	148	148	148

Source: Author's Compilation, using Quarterly time series data.

Table 4.2b shows the Descriptive Statistics of the selected Macroeconomic Variables that can affect the aggregate Relative share of agriculture in Nigeria from 1981Q1 to 2017Q4.

Jarque-Bera probabilities are used to determine for normality test of the series in the above tables. From the two tables above, all the variables are normally distributed at a 5% level of significance except Interest rate (INTR) which is not normally distributed since its Jarque-Bera value is greater than 0.05 level of significance. We fail to accept the null hypotheses that it is normal.

4.3 Stationarity (Unit Root) Test.

Table 4.3 showed that the variables are all stationary at 1st difference. This is because their t-statistics values at first (1st) difference were all greater than their critical values at 5% in absolute terms. Table 4.3 above shows the unit root test results for all the variables. The result was estimated in one compact method (PP). The PP was estimated under the Default Bartlett Kernel Info Criterion of Philip Perron (PP). We based our analysis on the PP tests because it corrects for any serial correlation and heteroscedasticity in the errors(ε_t) non-parametrically by modifying the Dickey-Fuller t-statistics unlike the Augmented Dickey-Fuller test (ADF).

Table 4.3 Unit Root (PP) for all the Variables at levels and at first Difference.

Phillip-Perron (PP) Levels		**Phillip-Perron (PP) First Difference**	
Variable	**Intercept and Trend**	**Variable**	**Intercept and Trend**
RACG (Y)	-2.5213	*RACG (Y)*	**-12.1337***
ACGSF	-2.1937	*ACGSF*	**-12.4263***
LEAG	-1.9890	*LEAG*	**-12.7220***
CPI	2.6891	*CPI*	**-17.0819***
INTR	-2.8090	*INTR*	**-12.8823***
PDBTS	-2.3092	*PDBTS*	**-13.2137***

NOE	-2.6749	*NOE*	**-12.6559***
NOI	-1.6927	*NOI*	**-1.69271***
CPy	-2.4137	*CPy*	**-13.0971***
FHy	-2.9506	*FHy*	**-12.2576***
FTRy	-1.6056	*FTRy*	**-12.6517***
LVKy	-1.2599	*LVKy*	**-14.5763***

Source: Author's compilation. ***** Indicate level of significance at 1%.

4.4 Johansen cointegration test for the five equations.

This is done to determine the existence of a long-run relationship before estimating the long-run coefficients using FMOLS.

4.4.1 Aggregate Agricultural Output:

Above table 4.2.2 gives the leeway of testing for a long-run relationship using the Johansen cointegration test since all variable variables are integrated of order (1). Thus, the long-run equilibrium relationship between the variables is examined using the Johansen and Juselius (1990) cointegration test, while the Fully Modified Ordinary Least Square (FMOLS) as proposed by Phillips and Hansen (1990) is used to determine the long-run impacts/coefficients of the selected macroeconomic variables on the relative share of agricultural output in Nigeria.

4.4.1.1 Lag Length Criteria for Aggregate Agricultural Output in Nigeria.

Table 4.4.1.1 Lag Order Selection Criteria for aggregate Agricultural Output in Nigeria.

Critical / Lag Length	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Akaike Information Criterion (AIC)	28.2576	8.6774	9.3283	9.76114	8.8062	**6.71174***	7.4019
Schwarz Information Criterion (SC)	28.4241	**10.1761***	12.1593	13.9243	14.3015	13.5393	15.5616
Hannan-Quinn Information Criterion (HQ)	28.3253	**9.2864***	10.4787	11.4529	11.0392	9.4862	10.7177

Note: * indicates lag order selected by the criterion.

In adopting these procedures, we first determine the optimal lag length of the Vector Autoregressive (VAR) model using various criteria, and the test results of the lag length selection criteria are presented in Table 4.4.1.1 above. From Table 4.4.1.1 above, Akaike Information Criterion (AIC) suggests 5, while Schwarz Information Criterion (SIC) and Hannan-Quinn Information Criterion (HQ) both suggest a lag length of 1. Thus, we choose to use the AIC optimal Lag Length because it is suitable for the number of observations we considered and it applies the 2nd order correction considering all the parameters in the model. (Hamilton, 1994; Box, 2008 and Enders, 2014).

4.4.1.2 Johansen Cointegration Test for Aggregate Agricultural Output in Nigeria.

Table 4.4.1.2 Cointegration Table for aggregate Agricultural Output in Nigeria.

No. of Block	*Trace*				*Max-Eigen Value*			
Hypothesized No. Cointegration. Equation	***Trace statistic Value***	***0.05 Critical value***	***prob.***	***No. of Coint. Equation***	***Max-Eigen statistics Value***	***0.05 Critical value***	***prob.***	***No. of Coint. Equation***
None*	181.4301	159.5297	0.0018	7	38.5556*	52.3626	0.5856	*5*
At most 1*	142.8745	125.6154	0.0029		36.1715*	46.2314	0.3878	
At most 2*	106.7030	95.7537	0.0071		30.6330*	40.0776	0.3833	
At most 3*	76.0699	69.8189	0.0145		24.5645*	33.8769	0.4151	
At most 4*	51.5054	47.8561	0.0218		18.3017*	27.5843	0.4702	
At most 5*	33.2038	29.7971	0.0195		17.5812	21.1316	0.1463	
At most 6*	15.6226	15.4947	0.0478		13.1652	14.2646	0.0740	

* *denotes rejection of the hypothesis at the 0.05 level* **Source:** *Author's Computation..*

The Johansen cointegration test was estimated using a lag length of 5 as suggested by AIC, and the result is presented in Table 5.2.1.2 above. The result of the cointegration test shows a long-run equilibrium relationship between the relative share of agricultural output (RCAG) and the selected macroeconomic variables. The table reveals that trace tests indicate 7 cointegrating equations, while Maximum eigenvalue tests suggested 5. Thus, there is a long relationship among the variables, (the Relative share of Agricultural output to Capital which is proxied by Credit, Labour, Consumer Price Index, Interest Rate, Public Debt Servicing, and Non-Oil Trade (Export and Import))

DISAGGREGATED SUB-SECTORS.

4.4.2 Crop Production:

4.4.2.1 Lag Length Criteria for Crop Production Output in Nigeria.

From table 4.4.2.1 below, we choose to use the AIC optimal Lag Length of 5 because it is suitable for the number of samples we considered and it applies the 2nd order correction considering all the parameters in the model. Unlike the Schwarz criterion (SC) and Hannan Quinn(HQ) both consist of double log-likelihood functions in their model (Hamilton, 1994; Box, 2008 and Enders, 2014).

Table 4.4.2.1 Lag Length Criteria for crop Production Output in Nigeria.

Critical / Lag Length	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Akaike Information Criterion (AIC)	20.6972	1.8865	2.5226	2.9469	2.5195	**0.3825***	1.0331
Schwarz Information Criterion (SC)	20.8638	**3.3852***	5.3535	7.1100	8.0148	7.2101	9.1929
Hannan-Quinn Information Criterion (HQ)	20.7649	**2.4955***	3.6730	4.6386	4.7525	3.1570	4.3489

* indicates lag order selected by the criterion. **Source:** Author's Compilation.

4.4.2.2 Johansen Cointegration Test for Crop Production Output in Nigeria.

The Johansen cointegration test is estimated using a lag length of 5, and the result is presented in Table 4.4.2.2 below. The results reveal that the trace test indicated 4 cointegrating equations, while the Maximum eigenvalue test suggests 3. This implies a long-run equilibrium relationship between the relative share of agricultural output to Real GDP and the selected macroeconomic variables (Capital which is proxied by Credit, Labour, Crop Consumer Price Index, Interest Rate, Public Debt Servicing, and Non-Oil Trade (Export and Import))

Table 4.4.2.2 Cointegration Table for Crop Production Output in Nigeria.

No. of Block	Trace	Max-Eigen Value

Hypothesized No. Cointegration. Equation	Trace statistic Value	0.05 Critical value	prob.	No. of Coint. Equation	Max-Eigen statistics Value	0.05 Critical value	prob.	No. of Coint. Equation
None*	193.6356	159.5297	0.0002	4	45.9459*	52.3626	0.1954	3
At most 1*	147.6897	125.6154	0.0011		41.0867*	46.2314	0.1606	
At most 2*	106.6030	95.7536	0.0073		34.3012*	40.0775	0.1937	
At most 3*	72.3017	69.8188	0.0313		26.9172	33.8768	0.2678	
At most 4	45.3845	47.8561	0.0838		19.7423	27.5843	0.3592	
At most 5	25.6421	29.7970	0.1397		13.7841	21.1316	0.3830	
At most 6	11.8580	15.4947	0.1639		11.8166	14.2646	0.1177	
At most 7	0.0413	3.8414	0.8388		0.0413	3.8414	0.8388	
Source: Author's Computation.								

4.4.3 Fishery Production:

4.4.3.1 Lag Length Criteria for Fishery Production Output in Nigeria.

From the below table, we choose to use the AIC optimal Lag Length 5 (Hamilton, 1994; Box, 2008 and Enders, 2014).

4.4.3.1 Lag Length Criteria for fishery Production Output in Nigeria.

Critical / Lag Length	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Akaike Information Criterion (AIC)	23.1963	3.9803	4.6337	5.1027	4.9255	**3.3901***	4.0982
Schwarz Information Criterion (SC)	23.3628	**5.4790***	7.4647	9.2658	10.4208	10.2177	12.2580
Hannan-Quinn Information Criterion (HQ)	23.2640	**4.5893***	5.7841	6.7944	7.1585	6.1646	7.4141

Source: Author's Compilation.

4.4.3.2 Johansen Cointegration Test for Fishery Production Output in Nigeria.

The Johansen cointegration test is estimated using a lag length of 5, and the result is presented in Table 4.4.3.2 above. The results of the cointegration tests show a cointegration equation of 1 which implies a long-run equilibrium relationship between the relative share of fishing output and the selected macroeconomic variables (Capital which is proxied by Credit, Labour, Fishing Consumer Price Index, Interest Rate, Public Debt Servicing, and Non-Oil Trade (Export and Import))

Table 4.4.3.2 Cointegration Table for fishery Production Output in Nigeria.

No. of Block	Trace				Max-Eigen Value			
Hypothesized No. Cointegration. Equation	**Trace statistic Value**	**0.05 Critical value**	**prob.**	**No. of Coint. Equation**	**Max-Eigen statistics Value**	**0.05 Critical value**	**prob.**	**No. of Coint. Equation**
None*	164.1410	159.5297	0.0273	1	44.8804*	52.3626	0.2371	1
At most 1	119.2605	125.6154	0.1144		32.3974	46.2314	0.6314	
At most 2	86.8630	95.7536	0.1747		22.4594	40.0775	0.8995	
At most 3	64.4035	69.8188	0.1254		21.4579	33.8768	0.6495	
At most 4	42.9456	47.8561	0.1339		18.3482	27.5843	0.4664	
At most 5	24.5973	29.7970	0.1764		14.6437	21.1316	0.3146	
At most 6	9.9536	15.4947	0.2843		9.9529	14.2646	0.2150	
At most 7	0.0007	3.8414	0.9792		0.0007	3.8414	0.9792	
Source: Author's Computation.								

4.4.4 Forestry Production:

4.4.4.1. Lag Length Criteria for Forestry Production Output in Nigeria.

From the above table, we choose to use the AIC optimal Lag Length 4 (Hamilton, 1994; Box, 2008 and Enders, 2014).

Table 4.4.4.1 Lag Length Criteria Table for forestry Production Output in Nigeria.

Critical / Lag Length	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Akaike Information Criterion (AIC)	1.6157	2.4752	3.3029	4.0544	**0.3525***	1.2495	2.1441
Schwarz Information Criterion (SC)	**1.7830***	3.9809	6.1471	8.2371	5.8735	8.1090	10.3421
Hannan-Quinn Information Criterion (HQ)	**1.6836***	3.0870	4.4587	5.7541	2.5960	4.0369	5.4755

Source: Author's Compilation.

4.4.4.2 Johansen Cointegration Test for Forestry Production Output in Nigeria.

Table 4.4.4.2 Cointegration Table for Forestry Production Output in Nigeria.

No. of Block	Trace				Max-Eigen Value			
Hypothesized No. Cointegration. Equation	**Trace statistic Value**	**0.05 Critical value**	**prob.**	**No. of Coint. Equation**	**Max-Eigen statistics Value**	**0.05 Critical value**	**prob.**	**No. of Coint. Equation**
None*	283.8934	159.5297	0.0000	6	74.7986*	52.3626	0.0001	6
At most 1*	209.0947	125.6154	0.0000		51.2000*	46.2314	0.0136	
At most 2*	157.8947	95.7536	0.0000		44.4327*	40.0775	0.0152	
At most 3*	113.4620	69.8188	0.0000		37.8704*	33.8768	0.0158	
At most 4*	75.5916	47.8561	0.0000		36.2455*	27.5843	0.0030	
At most 5*	39.3461	29.7970	0.0030		26.2362*	21.1316	0.0087	
At most 6	13.1098	15.4947	0.1108		10.9020	14.2646	0.1592	
At most 7	2.2078	3.8414	0.1373		2.20780	3.8414	0.1373	
Source: Author's Computation.								

The Johansen cointegration test is estimated using a lag length of 4, and the result is presented in Table 4.4.4.2 above. The results of the cointegration tests show a cointegration equation of 6 which implies a long-run equilibrium relationship between the forestry output and the selected macroeconomic variables (Capital which is proxied by Credit, Labour, Forestry Consumer Price Index, Interest Rate, Public Debt Servicing, and Non-Oil Trade (Export and Import)).

4.4.5 Livestock Output:

4.4.5.1 Lag Length Criteria for Livestock Production Output in Nigeria.

Table 4.4.5.1 Lag Length Criteria for Livestock Production Output in Nigeria.

Critical / Lag Length	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Akaike Information Criterion (AIC)	0.8803	1.7331	2.5461	3.2377	**-0.4149***	0.4570	1.3076
Schwarz Information Criterion (SC)	**1.0476***	3.2389	5.390320	7.4204	5.1062	7.3166	9.5056
Hannan-Quinn Information Criterion (HQ)	**0.9482***	2.3450	3.701908	4.9374	1.8286	3.2445	4.6390
Source: Author's Compilation							

From the table above, we choose to use AIC optimal Lag Length of 4 (Hamilton, 1994; Box, 2008 and Enders, 2014).

4.4.5.2 Johansen Cointegration Test for Livestock Production Output in Nigeria.

Table 4.4.5.2 Cointegration Table.

No. of Block	Trace				Max-Eigen Value			
Hypothesized No. Cointegration. Equation	**Trace statistic Value**	**0.05 Critical value**	**prob.**	**No. of Coint. Equation**	**Max-Eigen statistics Value**	**0.05 Critical value**	**prob.**	**No. of Coint. Equation**
None*	294.7163	159.5297	0.0000	6	79.6979*	52.3626	0.0000	5
At most 1*	215.0184	125.6154	0.0000		58.6113*	46.2314	0.0016	
At most 2*	156.4070	95.7536	0.0000		55.6089*	40.0775	0.0004	
At most 3*	100.7981	69.8188	0.0000		37.6292*	33.8768	0.0170	
At most 4*	63.1688	47.8561	0.0010		28.6489*	27.5843	0.0364	
At most 5*	34.5199	29.7970	0.0133		20.0051	21.1316	0.0713	
At most 6	14.5147	15.4947	0.0698		10.7464	14.2646	0.1674	
At most 7	3.7682	3.8414	0.0522		3.7682	3.8414	0.0522	
Source: Author's Computation.								

The Johansen cointegration test is estimated using a lag length of 4, and the result is presented in Table 4.4.5.2. above. The results of the cointegration tests show a cointegration equation of 6 which implies a long-run equilibrium relationship between the forestry output and the selected macroeconomic variables (Capital which is proxied by Credit, Labour, Forestry Consumer Price Index, Interest Rate, Public Debt Servicing, and Non-Oil Trade (Export and Import))

4.5.0 The Coefficients of Long and Short-Run Impacts (FMOLS and ECM) of the variables and Diagnostic Tests for the 5 specified Equations.

4.5.1 The Result Of The FMOLS Estimation For Aggregate Agricultural Output In Nigeria.

One important econometric issue is the verification of long-run impact after examining the existence of long-run relationships among the variables under consideration using whether Engel Granger (1987) or Johansen approach (1991). Various modern econometric techniques (FMOLS, DOLS and CRR) were introduced to determine the existence of a long-run impact/coefficients among variables in a given equation from Fully Modified OLS by Phillip and Hensen (1992); to Dynamic OLS by Saikkonen (1992) and Stock and Watson (1993) to Conical Cointegrating Regression by Park, (1992).

Table 4.5.1 FMOLS Result For Aggregate Agricultural Output In Nigeria.

VARIABLES	**Dependent Variable: Y (Share of Agricultural output to Real Output.)**		
	Coefficient	**t-Statistic**	**Prob.**
Constant	15.1168	1.5385	0.1262
LNACGSF	1.8475*	3.9297	0.0001
LNLEAG	-1.5727*	-2.6289	0.0095
CPI	-0.0525*	-4.0376	0.0001
INTR	0.0352	0.5924	0.5546
LNPDBTS	1.3286**	2.5654	0.0114
LNNOE	0.6001**	0.9124	0.0363
LNNOI	-2.0771*	-3.1192	0.0022
R-squared	**0.846770**		
Adjusted R- Squared	**0.837887**		

Source: Author's Compilation. * Significant at 1%. ** significant at 5%

Where: **Y**=Relative share of Real Agricultural output to Real GDP (RACG); **ACGSF**= Agricultural Guaranteed Credit Scheme Fund; **LEAG**= Labour Employed in the Agric Sector, **CPI**= Consumer Price Index; **INTR**=Interest Rate; **PDBTS**= Public Debt servicing;

NOE= Non-Oil Export; **NOI** = Non-Oil Imports; **CPY** = Proportion of Crop production output in aggregate agricultural output; **FHY** = Proportion of Fishery production output in aggregate agricultural output; **FTRY** = Proportion of Forestry production output in aggregate agricultural output; **LVKY** = Proportion of Livestock production output in aggregate agricultural output and

υ, ε, μ, λ and **ν** = error term for each equation.

This study uses the FMOLS approach by Phillip and Hensen (1992) to determine the long-run coefficient and impact of selected macroeconomic variables on the relative share of agricultural sector output in Nigeria. The FMOLS among the three long-run estimation techniques (FMOLS, DOLS and CCR), produces more reliable estimates for small and large sample size and provides a check for robustness of the results than the Dynamic OLS (DOLS) which tries to include leads and lags and measure the elasticity of variables; and Conical Cointegrating Regression (CCR) by Park, (1992) which tests for cointegration using residuals in the presence of variables with I(1) and I(2).

Table 4.5.1. shows the result of the FMOLS for equation 3.3 in chapter three. Equation 3.3 is the estimable equation for the long and short-run impact of selected macroeconomic variables on the aggregate relative share of Agricultural output to real GDP in Nigeria. Thus, table 4.5.1 reports the results of the impacts of these selected macroeconomic variables on the dependent variable in the long run as this addresses the second objective of this study. There is no doubt empirically, macroeconomic variables and economic reforms have had varying impacts on the output performance of agriculture in Nigeria. However, the effects of other variables such as the amount of rainfall, changes in climate condition, changes in the demand or consumption of some crops and some specific policies targeted on specific sub-sectors do affect the overall sector's outputs over the period under study; which were not captured in the model. We also have to acknowledge that the deregulation of interest rates, the creation of agricultural support schemes

and institutions such as the Agricultural Development Programmes (ADP), the Fadama schemes, and even agricultural extension services, all had some form of direct or indirect impact to the agricultural sector output.

Considering all the variables of interest, the FMOLS result suggests that the coefficient of Capital on the agricultural sector proxied by Credit (ACGSF) is positive, thereby indicating a positive impact of capital on Agricultural output in the long run. The coefficient (1.8475) is also statistically significant, which implies that as capital rises, the relative share of agricultural output also rises. This goes in line with the prior expectations that are derived from economic theory which explains that as farmers access more agricultural credits, investment in agricultural activities tends to increase and consequently the sector’s total output improves. This is similar to the result obtained by some previous studies such as Adetoun, (2010); Benson, (2012); Odor, (2014) and Jim, (2015).

The impact of labour is negative and statistically significant in the long run. This implies a 10% increase in labour will reduce agricultural output by 15.2% in the long run. This suggests that the Nigerian agricultural sector needs quality labour, because the sector is already occupied by semi and unskilled labour hence, adding more of such unskilled or semi-skilled labour may lead to less marginal outputs which are not commensurate to the amount of investments infused into the sector. Furthermore, the result also implies that due to modernization, farmers in the sector are gradually moving towards capital intensive which does not depend more on a large number of labour like it was during the pre-colonial era up to the new millennium where large labour was a prerequisite for higher agricultural outputs.

Finally, this can be attributed to how marginal productivity of labour (MP_L) contribution is unequal to the inputs or resources that are utilized to realize the total output in the long run in the production process; that is in the long run, labour most have been saturated thus, its impact on the total output may be negative instead of positive (Sloman and Wride, 2010). Studies like Jim, (2015) found out that labour force in Agriculture is positive and statistically significant only in the short run; while our result suggests in the long run, an increase in labour does not affect the agricultural sector’s output positively.

CPI and non-oil imports are found to be negative and statistically significant. This also follows the theoretical a-priori expectation of negative impact of inflation proxied by aggregate Consumer Price Index and Non-oil imports as they affect the performance of agricultural sector's output negatively. This is done by affecting the farmer's income since farmers need to buy other crops they do not cultivate. Again, based on the Nigerian CPI data obtained in CBN statistical bulletin (2016) which revealed that total food less imported food makes the local food production lesser in percentage compared to the remaining component of the CPI; thus, increase in the prices of the remaining components will affect the agricultural output negatively. Also, Non-Oil imports affect the sector negatively; this implies Non-Oil Imports of goods and services into the economy tend to relegates the consumption of locally cultivated foods, hence discouraging farmers from farming more of some kind of produce thus, negatively affecting the output of the sector.

The interesting variables in the result are the two policy variables (interest rate and public debt servicing) and both have a positive impact; though the interest rate is non-statistically significant on agricultural output in the long run. Some previous studies like Eric, Kalu, Okey, Uzochukwu and Oliver, (2004) stated that Nigeria has more comparative advantage in agricultural output and may experience annual improvement in yields independent of some macroeconomic factors due to the abundance of un-used arable fertile land and resources that the sector accumulates but is yet to explore, coupled with the application of incremental technological development which does make the output to also increase. Thus, the agricultural output may increase the same as the interest rate, but one cannot directly account for the increase in yield to increase in interest rate. Furthermore, the interest rate is not solely agricultural specific, it's the maximum lending rate that is most patronized by investors in the industrial sector. Furthermore, the agricultural sector is a primary sector with lots of untapped resources unlike the industrial sector that depends so much on the agricultural sector and services sector for raw materials and capital respectively, therefore, agriculture in Nigeria does not so much depend on the general interest rate to assist it in raising output in the long run as there are other factors which can help the sector like the supports giving by Non-governmental Organisation (NGOs) that have supported and are still supporting the sector by initiating programs like the FADAMA project, One Acre, Action Against Hunger, International Fund for Agricultural Development (IFAD), World Food Programmes by World Bank among others. These Programmes have been supporting the sector's output by providing machinery, farm inputs (seeds, fertilizer, etc), training and funds (Ime, 2014 and Kehinde, 2012) And these have been impacting the sector's output irrespective of the changes in interest rate. This finding also corroborates with Aniekan, (2015).

For public debt servicing being positive and significant, this implies that government has an absolute degree of influence in the control of this variable which is usually independent of the agricultural sector. Hence, it serves the general economy purpose other than just the agricultural sector's purpose only making it independent of the agricultural sector. Again, monetarily considering this, the composition of the Nigeria public debt for the past two decades shows that domestic debt always accounts for about 35-45% of the public debt annually (NBS, 2016). Thus, any attempt to service public debt by the government tends to increase the total money supply within the economy via the various financial institutions, which will affect the interest rate(interest rate decrease with increase in the money supply), thereby making credit (loans) cheaper for investors and commercial farmers and finally may lead to a positive impact on aggregate agricultural output (Sloman and Wride, 2010).

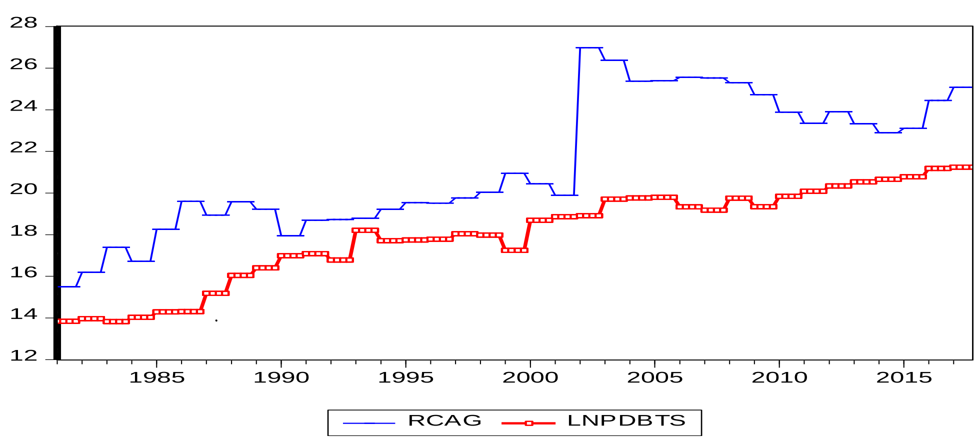


Fig. 4.5.1 A simple trend showing the relationship between agricultural output and Public debt servicing.

Source: Author Computation

From the figure above, the trends showed, within the time under review(1981-2017), the trend of public debt servicing in Nigeria has been increasing corresponding with each year that agriculture experienced a rise in output; which reveals a positive relationship with the agricultural output. In addition to the above outcome, it also implies that government expansionary fiscal policy like servicing of debt does not have crowding-out effects on the agricultural sector which may be as a result of the fact that government does not get directly involved in agricultural production in Nigeria. This result further corroborates with some earlier works carried out by Kwanashie, et al. (1997) and Yaqub, (2010). From the outlook of the model, the results of the estimated FMOLS show that selected macroeconomic variables explain well about 83% of the variations of agricultural output factors in the model. This is adjudged by the value of the coefficient of determination, R-squared. Which suggests the model is fitted well.

4.5.2 Error Correction Model (ECM) for Short Run Analysis For Aggregate Agricultural Output In Nigeria.

To achieve the second part of the second objective of the study, the ECM is estimated to determine the short-run impact of the selected macroeconomic variables on the dependent variable. The results below (Table 4.5.2) are the parsimonious ECM (output with the lowest AIC) which revealed the significant variables in the model. That is, it contained only the variables that have a short-run significant impact on agricultural output. This result is derived from the over- parameterized model which contained all the significant variables and those that are not significant are remove from the estimated model. From the result (Table 5.3.2) below, credit, interest and non-oil exports are positively related to agricultural output.

Table 4.5.2 Parsimonious Error Correction Model For Aggregate Agricultural Output In Nigeria.

Dependent Variables: Aggregate Agricultural Output (RACG)			
Variables	**Coefficient**	**t-Statistic**	**Prob.**
Constant	0.0484	1.1229	0.2634
D(LNACGSF)	0.5751**	2.3136	0.0222
D(LNLEAG)	-1.3387*	-3.6814	0.0003
D(INTR)	0.0669*	3.6454	0.0004
D(LNPDBTS)	-0.4962*	-2.7395	0.0070
D(LNNOE)	2.4643*	9.7044	0.0000
D(LNNOI)	-2.0588*	-7.6132	0.0000
ECT	**-0.0885***	**-2.6339**	**0.0094**
R^2	**0.4826**		
F-STATISTIC	**18.5262**		
D.W STATISTICS	**1.9484**		
Source: *Author's Computation, 2019.* * Significant at 1%. ** significant at 5%			

while labour, debt servicing and non-oil imports are negatively related to the dependent variable. This implies that labour in the short run impacts negatively on the total agricultural output. With a 13% reduction to any 10% increase in labour formally employed in the sector in the short run. This implies that other informal farmers are involved in the farming activities but were not captured formally. Hence, the outcome would not give adequate representations of what. Again the result for non-oil exports implies that non-oil exports have much impact on agricultural output as a 10% increase in non-oil exports can cause agricultural output to increase by 24.6%. This is based on fact that income generated from non-oil exports is capable of stimulating farmers to farm more agricultural produce. Again, local market prices at times don't encourage farmers to farm more, as prices of agricultural output locally tend to fluctuate quickly within a short time. Unlike the international market which guaranteed more stable prices. On the contrary, the non-oil export has a more negative impact on agricultural outputs in the short run. The ECT which measures the speed of adjustment to equilibrium is 8%. This implies that the speed to the equilibrium is fairly not fast.

4.5.3 Serial Correlation Test

The result of the Breusch-Godfrey Serial Correlation LM Test below examines the relationship between the variables and their lagged version over various time intervals. Table 4.5.3 shows no serial correlation in the model since the probability value of the Observed R-Squared is greater than 5%. (0.4337). Hence there no serial correlation in the residual.

Table 4.5.3 Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.5691	Prob. F(1,135)	0.4519
Obs*R-squared	0.6129	Prob. Chi-Square(1)	0.4337

Source: Author's computation.

4.5.4 Heteroscedasticity Test.

Table 4.5.4 Breusch-Pagan Heteroscedasticity Test:

F-statistic	0.5168	Prob. F(16,129)	0.9345
Obs*R-squared	8.7960	Prob. Chi-Square(16)	0.9216

Source: Author's computation.

One of the assumptions made about the residuals in OLS regression is that the errors should have constant variance (homoscedasticity). The result of the Breusch-Pagan heteroskedasticity test below shows no heteroskedasticity in the model since the probability value of the Observed R-Squared is greater than 5%. (0.9216). Hence there exist a Constance variance in the residual.

4.5.5 CUSUM TEST.

CUSUM parameter stability test is used to detect the instability of the variables and their coefficients over time. This test is most commonly employed in time series data after the Error Correction Model is conducted, to reveal the existence of any structural breakpoint.

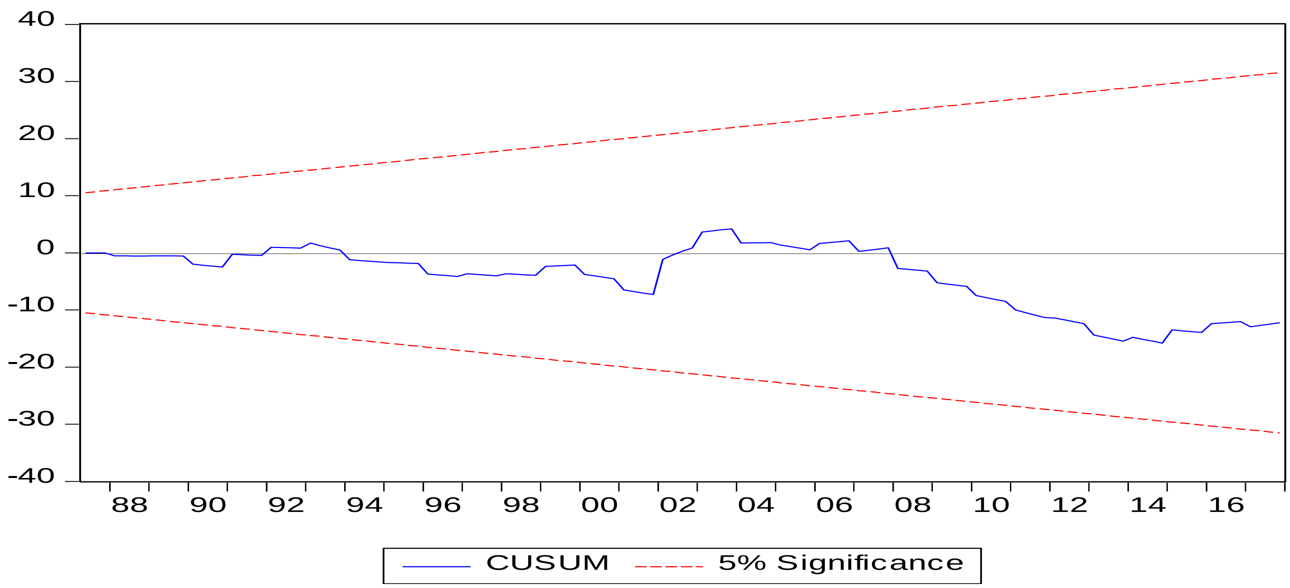


Figure 4.5.5. The CUSUM graph for aggregate agricultural output above revealed that the coefficients of the variables in the model are stable over some time.

4.6.0 The Coefficients For The Long And Short-Run Impact Analysis For The Disaggregated Agricultural Sector's Outputs.

4.6.1 CROP PRODUCTION.

4.6.1.1 The Result Of The FMOLS Estimation For Crop Production Output In Nigeria.

Table 4.6.1.1 below is the FMOLS result for equation 3.4 in chapter three. Equation 3.4 is the equation for the first disaggregated sub-sector – Crop Production of Agricultural output to Real GDP and the considered selected macroeconomic variables affecting the dependent variable. In the equation, the CPI is specifically computed for crop production. Thus, table 4.6.1.1 below reports the results of the impact of selected macroeconomic variables on the dependent variable (Crop Production) in the long run as this addresses the last objectives of this study. No doubt, macroeconomic variables and economic reforms, in general, have had varying impacts on the output performance of crop production under the agricultural sector in Nigeria.

Considering all the variables in the model, the FMOLS result below suggests that the coefficient of Capital on crop production proxied by credit (ACGSF) is positive, thereby indicating a positive impact of capital on crop production output in the long run. The coefficient is also statistically significant, which implies that as capital rises, crop production output also rises. This goes in line with the a-priori expectations that are derived from economic theory which explains that as agricultural credit increases, investment in agricultural activities will also increase and consequently the output which can come from some of the sub-sectors improves.

Table 4.6.1.1 FMOLS Result For Crop Production Output In Nigeria.

VARIABLES	**Dependent Variable: Y (Crop Production Output.)**		
	Coefficient	t- Statistic	Prob.
Constant	18.8149	83.9476	0.0000
LNACGSF	0.2067*	6.9300	0.0000
LNLEAG	-0.0248	-0.6635	0.5081
CPI	0.0046*	3.8249	0.0002
INTR	0.0051	1.5550	0.1222
LNPDBTS	0.0684**	2.5881	0.0107
LNNOE	0.0175	0.4437	0.6579
LNNOI	-0.0421	-1.2461	0.2148
R-squared		**0.9892**	
Adjusted R-squared		**0.9886**	

Source: Author Compilation. * Significant at 1%. ** significant at 5%

For Labour, it is negative and not statistically significant. This implies a 10% increase in labour will reduce crop production output by 0.24%. This depicts that the crop production sub-sector is more capital intensive and does not strictly depend on labour hence, its impact on the dependent variable is insignificant as suggested by the result. Crop production consumer price index, interest rate, public debts and non-oil exports are found to be all positive and statistically significant. The positive and significant impact with which Crop CPI has on crop production be attributed to the incentive that comes from the sub-sectors. Intuitively, it implies when the price of crop increase, it stimulates farmers to concentrate on cultivating more of crops and less of another component of the agricultural sector. The lower the prices, the less attractive farmers may find to cultivate more crops compared to other forms of agriculture. Hence, Crop CPI is an important instrument that can help to boost output production within the sub-sector.

For the interest rate, being positive and not statistically significant to crop production, though this deviates from the a-priori expectation, however, it is acceptable. It is acceptable because the interest rate is a general rate, regulated without the consideration of crop production. Hence its impact on crop production may not be determined using crop production as the endogenous variable. For public debt servicing, which is the surprising variable in the model; it statistically looks unacceptable as the impact is significant and it is positively related to crop production output. But worthy of note is that public debt servicing is an independent variable control by the government without the consideration of crop production. This is further shown from the figure below- a positive correlation exists between the variable and crop production. This is different from the findings of Okidim and Albert, (2012) because they base their studies on selected cereal crops (maize, sorghum, rice, millet and wheat) and the technique they employed was multiple regression which is not sufficient enough to reveal the impact of these macroeconomic variables in the long run.

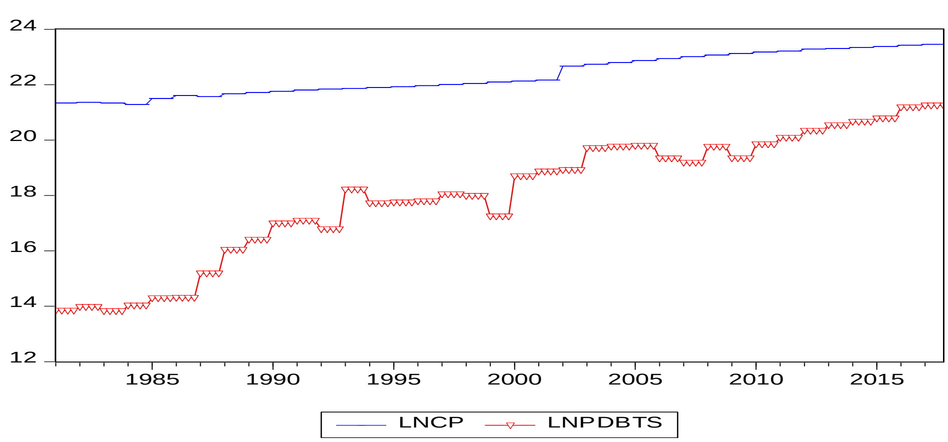


Figure.4.6.1.1 Showing the trend nature of Crop Production and Public Debt Servicing from 1981Q1 to 2017Q4.

Source: Author Computation.

Hence, from the beginning of our time frame, the debt servicing figure has been on the rising with just two periods which it dropped (figure 4.6.1.1.) above. Hence crop production output may independently increase, but the impact is not from public debt servicing. Finally, for Non-oil trade, the Export variable is positive, while the Import is negative both agreeing to the a-priori expectation. Both variables suggest their impacts on crop production output are insignificant. From the look of the estimated model for FMOLS, the result shows that selected macroeconomic variables explain about 98% of the variations of crop production output factors in the model (R-square).

4.6.1.2 Parsimonious Error Correction Model (ECM) for Short Run Analysis-Crop Production

To achieve the second part of the last objective of the study, the ECM is estimated to determine the short-run impact of selected macroeconomic variables on the dependent variable. The results below (Table 4.6.1.2) is the parsimonious ECM which is obtained from the over parameterized model revealed the short run significant variables in the model. That is, the result shows the significant variables capable of imposing an impact on crop production output in the short run. From the result (Table 4.6.1.2) above, credit, CPI, interest and non-oil exports are positively related to crop production output, while non-oil import is negatively related to the dependent variable.

Table 4.6.1.2. Parsimonious Error Correction Model for Crop production in Nigeria.

Dependent Variables: *Crop Production (CP)*			
Variables	**Coefficient**	**t- Statistics**	**Prob.**
Constant	0.0032	1.0688	0.2870
D(LNACGSF)	0.0384**	2.4807	0.0143
D(CP_CPI)	0.0095*	6.8707	0.0000
D(INTR)	0.0032*	2.5989	0.0126
D(LNNOE)	0.0804*	4.6935	0.0000
D(LNNOI)	-0.0815*	-4.4584	0.0000
ECT	**-0.1040****	-2.5856	**0.0107**
R^2	**0.5505**		
F-STATISTIC **28.5767**		***D.W STATISTICS*** **1.9182**	

Source: Author Computation, 2019. * Significant at 1%. ** significant at 5%

Intuitively, the result implies that non-oil exports have much impact on crop production output as a 10% increase in Non-oil exports can cause total agricultural output to increase by 0.8%. This is based on fact that income generated from Non-Oil exports is capable of stimulating farmers to farm more agricultural produce. Again, local market prices at times do not encourage farmers to farm more, as prices of agricultural output locally tend to fluctuate quickly within a short time. Unlike the international market which guaranteed quite stable prices of outputs and foreign exchange for a relatively long time. Thus, the export of agricultural output will encourage farmers to farm more. On the contrary, the Non-Oil export has a more negative impact on agricultural outputs in the short run. The ECT which measures the speed of adjustment to equilibrium is 10.4%. This implies that the speed of the variables in the model to equilibrium is fairly not fast.

4.6.1.3 Serial Correlation Test

The result of the Breusch-Godfrey Serial Correlation LM Test above shows no serial correlation in the model since the probability value of the Observed R-Squared is greater than 5%. (0.1118). Hence there no serial correlation in the residual.

Table 4.6.1.3 Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.0735	Prob. F(1,135)	0.1298
Obs*R-squared	4.3828	Prob. Chi-Square(1)	0.1118

Source: Author's computation.

4.6.1.4 Heteroskedasticity Test

Table 4.6.1.4 Breusch-Pagan Heteroscedasticity Test:

F-statistic	0.9406	Prob. F(48,93)	0.5252
Obs*R-squared	15.254	Prob. Chi-Square(48)	0.5061

Source: Author's computation using.

The result of the Breusch-Pagan heteroskedasticity test shows no heteroskedasticity in the model since the probability value of the Observed R-Squared is greater than 5%. (0.5061). Hence there exist a Constance variance in the residual.

4.6.1.5 CUSUM Test

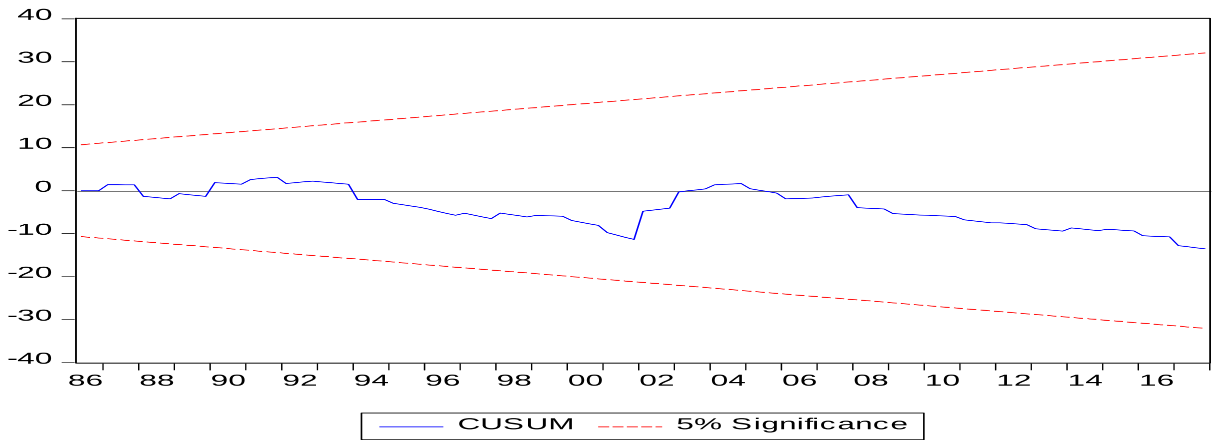


Figure 4.6.1.5 The CUSUM graph above revealed that the variables in the model are stable over some time.

4.6.2.0 FISHERY OUTPUT.

4.6.2.1 The Result Of The FMOLS Estimation For Fishery Output In Nigeria.

Table 4.6.2.1 below is the FMOLS result for equation 3.5 in chapter three. Equation 3.5 is the equation for the second disaggregated sub-sector –Fishery production output and the considered selected macroeconomic variables affecting its output. Thus, table 4.6.2.1. below reports, the results of the coefficients and impacts of these selected macroeconomic variables on the dependent variable (Fish Production) in the long run as this also addresses the last objectives of this study.

For the fishery model, the FMOLS result suggests that the coefficient of capital on crop production proxied by credit (ACGSF) is positive, thereby indicating a positive impact of capital on fish production output in the long run. The coefficient is also statistically significant, which implies that as capital rises, fish production output also rises. This goes in line with the a-priori expectations that are derived from the classical theory of loanable funds which explains that as credit in the real sector increases, investment in the sector's activities will also increase and consequently the outputs which come from some of the sectors improve. For Labour, it is negative and statistically insignificant. This implies a 10% increase in labour will reduce fish production output by 0.88%. This depicts that the fish production output does not strictly depend on labour rather it depends on credit, and non-oil imports as the result suggested.

Table 4.6.2.1 FMOLS Result For Fishery Production Output In Nigeria.

VARIABLES	**Dependent Variable: Y (Fishery Output.)**		
	Coefficient	t- Statistic	Prob.
Constant	16.1785	30.7401	0.0000
LNACGSF	0.2324*	3.3723	0.0010
LNLEAG	-0.0882	-1.0537	0.2938
CPI	0.0062**	2.8777	0.0046
INTR	0.0149	1.8550	0.0657
LNPDBTS	-0.0275	-0.4119	0.6810
LNNOE	-0.1996**	-2.2309	0.0273
LNNOI	0.1811**	2.2156	0.0283
R-squared		**0.9123**	
Adjusted R-squared		**0.9078**	

Source: Author Compilation.. * Significant at 1%. ** significant at 5%

In Fish production, CPI is found to be positive and statistically significant. The positive and significant impact with which Fish CPI has on Fish production can be attributed to the benefit that comes from the sub-sectors. Intuitively, it implies when the prices of fish increase, it stimulates fish farmers to concentrate on cultivating more fish which consequently leads to more output. Also, positive CPI can attract more farmers who are in other sub-sectors to join in the production of fish which can consequently lead to more output production of fish in the long run. Hence, the lower the prices, the less attractive fish farmers may find the activity which can inhibit the cultivation of more fish output. Hence fish CPI is an important instrument that can help to boost output production within the sub-sector. For the interest rate, being positively related and insignificant to fish production, in the long run, it's also acceptable as the interest rate is a general rate, regulated without specific consideration of fish production. Hence its impact on fish production may not be determined using fish production as the endogenous variable.

For public debt servicing, its impact is negative and statistically insignificant. This implies 10% increase in public debt servicing can reduce fish production by 0.27%. For Non-oil export being Negative in the result above implies that in Nigeria, the main components with which fish feeds are grown come from the crop production which is a sub-sector (maize, sorghum, groundnut, soya beans, etc.) and formed a good proportion of the non-oil exports. Hence, the more these goods are exported without good regulations, the little the proportion left for people and local industries like Fish Feed to consume. Thus, affecting the cost of inputs used in the fishery and consequently impacting negatively to fish production and not positive like the case in crop production. While for Non-Oil import, its impacts are positive on fishery outputs and this can be attributed to the high importation of rich fishery feeds, chemicals and implements (tools) use for fishing such as trawlers, vessels, Net, fishing boat and its parts, etc. which are imported to help in the production and harvest of more fish in the country. Again Nigeria imports fish products and these sometimes cannot be differentiated and may be accounted for and recorded as local harvest despite the country having about 853Km bordering the Atlantic Ocean (Nigeria Fishery Statistics, 2016). Hence, this unknowing act can be said to be boosting our fishery output. From the outlook of the model generally, the R-squared value of the estimated FMOLS shows that the selected macroeconomic variables explain well about 91% of the variations of crop production output factors that affect agricultural output in the model in the long run.

4.6.2.2 Parsimonious Error Correction Model (ECM) for Short Run Analysis- Fishery Output.

Inline to achieve the second part of the last objective of the study, the ECM is estimated to determine the short-run impact of selected macroeconomic variables on the dependent variable. The results below (Table 4.6.2.2) are the parsimonious ECM for fishery output which revealed the significant variables in the model in the short run. That is, it contains only the variables that have a short-run significant impact on fish production output. From the result (Table 4.6.2.2) below, fish CPI and Non-Oil Imports are positively related to fish production output.

Table 4.6.2.2 Parsimonious Error Correction Model For Fishery Output In Nigeria.

Dependent Variable: FH			
	Coefficient	**t-Statistic**	**Prob.**
Constant	0.0037	0.5345	0.5938
D(FH_CPI)	0.0068*	2.6536	0.0089

D(LNNOE)	-0.1013*	-2.7374	0.0070
D(LNNOI)	0.0990**	2.2721	0.0246
ECT	**-0.0862****	**-2.3081**	**0.0224**
R^2	**0.5128**		
F-STATISTIC	**4.5142**	***D.W STATISTICS***	**1.9190**
Source: *Author's Computation.* * Significant at 1%. ** significant at 5%			

While non-oil exports are negatively related to the dependent variable. Intuitively, the result implies that non-oil exports have much impact on crop production output as a 10% increase in Non-oil exports can cause total fish output to decrease by 1.01%. This has been explained from the FMOLS result (table 4.6.2.1) above. The ECT value shows that the speed of adjustment to equilibrium is 8.62%.

4.6.2.3 Serial Correlation Test

The result of the Breusch-Godfrey Serial Correlation LM Test above shows no serial correlation in the model since the probability value of the Observed R-Squared is greater than 5%. (0.8238). Hence there no serial correlation in the residual.

Table 4.6.2.3 Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.1341	Prob. F(1,135)	0.8746
Obs*R-squared	0.3876	Prob. Chi-Square(1)	0.8238

Source: Author's computation.

4.6.2.4 Heteroscedasticity Test

Table 4.6.2.4 Breusch-Pagan Heteroscedasticity Test.

F-statistic	0.8540	Prob. F(48,93)	0.7234
Obs*R-squared	43.4447	Prob. Chi-Square(48)	0.6598

The result of the Breusch-Pagan heteroskedasticity test in table 5.4.2.4 above shows no heteroskedasticity in the model since the probability value of the Observed R-Squared is greater than 5%. (0.6598). Hence there exist a Constance variance in the residual.

4.6.2.5 CUSUM TEST

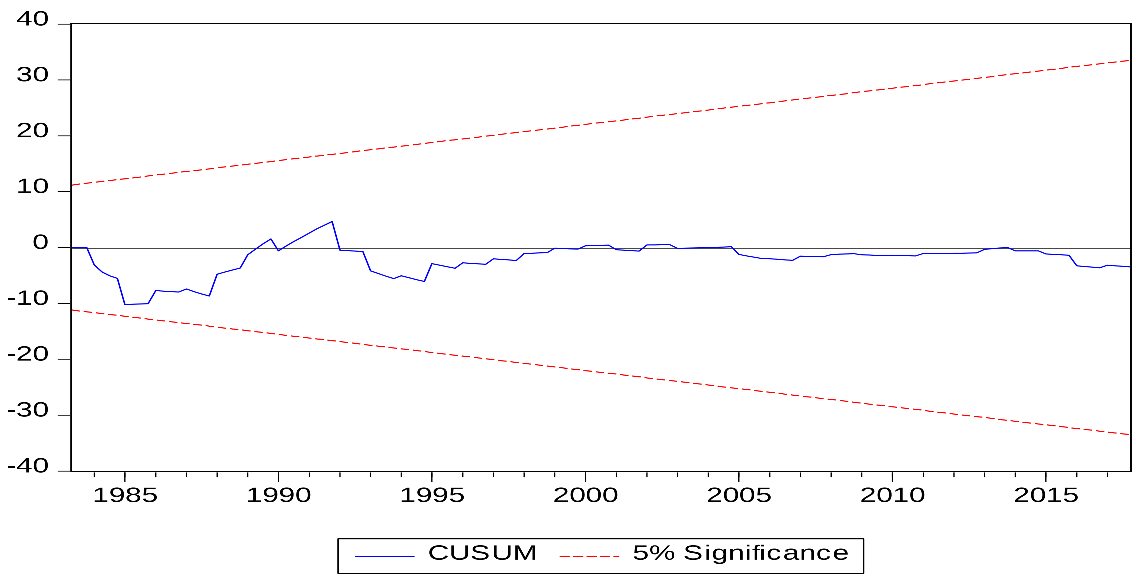


Figure 4.6.2.5 The CUSUM graph above revealed that the variables in the model are stable over some time.

4.6.3.0 FORESTRY OUTPUT.

4.6.3.1 The Result for The FMOLS Estimation For Forestry Production Output In Nigeria.

Table 4.6.3.1 below is the FMOLS result for forestry which is the third disaggregated long-run equation for the agricultural sub-sectors which addresses the last objectives of this study. Considering all the variables in the model, the FMOLS result suggests that the coefficient of Capital on forestry production proxied by Credit (ACGSF) is negative, thereby indicating a negative impact of capital on forestry production output in the long run. The coefficient is also statistically significant, which implies that as capital in terms of credit to forestry farmers rises, forestry output tends to decline in the long run. This may be because most forestry farmers that do benefit much by taking a loan from this scheme fund and as a result of this, a large proportion of the fund do go into either crop, fishing, or livestock which takes less time to harvest their yield and pay back the loans unlike the cultivation of forestry which yield can be affected by factors like drought, forest blast diseases, etc. Hence, driving more farmers into other agricultural sub-sector farming other than forestry; thereby leading to a smaller number of farmers in the sub-sector and hence affecting forestry yield in the long run since labour is an important factor.

Table 4.6.3.1 FMOLS Result For Forestry Production Output In Nigeria.

VARIABLES	**Dependent Variable: Y (Forestry Output.)**		
	Coefficient	t- Statistic	Prob.
Constant	18.7805*	137.4233	0.0000
LNACGSF	-0.0716*	-3.5733	0.0005
LNLEAG	0.0207	0.9186	0.3599
CPI	0.0076*	13.043	0.0000
INTR	-0.0014	-0.6872	0.4931
LNPDBTS	-0.0285	-1.6109	0.1095
LNNOE	0.0616**	2.5680	0.0113
LNNOI	-0.0249	-1.1071	0.2702
R-squared	0.9715		
Adjusted R-squared	0.9701		

Source: Author Compilation. * Significant at 1%. ** significant at 5%

For labour, it is an important factor in the cultivation and monitoring of forestry output as identified due to its socio-economic and health impact as identified by Ahmed and Oruonye 2017. As the relationship is positive even though its impact is not expected to drive policy. The result for labour implies that forestry depends on labour but not strictly. This goes in line with the a-priori expectations that are derived from economic theory which explains that as agricultural credit increases, investment in agricultural activities will also increase and consequently the output also increases. For Labour, it is negative and non-statistically significant. This implies a 10% increase in labour will increase forestry production output by 0.20%. Depicting forestry production output does not strictly depend on labour. Hence, labour impact on the dependent variable is insignificant as suggested by the result.

Forestry output CPI is found to be positive and highly statistically significant. The positive and significant impact with which Forestry CPI has on forestry production can be attributed to the benefit that comes from the sub-sectors. Intuitively, it implies when prices of forestry produce increase, it stimulates more farmers to go into the cultivation of forestry produce which consequently can lead to more output within the sub-sector. The lower the prices, the less attractive forestry farmers may find to cultivate more forest produce. Hence forestry CPI is an important instrument that can help to boost output production within the sub-sector. Though, this also deviates from the negative sign as stated earlier in the a-priori expectation in the previous chapter. This sign implies that Consumer Price Index in agriculture, in general, serves as an instrument that stimulates farmers to produce more produce. For the interest rate, since credit has a negative impact on forestry output, so also is the interest rate being negatively related but insignificant. This also implies that the interest rate a general rate that is regulated without specific consideration of forestry production. Hence its impact on forestry production may not be determined using its products as the exogenous variable.

For public debt servicing, its impact is negative and non-statistically significant this is acceptable as the relationship should be negative and insignificant. This implies 10% increase in public debt servicing can reduce forestry production by 0.28%. For non-oil export being positive is not surprising; this implies that as non-oil exports increase, it has a positive impact on the general output of forestry products. Thus, non-oil exports of goods such as timbers and also forestry products which are used in the form of pharmacognosy and botany should have a positive impact on the sub-sector. While Non-oil imports of goods should be negatively related to the total output of forestry as the importation of goods such as timber can discourage farmers from going into forestry farming. From the outlook of the model generally, the results of the estimated FMOLS show that selected macroeconomic variables explain well about 97% of the variations of forestry production output factors in the model. This is adjudged by the value of the coefficient of determination (R-squared) which suggests the model is fitted well.

4.6.3.2 Error Correction Model (ECM) for Short Run Analysis- Forestry Production.

To achieve the third part of the last objective of the study, the ECM is estimated to determine the short-run impact of some selected macroeconomic variables on the dependent variable. The result below (Table 4.6.3.2) is the parsimonious ECM which revealed the significant variables in the model in the short run. This result contains only the significant variables that have an impact on forestry output in the short run. The result is derived from the over- parameterized model which contained all the variables that are significant and insignificant impact. From the result (Table 4.6.3.2) below, forestry CPI, Interest and non-oil exports are positively related to crop production output. While non-oil import only is negatively related to the dependent variable. Intuitively, the result implies that non-oil export have much impact on forestry production output as a 10% increase in non-oil exports can cause forestry output and consequently total agricultural output to increase by 0.3%. This is based on fact that income generated from non-oil exports is capable of stimulating farmers to raise more forestry products. Again, local market prices of forestry may not encourage forestry farmers, unlike the international markets, as prices of agricultural output locally tend to fluctuate quickly within a short time.

Table 4.6.3.2. Parsimonious Error Correction Model For Forestry Output In Nigeria.

Dependent Variable: Forestry Output (FTRY)			
	Coefficient	**t-Statistic**	**Prob.**
Constant	0.0007	0.3307	0.7413
D(FTRY_CPI)	0.0048*	4.8629	0.0000
D(INTR)	-0.0023**	-2.4979	0.0136
D(LNNOE)	0.0322*	2.6990	0.0078
D(LNNOI)	-0.0255**	-1.8388	0.0480
ECT	**-0.1687**	**-3.6616**	**0.0004**
R^2	**0.5901**		
F-STATISTIC	**11.52539**	***D.W STATISTICS***	**1.865046**
Source: *Author's Computation.* . * Significant at 1%. ** significant at 5%			

Unlike the international market which guaranteed quite stable prices of outputs for a long time. On the contrary, the non-oil import has a more negative impact on agricultural outputs in the short run than the Interest rate. The ECT which measures the speed of adjustment to equilibrium is 16.4%. This implies that the speed to the equilibrium is fairly fast.

4.6.3.3 Serial Correlation

Table 4.6.3.3 Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.5231	Prob. F(48,93)	0.5942
Obs*R-squared	1.4519	Prob. Chi-Square(48)	0.4838

Source: *Author's Computation.*

The result of the Breusch-Godfrey Serial Correlation LM Test above shows no serial correlation in the model since the probability value of the Observed R-Squared is greater than 5%. (0.4838). Hence there no serial correlation in the residual.

4.6.3.4 Heteroskedasticity Test

Table 4.6.3.4 Breusch-Pagan Heteroscedasticity Test:

F-statistic	0.8937	Prob. F(48,93)	0.6487
Obs*R-squared	37.1137	Prob. Chi-Square(48)	0.6009

Source: *Author's Computation.*

The result of the Breusch-Pagan heteroskedasticity test shows no heteroskedasticity in the model since the probability value of the Observed R-Squared is greater than 5% (0.6009). Hence there exist a Constance variance in the residual.

4.6.3.5 CUSUM Test

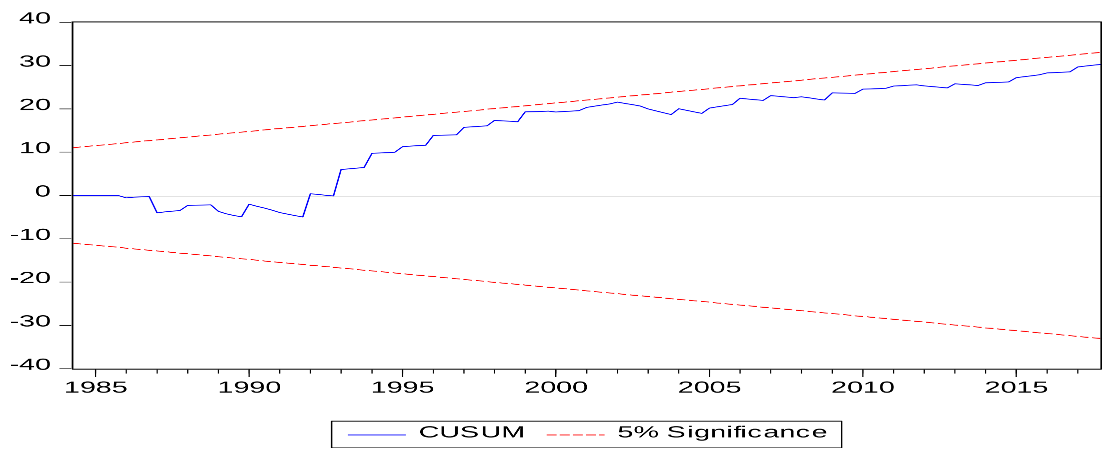


Figure 4.6.3.5 The CUSUM graph above revealed that the variables in the model are stable over some time.

4.6.4 LIVESTOCK OUTPUT.

4.6.4.1 The Result of the FMOLS Estimation.

Table 4.6.4.1 is the FMOLS result for equation 3.7 in chapter three. Equation 3.7 is the equation for the last disaggregated sub-sector–livestock output and the considered selected macroeconomic variables that may affect it. Thus, table 4.6.4.1 below reports the results of the impacts of selected macroeconomic variables on the dependent variable (Forestry Production) in the long run as this still addresses the last objective of this study. Considering all the variables in the model (table 4.6.4.1) below, the FMOLS result suggests that the coefficient of Capital on livestock production proxied by Credit (ACGSF) is positive, thereby indicating a positive impact of capital on livestock output in the long run.

Table 4.6.4.1 FMOLS Result for Livestock Output in Nigeria.

VARIABLES	**Dependent Variable: Y (Livestock Output.)**		
	Coefficient	t- Statistic	Prob.
Constant	19.0018*	158.9371	0.0000
LNACGSF	0.0393**	2.5058	0.0134
LNLEAG	0.0513**	2.5406	0.0122
CPI	0.0044*	10.8098	0.0000
INTR	0.0007	0.3876	0.6989
LNPDBTS	-0.0139	-0.8594	0.3916
LNNOE	0.0195	0.8804	0.3801
LNNOI	-0.0067	-0.3332	0.7395
R-squared	0.9889		
Adjusted R-squared	0.9883		

Source: Author Compilation. * Significant at 1%. ** Significant at 5%

The coefficient is also statistically significant, which implies that as capital in terms of credit to livestock farmers rises, livestock output tends to increase in the long run. This may be based on the fact that most farmers do prefer to take credit and go into livestock farming. Hence, the scheme fund becomes vital to these farming activities; thus, the higher the credit availability, the higher will the number of livestock farmers be who may find interest in livestock, hence affecting the output of the livestock positively in the long run. This also depicts that the loan taken by farmers is properly channeled into the sub-sector and not abused.

For labour, it is an important factor in a livestock activity. This shows the relationship between it and livestock output to be positive and significant. The result for labour implies that livestock activity depends so much on labour. This goes in line with the a-priori expectations that are derived from economic theory which explains that livestock farming in Nigeria is more laborintensive which has a direct relationship with output. This implies a 10% increase in labour will increase livestock output by 0.51%.

CPI of Livestock output is found to be positive and highly statistically significant. The positive and significant impact with which livestock CPI has on livestock production can be attributed to the benefits obtained from the sub-sector. Intuitively, it implies when prices of livestock products are capable of increasing livestock output, That is, livestock prices can stimulate more farmers to go into the livestock activity which can consequently lead to more output within the sub-sector. On the other side, the lower the prices, the less attractive livestock farmers may find to practice livestock activity. Hence, livestock CPI is an important instrument that can help to boost output production within the sub-sector. Though this also deviates from the a-priori expectation it's acceptable as the Consumer Price Index in agriculture in general serves as an instrument that stimulates farmers to produce more produce. For the interest rate, since credit has a positive impact on forestry output, so also is the interest rate being positive. The key point to note is that credit to farmers is given on soft interest rate, thus, farmers can take more credit even if interest rises, and the resultant effect will be an increase in output. related but insignificant, it's acceptable as the interest rate is a general rate, regulated without specific consideration of forestry production.

For public debt servicing, its impact is negative and statistically insignificant. This implies 10% increase in public debt servicing can reduce livestock production by 0.13%. that is, in the long run, public debt servicing would contribute negatively to livestock. For Non-oil export being positive is not surprising; this implies that as non-oil exports increase, it has a positive impact on the general output of livestock products. This implies non-oil exports encourage the output of livestock in Nigeria. While non-oil imports of goods should be negatively related to the total output of livestock as it leads to high competition of livestock products which can affect the supply of livestock in the market and hence, affect the price level which can discourage farmers into going into livestock farming. From the outlook of the model generally, the results of the estimated FMOLS show that selected macroeconomic variables explain well about 98% of the variations of forestry production output factors in the model. This is adjudged by the value of the coefficient of determination (R-squared) which suggests the model is fitted well.

4.6.4.2 Error Correction Model (ECM) for Short Run Analysis- Livestock Production.

To achieve the third part of the last objective of the study, the ECM is estimated to determine the short-run impact of selected macroeconomic variables on the dependent variable. The result below (Table 4.6.4.2) is the parsimonious ECM which contains only the variables that have a short-run significant impact on livestock production output. The result is derived from the over-parameterized model. From the result (Table 4.6.4.2) below, Labour employed in agriculture, Livestock CPI and non-oil exports are positively related to livestock production output, with a non-negative variable in the model. Intuitively, the result implies that labour employed in livestock output has much impact on livestock production output as a 10% increase in labour can cause livestock output to increase by 0.3%. This is further supported by the FMOLS above, which revealed that in the long run, labour will increase its impact on livestock output from 0.3% to 0.51%. This is based on fact that income generated by labour in livestock is mostly plough back into such venture which does help in the expansion of such activity and more labour is needed due to the expansion. After labour is non-oil exports which also encourage livestock farming. The ECT which shows the speed of adjustment to equilibrium in the short run was 9.2% which is fairly not fast.

Table 4.6.4.2. Parsimonious Error Correction Model.

Dependent Variable: Livestock (LVK)			
	Coefficient	**t-Statistic**	**Prob.**
Constant	0.0032*	2.4567	0.0152
D(LNLEAG)	0.0307*	3.1860	0.0018
D(LVK_CPI)	0.0035*	7.7435	0.0000
D(LNNOE)	0.0137**	2.2385	0.0267
ECT	**-0.0929***	**-2.8527**	**0.0050**
R^2	**0.5461**		
F-STATISTIC	**28.60150**	***D.W STATISTICS***	**2.033234**
Source: Author's Computation. * Significant at 1%. ** Significant at 5%			

4.6.4.3 SERIAL CORRELATION

Table 4.6.4.3 Breusch-Godfrey Serial Correlation Test:

F-statistic	0.237098	Prob. F(48,93)	0.7893
Obs*R-squared	0.661727	Prob. Chi-Square(48)	0.7183

The result of the Breusch-Godfrey Serial Correlation LM Test above shows no serial correlation in the model since the probability value of the Observed R-Squared is greater than 5%. (0.4838). Hence there no serial correlation in the residual.

4.6.4.4 Heteroscedasticity Test

Table 4.6.4.4 Breusch-Pagan heteroscedasticity Test:

F-statistic	1.0932	Prob. F(48,93)	0.3530
Obs*R-squared	42.9106	Prob. Chi-Square(48)	0.3475

Source: Author computation.

The result of the Breusch-Pagan heteroskedasticity test shows no heteroskedasticity in the model since the probability value of the Observed R-Squared is greater than 5%. (0.3475). Hence there exist a Constance variance in the residual.

4.6.4.5 CUSUM Test

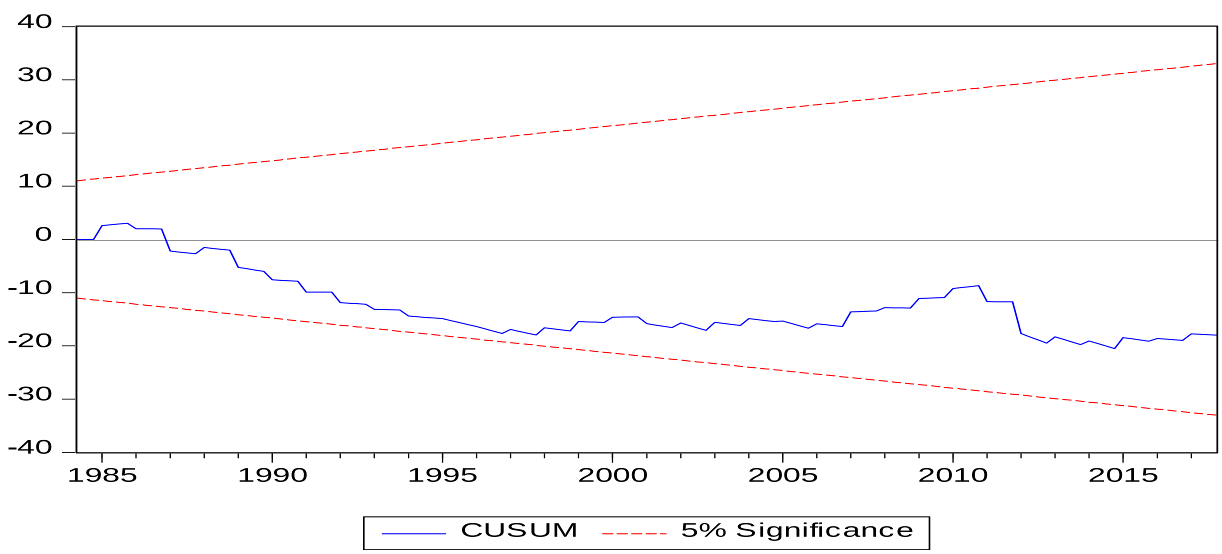


Figure 4.6.4.5 The CUSUM graph above revealed that the variables in the model are stable over some time

4.7 KEY FINDINGS

The key findings from all the empirical results suggest a long-run equilibrium relationship exists between selected macroeconomic variables and the real share of agricultural output as indicated from the Johansen cointegration results. Furthermore, the selected macroeconomic variables have long-run impacts that vary between aggregate agricultural output and its sub-sector in Nigeria. Evidenced from the FMOLS result obtained from the aggregate equation, credit to agricultural activities(ACGFS), interest rate, public debt servicing and non-oil exports) all had positive impacts on the share of agriculture; while labour employed in the agricultural sector, Consumer Price Index and imports of the non-oil sector all had negative impacts on the dependent variable. We also found out that in the short run, Consumer Price Index is not a suitable macroeconomic variable with which aggregate agricultural output can be stimulated this is because it encompasses other non-oil products that are sold within the economy which can invariably influence it. The another major key finding is the positive impact of public debt servicing on agricultural output. We thus had to further investigate and understood that public debt servicing comprises of foreign and local debts, and since local debts account for about 50% of the total debts stock, whenever that debts stock is service, the volume of money within the economy tends to increase which will consequently lead to a decline in the interest rate which can lead to more borrowing of funds for agricultural activities by farmers that are willing. This practice can lead to more agricultural outputs in the end. Furthermore, the aggregate equation results suggest that to achieve a quick and much positive response, in the long run, credit is the most suitable variable to use with an 18.47% increase to the total output for any 10% increase; while non-oil imports most affect the real share of agricultural output negatively.

While in the short run, non-oil exports impact much positively with a 24.6% increase in aggregate agricultural output for any 10% increase. While non-oil import impacts much negatively -20.6% for any 10% increase. Some of our findings relate to the a-priori expectations.

From the FMOLS sub-sector results, we found out that credit, Consumer Price Index(CPI), interest rate, public debt servicing, and non-oil exports impact positively on the endogenous variable. While labour employed in the agricultural sector and imports of the non-oil sector impact negatively on the endogenous variable. Furthermore, in the short run, labour and public debt servicing are not suitable variables on which agricultural output can depend on. Still, in the short run, only non-oil imports impact negatively on crop production while credit, CPI, interest rate and non-oil exports have a positive impact on crop production. The speed of adjustment to equilibrium for any endogenous shock in the short run is 10.41% which is fairly not fast (Table 4.6.1.1). To achieve a quick and much positive response in the crop production, in the long run, credit is the most suitable with a 2.07% increase to the crop output for any 10% increase; while Non-Oil imports can impose quick most negative impact with -0.41% reduction of crop output for any 10% increase. While in the short run, Non-oil exports impact much positively with 0.804% for any 10% increase; while Non-oil imports impact much negatively with -0. 8.15% for any 10% increase.

The finding from fish production empirical result suggested that credit for agricultural activities, Consumer Price Index, interest rate, and non-oil imports impact positively the dependent variable in the long run. While labour employed in the agricultural sector, public debt servicing and Exports of non-oil sector impact negatively on the dependent variable. However, in the short run, credit for agricultural activities, labour employed in the sector, interest rate and public debt servicing are not macroeconomic variables on which fishery sub-sector can depend so much on. Furthermore, only non-oil exports impact negatively on fish production, while CPI and non-oil imports have a positive impact on fish production. The speed of adjustment to equilibrium for any endogenous shock in the short run is 8.62% which is fairly not fast (Table 4.6.2.1). For government and agricultural policymakers can use credit to achieve a quick and positive response in fish production in the long run, while non-oil exports can impose a quick and most negative impact with a -1.996% reduction of fish output for any 10% increase. While in the short run, non-oil imports impact much positively with a 0.990% increase in fish output for any 10% increase, while non-oil export impact much negatively with -1.013%. reduction for any 10% increase.

The long-run coefficients obtained from the forestry FMOLS suggested the sub-sector output can be negatively be affected by Credit, Interest, public debt servicing and imports of the non-Oil sector; and positively affected by labour employed in the agricultural sector CPI and Non-Oil Exports. And in the short run, credit, labour and public debt servicing are not instruments on which the forestry sub-sector can depend so much. Still, in the short run, Interest rates and non-oil imports impact negatively on forestry production while CPI and non-oil exports have a positive impact on fish production. The speed of adjustment to equilibrium for any endogenous shock in the short run is 16.87% which is moderately fast (Table 4.6.3.1). For government and agricultural policymakers to achieve quick and much positive response in forest products, in the long run, the result suggests Non-Oil export as the most suitable variable with a 0.616% increase to the forestry output for any 10% increase; while credit can impose quick most negative impact with -0.716% reduction of forestry output for any 10% increase. While in the short run, Non-oil exports impact much positively with a 0.322% increase in forest output for any 10% increase; while Non-Oil imports impact much negatively with a -0.255% reduction for any 10% increase.

Lastly, the finding from livestock production empirical result revealed public debts servicing and non-oil imports, can impact negatively on the real share of agricultural output in Nigeria; while credit, labour employed in the agricultural sector, CPI, Interest and non-oil exports had positive impacts. However, in the short run, credit, interest rate, public debt servicing and non-oil imports are not macroeconomic variables with which the livestock sub-sector can be boosted with. Still, in the short run, labour, CPI and non-oil exports all have a positive impact with no variable with negative impact in the model. The speed of adjustment to equilibrium for any endogenous shock in the short run is 9.30% (Table 4.6.4.1). For government and agricultural policymakers to achieve quick and much positive response in livestock production, in the long run, the result suggests labour as the most suitable variable that can be used to boost the sub-sector; while public debt servicing can impose the most negative impact on livestock output. While in the short run, still labour impact much positively with a 0.307% increase in the output for any 10% increase. This generally implies that if the government wants to promote livestock production as a sub-sector of agriculture, in the long run, they can do that by promoting policies that will have a positive impact on Credit, Labour employed in the agricultural sector, boost CPI, interest and non-oil exports.

CHAPTER FIVE

This chapter contains the summary, conclusion and policy recommendations of the study.

5.0 SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS.

5.1 Summary of Key Findings.

The study seeks to determine the impact (long and short-run) of selected macroeconomic variables on agricultural sector output in Nigeria with long-run emphasis. Thus, after identifying the problem, reviewing relevant literature, identified some gaps, adapting the Cobb Douglass production function and using quarterly data of each variable from 1981Q1 to 2017Q4 for the empirical results, the following were found base on the stated objectives:

Using quarterly data for all the variables, the trends obtained from the analysis tool for the past decade (2006-2017) all showed that there is relationship between the selected macroeconomic variables and the real share of agriculture in Nigeria within the time under review (objective 1). From the trends obtained, inflation rate and relative share of agricultural output all move in the same direction (positively), however, the inflation rate has always been below the share of agricultural output; the trend for interest rate showed that before 2012 it was below the relative share of agricultural output, however, in the year 2012, it equals the share of agricultural output and after 2012, interest rate exceeded the share of agricultural output to 2017. For public debt trend in relation to the share of agricultural output, we found out a steady rise from 2009 to 2017, with the highest amount of debt service in 2017. Finally, we found out that from the establishment of the agricultural credit guaranteed Scheme Fund in 1978 the scheme had disbursed the total value of the loan of N 121.037 billion to 844,486 farmers in all 36 States, averaging N3.7 billion loan from 1981 to 2017 (CBN, 2017).

To determine for the long-run relationship and impact of macroeconomics variables on the aggregate agricultural output in Nigeria (objective 2), there was need for us to establish if our variables were stationary at level or first difference. From the unit root results obtained, all the variables were stationary at first difference; qualifying for the next estimation process of long-run equilibrium relationship(co-integration). This finding is in line with Engel and Granger (1987) and Cheung and Lai (1993), who proposed that for a co-integration test to take place, the series should be stationary at first difference. However, after the Johansen cointegration test was conducted, and the result suggests the existence of a long-run equilibrium relationship between macroeconomic variables and aggregate agricultural output in Nigeria. This further makes it necessary to determine the long-run impacts using the Fully Modified OLS. The result from the FMOLS suggest that credit for agricultural activities, interest rate, public debt servicing, and non-oil exports impact positively on the share of agricultural output in Nigeria between 1981-2017. One remarkable finding was the positive impact of public debt servicing on the dependent variable. This implies that public debt comprises of two components(foreign and local debt). Thus whenever the public debt is serviced, there is a tendency for the local money supply to increase, which lowers the interest rate and makes borrowing of credit friendlier to desire farmers and consequently lead to more agricultural output. This finding conforms with earlier studies like Abdullahi (2009) and Essien, et al. (2011) as cited in Mbutor and Uba (2013). It also implies that government expansionary fiscal policy like servicing of debt does not have crowding-out effects on the agricultural sector which may be as a result of the fact that government does not get directly involved in agricultural production in Nigeria. This result further corroborates those of earlier works carried out by Kwanashie, et al. (1997) and Yaqub, (2010). Furthermore, CPI impact was found to be positive and significant on aggregate agriculture output only in the short run. This depicts how price stimulates farming activities and can increase the supply of commodities since it serves as a motivator for farmers to increase outputs to earn more income in the short run.

To examine the existence of long-run equilibrium relationship and impacts for the four agricultural sub-sectors in Nigeria(Objective 3) given the time series data, the same procedures that were carried out for aggregate agricultural output, were also repeated. The outcome of the results revealed that non-oil exports contributed positively, while non-oil imports contributed negatively in all sub-sectors except for fishery sub-sector output which the result inter-changed. However, we investigate further and realized that in Nigeria, the main components with which fish are grown is fish feeds which most of its production is done locally with local materials(maize, sorghum, groundnut, soya beans, etc.) that are obtained from crop production which is one of the major components of non-oil exports. Hence, the more these goods are exported without good regulations and consideration to our local industries, the little the proportion that will be left for people and local industries like fish feed to consume. In summary, this study has found significant evidence to support the hypothesis that selected macroeconomic variables(Agricultural Credit Guarantee Funds Scheme(ACGFS), interest rate, consumer price index, public debt servicing, non-oil exports and non-oil imports) have impacts on the output of agricultural sector in Nigeria. Furthermore, CPI was found to contributes positively and significantly in all the sub-sectors results. That showed how price can influence agricultural production in the short run.

5.2 Conclusion

The inadequate supply of agricultural outputs in relation to Nigeria's fast-growing population necessitates the need to investigate the impact of selected macroeconomic variables on agricultural output in Nigeria(1981-2017). The study explored the long-term relationship of macroeconomic variables on agricultural output in Nigeria for the data spanned 1981-2017. The study employed a co-integration model to examine long-term equilibrium relationships and Fully modified OLS for long-run impacts between the variables, which have their advantage of the application to level series. The results of the five co-integration models confirm the presence of a long-term relationship between macroeconomic variables and agricultural output in Nigeria, while the FMOLS result showed the various long-run impacts that macroeconomic variables have on agricultural output in Nigeria. The study also examined the short-run relationship on the variables under study using Error Correction Model. The conclusion is that selected macroeconomic variables (Consumer Price Index, interest rate, public debt servicing, and non-external trade) are factors that also need to be managed properly as their impacts can affect the growth of the agricultural sector output. Thus, by empirically identifying these, we draw out the following policy recommendations:

5.3 Policy Recommendations

Based on the empirical findings, credit was found to have the highest significant impacts on the aggregate agricultural output and other agricultural sub-sectors (crop, fishery and livestock) in the long-run. Thus, this study recommends that government through its policymakers and private organisations through their board of directors should make credit available and affordable to farmers. Though, past governments have established several agricultural credit institutions and programmes such as the Bank of Agriculture (BOA), Agric-Business Small and Medium Enterprises Investment Scheme (AGSMEIS), Commercial Agricultural Credit Scheme (CACS), the Nigerian Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL) among others, to help provide and make credit cheap to farmers, however, the mandates with which these intitutions were established have gradually diminished and some can barely adequately perform their functions. Hence, to revamp and make these institutions effective, government through its policy makers has to do a lot of funding and monitoring so that the funds can be used judiciously and the target audience can benefit from them. Similarly, financial institutions especially the micro-finance banks which are closer banks to most rural communities and farmers should also be incorporated in carrying out these functions with fairer borrowing terms (e.g. low or zero interest rate) and adequate repayment time to farmers. On famers side, any farmer or group of farmers that are beneficiaries of any agricultural credit such as Cooperative Societies, should be monitored to ensure that the credit they obtain is not misused or use differently other than the purpose it is meant for. By so doing, more farmers that desire to expand their farmlands can do so, and consequently, more output can be realized from the sector not only in the short-run but even in the long run.

Another finding from the empirical results of aggregate agricultural output and other agricultural sub-sectors (crop, forestry and livestock) suggest non-oil exports as another macroeconomic variable that has more positive and significant impact on agricultural output in Nigeria. Thus, this study recommends that for Nigerian agricultural output to be sustained or improved both in short and long-run, the Nigerian government via export policy makers should encourage more non-oil exports. To achieve this, the government can regulates the trade activities via the responsible public organizations like the Marketing Board, Nigeria Export Promotion Council; or via some private non-oil exports agencies like Ecoplatinum International LTD, A3 Exim

Company among others. These agencies can help farmers create demand for their products, help them export the desire proportion of their outputs, may link them to some interested international clients and as well as monitor and shield them from being exploited by rent-seeking clients that may want to use their inadequate knowledge in some areas within the markets at the international level. Thus non-oil exports will go a long way to encourage more people to go into farming and the existing farmers to cultivate more so that they can earn more income (local or foreign currencies) since they are optimistic about the market demand of their outputs and prices.

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