**TITLE PAGE**

 **RE-EVALUATION OF THE IMPACT OF MONETARY POLICY ON AGRICULTURAL OUTPUT IN NIGERIA**

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**APPROVAL PAGE**

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**DEDICATION**

This project work is dedicated to the loving memory of my grandma,Mrs Veronica Okafor.

**ACKNOWLEDGEMENTS**

I am so grateful to this awesome God from whom all knowledge, wisdom come; it was his grace that made this work a success.

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ABSTRACT

This research work is an empirical effort attempted to re-evaluate the impact of monetary policy on agricultural output with annual secondary data from 1980 to 2015 sourced from Central Bank of Nigeria Statistical Bulletin. The ordinary least square techniques was employed for its estimation. The result shows that the independent variables interest rate, cash reserve ratio and deposit money bank credit to agriculture have significant impact on the Agricultural sector in Nigeria which means that monetary policy instruments is relevant to agricultural. From the study the government is advised to seek a proper role for monetary policy in promoting strong and sustainable growth in a stable macroeconomic environment in Nigeria through monetary authority also the government should advocate for a moderate interest rate which is needed for a sustainable economic growth and development.

 **CHAPTER ONE**

**INTRODUCTION**

* 1. **Background of the Study**

Monetary policy includes a number of policies by which a country controls its money stock so as to achieve macroeconomic goals. Monetary policy refers to the combination of measures designed to regulate the value, supply and cost of money in an economy. It can be described as the art of controlling the direction and movement of credit facilities in pursuance of stable price and economy growth in an economy (CBN, 1992). Monetary policy in the Nigerian context refers to the actions of the Central Bank of Nigeria to regulate the money supply which could be through discretional monetary policy instruments such as the open market operation (OMO), discount rate, reserve requirement, moral suasion, direct control of banking system credit, and direct regulation of interest rate (Iyoha, 2002). Agricultural financing also plays a fundamental role in determining access to the needed inputs that facilitates farming and other extensive agricultural practices which ultimately transforms into increased output while increased agricultural output establishes a forward linkage in terms of development to other sectors as well as higher income and better quality of life for the rural poor, (Hazell, 2005).

There exist relationship between monetary policy and other macro-economic variable, the objectives of monetary policy include price stability, full employment and economic growth, targets of monetary policy refer to the variables such as supply of money or bank credit, interest rates which are sought to be changed through the monetary policy instruments such as open market operation and selective credit control etc, so as to attain the laid out objectives (Ahuja, 2013).

Monetary policy thus becomes an indispensable and inevitable variable in any economy that it cuts across every sector, agricultural sector inclusive. The agricultural sector is seen as one of the major sectors in the economy and a key determinant of long run economic development in Nigeria with the sector contributing to development of an economy through production of goods, foreign exchange and exports. Prior to oil discovery in Nigeria, agriculture was the mainstay of the nation. However, with oil discovery and the oil boom of the 1970s, the sector suffered neglect with the sector’s contribution to GDP declining to 35% in 2014 from 65.7% in 1957 leading to food insecurity and increased level of poverty in the country with the poverty level standing at 33.1% in 2013 (NBS, 2014).

Due to the failing agricultural sector, the Nigerian government became directly involved in boosting the agricultural sector, with several large scale agricultural projects and programmes launched and established while concessionary interest rate structure was employed with direct cheap credit to agricultural sector. Despite these efforts of government in boosting the performance of the sector, the sector is still not witnessing significant development.

 Monetary policy facilitates the establishment of agricultural businesses through availability of credit and finance for start-up, investments, and expansion. The CBN controls the availability of credit through monetary policy instruments. These instruments affect agricultural output through agricultural banks and other financial institutions. Therefore, it is imperative in this study to re-evaluate the concept of monetary policy and agricultural output.

* 1. **Statement Of The Problem**

The fundamental problem of any government is it economic or otherwise its implementation. A number of government monetary policy instruments have been designed and applied in Nigeria in the hope of achieving the desired result of stable price level, low level of unemployment, efficient banking system etc.

The agricultural sector in Nigeria today has been characterized by low productivity. Recognizing this, the Nigerian government introduced series of macroeconomic programmes and policies (both monetary and fiscal policy) aimed at improving the sector performance. However, the share of agriculture contribution to GDP declined from 42.20% in 2007 to 40% in 2010 and to a more worsening rate of 35% in 2013 (CBN 2013).

Low agricultural output has a negative effect on the economy as a whole; there is a low production of goods for food and raw materials for industries. A major challenge facing Nigeria is the inability to capture the financial services requirements of farmers and agribusiness owners who constitute about 70 percent of the population. Farmers need access to capital to purchase land and equipment and to invest in the development of new products, services, production technologies and marketing strategies. Yet banks are often reluctant to lend money to farmers for agricultural enterprises due to the lack of creditability and collateral.

Therefore there is need for a research in order to effect necessary changes because activities of the monetary authorities through monetary policy affect the financial institutions and credit availability to the agricultural sector in no small measure this will further affect agricultural output positively.

* 1. **Research question**

1. To what extent has monetary policy impacted on agricultural output in Nigeria?

2. What is the nature of the relationship between monetary policy and the agricultural output in Nigeria?

* 1. **Objectives of Study**

The general objective is to empirical re-evaluate the impact of monetary policy on agricultural output in Nigeria for the period of 1980-2015. . Under this general objective, the specific objectives this study covers are;

1. To find out if there is a long-run relationship between monetary policy and agricultural output.

2.To determine the impact of monetary policy on agricultural output.

**1.5 The statement of hypothesis**

**HAo:**monetary policy has no significant impact on agricultural output.

**HA1**: monetary policy has significant impact on agricultural output.

**HBo:**there is no long-run relationship between monetary policy and agricultural output.

**HB1**: there is a long-run relationship between monetary policy and agricultural output.

**1.6             Significance of Study**

This research work is being carried out to empirical re-evaluate the overall impact of monetary policy on agricultural output. The findings of this work will be of immense use and benefit to government Ministries like Ministry of agriculture and Monetary Authorities (Central Bank of Nigeria), Department and Agencies at federal level in solving some macro-economic problems, state and local, policy makers and intellectual researchers who may be willing to improve the work subsequently. Lastly, it will educate the public on various government policies as related to monetary and agricultural issues.

**1.7             Scope of Study**

This research seeks to re-evaluate the impact of monetary policy on agricultural output in Nigeria. The study shall be carried out using secondary time series data, for a span of 36 years that is from 1980 to 2015 which is sufficient and suitable for conducting a research, making new findings and relevant recommendations.

**CHAPTER TWO**

**LITERATURE REVIEW**

**2.1 CONCEPTUAL LITERATURE**

This study shall be examining the relationship between monetary policies and agricultural output.

Monetary policy in the Nigerian context refers to the actions of the Central Bank of Nigeria to regulate the money supply which could be through discretional monetary policy instruments such as the open market operation (OMO), discount rate, reserve requirement, moral suasion, direct control of banking system credit, and direct regulation of interest rate (Iyoha, 2002)

Contractionary or expansionary depending on existing circumstances, the success of monetary policy in an economy depends on the operating economic environment, the institutional framework adopted and implementation with a view that there is a stable relationship between the quantity of money in an economy and her economic activities with the prime aim being to make sure that money supply is in consonance with the growth level of the economy without committing errors (Nzotta & Okereke 2009).

Friedman, M. (1969) defines monetary policy as the action taken by the monetary authorities usually the Central Bank to affect monetary and other financial conditions through influence over the availability and cost of credit in pursuit of the broad objectives of sustainable growth of output, price stability and a healthy balance of payments position. The discretionary control of the money stock to him involves the expansion or contraction of money and influencing interest rate to make money cheaper or more expensive depending on the prevailing economic conditions and thrust of policy. He went further to classify the instruments of monetary control into two broad categories - direct and indirect instruments. Under a system of direct monetary control, the Central Bank uses some criteria to determine monetary, credit and interest rate targets that would achieve the goals of economic policy. In a regime of indirect monetary control, the monetary base (specifically bank reserves) is managed while the market is left to determine interest rates and credit allocation.

The Central Bank of Nigeria (CBN) derives its mandate from the CBN Act of 1958. Section one of the CBN Decree No. 24 of 1991, stipulates that the principal objects of the Bank shall be to issue legal tender currency in Nigeria; maintain external reserves to safeguard the international value of the legal tender currency, promote monetary stability and a sound financial system in Nigeria, and act as banker and financial adviser to the Federal Government (CBN, 2006). Therefore the central bank is the principal monetary authority.

Ahmed (1991), opines that monetary policy is a central bank‘s actions to influence the availability and cost of money and credit, as a means of helping to promote national economic goals. Eze (1993), stresses that monetary policy regulates the supply of money and the cost and availability of credit in the economy. It deals with both the lending and borrowing rates of interest for commercial banks. The monetary policy aims to maintain price stability, full employment and economic growth. The Central Bank of Nigeria is responsible for formulating and implementing monetary policy. It can increase or decrease the supply of currency as well as interest rate, carry out open market operations, control credit and vary the reserve requirements. Kogar (1995), argues that monetary policy is an effective instrument in relation to influencing demand. He noted that it is crucial to generating an environment for sustainability of lower inflation. He examined the relationship between financial innovations and monetary control and concluded that in a changing financial structure Central Banks cannot realise efficient monetary policy without setting new procedures and instruments in the long-run, because profit seeking financial institutions change or create new instruments in order to evade regulations or respond to the economic conditions in the economy.

Agriculture was given the highest priority both for poverty reduction in the rural areas, and for the improvement of the economy generally, government embarked on massive expansion of agricultural extension services and tried to ensure better and easier delivery of credits to farmers. The government also embarked on a massive campaign, with appropriate policies designed to achieve self-sufficiency and extended export volumes in crops such as rice, maize, sorghum, ginger, groundnuts, cocoa, coffee etc. as well as self-sufficiency in industrial crops such as Soya beans, palm produce, rubber and cotton. Government also encouraged the involvement of non-governmental organizations in all these measures.

 The agricultural sector is seen as one of the major sectors in the economy and a key determinant of long run economic development in Nigeria with the sector contributing to development of an economy through production of goods, foreign exchange and exports. In the global world, the contribution of agriculture in food production has been worsening and resulted in food price hikes in 2007 and 2008 (Enoma 2010).

According to the central bank of Nigeria's data (2003), oil still accounts for our major revenue (gearing towards 80%) and almost 100% of our earnings. The economic salvation cannot be preached without due regard to agricultural development. Agriculture is the most certain path to economic growth and sustainability. Poverty has taken over Nigeria although we cannot get out of it today by just relying on oil and gas. We cannot pretend to neglect the importance of Agriculture for the economy to move forward.

The importance of Agriculture cannot generally be over-emphasised in Africa or particularly in Nigeria. With poverty having finally taken resident permit in Nigeria in - although we were warned against it by Professor Pat Utomi in 2003, we cannot get out of it today by just relying on oil and gas. We cannot pretend to neglect the importance of Agriculture in the economic forward-wheeling of our nation.

**2.2 THEORETICAL LITERATURE**

**2.2.1 MONETARY POLICY IN NIGERIA**

During the independence era in the 1960s, with the creation of the CBN, the monetary issues that needed prompt attention were the issue of the Nigerian currency, the establishment of a strong financial base and the promotion of domestic financial infrastructures such as the money and capital market institutions and instruments. This led to the introduction of the first Nigerian money market instrument- the Treasury bill and the establishment of the Lagos stock exchange. Between 1964 and 1966 the defense of the BOP was the focus of monetary policy due to the credit expansion policy adopted in 1962 which subsequently led to increase in the demand for imports causing a drain on the foreign reserves. Policy instruments such as discount rate control, interest rate, moral suasion etc were used to reverse the trend with a ceiling of 15% imposed on commercial bank's credit and granting credit to finance imports and construction were restrained, minimum rediscount rate was rate from 4% to 5% in 1965. Thus, a restrictive monetary policy was pursued in Nigeria during this period (Gbosi 2005). With the end of the civil war in 1970, which disrupted economic activities and an upsurge in wages due to revenues from the oil boom, inflationary trends were noticed in the economy. Anti inflationary measures were introduced with the aim of reducing commercial bank's liquidity and also, encourage the channeling of greater credit to productive sector. Consequently, the monetary authority imposed quantitative interest rate and stabilization securities and advocated sectoral credit allocation to the various sectors of the economy with preference to agricultural sector, manufacturing sector and construction sector (sectors believed will revamp the economy) with a below market lending rate (Imuoghele & Ismaila 2014). Loans and advances to these sectors were fixed at 30 to 40% of banks aggregate loans and advances in the early 1980s, but was reduced by 7% in 1985 while the number of sectors attracting credit was reduced from about 18 in the 1970s to 4 in 1986 (Nwaru 2014). With the deregulation of the economy through the adoption of the Structural Adjustment Programme (SAP) aimed at achieving fiscal balance and balance of payment equilibrium due to the economic crisis of the early 1980s occasioned by the collapse of world oil price, monetary policy in the era aimed at stimulating output and employment, promote domestic and external stability through a market oriented financial saving and efficiency resources allocation. strategy involved the deregulation of the financial system to accomplish a market-oriented financial system characterized by the free entry and free exit of banks and the use of indirect instruments for monetary control that would support efficient financial intermediation so as to increase competition, strengthen the supervisory and regulatory capacity of the CBN, improve the financial structure and redress the financial repression already identified (Oke, 1995). However, some direct control measures were maintained and new ones introduced to check excess liquidity. For instance, Stabilisation Securities were introduced in 1990. Similarly, Special Treasury Bills (STBs) were also introduced in April 1999 and discontinued before the end of 2000. Specifically, under the SAP regime, the objectives of monetary policy has been the stimulation of output and employment and the promotion of domestic and external sector stability while ensuring price stability and inflation control.

 **2.2.2 AGRICULTURAL SECTOR IN NIGERIA AND ITS PERFORMANCE**

Agriculture constitutes one of the most important sectors of the Nigerian economy. It is also a veritable tool in combating poverty in third world countries and achieving long-term economic development. Although Nigeria depends heavily on the oil industry for its budgetary revenues, the country is predominantly still an agricultural society with approximately 70% of the population engaging in agricultural production at a subsistence level. Based on the varying climatic conditions of regions and the vast and rich soil, the country produces varieties of crops while a significant portion of the agricultural sector in Nigeria involves livestock production, fishing, poultry, and lumbering, hence, agricultural products were major export product in the 1960s and early 1970s with the sector contribution to the GDP standing at 35% in 2013 (CBN 2013). Due to the sector's importance successive governments have propounded policy programmes and strategies both monetarily and otherwise to revitalise agriculture in Nigeria from 1960 with all programmes aimed at increasing agricultural output for consumption and export, provide inputs and subsidies to small scale farmers, make credit facilities accessible to a large segment of rural farmers, eradicate poverty, create employment and raise the standard of living. These programmes included the Farm Settlement Scheme policy of 1959, the National Accelerated Food Production Programme (NAFPP) launched in 1972, the Agricultural Development Programme (ADP) of 1974 and 1989, Operation Feed the Nation (OFN) in 1976, the River Basin Development Authorities (RBDAs) was launched in 1976, and the Green Revolution (GR) launched in 1980. The Directorate for Food Roads and Rural Infrastructure (DFRRI) launched in 1986, the Better Life Programme (BLP) For Rural Women introduced in 1987, the National Agricultural Land Development Authority (NALDA) , launched in 1992 , the Family Support Programme (FSP)/ Family Economic Advancement Programme (FEAP) launched in 1994 and 1996 respectively, the National Fadama Development Project (NFDP) of the early 1990s , the National Economic Empowerment and Development Strategy (NEEDS) launched in 1999, the National, Special Programme on Food Security (NSPFS) launched in 2002, the Root and Tuber Expansion Programme (RTEP) launched in 2003, Seven Point Agenda of 2007 and Transformation Agenda of 2011. Agriculture provided 41% of the country's GDP, with its contribution to the GDP dropping to 35% in 2013 (CBN 2013). Today, less than 50 percent of the country's cultivable agricultural land is being cultivated with smallholder and traditional farmers who use crude agricultural tools cultivating most of this land. This has not been helped by the discovery of oil in the country. (Manyong et al 2003). The sector is bedeviled by problems such as organisational and weak policy, limited access to improved technologies in the form of improved seeds and the use of mainly crude farm tools such as hoes and cutlasses. Also, there are infrastructural inadequacies as the sector suffers from poor road network, lack of storage/processing facilities as well as inadequate irrigation facilities and underfunding leading to the problem of high food importation. Government has played a more dynamic role in agricultural production by ensuring stability of the financial system as well as guarantee sources of credit to the farmers through the manipulation of interest rate. Concessionary interest rate was given to the sector between 1970 and 1985. However, the SAP programme led to the deregulation of interest rates in 1990 and indirect monetary policy control was put in place. Hence agricultural sector had to compete for funding with the other sectors of the economy leading to the stoppage of sectoral credit allocation policy (Gbosi 2005). This led to increased food import bills and hike in prices with food import increasing from 6.36% in 1991 to 27.02% and 30.56% in 1999 and 2011 respectively (NBS 2012). Due to the above negative impact of SAP and to safe-guard the sector from competition as well as enhance flow of credit, the Agricultural Credit Guarantee Scheme (ACGS) was established in 1977 with the share capital of the ACGS increased from ₦199 million in 1977 to ₦3 billion in 2001. Other financial institutions were formed to complement the funding capacity of ACGS. In 2000, the Nigerian Agricultural Commerce and Rural Development Bank (NACRDB) was formed. The National Micro Finance Policy was also launched in 2006 with the aim of creating accessible and easy credit facilities to rural Nigerians. Also Agricultural Credit Support Scheme (ACSS) was established to provide credit facilities to farmers at single digit interest rate with a view to reduce the cost of agricultural production and increase output on a sustainable basis (Ehinomen & Akorah 2013). The effectiveness of these policies remained questionable as the interest rate remained high as well as inflation rate throughout the period. The average interest rate stood at 12.475% between 1970 and 2005, it increased to 17.26 in 2006, stood at 17.59% and 16.79% in 2010 and 2012 respectively (CBN 2012). Also, food inflation rose from 3.9 % in 2006 to 8.2 % in 2007 and 18.0 % in 2008. It fell 15.5% in 2009 and 12.7% in 2010 (NBS 2012).

**2.2.3 THE NATIONAL AGRICULTURAL POLICY**

In an attempt to tackle the problems facing the Agricultural Sector in Nigeria, Government has put in place the National Agricultural Policy, which was jointly formulated by the national stakeholders and International Development Partners and approved by the Federal Government in 2002. The major components of the National Agricultural Policy feed the National Economic Empowerment and Development Strategy (NEEDS) document. Specifically, the National Agricultural Policy assigns supportive roles to the government, while investments in the sector are left to the private sector initiative. The broad objectives of the National Agricultural Policy include: Promotion of self-sufficiency in food and raw materials for industries; recognition that agriculture is business, hence a private sector concern where the role of government is to facilitate and support private sector initiatives; promoting reliance on local resources; diversification of the sources of foreign exchange earnings through increased agricultural exports arising from adoption of appropriate technologies in food production and distribution, which specifically responds to the needs of women, bearing in mind that they constitute over 50% of the labour force in agriculture.

**2.3 Empirical Review**

 There have been several empirical studies to re-evaluate the impact of monetary policy on agricultural output in the recent decades.

Classical monetary theory in their study of money, posited that there is a direct and proportionate relationship between changes in the quantity of money and general price level. The theory had its roots with the work of Jean Boldin in the 16th century. John Lock (1690), examined the effects of money on trade, the role of interest rate and demand for money in the economy. However, the classical quantity theory of money is today, hinged on the theory of Irvin Fisher (1867-1947). He posited that " Other things remaining unchanged, as the quantity of money in circulation increases, the price level also increases in direct proportion while the value of money decreases and vice versa" (Jhingan 1997). If the quantity of money is doubled, the price level will also double and the value of money will be one half.

Nwosa and Saibu (2012), investigated the transmission channels of monetary policy impulses on sectoral output growth in Nigeria for the period 1986 to 2009. Using quarterly data, the study showed that interest rate channel was most effective in transmitting monetary policy to Agriculture and Manufacturing sectors.

 Abdurrahman (2010), empirically examined the role of monetary policy on economic activity for the period 1990 to 2004 and found that monetary policy had little impact on economic activity during the period under consideration.

Imoughele and Ismaila (2014), examined the relationship between manufacturing sector output and monetary policy variables (exchange rate, interest rate, broad money, external reserve and inflation rate), they found out that a long run relationship exist between manufacturing sector output and monetary policy variables in their study indicating a self-adjusting mechanism for correcting any deviation of the variables from equilibrium.

 Saygin and Evren (2010), evaluated sectoral growth cycles and the impact of monetary policy in the Turkish manufacturing industry. They found out that all manufacturing sectors respond to a tightening monetary policy shock with a reduction in absolute output.

Onyeiwu (2012), studied the effect of monetary policies on selected macroeconomic variables GDP, inflation rate and balance of payment between 1981 and 2008. His findings show that monetary policy exerts a positive impact on GDP growth and Balance of Payment but negative impact on rate of inflation. Ehinome and Akorah (2010), Examined the impact of monetary policy on agricultural development in Nigeria. it has not recorded significant progress in terms of providing enabling environment for better performance in the agricultural sector.

Nnanna (2001), examines that the evolution of monetary policy in Nigeria in the past four decades and observed that though, the Monetary management in Nigeria has been relatively more successful during the period of financial sector reform, the socio-economic and political milieu, including the legal framework under which the Central Bank of Nigeria has operated, was the critical factor that influenced the outcome of monetary policy. He further noted that the granting of instrument autonomy to the CBN has enhanced its operational efficiency, in terms of its ability to achieve its key objective of monetary policy, namely price stability.

 Batini (2004), argues that the implementation of monetary policy in Nigeria has been complicated by a number of factors, including fiscal largesse, lack of operational autonomy of the central bank, insufficient and low-quality statistics, a weak transmission mechanism, and a weak financial system. His analysis revealed that neither the stable prices/free float nor the fixed exchange rate solutions are particularly appealing for Nigeria in the long run. He argued that inflation targeting with a free float still seems to be a superior option on various grounds.

Okonkwo, Egbulonu & Emerenini (2015), examined the impact of monetary policy on manufacturing in Nigeria. Their findings revealed that money supply (MS) and credit to private sector (CPS) exert tremendous pressure on manufacturing.

**Summary and Limitation of Previous Studies**

 The reviewed literatures have attempted to show evidence of the impact of monetary policy on agricultural output. Monetary policy have been shown to be a core variable in determining the level of agricultural output of a nation given the increasing role of government in the economy especially developing countries. However, studies which have been carried out in Nigeria are very few. It is therefore the aim of this study to contribute to the existing literature in Nigeria, using time series data.

**CHAPTER THREE**

**RESEARCH METHODOLOGY**

 **3.1** **THEORETICAL LITERATURE**

 This section presents the research method adopted for the study. This research provides us with the frame work for model specification, parameter estimation, evaluation technique, data collection and transformation for the study.

**3.2 Model Specification**

An econometric model stipulates some aspect of the real economy. It concentrates on the point it is studying and leaves out the thing not essential. The study will adopt the model of Kogar (1995), to empirically re-evaluate the impact of monetary policy on agricultural output. The specification of the model is related to the information relevant to the study.

Thus to study any relationship between variables, it is essential to express it in mathematical form.

The research techniques postulate a functional model to capture the objective as follows

AGRQt = F [INTRt, CRRt, DMBAt]……………………………………………..[3.1]

The mathematical form of the model is represented as

In AGRQt = β1 + β 2INTRt + β 3InCRRt + β 4InDMBAt + µt ……………[3.12]

Where

In AGRQt = Log of Agricultural Output

INTRt = Interest Rate

In CRRt = Log of Cash Reserve Ratio

In DMBAt= Log of Deposit Money Bank Credit to Agriculture

β1 = intercept

β 2, β 3 ,β 4  are partial slopes or parameters

µ t = the stochastic term.

**3**.**2.1 Estimation Procedure**

Conceptually, in building models, ordinary least square [OLS] will be used as the estimation technique based on E views 3.1 regression software package.

However, the OLS possess some limitation that may render it unrealistic, such as multi- co-linearity, heteroskedasticity, autocorrelation and specification basis.

**3.3 METHOD OF EVALUATION**

The techniques for evaluating the result of the regression imply the use of statistical criteria and econometric test.

**3.3.1 Statistical Criteria [First Order Test]**

These test include

**3.3.1.1 T – test** –This is used to verify individual significant parametric estimates of the regression.

**3.3.1.2 F- test** - this measures the overall level of significance of the model. It tests the simultaneous null hypothesis to be equal to zero in the regression model.

**3.3.1.3 R2** - this is the coefficient of determination and it is used to measure the goodness of fit of a regression line.

**3.3.2 Econometric Test (Second Order Test)**

The test include

 **3.3.2.1Test of stationary**

This is used to test whether a variable’s mean value and variance varies over time. It is necessary in time series variables in order to avoid the problem of spurious regression. The Augmented Dickey Fuller Test would be used for the analysis.

**3.3.2.2 Co integration Test**

Economically two variables or more are said to be co integrated if they have a long run equilibrium relationship between them.

 **3.3.2.3 Test for Nomality**

This is used to verify whether the error term is normally distributed. The Jarque Bera test for normality will be applied.

**3.3.2.4 Test for Multicollinearity**

This is used for testing the linear collinearity or dependence among the explanatory variable. The correlation matrix will be used.

 **3.3.2.5 Test for Autocorrelation**

This is used to verify the randomness of the error term between members of the same series of observations. The Durbin Watson d statistics test will be used.

 **3.3.2.6 Test for Heteroskasdasticity**

This is necessary in order to determine the uniformity of the error variances. The white’s heteroscadasticity test will be applied in the model.

**3.3.3 Evaluation of the A Prior Expectation**

**Variable sign**

 INTR -

 CRR +

DMBA +

**3.4 Data Transformation and Collection Techniques**

The annual time series data used in this study is secondary in nature ranging from 1980 to 2015 which give a total of 36 observations. The data was gotten from CBN statistical bulletin (2015).

**CHAPTER FOUR**

 **PRESENTATION AND ANALYSIS OF RESULT**

 The result of the ordinary least square (OLS) regression model was presented in this chapter. The analysis of the result was subjected to economic criteria, statistical first order test and econometric second order tests. An OLS model was estimated to re-evaluate the impact of monetary policy on agricultural output in Nigeria.

**4.1 Analysis of Unit Root and Co-Integration Results of** **Model I**

 To test for the unit root, we employ Augmented Dickey-Fuller (ADF) test. The results are shown in the table below.

**Table 4.1**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Variable at level form** | **Variable at difference form** | **Order of integration** |
| **Variable**  | **ADF Stat.** | **Lag** | **5%** | **ADF Stat.** | **Lag** | **5%** |  |
| In(AGRQ) | -1.102289 | **1** | -2.9499 | -3.875567 | **1** | -2.9527 | 1 (1) |
| INTR | -1.611799 | **1** | -2.9499 | -5.866815 | **1** | -2.9527 | 1 (1) |
| In (CRR) | -0.568639 | **1** | -2.9499 | -3.580889 | **1** | -2.9499 | 1 (1) |
| DMBA | -2.467834 | **1** | -2.9499 | -3.458945 | **1** | -2.9527 | 1 (1) |
| (RESIDUAL) | -3.613971 | **1** | -1.9510 | NA | NA | NA | 1(0) |

 The results show that all the variables are integrated of order one 1(1) (differenced once to attain stationarity).In other words, all the variables have unit roots, but stationary after being differenced. This is because the ADF statistics for each of the variables are less than the critical levels at 5%. In other words, the null hypothesis for unit root is accepted for all the variables at the level form. On the other hand, the ADF statistics for each of the variables when differenced are higher than their critical values at 5% which implies that the null hypothesis of unit root is rejected.

 However, though the variables are not stationary, there is tendency of long-run relationship between the dependent variable and the independent variables. Thus, we proceeded to examine their long-run equilibrium relationship using co-integration ADF (CADF) test after which we examined the adjustment to short-run discrepancies when co-integration was established. As already shown in table 4.1 above, the error term (residual) is stationary at its level form. This implies that there exists a long-run relationship between dependent and independent variables.

 **4.1.1 DETERMINANT OF SAVING IN NIGERIA.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable**  | **Coefficient**  | **Std. Error** | **t-stat.** |
| Constant  |  8.218414 | 0.176217 | 46.63799 |
| INTR | -0.021371 | 0.009862 | -2.166940 |
| In(CRR) | 1.110309 | 0.035270 | 31.48040 |
| DMBA | -0.002412 | 0.000898 | -2.684837 |

R2 = **0.987720** **F-stat. = 857.9 D.W =0.692**

**4.2 Evaluation Based On Economic Criteria**

**4.2.1** **Autocorrelation Test**

 This test whether the error are correlated with one another. To do that, we apply the Durbin Watson‘d’ test with the hypothesis as below.

 From the Durbin Watson table, the estimated d\* is 0.692 while the dl is 1.098 at 0.01 level of significance (0 < d < dl => 0 <0.692< 1.0098 ) which falls under the do not reject region. However, we conclude that there is no autocorrelation problem.

**4.2.2 Heteroskedasticity Test**

 This test is conducted if errors have constant variance or not. The null hypothesis is that the errors are homoscedastic (no heteroscedasticity). Note that this test follows chi-square distribution. We compare the estimated chi-square statistics with the critical chi-square statistics. From the result obtained χ2 Cal = is 10.80252 less than χ2 critical of 20.599 which is statistically insignificant and therefore do not reject the null hypothesis of homoscedasticity.

**4.2.3 Multicollinearity Test**

 This test was carried out through the use of correlation matrix. It suggests that if the pair wise correlation coefficient between two regressors is high can conclude, say in excess of 0.8, then multicollinearity is a serious problem (Gujarati, 2009). The correlation matrix as shown in the appendice; from the result, the existence of collinearity can be found among the explanatory variable. Thus, we that multicollinearity is a problem in this model. Hence, the highest value is 099.

 **4.2.4 Normality Test**

 This test is to know if the error term is normally distributed. The null hypothesis is that the error term follows normal distribution. From our result, the Jarque Bera Statistic of 0.4725. The Jarque Bera is less than critical chi-square values of 5.99. Thus, we accept the null hypothesis which implies that the errors do follow normal distribution.

 **Summary of the Signs**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable**  | **Expected Sign** | **Realized Sign** | **Remark**  |
| INTR | Negative | Negative  |  Conforms |
| In(CRR) | Positive  | Positive  | Conforms  |
| DMBA | positive | Negative  | Does not conform |

**4.3 Evaluation Based On Statistical Criteria**

**4.3.1 Coefficient of Determination (R2)**

This measures the goodness of fit of the regression model. It shows how the variation in the dependent is explained by explanatory variables, from the table, R2 = 0.987720. This implies that about 98% variation on aggregate saving is explained by the explanatory variables.

 **4.3.2 Student t-Test**

 This tests the explanatory power of the Independent variables; the result shows that the interest rate (INTR) has a significant impact on agricultural output. This is because its absolute t-statistic of -2.166940 is greater than the critical t-statistics of 2.042 at 5% level of significance. Its coefficient of -0.021371 implies that a unit increase in interest rate will decrease agricultural output (AGRQ) by -0.021371 units.

 Again, the variable cash reserve ratio (CRR) has a significant impact on agricultural output. This is because its absolute t-statistic of 31.48040 is greater than the critical t-statistics of 2.042 at 5% level of significance. Its coefficient of 1.110309 implies that a percentage increase in cash reserve ratio (CRR) increases agricultural output by 1.110309 percent.

 Lastly, the variable deposit money bank to agricultural (DMBA) has a significant impact on agricultural output. This is because its absolute t-statistic of -2.684837 is greater than the critical t-statistics of 2.042 at 5% level of significance. Its coefficient of -0.002412 implies that a unit increase in deposit money bank to agricultural (DMBA) decreases agricultural output by -0.002412 unit.

 **4.3.3 F-Statistic**

 The F-statistic is used to determine the overall significance of the entire variable in the model. The calculated f-statistic of857.9is greater than the critical f-value of 8.59. This implies that the entire variables joined together are significantly different from zero.

 **4.4 Implication of Result**

 The OLS regression applied the Log Linear Model in order to determine the relative change in the dependent variable from a relative change in each of the explanatory variables.

 The result has established a negative but significant relationship between interest rate and agricultural output. This has been found to be consistent with the theory.This means that an increase in Interest rate leads to a decrease in Agricultural output.

 The result also revealed a positive and significant relationship between cash reserve ratio and agricultural output. This has been found to be consistent with the theory.This means that an increase in cash reserve ratio leads to an increase in Agricultural output.

 The result also revealed a negative and significant relationship between deposit money bank to agriculture and agricultural output. This has been found to be inconsistent with the theory

**CHAPTER FIVE**

**SUMMARY, POLICY RECOMMENDATIONS AND**  **CONCLUSION**

**5.1 Summary**

 In this study, we set out to empirically re-evaluate the impact of monetary policy on agricultural output in Nigeria from 1980- 2015. The study was conducted to ascertain how monetary policy effect agricultural output.

 Secondary data was used; the source of data included CBN Statistical Bulletin (2015). In order to achieve the objectives of the study, an econometric model was formulated using the Ordinary Least Square (OLS). In the model agriculture output was regressed on interest rate, cash reserve ratio, and deposit money bank on agriculture.

**The major findings of the study are summarized below:**

1. The result has established a negative but significant relationship between interest rate and agricultural output. This has been found to be consistent with the theory.
2. The result also revealed a positive and significant relationship between cash reserve ratio and agricultural output. This has been found to be consistent with the theory.
3. The result also revealed a negative and significant relationship between deposit money bank to agriculture and agricultural output. This has been found to be inconsistent with the theory.

**5.2 Conclusion**

 In this study, we re-evaluated the impact of monetary policies on agricultural output in Nigeria from 1980 - 2015. From our findings, there exist a negative but significant relationship between interest rate and agricultural output.

Also, the result revealed a positive and significant relationship between cash reserve ratio and agricultural output. The general conclusion is that interest rate, cash reserve ratio, and deposit money bank to agriculture have impact on agricultural output.

**5.3 Policy Recommendations**

 Based on the following findings of this study, the following policy recommendations are suggested:

1. The empirical results of the study have revealed a negative impact on agricultural output. We therefore, advocate for a moderate interest rate which is needed for sustainable economic growth and development.
2. The government should through the monetary authority effectively check the cash reserve ratio over time in order to dictate when there is need for adjustment.
3. There is need for the government to seek a proper role for monetary policy in promoting strong and sustainable growth in a stable macroeconomic environment in Nigeria through monetary authority
4. The government should always sustain policies that would enable agricultural output thrive through the efficacy and actualization of all macro economic variables.
5. The government should through the CBN pursue an effective monetary policy in a globalised and rapidly integrated financial market environment and at all time evaluate and implement monetary policies.

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 **APPENDIX I**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  Year  |  AGRUT (millions) | CRR  (%) | DMBA(millions) | INTR(%) |
|  1980 | 2,313.5 | 10.6 | 1,324.5 | 7.5 |
|  1981 | 2,364.37 | 9.5 | 425.3 | 7.75 |
|  1982 | 2,425.96 | 10.7 | 2,452 | 10.3 |
|  1983 | 2,409.08 | 7.1 | 2,303.51 | 10 |
|  1984 | 2,303.51 | 4.7 | 2,409 | 12.5 |
|  1985 | 2,731.06 | 1.8 | 2425 | 9.25 |
|  1986 | 2,986.84 | 1.7 | 272.5 | 10.5 |
|  1987 | 2,891.67 | 1.4 | 482 | 17.5 |
|  1988 | 3,174.57 | 2.1 | -3820.8 | 16.5 |
|  1989 | 3,325.95 | 2.9 | -10326 | 26.8 |
|  1990 | 3,464.72 | 2.9 | 1932.5 | 25.5 |
|  1991 | 3,590.84 | 2.9 | -7414.3 | 20.0 |
|  1992 | 3,674.79 | 4.4 | 230.8 | 29.8 |
|  1993 | 3,743.67 | 6 | -53233.5 | 18.3 |
|  1994 | 3,839.68 | 5.7 | 647.7 | 21 |
|  1995 | 3,997.38 | 5.8 | 122138.3 | 20.2 |
|  1996 | 4,133.5 | 7.5 | 244975.7 | 19.7 |
|  1997 | 4,305.68 | 7.8 | 264651.7 | 13.5 |
|  1998 | 4,475.24 | 8.3 | 175626.3 | 18.3 |
|  1999 | 4,703.64 | 11.7 | 212922.9 | 21.3 |
|  2000 | 4,840.97 | 9.8 | 135673.6 | 17.98 |
|  2001 | 5,024.54 | 10.8 | 217647.6 | 18.3 |
|  2002 | 7,817.08 | 10.6 | 19976.5 | 24.85 |
|  2003 | 8,364.83 | 10 | 38963.6 | 20.71 |
|  2004 | 8,888.57 | 8.6 | 220800 | 19.18 |
|  2005 | 9,516.99 | 9.7 | 437000 | 17.95 |
|  2006 | 10,222.47 | 2.6 | 546403.1 | 17.26 |
|  2007 | 10,958.47 | 2.7 | 744385.9 | 16.9 |
|  2008 | 11,645.37 | 3.0 | 1076078 | 15.1 |
|  2009 | 12,330.33 | 1.3 | 342788 | 18.36 |
|  2010 | 13,048.89 | 1.0 | -221565 | 17.6 |
|  2011 | 13,429.38 | 8.0 | 546810.3 | 16.0 |
|  2012 | 14,329.71 | 12.0 | 370387.9 | 16.8 |
|  2013 | 14,750.52 | 12.0 | 379587.8 | 16.7 |
|  2014 | 15,380.39 | 20.0 | 432262 | 16.5 |
|  2015 | 15,952.22 | 22.5 | 394079.2 | 16.8 |

Source; CBN Statistical Bulletin(2015)

 **Appendix II**

REGRESSION RESULT

|  |
| --- |
| Dependent Variable: LAGRQ |
| Method: Least Squares  |
| Date: 01/27/18 Time: 04:33 |
| Sample: 1980 2015 |
| Included observations: 36 |
| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
| C | 8.218414 | 0.176217 | 46.63799 | 0.0000 |
| INTR | -0.021371 | 0.009862 | -2.166940 | 0.0378 |
| LCRR | 1.110309 | 0.035270 | 31.48040 | 0.0000 |
| DMBA | -0.002412 | 0.000898 | -2.684837 | 0.0114 |
| R-squared | 0.987720 |  Mean dependent var | 13.35900 |
| Adjusted R-squared | 0.986569 |  S.D. dependent var | 2.484567 |
| S.E. of regression | 0.287942 |  Akaike info criterion | 0.452321 |
| Sum squared resid | 2.653132 |  Schwarz criterion | 0.628268 |
| Log likelihood | -4.141778 |  F-statistic | 857.9724 |
| Durbin-Watson stat | 0.692816 |  Prob(F-statistic) | 0.000000 |

UNIT ROOT TEST AT LEVEL FORM

|  |  |  |  |
| --- | --- | --- | --- |
| ADF Test Statistic | -1.102289 |  1% Critical Value\* | -3.6353 |
|  |  |  5% Critical Value | -2.9499 |
|  |  |  10% Critical Value | -2.6133 |
| \*MacKinnon critical values for rejection of hypothesis of a unit root. |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation |
| Dependent Variable: D(LAGRQ) |
| Method: Least Squares |
| Date: 01/27/18 Time: 04:42 |
| Sample(adjusted): 1982 2015 |
| Included observations: 34 after adjusting endpoints |
| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
| LAGRQ(-1) | -0.012511 | 0.011350 | -1.102289 | 0.2788 |
| D(LAGRQ(-1)) | 0.293595 | 0.169383 | 1.733318 | 0.0930 |
| C | 0.316119 | 0.164472 | 1.922029 | 0.0638 |
| R-squared | 0.139373 |  Mean dependent var | 0.212855 |
| Adjusted R-squared | 0.083849 |  S.D. dependent var | 0.159906 |
| S.E. of regression | 0.153056 |  Akaike info criterion | -0.831933 |
| Sum squared resid | 0.726207 |  Schwarz criterion | -0.697254 |
| Log likelihood | 17.14286 |  F-statistic | 2.510128 |
| Durbin-Watson stat | 1.828075 |  Prob(F-statistic) | 0.097641 |

|  |  |  |  |
| --- | --- | --- | --- |
| ADF Test Statistic | -1.611799 |  1% Critical Value\* | -3.6353 |
|  |  |  5% Critical Value | -2.9499 |
|  |  |  10% Critical Value | -2.6133 |
| \*MacKinnon critical values for rejection of hypothesis of a unit root. |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation |
| Dependent Variable: D(INTR) |
| Method: Least Squares |
| Date: 01/27/18 Time: 04:47 |
| Sample(adjusted): 1982 2015 |
| Included observations: 34 after adjusting endpoints |
| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
| INTR(-1) | -0.181833 | 0.112814 | -1.611799 | 0.1171 |
| D(INTR(-1)) | -0.083473 | 0.178925 | -0.466528 | 0.6441 |
| C | 2.648022 | 1.761608 | 1.503185 | 0.1429 |
| R-squared | 0.105221 |  Mean dependent var | -0.002941 |
| Adjusted R-squared | 0.047494 |  S.D. dependent var | 3.781716 |
| S.E. of regression | 3.690819 |  Akaike info criterion | 5.533671 |
| Sum squared resid | 422.2865 |  Schwarz criterion | 5.668350 |
| Log likelihood | -91.07241 |  F-statistic | 1.822722 |
| Durbin-Watson stat | 2.043140 |  Prob(F-statistic) | 0.178481 |

|  |  |  |  |
| --- | --- | --- | --- |
| ADF Test Statistic | -0.568639 |  1% Critical Value\* | -3.6353 |
|  |  |  5% Critical Value | -2.9499 |
|  |  |  10% Critical Value | -2.6133 |
| \*MacKinnon critical values for rejection of hypothesis of a unit root. |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation |
| Dependent Variable: D(LCRR) |
| Method: Least Squares |
| Date: 01/27/18 Time: 04:48 |
| Sample(adjusted): 1982 2015 |
| Included observations: 34 after adjusting endpoints |
| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
| LCRR(-1) | -0.007277 | 0.012797 | -0.568639 | 0.5737 |
| D(LCRR(-1)) | 0.440456 | 0.161228 | 2.731874 | 0.0103 |
| C | 0.153638 | 0.075574 | 2.032945 | 0.0507 |
| R-squared | 0.195962 |  Mean dependent var | 0.208060 |
| Adjusted R-squared | 0.144089 |  S.D. dependent var | 0.180875 |
| S.E. of regression | 0.167338 |  Akaike info criterion | -0.653510 |
| Sum squared resid | 0.868058 |  Schwarz criterion | -0.518831 |
| Log likelihood | 14.10967 |  F-statistic | 3.777699 |
| Durbin-Watson stat | 2.056766 |  Prob(F-statistic) | 0.034024 |

|  |  |  |  |
| --- | --- | --- | --- |
| ADF Test Statistic | -2.467834 |  1% Critical Value\* | -3.6353 |
|  |  |  5% Critical Value | -2.9499 |
|  |  |  10% Critical Value | -2.6133 |
| \*MacKinnon critical values for rejection of hypothesis of a unit root. |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation |
| Dependent Variable: D(DMBA) |
| Method: Least Squares |
| Date: 01/27/18 Time: 04:51 |
| Sample(adjusted): 1982 2015 |
| Included observations: 34 after adjusting endpoints |
| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
| DMBA(-1) | 0.185021 | 0.061436 | 3.011620 | 0.0051 |
| D(DMBA(-1)) | -0.458070 | 0.189908 | -2.412063 | 0.0220 |
| C | 3.245322 | 5.835896 | 0.556097 | 0.5821 |
| R-squared | 0.243714 |  Mean dependent var | 11.13824 |
| Adjusted R-squared | 0.194922 |  S.D. dependent var | 30.49015 |
| S.E. of regression | 27.35764 |  Akaike info criterion | 9.539966 |
| Sum squared resid | 23201.65 |  Schwarz criterion | 9.674645 |
| Log likelihood | -159.1794 |  F-statistic | 4.994897 |
| Durbin-Watson stat | 2.188009 |  Prob(F-statistic) | 0.013171 |

UNIT ROOT AT DIFFERENCE

|  |  |  |  |
| --- | --- | --- | --- |
| ADF Test Statistic | -3.875567 |  1% Critical Value\* | -3.6422 |
|  |  |  5% Critical Value | -2.9527 |
|  |  |  10% Critical Value | -2.6148 |
| \*MacKinnon critical values for rejection of hypothesis of a unit root. |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation |
| Dependent Variable: D(LAGRQ,2) |
| Method: Least Squares |
| Date: 01/27/18 Time: 04:55 |
| Sample(adjusted): 1983 2015 |
| Included observations: 33 after adjusting endpoints |
| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
| D(LAGRQ(-1)) | -0.806917 | 0.208206 | -3.875567 | 0.0005 |
| D(LAGRQ(-1),2) | 0.207474 | 0.178277 | 1.163779 | 0.2537 |
| C | 0.173863 | 0.052824 | 3.291393 | 0.0026 |
| R-squared | 0.359548 |  Mean dependent var | -0.001379 |
| Adjusted R-squared | 0.316852 |  S.D. dependent var | 0.186812 |
| S.E. of regression | 0.154405 |  Akaike info criterion | -0.811963 |
| Sum squared resid | 0.715230 |  Schwarz criterion | -0.675917 |
| Log likelihood | 16.39740 |  F-statistic | 8.420972 |
| Durbin-Watson stat | 1.954217 |  Prob(F-statistic) | 0.001251 |

|  |  |  |  |
| --- | --- | --- | --- |
| ADF Test Statistic | -5.866815 |  1% Critical Value\* | -3.6422 |
|  |  |  5% Critical Value | -2.9527 |
|  |  |  10% Critical Value | -2.6148 |
| \*MacKinnon critical values for rejection of hypothesis of a unit root. |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation |
| Dependent Variable: D(INTR,2) |
| Method: Least Squares |
| Date: 01/27/18 Time: 04:56 |
| Sample(adjusted): 1983 2015 |
| Included observations: 33 after adjusting endpoints |
| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
| D(INTR(-1)) | -1.554309 | 0.264932 | -5.866815 | 0.0000 |
| D(INTR(-1),2) | 0.324237 | 0.173110 | 1.873014 | 0.0708 |
| C | -0.016384 | 0.643366 | -0.025466 | 0.9799 |
| R-squared | 0.630181 |  Mean dependent var | -0.010303 |
| Adjusted R-squared | 0.605526 |  S.D. dependent var | 5.884201 |
| S.E. of regression | 3.695698 |  Akaike info criterion | 5.538724 |
| Sum squared resid | 409.7455 |  Schwarz criterion | 5.674770 |
| Log likelihood | -88.38894 |  F-statistic | 25.56038 |
| Durbin-Watson stat | 1.851576 |  Prob(F-statistic) | 0.000000 |

|  |  |  |  |
| --- | --- | --- | --- |
| ADF Test Statistic | -3.580889 |  1% Critical Value\* | -3.6353 |
|  |  |  5% Critical Value | -2.9499 |
|  |  |  10% Critical Value | -2.6133 |
| \*MacKinnon critical values for rejection of hypothesis of a unit root. |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation |
| Dependent Variable: D(LCRR,2) |
| Method: Least Squares |
| Date: 01/27/18 Time: 04:57 |
| Sample(adjusted): 1982 2015 |
| Included observations: 34 after adjusting endpoints |
| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
| D(LCRR(-1)) | -0.568483 | 0.158755 | -3.580889 | 0.0011 |
| C | 0.118664 | 0.043449 | 2.731104 | 0.0102 |
| R-squared | 0.286077 |  Mean dependent var | 0.000894 |
| Adjusted R-squared | 0.263767 |  S.D. dependent var | 0.192950 |
| S.E. of regression | 0.165559 |  Akaike info criterion | -0.701957 |
| Sum squared resid | 0.877112 |  Schwarz criterion | -0.612171 |
| Log likelihood | 13.93327 |  F-statistic | 12.82277 |
| Durbin-Watson stat | 2.031565 |  Prob(F-statistic) | 0.001118 |

|  |  |  |  |
| --- | --- | --- | --- |
| ADF Test Statistic | -3.458945 |  1% Critical Value\* | -3.6422 |
|  |  |  5% Critical Value | -2.9527 |
|  |  |  10% Critical Value | -2.6148 |
| \*MacKinnon critical values for rejection of hypothesis of a unit root. |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation |
| Dependent Variable: D(DMBA,2) |
| Method: Least Squares |
| Date: 01/27/18 Time: 04:58 |
| Sample(adjusted): 1983 2015 |
| Included observations: 33 after adjusting endpoints |
| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
| D(DMBA(-1)) | -1.018898 | 0.294569 | -3.458945 | 0.0016 |
| D(DMBA(-1),2) | -0.116369 | 0.191276 | -0.608386 | 0.5475 |
| C | 11.79369 | 6.099839 | 1.933443 | 0.0627 |
| R-squared | 0.569834 |  Mean dependent var | 1.621212 |
| Adjusted R-squared | 0.541157 |  S.D. dependent var | 46.26776 |
| S.E. of regression | 31.34084 |  Akaike info criterion | 9.814229 |
| Sum squared resid | 29467.45 |  Schwarz criterion | 9.950275 |
| Log likelihood | -158.9348 |  F-statistic | 19.87030 |
| Durbin-Watson stat | 1.932694 |  Prob(F-statistic) | 0.000003 |

COINTEGRATION TEST

|  |  |  |  |
| --- | --- | --- | --- |
| ADF Test Statistic | -3.613971 |  1% Critical Value\* | -2.6321 |
|  |  |  5% Critical Value | -1.9510 |
|  |  |  10% Critical Value | -1.6209 |
| \*MacKinnon critical values for rejection of hypothesis of a unit root. |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation |
| Dependent Variable: D(RESIDUAL) |
| Method: Least Squares |
| Date: 01/27/18 Time: 05:03 |
| Sample(adjusted): 1982 2015 |
| Included observations: 34 after adjusting endpoints |
| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
| RESIDUAL(-1) | -0.499898 | 0.138324 | -3.613971 | 0.0010 |
| D(RESIDUAL(-1)) | 0.325246 | 0.157936 | 2.059357 | 0.0477 |
| R-squared | 0.297856 |  Mean dependent var | 0.008645 |
| Adjusted R-squared | 0.275914 |  S.D. dependent var | 0.232162 |
| S.E. of regression | 0.197554 |  Akaike info criterion | -0.348583 |
| Sum squared resid | 1.248888 |  Schwarz criterion | -0.258797 |
| Log likelihood | 7.925914 |  Durbin-Watson stat | 2.126459 |

HETROSKEDASTICITY TEST

|  |
| --- |
| White Heteroskedasticity Test: |
| F-statistic | 2.072120 |  Probability | 0.087653 |
| Obs\*R-squared | 10.80252 |  Probability | 0.094675 |
|  |  |  |  |  |
| Test Equation: |
| Dependent Variable: RESID^2 |
| Method: Least Squares |
| Date: 01/27/18 Time: 05:04 |
| Sample: 1980 2015 |
| Included observations: 36 |
| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
| C | 0.091424 | 0.137738 | 0.663754 | 0.5121 |
| INTR | 0.012213 | 0.016473 | 0.741393 | 0.4644 |
| INTR^2 | -8.91E-05 | 0.000412 | -0.216403 | 0.8302 |
| LCRR | -0.068210 | 0.101090 | -0.674748 | 0.5052 |
| LCRR^2 | 0.004981 | 0.012404 | 0.401596 | 0.6909 |
| DMBA | 0.000535 | 0.001412 | 0.378641 | 0.7077 |
| DMBA^2 | -1.24E-06 | 2.75E-06 | -0.451631 | 0.6549 |
| R-squared | 0.300070 |  Mean dependent var | 0.073698 |
| Adjusted R-squared | 0.155257 |  S.D. dependent var | 0.096342 |
| S.E. of regression | 0.088548 |  Akaike info criterion | -1.837874 |
| Sum squared resid | 0.227383 |  Schwarz criterion | -1.529967 |
| Log likelihood | 40.08173 |  F-statistic | 2.072120 |
| Durbin-Watson stat | 1.962567 |  Prob(F-statistic) | 0.087653 |

NOMALITY TEST

MULTICOLLINEARITY TEST

|  |  |  |  |
| --- | --- | --- | --- |
| LAGRQ | INTR | LCRR | DMBA |
|  1.000000 | -0.170094 |  0.992313 |  0.754209 |
| -0.170094 |  1.000000 | -0.155075 | -0.457187 |
|  0.992313 | -0.155075 |  1.000000 |  0.782107 |
|  0.754209 | -0.457187 |  0.782107 |  1.000000 |