Effect of Monetary Policy on Agricultural Sector in Nigeria

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Abstract

The study examined the effect of monetary policy on agricultural sector in Nigeria, utilising time series data for the periods spanning from 1970 to 2010. The study captured both monetary and non-monetary policy variables such as lending rate, commercial banks credit to agriculture, exchange rate, government expenditure in agriculture and inflation rate in examining the effect of monetary policy on agricultural output. The methodology adopted is the Auto- Regressive Distributed Lag (ARDL) Bound Testing Approach. The results obtained showed that exchange rate and government expenditure had positive and significant effect on agricultural output and, hence agricultural sector in Nigeria. It is recommended that a sound exchange rate policy should be implemented aimed at boosting agricultural exports in Nigeria. Also, government investment to provide the basic infrastructure and institutions   should be sustained because without the appropriate institutions, monetary policy cannot impact positively on real sector.

Keywords: Monetary Policy, Agriculture

JEL Classification: E5, O15

I.   Introduction

Mainstream macroeconomic theory has identified two major policies used for the management of an economy. These two most widely used policies are the fiscal and monetary policies. The existence of these policies over the years has created some sort of debate as to the relative effectiveness of one policy over the other. The debate notwithstanding, it is generally held that both monetary and fiscal policies if properly executed, are capable of correcting distortions as well as streamlining economic activities in an economy.

Departing from the above debate and beaming the searchlight on monetary policy, one question usually asked is how potent is monetary policy in regulating economic activities?

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The answer to this question hangs on the transmission channels through which money supply passes through to influence economic activities. Three transmission channels can be identified through which monetary policy works to affect real output. These include: interest rate channel; credit channel; and exchange rate channel. Nwosa and Saibu (2012) had noted that while issues on monetary transmission channels and aggregate output abound in the literature, a sectoral analysis of the transmission channels through which monetary policy impulse had suffered neglect.

The effect of macroeconomic policy on agriculture is well documented in studies such as Schuh (1974), Tweeten (1980), Chambers (1984), Orden (1986), Barbhart (1989), Orden and Fackler (1989) and Oden (2003). The general consensus from these studies is that any change in macroeconomic policy should have a significant impact on agricultural prices, agricultural incomes and agricultural exports. On the other hand, there is an assertion that monetary policy has real and nominal effect on the overall economic activities and hence agricultural sector only in the short-run and medium-run but has no significant effect in the long-run (Ardeni and Freebrain, 2002). This assertion is further buttressed by the fact that the fundamental forces that shape outcome and, hence forces that determine the behaviour of prices and output in the agricultural sector are believed to be consequences of non-monetary conditions (Kliesen and Poole, 2000). Forces such as high productivity growth, natural hazards, low price and income elasticities of demand for agricultural products, and fluctuations in the export market for agricultural commodities, among others, are well beyond the control of the central banks. However, the monetary authority can influence outcomes in the agricultural sector by maintaining low/steady inflation rate, low interest rate and operating easy money supply. In this reasoning and following the Keynesian view on monetary policy, an increase in money supply should lead to a fall in interest rate, which in turn, leads to increased investment in agriculture and consequently increase in output.

In Nigeria, the role of agriculture in economic development cannot be

underestimated. Apart from being the major employer of labour, particularly in the rural areas, and providing food for the teeming population, the sector is a veritable source of industrial linkages and development. However, the dismal performance of the sector has been attributed to several factors, including macroeconomic environment. Here, macroeconomic environment comprises, among other things, the monetary policy, which is used to regulate activities in the agricultural sector. In essence, the degree to which monetary policy affects agriculture depends solely on what policy variable(s) and target the monetary authority decides to vary. Previous studies have identified the credit channel as the major source through which monetary policy can impact on the agricultural sector (Omojimite, 2012). However, in recent times, monetary policy appears to have failed in directing credit to the agricultural sector. Credit to the agricultural sector declined from 19.8 per cent in 1960 to 2.2, 1.3 and 1.7 per cent in 2007, 2009 and 2010, respectively. The spread between lending and deposit rates have widened despite the drop in the policy rate to 6.00 per cent in 2010. It is against this backdrop that we need to examine the role of monetary policy in agricultural sector performance in Nigeria for the period 1970 to 2010.

This paper is organised in five sections. Following the introduction is section 2, the literature review and theoretical framework. Section 3 provides trends on monetary policy variables. Analysis of monetary policy and performance of agricultural sector in Nigeria is the focus of section 4. Method of analysis and empirical results are presented in section 5, while section 6 offers recommendations for policy and conclusion.

II.   Literature Review
II.1   Theoretical Framework

The basic macroeconomic texts have documented a long standing dispute about the role of monetary policy in the determination of income and prices. Three contending schools of thought each with different view about the role of money have evolved over time. They include: the classical school; the Keynesian school; and the monetary school.

To the classical, the link between money, income and prices is explained under the framework of the quantity theory. According to classical theory, an increase in the supply of money leads to an increase in the general price level, while real variables such as real income, the rate of interest and the level of real economic activity remain constant. Thus, the classical transmission mechanism proceeds as follows: an increase in the money supply (given the constancy of both velocity of money and real output) will increase the level of liquidity in the system. The increase in the level of liquidity leads to the demand for goods and services, which in turn, results in rising prices. This rising prices reduce the real wage and provides incentives for employers to expand employment and pushes output towards equilibrium.

Unlike the classical view, the Keynesian model recognises the crucial role monetary policy can play in an economy. According to Keynes, variations in money supply have an inherent impact on real variables such as the aggregate demand, the level of employment, output and income (Jhingan, 2004). Thus, in the Keynesian transmission mechanism, the impact of monetary policy is indirect, through the interest rate. As observed by Keynes, when the quantity of money increases, its first impact is on the interest rate, which tends to fall. Given the marginal efficiency of capital, the fall in interest rate will increase the level of investment through the multiplier effect, thereby increasing income, output and employment.

To the monetarists, changes in money supply have a direct impact on the level of economic activity. The monetarists are of the view that interest rate plays no part in influencing the workings of the monetary policy. Thus, according to the monetarist transmission mechanism, variations in the money supply, which causes variations in the real variables, are strictly a portfolio adjustment process (Jhingan, 2004). This was based on their belief that money is a veritable substitute for all types of assets. Thus, if money supply increases, say government buying securities in an open market, sellers will probably rid themselves of excess cash by depositing them in their bank account thereby increasing banks reserves and ability to create money. When this happens, economic agents will bid for assets, forcing prices of these

securities to rise relative to the prices of real assets, thereby creating further desire by wealth holders to acquire more real assets. All these combine to raise the demand for current productive services both for producing new and for purchasing production services (Ajayi and Ojo, 2006). In this way, monetary impulse spreads from the financial market to the goods markets, thereby increasing aggregate output (Friedman, 1969).

The theoretical leaning of this paper is Keynesian, which emphasise the role of interest rate and credit channel. The Monetarists stressed the role of financial market, which in Nigeria context is underdeveloped. Furthermore, the agricultural sector is still peasantry and not fully commercial and mechanised, hence an insignificant participant in the financial market.

II.2   Empirical Studies

Macroeconomic literature has established a theoretical link between monetary policy variables and real economic activity. For instance, the Keynesian monetary theory has recognised the crucial role played by money supply in causing inherent variations in the level of economic activity. According to the Keynesians, changes in money supply have the potency of causing permanent influence on real output via a fall in interest rate, working through the marginal efficiency of capital to stimulate investment and raise output (Athukorala, 1998). Such a theoretical postulate has raised empirical question as to what real effect does monetary policy have on the level of output. This theoretical puzzle has generated a lot of curiosity in the minds of researchers and policy analysts alike in investigating this relationship. Large amount of studies have been conducted both in the advanced economies as well as in developing ones in establishing the effect of monetary policy on output in general and sector specific in particular. Modern studies in this respect have improved upon the earlier ones by adopting recent methods of estimation.

Eyo (2008) examined the extent to which macroeconomic policies adopted have affected agricultural output growth in Nigeria. The study employed time series

data for the periods 1970-2005 on selected macroeconomic variables in the framework of Multiple Ordinary Least Squares (MOLS) regression technique. The empirical results from this study showed that macroeconomic policies had not affected agricultural output growth in Nigeria, as macroeconomic environment has not been able to support operators of agricultural sector to acquire high-pay-off-input that are very important in improving the capital base of the agricultural sector in Nigeria.

Using Three Stage Least Squares (3SLS) estimation technique and Simulation experiment, Udah (2009) investigated how monetary policy variables interact with aggregate supply, demand and prices to aid stabilisation policies in Nigeria, using time series data for the periods between 1970 and 2004. The simulation result showed that an increase in money supply will lead to a higher output, employment and higher price level in Nigeria. On the other hand, the result showed that a reduction in money supply by 10 per cent will lead to a reduction in inflation rate by 2.17 percentage points, while output and labour demand would reduce by 0.41 and 0.35 percentage points, respectively. As the paper further noted, this monetary squeeze may as well impose a huge burden on the Nigerian economy. Onoja and Agumagu (2009) examined the impact of economic policy variables on agricultural output (food production) in Nigeria during the two-term tenure of Obasanjo administration in Nigeria. The data set used for this study spanned from 1999 to 2006. Three functional forms of the model (Linear, Double log and Semi-log forms) were estimated, using Multiple OLS regression technique after transformation using Prais-Winsten method. The results of the study showed that the Federal Government's macroeconomic policy had very little impact in boosting agricultural output (food production) in Nigeria during the period. Specifically, the study showed that commercial banks' credit to agriculture, Agricultural Credit Guarantee Scheme Fund and interest rate had insignificant impact on food production in Nigeria for the period reviewed.

Using a structural vector autoregresion (SVAR) approach, Chuku (2009) conducted a controlled experiment to assess the effects of monetary policy

shocks on output and prices in Nigeria, utilising quarterly data from 1986:1 to 2008:4. The result found evidence that monetary policy innovations had both real and nominal effects on economic parameter depending on the policy variables selected. Specifically, the result of the paper indicated that price-based nominal anchors (MRR and REER) do not have a significant influence on real economic activity, whereas innovations in the quantity-based nominal anchor (m_2) affected economic activities modestly. The conclusion from the study is that the manipulation of the quantity of money (m2) in the economy is the most influential instrument for monetary policy implementation.

Udoh (2011) tested the relationship between government expenditure, private investment and agricultural sector growth in Nigeria during 1970 to 2008 within the framework of autoregressive distributed lag (ARDL) modelling and bound testing approach. Result of the error correction model showed that increase in public expenditure had a positive and significant influence on the growth of the agricultural output in Nigeria. On the contrary, foreign direct investment was insignificant on agricultural output in Nigeria. Similar results were also obtained in subsequent work by Udoh et. al., (2012).

Saibu and Nwosa (2011) examined the effect of monetary policy on sectoral output growth in Nigeria, using time series quarterly data for the periods from 1986:1 to 2008:4 within the framework of an Autoregressive Distributive Lag (ARDL) model. The result of the co-integration test showed that there is a long-run relationship between the sectors' output and monetary policy variables. However, the overall results from the study showed that to a considerable extent, different monetary policy variables had different influence on the sectors' output. Thus, unlike manufacturing, which was non-responsive to all policy variables, agricultural sector was responsive to changes in interest rate and bank credit. Meanwhile, further examination of the results revealed that exchange rate was the most important monetary policy variable as it had significant effect on four sectors (Building/Construction, Mining, Service and Wholesale/Retail), while asset price was not significant in any of the sectors. The paper, therefore, advocated for the

adoption of sector specific policy based on relative strength and importance of each sector to the economy.

Large amount of literature also abound linking changes in agricultural prices to monetary changes. Studies in this regard attempted to establish whether monetary changes have any real effect on agricultural product prices both in the short-run (overshooting hypothesis) and in the long-run (money neutrality hypothesis). Empirical studies such as Frankel (1986), Chambers and Just (1980), Orden (1986), Bessler (1984), Devadoss and Meyers (1987), Lai, Hu and Wang (1996) among others have established that monetary policy changes have real short-run effect on agricultural prices. In other words, these studies provided empirical support for the overshooting hypothesis. For instance, Lai, Hu and Wang (1996), using an extended Frankel's framework, investigated the robustness of overshooting hypothesis under the conditions of anticipated and unanticipated monetary changes and found that agricultural prices could overshoot their long-run equilibrium state if monetary policy is unanticipated.

On the other hand, the results from studies on long-run analysis have remained inconclusive. This, according to Bakucs and Ferto (2005), could be attributed to choice of variables, mistreatment of the time series nature of the data and the misspecification of the model. However, there exists other studies providing evidences for both short-run (overshooting hypothesis) and long-run (money neutrality hypothesis) effects of monetary changes on agricultural prices (Orden and Fackler, 1989; Roberton and Orden, 1990; Saghaian, Reed and Merchant, 2002; Cho et al., 2004; Bakucs and Ferto, 2005 and Asfaha and Jooste, 2006). For example, Asfaha and Jooste (2006) investigate the short and long-run impacts of monetary policy on relative agricultural prices in South Africa using monthly time series data for the periods spanning January 1995 to June 2005. The study employed the Johansen Co-integration analysis and Vector Error Correction Model (VECM). The result of the co-integration test showed that monetary changes had a long-run real effect on agricultural prices. The result, according to the study, rejected the long-run money neutrality hypothesis. The result of the short-

run dynamics provided evidence that agricultural prices overshoot their long-run values in the short-run, indicating that when a monetary shock occurs, the agricultural sector will have to bear the burden of adjustment and increased vulnerability of farmers.

Omojimite (2012) examined the relationship between public institutions and the productivity of the agricultural sector in Nigeria using time series data for the period 1970 to 2008. Employing the fully modified ordinary least squares technique, the result indicated that there was a positive and significant relationship between the volume of credit to the agricultural sector and growth. The result also showed that the dummy for institutional framework (DUM) was positively related to agricultural productivity and was significant at the conventional level of significance. This indicated that the institutional support programmes and policies in the agricultural sector raised the volume of institutional credit to that sector and impacted significantly on the sector's output and growth.

From the review of the literature above, one observation can be made. This is the fact that most studies on the impact of monetary policy on the economy concentrated more on the aggregate level of output, neglecting sector specific analysis. Such neglect has produced inference gap and may undermine empirical strength of these studies. The study differs from previous studies by concentrating its findings in the agricultural sector through examining how monetary policy influences outcomes in the sector in Nigeria. This is the gap the study attempts to fill.

II.3   Agricultural Sector Performance in Nigeria

The role of agriculture in any economy cannot be underestimated. This is because agriculture has been and will continue to be the bedrock of economic growth and development. Indeed, agriculture is one of the leading sectors of the Nigerian economy. Apart from providing food for the growing population, the sector provides the needed raw materials and other allied products for the productive sector. The sector is also a major employer of labour, particularly in the rural areas. According to Abayomi (2006), over 70 per cent of the labour force mostly from rural

areas was employed in agriculture in the 1950s and 1960s in Nigeria. The sector was also the major foreign exchange earner during the years preceding oil revolution in Nigeria. As observed by Uniamikogbo and Enoma (2001), increments in the export of agricultural products are major ways of increasing income and foreign exchange earning in most developing countries. In the 1960s, agriculture was the dominant economic activity, employing over 60 per cent of the population, providing about 70 per cent of the Federal Government revenue, accounting for over 65 per cent of the total gross domestic product and constituting almost 80 per cent of Nigeria's total exports.

Table 1: Contribution to Real Gross Domestic Product by Sector (1960-2010)

Economic Activity	Agriculture	Industry	Building/ Construction	Wholesale & Retail Trade	Services
1960	64.27	5.85	4.45	12.43	12.99
1965	55.36	11.83	5.15	13.30	14.40
1970	44.74	19.41	5.24	12.16	18.45
1975	28.11	27.47	7.11	21.05	16.26
1980	20.61	34.62	9.69	20.03	15.05
1985	32.70	42.33	1.65	13.87	9.45
1990	31.52	43.20	1.63	13.39	10.25
1995	34.19	38.44	1.86	13.97	11.55
2000	35.83	36.99	1.95	13.11	12.12
2005	41.19	28.32	1.52	13.75	15.21
2006	41.72	26.04	1.62	14.95	15.66
2007	42.01	23.92	1.72	16.18	16.17
2008	42.13	21.80	1.84	17.41	16.84
2009	41.84	20.56	1.93	18.16	17.50
2010	40.84	20.36	1.20	18.70	18.10

Source: Central Bank of Nigeria Statistical Bulletin, 2010 and Author's compilation.

The above impressive track record has, however, diminished, following the emergence of oil in the late 1960s and the subsequent boom of the early 1970s. As shown in Table 1 below, agriculture was the dominant economic sector from 1960 to 1970, contributing 64.3 per cent to real GDP in 1960, 55.4 per cent in 1965 and 44.7 per cent in 1970. This was the biggest economic activity when compared with productivity shares of other sectors during the periods.

Beginning from 1970, the role of agriculture in economy started diminishing and by 1975, agriculture share of the total real GDP had fallen to 28.1 per cent and further to 20.6 per cent in 1980. This was in sharp contrast to the industrial, trade and services sectors whose share rose during the period (see Table 1). However, following the implementation of the Structural Adjustment Programme (SAP) in 1986, productivity in the agricultural sector showed significant revival, rising from 31.5 per cent in 1990 to 35.8 per cent in 2000 and further to 41.2 per cent in 2005 and stood at 40.8 per cent in 2010. On the contrary, the hitherto buoyant industrial sector's share in the total real GDP had began to fall starting from 2005, when compared with that of agriculture. From 42.3 per cent in 1990, industrial share of the total real GDP fell to 28.3 per cent in 2005, and further fell to 20.4 per cent of real GDP in 2010. As also shown in table 1, productivity shares of both the domestic trade and services subsectors had fluctuated between 1980 and 1990, while stagnation in productivity was recorded in the domestic trade sector from 1985 to 2005. However, beginning from 2006, the trade and services sub-sectors had recorded increasing productivity shares in the total real output. It is rather sad that the building and construction barely contributed up to 2 per cent of the total real GDP since 1985 till date.

From the analysis above, it is clearly seen that agriculture is the largest economic activity in Nigeria, thereby stressing the almost indispensable role it performs in the country. It is, however, worthy of note that the impressive performance of the agricultural sector would not have been possible without the crop sub-sector's brilliant performance (see table 2 below).

Table 2: Agriculture Production by Activity (per cent of Total) in Nigeria

Year	Crop Production	Livestock	Forestry	Fishing
1960	79.6	8.5	9.4	2.5
1965	77.3	9.2	8.9	4.6
1970	76.6	6.9	5.7	10.8
1975	63.2	13.4	5.5	17.9
1980	66.0	18.7	3.1	12.2
1985	74.1	18.2	5.0	2.7
1990	81.1	11.3	2.5	5.0
1995	85.1	10.6	1.2	3.1
2000	83.9	9.7	1.7	4.7
2005	88.6	6.6	1.3	3.6
2006	89.1	6.4	1.2	3.3
2007	89.1	6.4	1.2	3.3
2008	89.1	6.4	1.2	3.3
2009	89.3	6.4	1.2	3.1

Source: Central Bank of Nigeria Statistical Bulletin, 2009 and Author's compilation.

From table 2 above, crop production had contributed over 80 per cent of the sector's total output, followed by the livestock production and fishing and forestry making the rear. It must be stressed here that the high performance of crop production sub-sector is the manifestation of the dominant agricultural activity in the country over the years.

III.   Trend Analysis of Key Policy Variables

This section analyses trends in key variables used by the monetary authorities in influencing the economy.

III.1   Commercial Bank Sectoral Credit Allocation in Nigeria

One of the Central Bank's monetary policy instruments in Nigeria is the sectoral credit allocation. The Central Bank in its monetary policy formulation issues

guidelines on domestic credit allocation which also set credit limits for each sector of the economy from the aggregate commercial banks' loans and advances to the private sector. The main purpose of the guidelines on sectoral credit allocation is to stimulate the productive sectors of the economy so as to stem the inflationary tide in the country and to encourage investment by fixing interest rate relatively low.

In the CBN credit allocation guidelines, the economy is divided into three, namely: the priority sector; the less-preferred sector and the unclassified sector. The priority sector comprises Agriculture, Solid Minerals, Exports and Manufacturing. The less-preferred sector, on the other hand, consist of Real Estate, Public Utilities, Transport and communications, Finance and Insurance, Government, Import and Domestic trade, while the unclassified sector includes all other activities not mentioned above. However, for the purpose of this study, we will center our analysis on the priority sector in which the agricultural sector is the main focus.

Table 3: Commercial Banks Credit to the Priority Sector in Nigeria (as Percentage of Total Credit)

Year	Agriculture	Solid Minerals	Exports	Manufacturing	Total
1960	19.8	9.7	-	4.2	33.7
1965	25.3	0.5	-	10.7	36.5
1970	2.0	1.9	19.8	21.7	45.4
1975	2.6	1.1	7.0	28.6	39.3
1980	7.3	8.0	1.6	30.8	47.7
1985	10.8	1.9	1.0	26.6	40.3
1990	16.2	1.4	2.9	30.3	50.8
1995	22.0	10.5	16.9	50.6	100.0
2000	8.2	7.4	5.5	28.9	50.0
2001	7.2	7.9	4.1	25.7	44.9
2002	6.3	8.2	3.1	24.6	42.2
2003	5.6	7.6	3.2	23.0	39.4
2004	4.6	9.1	2.2	23.0	38.9
2005	3.5	8.3	1.7	18.8	32.3

2006	2.5	8.6	1.4	16.4	28.9
2007	2.2	9.0	1.3	9.4	21.9
2008	1.9	10.1	1.1	10.7	23.8
2009	1.3	11.3	0.7	11.3	24.6
2010	1.7	15.3	5.8	12.8	35.6

Source: Central Bank of Nigeria Statistical Bulletin, 2010 and Author's Compilation

As evidenced from table 3, manufacturing sector has been the biggest beneficiary of commercial banks credit allocation to the priority sector of the Nigerian economy during the period under review. Apart from the 1960s, mid-1980s and the 1990s, where credits to the agricultural sector recorded appreciable results, credit to agricultural sector for the rest of the period under review had been relatively low. As shown in the table, commercial banks credit to the priority sector in 1960 was 33.7 per cent of total credit, of which 19.8 per cent went to Agriculture, 9.7 per cent mining and solid minerals and 4.2 per cent manufacturing. This increased to 36.5 per cent of total credit in 1965 with the share of Agriculture 25.3 per cent, mining and solid minerals sector 10.5 per cent, while 10.7 per cent accrued to manufacturing. By 1970, commercial banks credit to the priority sector had reached 45.4 per cent of the total credit of which 2.0 per cent went to Agriculture, 1.9 per cent to mining and solid minerals, 19.8 per cent to export, and 21.7 per cent to manufacturing. After falling to 39.3 per cent in 1975, credit to priority sector rose to 47.7 per cent in 1980, but fell again to 40.3 per cent before rising to 50.8 per cent in 1990.

The sub-sectoral analysis showed that the manufacturing sector continued to amass greater percentage of credit to priority sector during the review period. In 1995, credit to the priority sector reached 100 per cent with Manufacturing taking 50.6 per cent, 16.9 per cent went to export, and 10.5 per cent to mining and solid minerals, while 22.0 per cent went to Agriculture.

The sectoral credit allocation was, however, discontinued in 1996. Notwithstanding, the flow of credit to the agricultural sector did not remarkably

change. Beginning from 2000, the percentage of credit to agriculture from total credit allocated to the priority sector had continued to fall. From 22.0 per cent in 1995, credit to agriculture fell to 8.2 per cent in 2000, 3.5 per cent in 2005, 2.5 per cent in 2006, 2.2 per cent in 2007, 1.9 per cent in 2008, and down to 1.3 per cent in 2009 before rising marginally to 1.7 per cent in 2010. The reasons for the poor performance of credit to the agricultural sector are not farfetched. The neglect of the sector following the emergence of oil; the reluctance on the part of commercial bank to loan to small scale farmers; high interest rate charged by banks; and unfavourable macroeconomic environment among others are some of the reasons for the poor credit allocated to agriculture in Nigeria.

From the analysis above, it can be shown that manufacturing sector continued to dominate credit allocation to priority sector during the review period, with credit to mining and solid minerals sector showing some improvement, while the shares of credit to agriculture and export in total credit continued to plunge.

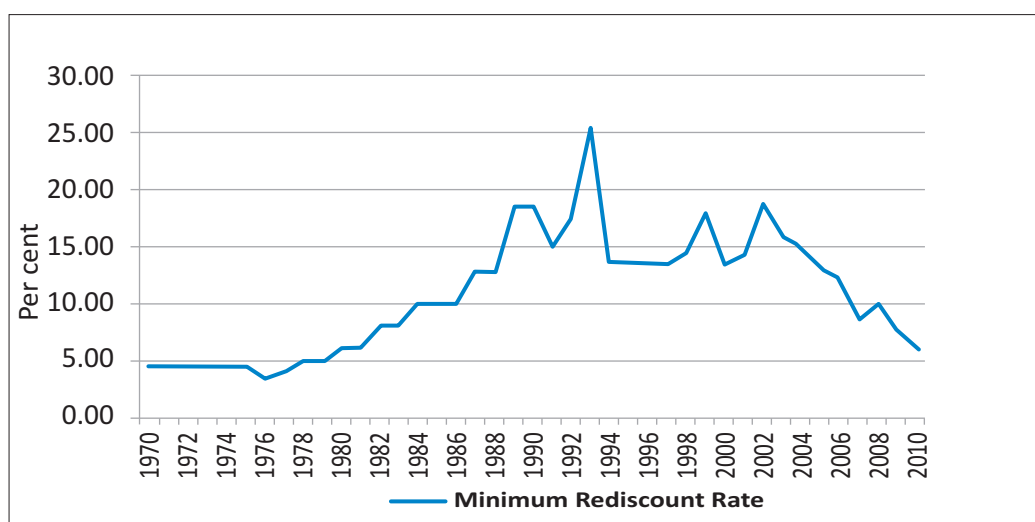**III.2   Minimum Rediscount Rate (MRR), Deposit and Lending Rates in Nigeria (1970-2010)**

The implementation of monetary policy in Nigeria over time was anchored on the Minimum Rediscount Rate (MRR). By definition, the MRR is the minimum rate at which the Central Bank discounts first class bill with the commercial banks. This rate represents a benchmark upon which other interest rates are determined in the economy. The rate also acts as a signal for other rates in the financial system. That means that movements in other interest rates are strongly tied to movements in MRR.

Prior to the deregulation and liberalisation of the Nigerian economy, monetary policy implementation was highly controlled. Interest rates (deposit and lending) were directly controlled by the government via the Central Bank. Interest rate was fixed at relatively low levels. The aim was to promote investment and growth. As revealed in figures 1 and 2, the MRR was fixed between 1970 and 1975 at an average rate of 4.5 per cent. This also led to the fixing of both Savings and Lending

rates at 3.0 and 7.0 per cent, respectively, between 1970 and 1974 with a spread of 4.0 per cent. The MRR, however, fluctuated between 3.5 and 8.0 per cent from 1976 to 1983, which also caused fluctuation in savings rate between 4.0 and 7.5 per cent from 1975 to 1983 and lending rate between 6.0 and 7.5 per cent from 1975 to 1983.

Between 1984 and 2006, the MRR was double digit reaching a peak of 26.0 per cent in 1993. The high rates of MRR during these periods were meant to stem inflationary pressures experienced in the country. The double digit MRR also led to double digit lending rate between 1982 and 2010. The savings rate, on the other hand, was double digit between 1987 and 1996, after which the rates were single digits from 1997 to 2010.

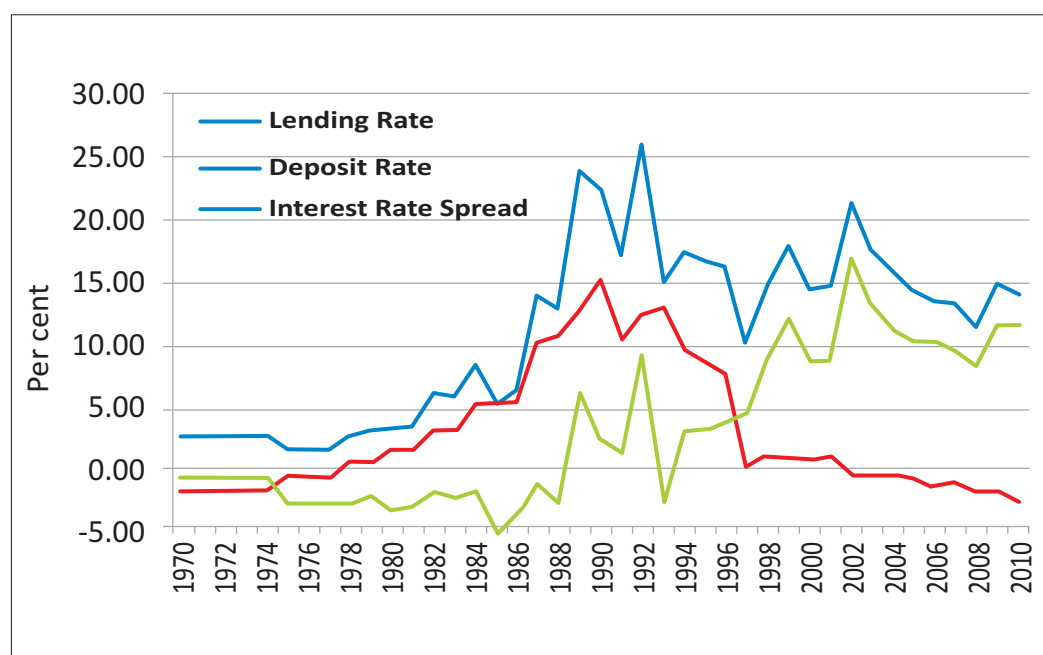**Figure 1: Minimum Rediscount Rate in Nigeria (1970-2010)**

Source: CBN 2010.

It is also worthy of note that the spread between lending and savings rates was relatively low between 1970 and 1988. The spread was 4.0 per cent from 1970 to 1974 but declined to 1.5 per cent in 1980, before assuming a negative value in 1985 (see figure 2). The spread, however, reached the highest peak of 20.7 per cent in 2002 and remained double digit till 2010. As revealed by figure 2, while lending rate

was double digit between 1997 and 2010, savings rate was in single digit and continuously declined. The low savings rate reflected disincentive to saving, which also affected availability of credit to the economy in general and agricultural sector, in particular.
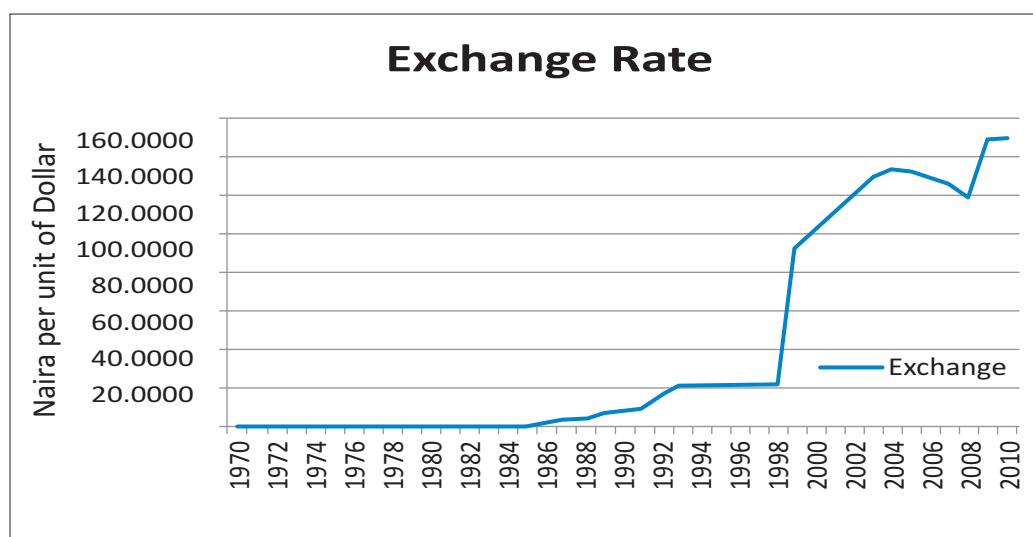
Figure 2: Lending Rate, Savings Rate and Spread In Nigeria (1970-2010)

Source: CBN 2010.

III.3   Exchange Rate Movements in Nigeria (1970-2010)

In line with monetary policy trend in Nigeria, exchange rate was controlled by the government. Nigeria operated a fixed exchange rate system between 1970 and the middle of 1980s. This is depicted in figure 3 as exchange rate was fixed at less than one naira to US dollar.

Figure 3: Exchange Rate in Nigeria (1970-2010)

Source: CBN 2010.

The fixed exchange rate system led to the overvaluation of the Naira relative to the major global currencies, resulting in distortions in the domestic economy as imports become relatively cheaper. The development resulted in balance of payments disequilibrium and subsequent capital flight and a drain on the external reserves. In 1980, following the oil glut, and the global depression and the mounting external debts that followed, it became imperative for the country to move away from the pegged exchange rate system to a flexible one. In 1986, under the Structural Adjustment Programme (SAP), Nigeria adopted the flexible exchange rate system, which allowed the exchange rate to be determined by the market forces. The adoption of the flexible exchange rate system, however, led to the depreciation of the currency from ₦0.8938/US$1 in 1985 to ₦2.0206/U$1 in 1986.

Various reforms were carried out in an attempt to achieve the objectives of exchange rate policy including the Second-Tier Foreign Exchange Market (SFEM) which metamorphosed from the Foreign Exchange Market (FEM), the Autonomous Foreign Exchange Market (AFEM), Inter-Bank Foreign Exchange Market (IFEM), the Retail Dutch Auction System (rDAS) and the Wholesale Dutch

Auction System (WDAS). The application of each arrangement also produced a significant effect on the exchange rate as the naira exchange rate continued to depreciate gradually. By 1991, the exchange rate had depreciated to ₦9.9095/US$1 and sharply to ₦17.2984/US$1 in 1992. The rate further depreciated to ₦92.6934/US$1 in 1999, ₦102.1052/US$1 in 2000, ₦132.1470/US$1 in 2005 before reaching a height of ₦150.66/US$1 in 2010.

IV.   Monetary Policy Objectives and Agricultural Sector in Nigeria

Generally, the objective of monetary policy is the same both in the developed and developing economies. The objectives of monetary policy include, among others, the achievement of price stability; attainment of full employment; attainment of balance of payments equilibrium; achievement of rapid economic growth and maintenance of exchange rate stability. However, as observed by Ajayi and Ojo (2006), there seems to be very scanty empirical studies on the objectives of monetary policy in Nigeria. This study therefore deviates in its analysis and concentrates more in reviewing monetary policy objectives over the years and its effect on the agricultural sector in Nigeria.

While earlier analysis in this respect has discussed monetary policy performance, using two broad epochs, this study splits the two epochs into short intervals and proceeds with the analysis. Following from Ajayi and Ojo (2006) analysis, the current study splits the periods as follows.

Phase 1: 1960 - 1969

The early part of this period was characterised by maintaining sound currency. The Central Bank of Nigeria was still at its infancy with limited power to fully administer a sound monetary policy. The then newly issued Nigerian currency suffered acceptability and convertibility as it was still tied to the British pounds and sterling. The objective of monetary policy was that of accumulation of external reserves. But after 1962, emphasis was put on development as policy objective strived to ensure adequate supply of credit to the economy without creating inflationary pressures (Ajayi and Ojo, 2006). The increase in credit greatly benefited the agricultural sector as credit to agriculture increased, leading to an increase in

agricultural output. Consequently, the contribution of agriculture to real total GDP stood at 55.4 per cent in 1965 (see table 1). The later part of 1965 witnessed the policy of credit rationing in the form of guidelines that placed ceilings on the ability of commercial banks to create credits. This led to a sharp fall in credit allocated to agriculture from 25.3 per cent in 1965 to 2.0 per cent in 1970 (see table 3). However, the later part of the period witnessed the outbreak of civil war, which redirected the objective of monetary policy. In effect, monetary policy was redirected at financing the war as government pursued the policy of cheap borrowing to execute the war.

Phase 2: 1970- 1974

This period is usually referred to as the inflationary era. This is because the period was characterised by rising inflationary pressures from the disruption of the economic activities by the civil war. Monetary policy stance was expansionary in line with the Federal Government's 3Rs- Reconstruction, Resettlement and Reconciliation programme. By 1975 inflation had become a serious national issue as inflation rate reached about 34 per cent from about 3 per cent in 1972 (Ajayi and Ojo, 2006). To stem such tide in inflation, the CBN introduced the sectoral distribution of credit policy, in which cheap credits were allowed to the more productive sectors of the economy, in particular the agricultural sector. Interest rate was also kept at relatively low levels at about 7.0 per cent. Other direct monetary measures to control the indiscriminate credit creation by commercial banks included: credit ceilings; selective credit controls; cash requirements; and special deposits. Following this monetary tightening policy, credit to agriculture fell from 25.3 per cent in 1965 to 2.6 per cent in 1975. The share of agriculture in total real GDP also fell from 44.7 per cent in 1970 to 28.1 per cent in 1975.

Phase 3: 1975-1985

The period was also characterised by direct control of monetary policy instruments by the Government through the monetary authorities. The main objective of monetary policy in this period was the promotion of rapid and sustainable

economic growth. To achieve this objective, the CBN continued with its direct control and rationing of credit policy as loans and advances were directed to the preferred sectors of the economy. The ceiling on individual banks' credit to the preferred sectors was fixed at 30-40 per cent of banks aggregate loans and advances in the early 1980s, but was reduced to 7 per cent in 1985 (Ajayi and Ojo, 2006). Agriculture being the core component of the preferred sector benefited from this policy as share of credit to the sector increased from 2.6 per cent in 1975 to 10.8 per cent in 1985. Its share of the total real GDP also rose from 20.6 per cent in 1980 to 32.7 per cent in 1985. However, beginning from early 1980s, there was shortfall in oil receipts which made it increasingly difficult for the Government to perform its fiscal responsibilities. The government therefore resorted to borrowing from the Central Bank to finance the existing huge deficits. The development had adverse implications for monetary management. The monetary control framework, which relied heavily on credit ceilings and selective credit controls, increasingly failed to achieve the set targets as their implementation became less effective (CBN,2007).

Phase 4: 1986-2010

Beginning from 1986, the monetary policy formulation and objectives assumed a different dimension. The deregulation of the economy following the implementation of SAP in 1986 brought with it monetary policy changes. SAP was introduced as a result of the crash in the international oil market prices and the resultant deteriorating economic conditions in the country. SAP was designed to achieve the following objectives, namely:

   i.   To achieve fiscal balance and balance of payments viability by altering and restructuring the production and consumption patterns in the economy;

   ii. To rationalise the role of the public sector and accelerate the growth potentials of the private sector;

   iii. To restructure and diversify the productive base of the economy so as to reduce dependency on the oil sector; and

   iv. To embark on privatization and commercialisation of the economy aimed

at promoting industrial efficiency, among others.
The main strategies of the programme were the deregulation of external trade and payments arrangements, the adoption of a market-determined exchange rate for the naira, substantial reduction in complex price and administrative controls and more reliance on market forces as a major determinant of economic activity.

Under the SAP framework, the objective of monetary policy was directed at inducing the emergence of a market-oriented financial system for effective mobilisation of financial savings and efficient resource allocation. To achieve this, monetary policy variables such as interest rate and exchange rate were liberalised thereby allowing banks to determine deposit and lending rates based on market conditions. The main instrument of the market-based framework was the open market operations (OMO). OMO was complemented by reserve requirements and discount window operations. Meanwhile, the deregulation of the interest rate had positive effects on the agricultural sector in Nigeria. First, following the deregulation of interest rate, credit allocation to agricultural sector rose from 10.8 per cent in 1985 to 16.2 per cent in 1990 and further to 22.0 per cent in 1995. Second, agricultural share of the total real GDP also experienced some sort of revival as it rose from 20.6 per cent in 1980 to 31.5 per cent in 1990 and further to 34.2 per cent in 1995 (see table 1).

Another major development was that the sector-specific credit allocation targets were compressed into four sectors in 1986, and subsequently to two in 1987 and by 1996, all mandatory credit allocation mechanisms were abolished. Both commercial and merchant banks were subjected to equal treatment since their operations were found to produce similar effects on the monetary process. In 2002, the CBN commenced a medium-term monetary policy framework with the primary aim of achieving price and exchange rate stability by minimising the problem of time inconsistency and over-reaction due to temporary shocks. The Dutch Auction System (DAS) of foreign exchange management was reintroduced. This action engendered relative stability, and stemmed further

depletion of reserves. However, the financial system was characterised by rapid expansion in monetary aggregates, particularly during the second half of 2000, influenced by the monetisation of enhanced oil receipts. Consequently, monetary growth accelerated significantly, exceeding policy targets by substantial margins. Savings rate and the inter-bank call rates fell generally due to the liquidity surfeit in the banking system and the spread between deposit and lending rates widened (see figure 2 for trend). The high lending rates constricted credit to agriculture as commercial banks loans to the sector fell from 22.0 per cent of total commercial banks credit in 1995 to 8.5 per cent of total credit in 2000 and fell further to 3.5 per cent of total credit in 2005.

In 2003, another monetary policy measure was designed aimed at promoting a stable macroeconomic environment and achieve a non-inflationary output growth rate of 5 per cent. In pursuit of its developmental effort, the Central Bank, in collaboration with the Bankers' Committee, established the Small and Medium Industries Equity Investment Scheme (SMIEIS). Credit delivery to real sector was encouraged through the SMIEIS and an incentive of lower Cash Reserve Requirement (CRR) regime was prescribed for those banks that increased their credit allocation to the real sector by 20 per cent or more. Moreover, the Bank provided guarantees for agricultural loans under the Agricultural Credit Guarantee Scheme (ACGS). In spite of these schemes, commercial banks credit to agriculture continued to plunge as shown in table 3.

Following the global financial crisis of 2008/2009, the Central Bank of Nigeria recognised the need to accompany the objective of maintaining price stability with financial system stability. The thrust of monetary policy during the period centered on providing adequate liquidity in the banking system. The Monetary Policy Rate (MPR) was upheld as an anchor to all other short-term market rates. The major instrument of the monetary policy was the Open Market Operations (OMO) conducted through Treasury Bills auction in the primary market. This policy continued into 2010 as monetary policy objective aimed at ensuring price and

financial stability.

V.   The Government's Interventions in Agricultural Sector through the Central Bank of Nigeria

The role of government through the Central Bank of Nigeria (CBN) in the agricultural sector has always been in term of financing. Over the years, the Nigerian government through the central bank has instituted various schemes aimed at enhancing the development of agriculture in Nigeria. Among these schemes are:

i.   **Sectoral Credit Allocation:** Prior to 1996, direct measures such as selective credit control, credit ceilings, administered interest rate and exchange rate, cash requirements and special deposits were frequently used to regulate the flow of credit in the economy by the CBN. Cheap credits were allowed to the more productive (priority) sectors of the economy and in particular the agricultural sector. Interest rate was also kept at relatively low levels at about 7.0 per cent.

ii. **Nigeria Agricultural Co-operative and Rural Development Bank (NACRDB):** The bank was established in 1972, but renamed Nigerian Agricultural and Cooperative Bank (NACB) in 1978. In 2000, it was merged with the People's Bank of Nigeria (PBN) to become Nigerian Agricultural Cooperative and Rural Development Bank Limited (NACRDB). The bank is jointly owned by the Central Bank of Nigeria (40 per cent) and the Federal Ministry of Finance (60 per cent). The bank was purposefully set up to promote growth in the quantity and quality of credit to agriculture, including lending to individuals and state governments. It was also aimed at directly making loans available and strengthening local micro finance banks, which deliver credit at the local community level. It was also to improve storage facilities and promote marketing of farm produce.

iii. **Agricultural Credit Guarantee Scheme Fund (ACGSF):** Agricultural Credit Guarantee Scheme Fund (ACGSF) was established in 1977 under the

management of the Central Bank of Nigeria (CBN), which handles the day-to-day operations of the Scheme. The Federal Government holds 60 per cent of the total shares, while, Central Bank of Nigeria holds the remaining 40 per cent of the shares. The main objective of the Fund was to guarantee credit facilities extended to farmers by banks up to 75 per cent of the amount in default net of any security realized. Agricultural activities for which loans can be guaranteed by the Fund include: establishment or management of plantation for the production of rubber, oil palm, cocoa, coffee, tea and similar crops; production of cereal crops, tubers, fruits of all kinds, cotton, beans, groundnuts, sheanuts, benniseed, vegetables, pine-apples, bananas and plantains; animal husbandry, including poultry, piggery, cattle rearing and the like, fish farming and fish capture; processing activities such as cassava to gari, oil palm fruit to palm oil and kernel, groundnut to groundnut oil, etc and farm machinery and hire services.

iv. **The Self-Help Group Linkage Programme:** The Self-Help Group Linkage programme was launched in 1991 by the government via the Central Bank of Nigeria. It became operational in 1992. This Scheme was a product under the Agricultural Credit Guarantee Scheme Fund (ACGSF). The aim of the Self-Help Group Linkage Banking is to inculcate the culture of savings and banking habit in group members as well enable them to build up resources for financing their farm projects without recourse to bank borrowing on the long-run. Under this Scheme, farmers are encouraged to form themselves into groups of between 5 and 15 on the basis of common purpose and undertake regular savings with a partner bank of their choice. After 6 months of regular savings, the group can apply for loan, which is given to them in multiples of the balance in their savings account at the time of the application for the loan.

v. **The Trust Fund Model (TFM):** The Trust Fund Model was established to enhance credit supply to the agricultural and rural sectors of the economy.

Under the Model, oil companies, State and Local Governments and Non-Governmental Organisations (NGOs) are required to place funds in trust with lending banks to augment the small group-savings of the farmers as security for agricultural loans. The Trust Fund secures 25 per cent or more of the intended loans of the prospective borrowers, the farmers' savings secure another 25 per cent while the ACGSF guarantees 75.0 per cent of the remaining 50.0 per cent, thereby leaving the lending bank with a risk exposure of only 12.5 per cent.

vi. **The Interest Drawback Programme (IDP):** The Interest Drawback Programme was developed as an interest rate management framework under the ACGSF to reduce effective borrowing rates without the complication of introducing dual interest rate regime or contradicting the existing deregulation policy of the government. Under the IDP, farmers will borrow from lending banks at market-determined rates, but the Programme will provide interest rebate of a determined percentage to them where the loans are repaid as and when due. The IDP is funded jointly by the Federal Government and the Central Bank of Nigeria in the ratio of 60:40. The IDP is regarded as a dedicated fund for interest drawback on agricultural loans or IDP Fund and separated from the ACGSF capital.

vii. **Small and Medium Industries Equity Investment Scheme (SMIEIS):** The Government through the Central Bank of Nigeria established the Small and Medium Industries Equity Scheme (SMIEIS) in 2001. The Scheme requires banks to set aside 10 per cent of their before-tax profit annually to be invested in equity in small and medium industries. The specific objectives of the scheme include: to facilitate the flow of funds for the establishment of new Small and Medium Investment (SMI) projects; stimulate economic growth, develop local technology and generate employment; develop and package viable industries with Nigerian entrepreneurs; provide venture capital and management that would spearhead the restructuring and financing of the small and medium scale industries (SMI). The range of

activities of which funds shall be applied are those in the real sector, which include: Agro-Allied; Information Technology and Communication; Manufacturing; Educational Establishments; Services; Tourism and Leisure; Solid Minerals; and Construction.

viii. **Refinancing and Rediscounting Scheme (RRF):** In 2002, the Refinancing and Rediscounting Scheme (RRF) was launched by the Central Bank of Nigeria. The RRF was developed to serve as an incentive for attracting loans to medium to long-gestation real sector projects such as agriculture, semi-manufacturing and manufacturing, exploration and exploitation of solid minerals, and Information Technology (IT). It is a window and an incentive meant to provide temporary relief to deposit money banks, which may face liquidity problems as a result of committing their resources to medium to long-term funding of real sector activities. To farmers, it offer concessionary interest rate on term loans for agricultural investments and afford them to conveniently repay the loans as well as to make profits.

ix. **Agricultural Credit Support Scheme (ACSS):** In 2006, the Federal Government through the Central Bank of Nigeria (CBN) with the active support and participation of the Bankers' Committee established the Agricultural Credit Support Scheme (ACSS) with the total fund portfolio of N50 billion. The main aim of the Scheme was to develop the agricultural sector of Nigeria by providing credit facilities to farmers at single digit interest rates to enable them make use of the untapped potentials in the sector, thereby reducing the cost of food products and inflation rate. This will consequently increase the production of agricultural exports and diversify the revenue base as well as increase the foreign exchange earnings of the country. The Scheme at its inception was billed to grant loans to deserving farmers at 14 per cent interest, but farmers who are able to pay back the loan within the stipulated period enjoy a rebate of 6 per cent, resulting to 8 per cent effective interest rate paid by farmers.

x. **Commercial Agriculture Credit Scheme (CACS) Fund:** As part of its developmental role, the Central Bank of Nigeria (CBN), in conjunction with the Federal Ministry of Agriculture and Water Resources (FMA&WR), established the ₦200 billion Commercial Agriculture Credit Scheme (CACS) fund in April 2009. The Funds are being channeled through the deposit money banks to farmers with interest rate not exceeding 9 per cent and maturity period not more than 7 years. The overall objective of the Scheme is to provide finance for the country's agricultural value chain comprising production, processing, storage and marketing. The specific objectives of the Scheme include:

- To speed up the development of the agricultural sector in Nigeria by providing credit facilities to large-scale commercial farmers at a single digit interest rate (precisely at 9 per cent);

- To enhance food security in the country by increasing food supply and effecting lower agricultural products prices, thereby ensuring low food inflation;

- To reduce the cost of credit in agricultural production to enable farmers exploit the untapped potentials of the sector; and

- To increase total output, generate employment, diversify Nigeria's revenue base, raise the level of foreign exchange earnings and provide input for manufacturing and processing on a sustainable basis.

VI.   Methodology

The study adopted the Auto- Regressive Distributed Lag (ARDL) model for its analysis. One advantage of the Bound Testing approach is that it can be applied irrespective of whether variables in the model are purely I(0), purely I(1) and mutually co-integrated. This avoids the pre-testing problems associated with standard co-integration test such as the classification of variables into I(0) and I(1). Moreover, the test is relatively efficient in small and finite sample data size. However, before estimating the ARDL model, the study tested for unit root and co-

integration among variables in the model. The unit root test is conducted using the Augmented Dickey Fuller (ADF) test proposed by Dickey and Fuller (1979) and Phillips-Perron (PP) test proposed by Phillips and Perron (1988) with intercept only.

VI.1   Empirical Model

Theoretical literature established three major transmission channels through which monetary policy affects agricultural output. These include interest rate channel, credit channel and exchange rate channel. The study considered these endogenous variables in addition to two non-policy variables, which also affect the agricultural sector.

Based on this theoretical exposition, the empirical model was formulated and expressed as:

    AGOUT= f (LEN, CBLA, EXCH, INF, GXPA)   (1)

Where:

    AGOUT = Agricultural GDP

    LEN = Lending Rate

    CBLA = Commercial Banks Loans and Advances to Agriculture in Nigeria

    EXCH = Exchange Rate

    INF = Inflation Rate

    GXPA = Government Expenditure in Agriculture in Nigeria

Given the time series nature of the data used, the unit root procedure requires estimating the following ADF and PP equations:

ADF Estimation:

$$\Delta Y_t = a_0 + \gamma Y_{t-1} + \sum_{i=1}^{k} \beta_i \Delta Y_{t-i} + U_t \qquad (2)$$

Where:

$\Delta Y_t = Y_t - Y_{t-1}$ is the first difference of series Y_t;

$\Delta Y_{t-1} = Y_{t-1} - Y_{t-2}$ is the first difference of Y_{t-1}

$$Y_t = \lambda_0 + \rho Y_{t-1} + \varepsilon_t. \tag{3}$$

Where:

$\alpha_0, \lambda_0, \gamma, \beta_i,$ and ρ are parameters to be estimated; U_t, and ε_t are stochastic error terms.

In both ADF and PP tests, the null hypothesis of non-stationarity (presence of unit root) is accepted if $\gamma = 0$ and $\rho = 1$, respectively, while the null hypothesis of non-stationarity is rejected if $\gamma < 0$ and $\rho < 1$, respectively.

Following from Pesaran, Shin and Smith (2001), the Error Correction Model (ECM) of the unrestricted Auto Regressive Distributed Lag (ARDL) equation based on equation (1) is specified as follows:

$$\Delta AGOUT_t = \alpha_0 + \alpha_1 LEN_{t-1} + \alpha_2 CBLA_{t-1} + \alpha_3 EXCH_{t-1} + \alpha_4 INF_{t-1} + \alpha_5 GXPA_{t-1} + \sum_{i=1}^{k} \beta_i \Delta AGOUT_{t-i}$$
$$+ \sum_{i=0}^{k} \varphi_i \Delta LEN_{t-i} + \sum_{i=0}^{k} \delta_i \Delta CBLA_{t-i} + \sum_{i=0}^{k} \omega_i \Delta EXCH_{t-i} + \sum_{i=0}^{k} \gamma_i \Delta INF_{t-i} + \sum_{i=0}^{k} \pi_i \Delta GXPA_{t-i} + U_t \tag{4}$$

Where:

U_t is the white noise error term.

The first part of the right hand side of equation (4) with parameters α_1 to α_5 represents the long-run dynamics of the model and the second part with parameters β_i to π_i represents the short-run dynamics of the model.

The ARDL approach involves testing first for the co-integration relationship among the variables in the model. In specific term, the bounds test involves estimating equation (4) and then testing the null hypothesis (H_0) of no long-run relationship against the alternative hypothesis (H_a) that there is a long-run relationship. That is: H_0: $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$, against the alternative hypothesis: H_a: $\alpha_1 \quad \alpha_2 \quad \alpha_3 \quad \alpha_4 \quad \alpha_5 \quad 0$. The calculated F-statistic is then compared with the critical values given in Pesaran et. al.,(2001). If the computed F-statistics exceeds the upper critical value, the null hypothesis of no long-run relationship can be rejected. On the other hand, if the F-statistics falls below a lower critical value, then the null hypothesis cannot be rejected. Lastly, if the F-statistics lies between the upper and lower critical values, it

renders the result inconclusive.

On the event that the existence of long-run relationship among the variables is established, the second stage involves the estimation of the error correction model of equation (4) for short-run and long-run dynamics.

VI.2   Data Sources

The study employed time series data collected on annual basis from 1970-2010. The relevant data for the study was obtained from the Central Bank of Nigeria Statistical Bulletin, the Central Bank of Nigeria (CBN) Annual Reports and Statement of Accounts and the National Bureau of Statistics.

VI.3   Analysis of Results

The result of the unit root tests using Augmented Dickey-Fuller test and Phillip-Perron test in Tables 4 and 5. As shown in table 4, the result of the unit root test using Augmented Dickey-Fuller test of stationarity revealed that only two variables (CBLA and GXPA) were stationary at levels. Hence, the null hypothesis of non-stationarity could not be rejected at levels. However, at first difference, all variables were stationary. That is, at first difference, the variables were integrated of order 1(1).

Table 4: Test for unit root using ADF Test

Variables	Levels	First Difference	Critical Values at 5per cent	Order of Integration
AGOUT	-0.4048	-6.1463*	-3.5297	1(1)
CBLA	3.3503*	-2.1374	-3.5683	1(0)
EXCH	-1.4815	-6.0650*	-3.5297	1(1)
GXPA	-5.5219*	-5.9211*	-3.5577	1(0)
LEN	-1.5707	-9.8502*	-3.5297	1(1)
INF	-3.3266	-6.2933*	-3.5330	1(1)

*denotes significance at 5per cent.

Table 5 also showed the test of unit root using Phllip-Perron test. As the result showed, only one variable (GXPA) was stationary at levels. Just as in the ADF test above, the null hypothesis of non-stationary of the series could not be rejected. All variables were, however, stationary when the series was differenced once.

From the unit root tests conducted above, it was revealed that the variables were integrated of order 1(1), which suggested the presence of co-integration relationship among them. To establish this long-run relationship, the bounds test co-integration analysis was carried out. The result of the bounds test was reported in table 6. From the result obtained, the calculated F-Statistics value of 1251.49 was greater than the upper- bound critical value of 4.90 at 1 per cent level. Since the F-Statistics value was greater than the upper-bound critical value, the null hypothesis of no co-integration was rejected; hence there was co-integration (long-run relationship) among the variables in the model.

Table 5: Test for unit root using PP test

Variables	Levels	First-diff	Critical Value at 5per cent	Order of Integration
AGOUT	-0.3609	-6.1503*	-3.5297	I(1)
CBLA	-2.0655	-28.7995*	-3.5297	I(1)
EXCH	-1.4815	-6.0650*	-3.5297	I(1)
GXPA	-5.5334*	-31.5919*	-3.5297	I(0)
LEN	-2.8068	-10.0030*	-3.5297	I(1)
INF	-3.1857	-11.5234*	-3.5297	I(1)

*denotes significance at 5 per cent.

Since it was established that there was a long-run relationship among the variables in the model, we proceeded to estimate the error correction model for short-run estimates. The results of the short-run dynamics from the error correction model presented in Table 7 showed that exchange rate and government expenditure on agriculture had significant short-run effect on agricultural output in Nigeria. The

coefficient of exchange rate was positive, showing that a shock to exchange rate (i.e. depreciation) will generate positive reaction to increased agricultural production for export. Precisely, the high elasticity of exchange rate is indicative of the strong sensitivity of agricultural output to exchange rate shock.   An appreciation of the exchange rate will increase competitiveness of agricultural export and attract investment in the agricultural sector. Similarly, the positive sign of the coefficient of Government expenditure on agriculture showed that there was a short-run positive effect of Government spending on agricultural output in Nigeria. This implied that a 1 per cent increase in Government expenditure in agriculture leads to 1.08 per cent increase in agriculture productivity in Nigeria, other things being equal. The result was in line with those obtained by Udoh (2011) and Udoh et. al.,(2012).

The adjusted R-Squared showed that the explanatory variables have explained 52 per cent of the total variations in agricultural output in Nigeria. The F-statistics (13.81) also showed that the explanatory variables collectively were significant in explaining short-run changes in agricultural output in Nigeria. The Durbin-Watson value of 1.91 showed there was no autocorrelation in the model. Meanwhile, the coefficient of the error correction term is negative in line with a priori expectation but however, not statistically significant. Thus, there is a slow rate of adjustment to equilibrium.

Table 6: Results from Bounds test

Bounds Test:	
F-statistic (p-value)	1251.49 (0.02)
Critical bounds (1per cent)[#]:	
lower and upper	3.60 and 4.90
Decision:	Co-integration

[#]Unrestricted Intercept and Unrestricted trend (k=6) from Pesaran et. al.,(2001).
 The full regression result is presented in Table A1 in the appendix.

Table 7: Error Correction Model

Dependent Variable: ?AGOUT			
Explanatory variables	**Coefficient**	**t-statistic**	**Probability**
Constant	4854.75	2.67	0.01
?EXCH(-4)	905.33	4.58	0.0001
?GXPA(-3)	1.08	5.94	0.0000
ECM(-1)	-0.009	-0.14	0.88
Adjusted R-squared	0.52	F-statistic	13.81

Diagnostic Tests: Serial Correlation [0.16 (0.85)], ARCH [0.039 (0.84)], Heteroscedasticity [0.18 (0.99)]
Functional Form (RAMSEY RESET) [0.12 (0.88)]

VII.   Policy Recommendations and Conclusion

The study examined the effect of monetary policy on agricultural output in Nigeria for the period 1970 to 2010, utilising monetary policy variables such as commercial banks credit to agricultural sector, exchange rate, lending rate and two non-policy variables, which were Government expenditure and inflation rate. As earlier stated, it is believed that monetary policy has real and nominal effect on the overall economic activities and, hence agricultural sector only in the short-run and medium–run, but has no significant effect in the long-run. The argument in this regard is that the fundamental forces that shape outcome and, hence forces that determine the behaviour of output in the agricultural sector are believed to be consequences of non-monetary conditions. Following from the above debate, the study was undertaken to examine whether monetary policy has effect on the outcomes of agricultural output in Nigeria.

The result obtained showed that monetary policy through exchange rate channel had significant positive effect on agricultural output in Nigeria. The results also showed that Government expenditure on agricultural sector had a positive and significant impact on output of agriculture in Nigeria.

To boost agricultural productivity in Nigeria, the following policy recommendations are relevant:

i   There is need for the Government to continue to invest in the agricultural sector in Nigeria through its direct spending in the sector. Spending may take the form of infrastructural development, establishment of research centres, provision of farm inputs at subsidised rates, and direct provision of credits to farmers through specialised agencies.

ii   There is need to maintain a sound exchange rate policy that will lead to increased agricultural output in the economy. The current exchange rate appears overvalued. The study has demonstrated that some level of depreciation should be permitted to help boost agricultural exports. However, excessive depreciation should be avoided as it can affect importation of essential farm inputs such as equipments and machineries needed by farmers.

iii   Farmers should be given easy access to credit so as to boost their productivity. Commercial banks should be mandated to lend to farmers at a very low interest rate. The existing small and medium scale investment scheme fund and the microfinance arrangements should be properly managed and made functional as they can prove to be veritable sources of finance to farmers.

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Appendix

Table A1: Results from Bounds test

Dependent Variable: ΔAGOUT			
Variable	**Coefficient**	**t-Statistic**	**Probability**
CONSTANT	537508.50	61.68	0.01
CBLA(-1)	152.54	57.11	0.01
EXCH(-1)	-13519.31	-42.60	0.01
INF(-1)	-3643.73	-29.06	0.02
GXPA(-1)	-433.77	-60.16	0.01
LEN(-1)	-70092.01	-63.53	0.01
ΔAGOUT(-1)	-0.31	-14.62	0.04
ΔAGOUT(-2)	0.40	21.98	0.02
ΔAGOUT(-3)	-0.29	-12.59	0.05
ΔAGOUT(-4)	0.17	4.04	0.15
ΔCBLA	12.60	57.20	0.01
ΔCBLA(-1)	-91.78	-58.25	0.01
ΔCBLA(-2)	-94.69	-49.33	0.01
ΔCBLA(-3)	-55.25	-48.38	0.01
ΔCBLA(-4)	-223.87	-59.79	0.01
ΔEXCH	30231.68	39.35	0.01
ΔEXCH(-1)	83151.46	62.73	0.01
ΔEXCH(-2)	58118.30	51.85	0.01
ΔEXCH(-3)	38478.03	42.19	0.01
ΔEXCH(-4)	-12009.18	-12.70	0.05
ΔGXPA	-42.53	-38.14	0.01
ΔGXPA(-1)	290.12	63.74	0.01
ΔGXPA(-2)	152.65	64.98	0.01
ΔGXPA(-3)	48.29	65.12	0.01
ΔGXPA(-4)	24.59	53.78	0.01
ΔLEN	-8935.57	-38.63	0.02

ΔLEN(-1)	48776.17	62.00	0.01
ΔLEN(-2)	64992.42	63.05	0.01
ΔLEN(-3)	59336.52	69.92	0.01
ΔLEN(-4)	37615.63	63.66	0.01
ΔINF	80.01	1.69	0.33
ΔINF(-1)	3685.46	36.80	0.02
ΔINF(-2)	2737.44	40.14	0.02
Δ INF(-3)	2377.59	37.50	0.02
ΔINF(-4)	2543.94	49.93	0.01
R-squared	0.99		
Adjusted R-squared	0.99		
Durbin-Watson stat	2.49		
F-statistic	626.52		
Prob(F-statistic)	0.03		

Bounds Test:

F-statistic	1251.49
(p-value)	(0.02)
Critical bounds (1per cent)#:	
lower and upper	3.60 and 4.90
Decision:	Co-integration

#Unrestricted Intercept and Unrestricted trend (k=6) from Pesaran et al (2001).

Table A2: Error Correction Model

Dependent Variable: ΔAGOUT

Variable	Coefficient	t-Statistic	Probability
CONSTANT	4854.75	2.67	0.01
ΔEXCH(-4)	905.33	4.58	0.0001
ΔGXPA(-3)	1.08	5.94	0.0000
ECM(-1)	-0.009	-0.14	0.88

R-squared	0.56
Adjusted R-squared	0.52
Durbin-Watson stat	1.91
F-statistic	13.81

Diagnostic Tests: Serial Correlation [0.16 (0.85)], ARCH [0.039 (0.84)], Heteroscedasticity [0.18 (0.99)] Functional Form (RAMSEY RESET) [0.12 (0.88).