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# STABILITY OF THE NIGERIAN MONEY DEMAND FUNCTION 1970-2010

**JULY, 2012**

# STABILITY OF THE NIGERIAN MONEY DEMAND FUNCTION 1970-2010

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**B.Sc**



**A DISSERTATION SUBMITTED TO THE DEPARTMENT OF ECONOMICS IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE (M.Sc) IN ECONOMICS**

**JULY, 2012**

# APPROVAL

This research titled “Stability of the Nigeria Money Demand Function 1970-2010’’has been assessed and approved by the Postgraduate Studies Committees of Department of Economics and Faculty of the Social Sciences

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# CERTIFICATION

This is to certify that this research titled "Stability of the Nigeria Money Demand Function 1970-2010'' was carried out by Gerald Chimezie Nwadike with Registration Number: EBSU/PG/M.Sc/2009/ 03907 under our supervision in the Department of Economics Ebonyi State University, Abakaliki.

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## DEDICATION

This research work is chiefly dedicated to my parents Chief and Lolo Okafor Innocent Nwadike and family.

## ACKNOWLEDGEMENTS

For a work of this magnitude, a lot of people and events have assisted in bringing it to a conclusive end. First, the grace of God covered me in my examinations, transportations, and finances and gave us favour among men. This is the God that blesses whom he wants to bless, I acknowledge and thank God for everything.

God uses men to make His will manifest. This is the position of my Chief supervisor, Professor Obinna. O. E. I wish to express unreserved gratitude to my Supervisor, whose suggestions, supply of materials, advice and constructive criticisms saw me through the tedious months when this work was in the pipeline. I have learnt a lot of his academic articulacy, fathering and exemplary teaching conduct, and his meticulous painstaking at reading, guiding and suggesting methods of improving the quality of this study. I am also indebted to Mr. Obiekezie L.C and the family who is my content reader. I remember clearly and appreciate all your contributions right from the first day I stepped into Ebonyi State University. You personally made available some of the materials for this work. Your technical and intellectual contributions as well as constructive criticisms at every stage of the work has produced more than expected in the beauty of this work.

I also wish to acknowledge my H.O.D. Prof. Ikpeze I. N, and Mrs Udude, for their encouragement, personal intervention and academic advice during the period of this project.

My gratitude and appreciation also goes to Mr. Thom Okoro and other dedicated lecturers for their contributions, corrections made to this project. My gratitude goes to Prof Ukwu I. Ukwu, Dr. Eugene Nweke, (Dean, F.S.S), and Dr. Barr. Ugwuanyi .I.C., (F.S.S PG coordinator), for their constructive criticisms at every stage of this work which has produced the beauty of this study.

I acknowledge Messer Onwukwe N.U, Nweze P.C, Onwe, and Okpala for their assistance, especially during the proposal defance.

My special gratitude goes to Chief and Lolo Okafor Innocent Nwadike (A.K.A Udo-ka-aku), and the Family for their encouragement, prayers, finances, morally, hope and presence in all aspects of my life and also to see that this program came to a glorious conclusion.

I wish to express my gratitude and appreciation to Barrister O.J Nnadi (SAN) and family who were the major financiers of my academic programme.

In all ramifications, I am highly indebted to Engr and Mrs Ogbuewu and family for provisions, care and for all necessities of life, spiritually, materially and physically. In fact, the family took all it could to be more than parents before and during the programme.

I appreciate the efforts of my friends, and course mates: Mr. Okechukwu Obunadike and family, Mr. Bernard Omogo and family, Makuochukwu, Chetachukwu, Uchenna (my typists), Mmesoma and Blessed Ogbuewu's family and others too numerous to mention for their psychological support, advice, help and contributions added to the reality of this study.

Also, my inestimable appreciation goes to my fellowship, Catholic Charismatic Renewal of Nigeria (CCRN), NFCS Ishieke, Rev. Dr. Echiegu (My zealous chaplain) for their spiritual guide and counseling.

My deepest gratitude and appreciation go to Mrs. Olubukola Oyebanjo Ogbuewu, Mrs. Grace Chinyere Nnadi and "Dike" for their irrevocable commitment to my success through out the course of my study by giving me all the necessary support, comfort, love, prayers and encouragement. I say a million kudos to all.

**Gerald Chimezie Nwadike**

# ABSTRACT

This study examines the stability of the Nigeria money demand function from 1970- 2010. Emphasis is on whether the broad money $M_2$ as an intermediate target, is the appropriate one for Nigeria. Based on application of advanced econometric techniques (chow, stability granger causality & co-integration test) conducted, it was observed that there existed long-run relationship between real money demand function and the independent variables. Our results indicated the presence of structural break effect during the period of the study. Furthermore only the CUSUM test confirms the stability of short-run parameters of real money demand function, while CUSUMSQ was found to be unstable. These empirical results do not support the CBN in its choice of $M_2$ as an intermediate target for monetary policy in Nigeria during SAP and after it. Based on these findings, the researcher hereby recommends that, The CBN should deviate from $M_2$ as an intermediate target for monetary policy.

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# CHAPTER ONE

# INTRODUCTION

## 1.1 Background of the study

A much-cited definition has it that money is anything generally accepted in final payment for goods and services and also for settlement of debt (Obinna, 1982). Based on this definition, he notes that money functions as a medium of exchange, as a store of value, as a unit of account and as a standard for deferred payment. Depending on function performed, a distinction can be made between money and liquid assets. Money consists of the liabilities of the commercial banks at the central bank and the deposits of the public at the commercial banks. To him, money is not synonymous with legal tender; only coin and notes are legal tender. Thus money is divided into two classes, namely, Primary and Secondary money. Primary money is called 'cash', consisting of coin, notes and bankers' deposits; secondary money consists of deposits at commercial banks on both current and deposit accounts.

Monetary authorities, however, work with money supply series, known as $M_1$, $M_2$ and $M_3$:

$M_1$ = coin and notes in circulation plus demand deposit accounts of the private sector.

$M_2$ = $M_1$ plus time deposit accounts of the private sector. Nowadays, central banks rarely use the money aggregate of $M_2$. They either use the narrow definition portrayed by $M_1$ or broad definition portrayed by $M_3$.

$M_3$ = $M_2$ plus deposits, including certificates of deposits in both private and public sectors. Foreign currency deposits are also included in a broader definition of $M_3$ (Obinna, 1982).

In fact our focus or interest among the money series is $M_2$ because $M_2$ is the measure of broad money and is chosen because it includes the private sector saving and fix deposits placed with commercial banks, finance companies, merchant banks and discount house and private holding of NCD and central bank certificates but excludes placements among these institution and it is the broadest measure of private sector liquidity.

A stable money demand function is essential for the conduct of monetary policy (Khan and Ali, 1997). The stability of money demand function has important implications for monetary policy in both developed and developing countries (Anoruo, 2002). The theory of money demand implies the average money the economy needs to bridge the time gap between current receipts and expenditures and this is functionally related to the level of price of goods and services produced in the economy, the level of real aggregate income and expenditure in the economy, the speed by which the economy desires to part with money in making expenditure and nominal interest rate. In other word, a change in either the price level or in aggregate income causes the demand for money to change proportionally and in the same directions and a change in how fast people want to pay for things causes the demand for money to change proportionally but in the opposite direction.

Thus from the above statement, it means that the demand for money is at the heart of how policy should be conducted effectively. Money demand serves as a conduit in the transmission mechanism for monetary policy so the stability of the money demand function is critical if monetary policy is to have predictable effects on inflation and real output. However, after the introduction of Structural Adjustment Programme (SAP) in 1986, the Nigerian economy went through some significant structural and institutional changes. These changes included the liberalization of the external trade and payments system, substantial degree of financial deepening and innovations in the banking sector, the adoption of a managed float exchange rate system, the elimination of price and interest rate controls policy. It is conceivable that these developments may have altered the relationship between money, income, price and other key economic variables and this may cause the money demand function to become structurally unstable. Thus, if the demand for money or money demand is not stable, for example, if velocity of money and the above stated structural changes are not constant, shocks to money demand under money supply targeting will translate into changes in real and nominal interest rates and result to economic fluctuations. An alternative policy of targeting interest rates rather than the money demand can improve upon this outcome as the money supply is adjusted to shocks in money demand, keeping interest rate (and hence, economic activity) relatively constant. The above discussion implies that the volatility of money demand matters for how

monetary policy should be conducted. If most of the "aggregate demand" shocks which affect the economy come from the expenditure side, the "IS curve", then a policy of targeting the monetary aggregate will be stabilizing, relative to a policy of targeting interest rates. However, if most of the aggregate demand shocks came from changes in money demand, which influences the "LM curve", then a policy of targeting the monetary aggregate will be destabilizing.

Consequently, determining whether the financial sector reforms of 2004, undertaken under both SAP and consolidation period impacted on the money demand relationship is important to the effective formulation and implementation of monetary policy in Nigeria. This is so because these factors that affect the behavior and stability of the money demand relationship assume greater urgency when the broad monetary aggregate became the official intermediate target for monetary policy (the CBN Amendment Decree Number 37 of 1998). This study will be undertaken to find out the stability of broad money demand function in Nigeria.

Over the years, review of monetary development shows that overall liquidity of the economy as measured by the end – year levels of broad money ($M_2$) grew rapidly. The rapid growth in $M_2$ reflected sharp increases in narrow money ($M_1$) which was the target variable. While ($M_2$) rose by 8.7 percent against a target of 6.5 percent in 1985, and recorded negative growth (4.5

percent) in 1986, it expanded in 1987 by 17.1 percent which was slightly higher than the target of 11.8 percent.

The initial declaration and modest growth was in line with low inflation figures of 5.5, 5.4 and 10.4 percent observed in 1985, 1986 and 1987 respectively. However, in 1985 money stock rose by 42.3 percent following the inflationary package of the year. From 1989, excess liquidity in the economy had started to be a source of concern as the growth rate of $M_2$ deviated significantly from targets (CNB Briefs, 1995).

Currently, the apex bank implements a medium term perspective monetary policy framework which targets inflation. As at first half of 2007, monetary targeting remained the apex bank's major strategy for monetary policy implementation. As a core policy target, the records of broad money ($M_2$) growth rates between 2003 and 2007 inclusive were 12%, 14%, 16.2%, 30.6% and 32% respectively (CBN Briefs,2007). These figures do not suggest bad performance since they compare favorably with the targets. The broad money targets were 12% in 2003, 16% in 2004, 15% in 2005, 27% in 2006 and 30% in 2007. As a financial deepening variable and as percentage of Gross Domestic Product, the last five years from 2003 to 2007 inclusive were 20%, 19.8%, 18%, 19.9% and 18% respectively. With monetary policy shift from interest rate and monetary targeting to the current framework of inflation targeting in Nigeria, the policy relevance of this study become clearer.

## 1.2 Statement of the Problem

In the late 1970s and early 1980s, a number of Central banks, worldwide, adopted monetary targets as a guide for monetary policy. Monetary targeting is an attempt by central banks to determine the optimum money stock that will achieve the desired macroeconomic objectives.

Theoretically, the choice of target that can be adopted by the monetary authority is normally between the stock of monetary aggregates and interest rates. Whenever the money demand function is unstable, interest rate is generally the preferred target; otherwise, the money stock is the appropriate target (Poole 1970, 1971 and McCallum, 1989). In the early 1990s, some Central banks adopted numerical inflation or nominal Gross Domestic Product (GDP), targets as guides for monetary policy in contrast to the conventional choice of interest rate or money stock. Economists and analysts attribute this departure to the unreliability of monetary aggregates as guides for monetary policy (McCallum, 1989).

For the Central Bank of Nigeria (CBN), the primary objective in its conduct of monetary policy is to maintain a stable price level that supports sustainable economic growth and employment. While other Central banks adopted numerical inflation or nominal GDP targets as guides for monetary policy since the 1980s and 1990s because financial market innovations and deregulations rendered monetary aggregates less reliable policy guides, the

CBN did not deviate from the conventional monetary aggregates as the appropriate intermediate target. An implicit assumption with respect to this choice is that the intermediate target chosen is measurable, controllable and predictable. In addition, it is assumed that the money demand function is stable in the conduct and implementation of monetary policy. This is very important because the money demand function is used both as a means of identifying medium term growth targets for money supply and as a way of manipulating the interest rate and reserve money for the purpose of controlling the total liquidity in the economy and for controlling inflation rate (McCulum, 1989 and Misnkin 2004).

In Nigeria, the rate of monetary aggregates as intermediate target has been downplayed (Iyoha, 2004). Previous Nigerian studies have shown a common feature. First, they investigated the stability of the demand for money function in the context of co-integration analysis. Second, these studies did not address the issue that co-integration relationship may have a structural break during the sample period. However, there has been renewed interest in the stability of the demand for money in Nigeria. Therefore, the researcher wishes to know whether the CBN choice of $M_2$ as an intermediate target, is the appropriate one by examining the underlying assumption of the stability of $M_2$ money demand function before and since the implementation of the Structural Adjustment Programme (SAP) in 1986 and the financial sector consolidation period of 2004.

## 1.3 Research Questions

With respect to the choice of intermediate targets by monetary authorities, economic theory suggests that the success or failure of such policy stance depends on the level of commitment to targets; therefore this raises a fundamental question as follows:

1. Is there long run real money demand function in Nigeria?
2. Does causal relationship exist between $M_{2,}$ and real gross domestic product, inflation rate and Nigeria broad ($M_2$) money demands function?
3. Are there structural breaks in the Nigerian long-run demand for broad money function equilibrium relationship? These puzzles are worth resolving for value to be added to literature on money demand function in Nigeria.

## 1.4 Objectives of the Study

. The specific objectives of this study are:

1. To estimate the long-run real money demand function in Nigeria
2. To ascertain if there is causal relationship between $M_{2,}$ and real gross domestic product, inflation rate and the Nigeria broad ($M_2$) money demands function.
3. To ascertain the presence of structural breaks in the Nigerian long-run demand for broad money equilibrium relationship from 1970 - 2010.

## 1.5 Hypotheses of the study

A hypothesis of any study must be properly derived from the objective of the study (Isiwu 2004). However, for the case of this research, the following hypotheses are formulated.

(i) $H_o$: There has been no stability of money ($M_2$) demand function in Nigeria (i.e. $b_1 = 0$).

$H_1$: There has been a stability of money ($M_2$) demand function in Nigeria (i.e. $b_1 \neq 0$)

(ii) $H_o$: There is no significant causal relationship between $M_2$, and real gross domestic product, inflation rate and the Nigeria broad ($M_2$) money demands function (i.e. $b_o = 0$).

$H_i$: There is a significant causal relationship between $M_2$, and real gross domestic product, inflation rate and the Nigeria broad ($M_2$) money demands function (i.e. $b_o \neq 0$)

(iii) $H_o$: There is no structural break effect on Nigeria money demand equilibrium relationship during the period under review (i.e.$b_1 = 0$).

$H_1$: There is structural break effect on Nigeria money demand equilibrium relationship during this period under review (i.e.$b_1 \neq 0$).

## 1.6 Significance of the Study

Since economic literature is of the consensus that monetary policy will impact positively on economic performance, a work of this nature is indeed necessary for monetary authorities to determine whether to continue with the

existing ($M_2$ target) measures or to initiate a review of the policy geared towards providing for the attainment of micro and macro economic growths.

Information from this work will help business sectors including commercial banks to understand the effect that changes in policy structure will make on the price level and monetary stability.

This advanced study will assist government in an attempt to stabilize the economy by use of effective and efficient monetary policies. The result will also assist policy markers to know the role of $M_2$ stability play as a macro economic variable being a determinant of economic growth. Finally, this research work will be of use to academics, most especially students who wish to carry out further research work on this topic or related topics.



## 1.7 Scope and Limitations of the Study

This study covered the period between 1970 -2010; this period was chosen because of the restraint in monetary growth changes that took place in 1986 SAP, in 2004 consolidation. Following the long-run relationship, large sample not less than 30 year is a requisite for stationary test.

Moreover, it has been observed that any piece of research work is not without unavoidable limitations. The process of data collection for the purpose of this research was not an easy one. A lot of problems were encountered which range from financial constraint form the part of the researcher, secondary data for regression analysis, is a constraint because

CBN statistic data was not common and not easy be obtain even at some CBN state barchan's, commercial banks and some financial offices (e.g. ministry of finance. It appears that the most limitative to this work is the problem of instability of power that delays the typing and brief reading of the soft word. This instability of power leads to damage of system (computer use for typing this work) and cause the researcher to draw back from the broad thereby increasing the cost of production of this work toward its hard word. Above all the six months strike by the members of Academic Staff Union of University (ASUU) really was a constraint that delayed and extended the period of this study.

# CHAPTER TWO

# REVIEW OF RELATED LITERATURE

## 2.1 Theoretical Framework

To answer the question raised in the first chapter regarding the stability of M2 real money demand, we employed an econometric analysis based on an open economy portfolio balance theory of real money demand function (Thomas, 1985). The underlying assumption of this theory is that economic agents may hold money either as an inventory to smooth differences between income and expenditure, or for its yield as an asset in a portfolio. Either motive suggests a specification in which the demand for money depends on a scale variable such as real income or wealth and the rates of returns to money and to alternative assets. In open economy macroeconomics, money is considered as part of portfolio, which consists of domestic financial assets, real assets and foreign assets. The return on the domestic money is the “own” rate of interest. The return on real assets is the expected rate of inflation. According to Friedman (1956), the purchasing power of money erodes quickly under high inflation while the value of real assets is maintained and as a result economic agents may wish to switch into real assets when the inflationary expectations are strong

The classical economics states that all markets are in equilibrium and are always in a full employment. The role of money is that it serves as the numerical, that is, a commodity whose unit is used in order to express prices

and values, but whose own value remains unaffected by this role (Sriram 1999). It also facilitates the exchange of goods. Money is “neutral” with no consequences for real economic activity.

The quantity theory emphasized a proportional relationship between money and price level. This relationship was developed in classical equilibrium framework by two alternative but equivalent expressions:

(1) The exchange equation associated with Prof. Irving Fisher states that money times its transactions velocity equals the volume of trade multiplied by the level of price. In other words

MV = PT

Where M = money

V = velocity

T = volume of trade

P = price level

Money is held only to facilitate transactions and has intrinsic utility.

### 2.1.1 Cambridge Approach Or Cash Balance Approach:

This is associated with the Cambridge University Economists, like A.C. Pigou. This alternative paradigm relates the quantity of money to nominal income and stresses the role and importance of money demand in determining the effect of money supply on the price level. Money is held in this approach not only as a medium of exchange as in Fischer’s case. But also as a store of value that provides satisfaction to its holder by adding convenience and

security. Cambridge economists pointed out the rate of wealth and the interest rate in determining the demand for money.

### 2.1.2 The Keynesian Theory

The most important relationship is the relationship between economic growth and the level of investments. This relationship is related to demand for money, where demand for money induces the money supply. In the long-run to Keynes, money demand and money supply are balanced. In comparison with the monetarist approach, the Keynesian theory assigns to the monetary policy a lower efficiency in the effects on economic development.

Furthermore, Keynes postulated that the individuals hold money with three motives: The transactions motive that is the need of cash for the current transaction of personal and business exchanges. The transaction demand for money arises because of the no synchronization of payments and receipts. Secondly, the precautionary motive which provides for a contingency plan for unscheduled expenditure during unforeseen circumstances. Finally, the speculative motive which centered on the object of securing profit from knowing better than the market what the future will bring forth. The speculative demand for money is what Keynes called “Liquidity Preference”. The theory of Liquidity preference provides an answer to why economic entities demand and hold money that does not yield any interest, instead of securities or similar assets.

The speculative motive of money demand possession is introduced by Keynes formula:

$M = L1 (y) + L2 (i)$

Where L1 = expresses the transactional and precautionary motive,

L2 = the speculative motive of liquidity preference,

Y = is normal GDP

i = is the interest rate

Wrigthsman (1983), stated that these motives exert influences simultaneously and are mutually independent and consequently M is a total money demand. Keynes considered only nominal level of money demand. After Keynes, on the same issue, Dornbusch and Fischer (1994) states, that "people possess money because of its purchasing power, which is the quantity of goods and services that they can purchase with money", what it means is that we must consider the real level of money demand.

### 2.1.3 The Neo –Keynesian Theory of Money Demand

The neo-Keynesian interpretation of the money demand theory was based on Keynesian principles. To them, transactional and precautionary motives are proportional to income while the speculative motive demand for money is dependent on interest rate. Formally, these statements were formulated as:

$Mda = ky$ and $Mds = \alpha i - \beta i$

Where Mda = demand for active balance,

K = the share of active balance in GDP

Y = nominal GDP,

Mds is speculative demand for money,

α and β are parameters

i = the interest rate.

However, the relationship between GDP and precautionary money demand were formulated as anti-cyclical instead of pro-cyclical by the Neo-Keynesians, similar to the transactions motive. Thus, the demand for money was expressed by Neo-Keynesian as follows:

Md = L(y,i)

Where to them, Md = demand for money,

L = the liquidity preference function,

Y = nominal GDP

i = is Interest rate.

Baumol (1952) and Tobin (1956), say that, an approach based on the transactional motive of liquidity preference is particularly emphasized. The results of such considerations led to the well-known formula:

$Md/p = \sqrt{cy/ai}$

Where Md is demand for real balance, c is transaction costs, y is real GDP and i is the interest rate. The Baumol-Tobin model assumption of cost stability in a transaction is not realistic in the long-run.

### 2.1.4 Post –Keynesian Theories of Money Demand

The post Keynesian economics emphasizes the role of uncertainty associated with the historical developments of the economy and puts the demand for money concept into a broader context. To them, the volume of money in the economy is the result of a demand and supply process interaction. Through its instruments, the apex bank is able to influence the conditions for issuing loans due to the impact of such instrument on interest rate developments. Additionally, the behavior of the banking sector towards economic entities applying for loans is significantly influenced by institutional characteristics of the banking sector. In this context an important role is maintained by banking regulation and banking supervision.

The Post-Keynesian economics inclusion of financial motive in the demand for money, reflect the fact that entrepreneurs must maintain certain money balances in the course of time, so that they purchase inputs necessary for production. If the planned investments do not change, the money balances will remain permanent; if they increase additional financial demand for money is crated. In this approach, the demand for money is usually expressed in nominal terms. For transformation to the real demand for money form, it is necessary to consider inflation (Fischer, 1983).

### 2.1.5 The Modern Monetarist Theory

The monetarist approach is based on the assumed direct influence of the volume of money in the economy and nominal income, usually expressed by

nominal GDP. Money plays a primary role with the money supply being a decisive factor. Modern monetarist withdrew from the notion of an exclusive tie between the demand for money and nominal income. They emphasize the influence of both interest rates and yields of other tangible and financial assets.

Among the modern monetarists, Milton Friedman's development of the demand for money depends on the overall wealth of society in various forms (money, bonds, securities, material and human resources) as well as on the tastes and preferences of holders of the wealth (Wrightsman ,1983).

Stability of demand for money development is an important assumption on which Friedman and other monetarist base their expansion of their theory. Formally, the demand for money in Friedman's concept was expressed as follows: Md = f(y, w, rm re – rm, rb – rm, idp/pdt, u)

Where

Md = demand for real money balances

Y = the overall wealth

W = a share of accumulated human resources in the overall wealth

rm = the expected money yield

re - rm = the expected yield of securities

rb - rm = the expected yield of bonds

idp/pdt = the expected change in commodity price and u is the influence of other factors.

However, Obinna (2008), notes that the supply of money determined exogenously by monetary authorities is not necessary. It assumes, first, that the demand for money depends on the value of national income and on the rate of interest. Secondly, the supply of money is an exogenously determined constant and thirdly, an express demand for or supply of money is reflected in the demand for or supply of securities (bonds). For him, it can be seen that the first part of assumption (1) is the same as the used in the traditional theory. The second assumption is also the same. The difference lays in part two of assumption (1) and the whole of assumption (3).

#### 2.1.2.1 Active –Passive Money View Theory

The active passive money view said that; “quantity of money is subject to the independent influence of the central Bank”. This influence, among other things to them can lead to a real quantity of money holdings that is larger (smaller) than desired. In contrast to the passive money view, the attempt to eliminate these excess balances is considered to have an important role in the transmission of monetary policy. The interpretation of a nominal “monetary shock” highlights the distinction between the two views. According to the passive-money view, a monetary shock is the consequence of a change in the demand for money caused by an output shock, for example that is accommodated by the central bank as it targets short –term interest rates. In contrast, the active- money view interprets a monetary shock as consequence

of a change in the supply of money induced by the central bank that is unanticipated by agents. If there is a positive shock, initially, agents have to hold the additional nominal balances. Over time, individuals perceive that the nominal quantity of money they hold corresponds to a real quantity that is larger than desired at current prices, and that this is not a temporary condition. That is, individuals are "off" their long-run demand for money function. However, all individuals cannot collectively dispose of the aggregate excess nominal balances. Nonetheless, the attempt to do so has economic effects: the increase in expenditure levels to an increase in nominal spending, an increase in economic activity, and ultimately an increase in prices (Wrightsman, 1983).

### 2.1.6 Monetary Targeting Versus Inflation Targeting

Mordi (2009), say's that central banks are not unconcerned with economic growth, which is the ultimate broad macro-economic policy objective. Consequently, CBN must adopt specific framework to achieve this goal. Empirical evidences abound on the relationship between money and inflation, and or money and output or output and inflation. Mordi stated that it is generally known in literature that inflation is a monetary phenomenon in the long-run. Based on this, central banks generally believe that they can contribute to overall policy objectives of sustained non-inflationary output growth by aiming at low and stable inflation.

**Monetary Policy Framework in Nigeria**

In Nigeria the overriding objective of monetary policy is price stability and exchange rate appreciation. The monetary authorities strategy for inflation management is based on the view that inflation is an essentially a monetary phenomenon. Because targeting money supply growth is considered as an appropriate method of targeting inflation in the Nigerian economy, the CBN chose a monetary targeting policy framework to achieve its objective of price stability. With the broad measure of money ($M_2$) as the intermediate target, and the monetary base as operating target, CBN utilized a mix of indirect (market determined) instruments to achieve it monetary objectives. These instruments included reserve requirements, Open market operation on Nigerian Treasury Bills (NTBs), liquid assets ratios and the discount window, international Monetary Fund (IMF) (Country Report No 3/60,2003).

Nnanna (2001), commend that CBN focus on the price stability objective was a major departure from past objectives in which the emphasis was on the promotion of rapid and sustainable economic growth and employment. Prior to 1986, on the same note, CBN relied on the use of direct (non-market) monetary instruments such as credit ceilings on the deposit money of banks, administrated interest and exchange rates, as well as the prescription of cash reserves requirements in order to achieve its objective of sustainable growth and employment. Nnanna stressed that during the period, the most popular instruments of monetary policy involved the setting of

targets for aggregate credit to the domestic economy and the prescription of low interest rates. With these instruments, Nnanna say's that the CBN hoped to direct the flow of loan-able funds with a view to promote rapid economic development through the provision of finance to the preferred sectors of the economy such as the agricultural sector, manufacturing and residential housing.

During the 1970s, the Nigeria economy experienced major structural changes that made it increasingly difficulty to achieve the aims of monetary policy. The dominance of oil in the country's export basket began in the 1970s, for example, in 1970s, the share of oil revenue in total export value was about 58 percent, and this increased to over 95 percent during the 1980s. The increased revenue from oil to the government led to rapid increase in Nigeria's external reserves in the 1970s. Furthermore, the rapid monetization of the increased crude oil receipts resulted in large injections of liquidity into the economy, which induced rapid monetary growth. Between 1970 and 1973, government spending averaged about 13 percent of Gross Domestic Product (GDP) and this increased to 25 percent between 1974 and 1980. This rapid growth in government spending according to IMF report came not from increased tax revenues but the absorption of oil earnings into the fiscal sector, which moved the fiscal balance from a surplus to a deficit that averaged about 2.5 percent of GDP a year. This new era of deficit spending led the government to borrow from the banking system in order to finance the

domestic deficits. At the same time, the government was saddled with foreign borrowing and the drawing down of external reserves. To reverse the deteriorating macro-economic imbalance (declining GDP growth, worsening balance of payment conditions, high inflation, debilitating debt burden, increasing fiscal deficits, rising unemployment rate, and high incidence of poverty), the government embarked an austerity measures in 1982. The austerity measures according to (IMF report, 2001) was successful judging by the fall in inflation rate to a single digit, the significant improvement in the external current account to positions of balance, and the 9.5 percent growth in real GDP in1985. However, these improvements were transitory because the economy did not establish a strong base for sustained economic growth.

To put the Nigerian economy back on a sustainable growth, path, international Monetary Fund (country report No. 3 volume 60 2003) state that Nigerian government adopted the comprehensive Structural Adjustment Program (SAP) sponsored by the International Monetary Fund (IMF) in June 1986. The SAP was a structural and sectoral macro-economic policy reform whose main strategies were

(a) The liberalization of the external trade and payment systems

(b) The adoption of a market-based exchange rate for the domestic currency naira.

(c) The elimination of price and interest rate controls and

(d) The reliance on market forces as the major determinant of economic activity.

Nnanna (2001), states that adoption of SAP marked the beginning of reforms in the financial sector as the banking system witnessed free entry and exit and the use of indirect but market- based monetary control instruments for implementing monetary policy in Nigeria.

To Judd and Motley (1992, 1993), the CBN reaches an important milestone in 1986 when it decided to adopt $M_2$ as an intermediate target for monetary policy while this choice raise a key question in terms of why the CBN considered $M_2$ as the appropriate intermediate target instead of interest rate or nominal GDP or inflation targeting?

Given the fact that interest rate and prices were controlled pre-SAP, it is not difficult to see why the CBN ruled out interest rate targeting or inflation targeting as viable policy options. Furthermore, the structure of the financial markets in less developed countries renders interest rate targeting ineffective.

However, as Taylor (2004) pointed out, “if financial markets are weak, the effectiveness of transmitting policy through interest rate will be limited”. With these controls and the constraints due to weak financial markets, nominal GDP targeting may not have succeeded. To Taylor, (2004), he says that as for the commitment to rules, many countries apply rules because policy rule may aid in focusing policy discussions in terms of intermediate and operating targets. Over the past decade, many countries adopted the Taylor

rule which he developed for the United States in 1993. To him, these rules can also be part of the monetary policy strategy in emerging market economies. More recently, Batini (2004) argued that for Taylor rule to be applicable to emerging market economy like Nigeria, modifications have to be made because of the specific features of the emerging market economies Batini identified six aspects:

(1) The feedback parameter on inflation must be set to a larger value than that commonly used for developed countries. Thus, aspects 2, 3, 4… and 6.

In emerging market economies, it may on occasion be sensible to consider policy based on money rather than interest rate as instruments). Therefore, if one examines the modifications suggested by Batini and the fact that rules assume that policy marker's seek to stabilize output and price along paths that are considered to be optimal, then one can conclude that CBN $M_2$ growth rate target can (and, could be meant to) influence output and prices if there is commitment to announced rules. The key issue with the application of Taylor rule to monetary policy making in Nigeria is commitment to target rules.

## 2.2 Empirical Literature

A number of studies that looked at the information content of monetary aggregates for inflation and output have been carried out. The studies we could access, however, are mainly on developed countries. However, many

inflation studies on developing countries in general and Africa specifically, although not focusing on monetary aggregates parameters, have included money aggregates, exchange rates and interest rate measures as explanatory variables.

These can give us an indication of the importance of these variables for output and inflation. We therefore, review a few studies specific to the topic and then $M_2$ studies in Nigeria.

A number of studies have employed the Vector Auto-Regressions (VARs) methodology. By evaluating F-statistics and forecast performance measures, empirical work has shown that the issue of whether monetary aggregates (M2) are important for Gross Domestic Product (GDP) and inflation or not, varies from country to country and from one period to another. One of the important studies to be discussed here, using US data, is that by Friedman and Kultner (1992). They find out both M1 and M2 were significant for output level and inflation before 1980 and the significance disappeared when the data set is extended beyond that period. Of particular interest is that the commercial paper bill spread was a good information candidate for industrial production.

This conclusion sparked a debate and some of the resulting papers are those of Emerg (1996) who estimates recursive regressions and uses both Ganger-causality and variance decompositions. He attributes the importance of this variable to the presence of outliner in the date.

Hafer and Kutan (1997) explored the importance of the commercial bill spread and argue that the conclusion on its significance was a result of wrong stationary assumptions about the money variables. They find that by carefully modeling the data, money variables are still useful beyond the 1980s. Bahmani et al (2000) performed forecasts of inflation and output, using the same data. They estimated an Auto-regression (AR) one model as a base model and calculated its means absolute percentage error. They then forecast inflation, adding one variable at a time to the AR one model and compared the Mean Absolute Percentage Errors (MAPEs) of the different models. They find that money improves the forecasts of inflation.

Durevall and Ndungu (2001) estimated a dynamic error correction model of inflation for Kenya, covering the period 1974 to 1996; they find that money supply affects prices only in the short-run. The excess money demand error correction term is not significant at any conventional levels. However, they find a significant role for the three month treasury bill rate. In a study of the monetary transmission mechanism in Uganda, Nachenge (2001) also finds a highly significant role of the treasury bill rate. He also finds that the first lag of growth in money supply is significant.

Sacerdoti and Xiao (2001) estimate a similar model for Madagascar, covering the period 1971 to 2000. They found out that the money variable is significant at all conventional levels. They found a very significant role for exchange rate. Similarly, Durevall and Kadenje (2001) found that after the

reforms, money supply ceases to be an important determinant of inflation in Zimbabwe. Instead, the exchange rate and foreign prices become more important.

In Nigeria, attempts to demonstrate the determinants and stability of money demand function date back to the early 1970s. The pioneering work in the area of money demand function in Nigeria was conducted by (Tomori 1972). He found out that income, interest rate and real income were the major determinants of demand for money in Nigeria. These findings however generated a lot of debate known as "TATOO" debate in the literature Ajayi (1977). Teriba (1974), Ojo (1974) and Odama (1974) reacted to Tomori's findings based on stability and reliability of the elasticities of the demand for money function as well as the speed of adjustment, policy relevance and the stability of the regression over the sample period. Since the "TATOO" (i.e. an acronym for Tomori, Ajayi, Teriba, Odama and Ojo, the economists that brainstormed on the issues of stability of money demand in Nigeria 1972). Other empirical studies on money demand have been conducted, which included among others, Akinnifesi and Philip (1978), Fakiyesi (1980), Adekunle (1980), Adejugbe (1980) and Onwioduokit and Osho (1996).

Adebiyi (2004), attempts to study the properties of money demand he evaluate its appropriate monetary policy using an Error Correction Mode (ECM).The study shows that the determinants of money demand are real GDP, nominal interest and inflation rate. The income elasticity of money

demand is very high. The demand for money in Nigeria was stable between 1970 and 1998 despite the reforms programmes embarked upon in 1986.

Anoruo (2002) investigates the stability of the Nigeria money demand function in the SAP regime. Results from Johansen and Juselius (1990) co integration test show that real $M_2$ economic activity and real discount rate have a long-run relationship. He employed Hansen (1992) stability test to argue that the M2 money demand function in Nigeria is stable in SAP era (from 1986.2 to 2000.1) the study suggests that $M_2$ is a highly monetary policy tool to boost economic activity in Nigeria.

Nwaobi (2002) discovers a long-run relationship existing between money supply and real GDP, inflation and real interest. The study employed annual series from 1960 to 1995 and Johansen co integration technique to confirm the stability of the demand for money function in Nigeria era.

Fielding (1994) investigates the demand for money function in Nigeria, Cameroon, Cote d'ivoire and Kenya. He concludes that $M_2$ inflation and real income are co integrated for Nigeria. Arinze, and Lott (1986) search for further evidence on the Nigerian money demand function. The study concludes that Nigerian money demand is well explained by real income and expected inflation.

Okechukwu, Agu and Onah (2010) study on the co-integration and structural breaks in Nigeria log-run money demand function, using $M_2$, interest rate, price level. The study employed quarterly data from 1986Q:1 to

2006Q:4, and ADF, PP unit root test, crash model, Gregory and Hansen co integration test. They find that there is log-run relationship among the variables used, that the variables exhibit stationary after their first difference and that here are no structural breaks.

Oluwole, and Olugbenga (2010) study on $M_2$ targeting, money demand and real GDP growth in Nigeria, using time series quarterly data from 1986:1-2001:4, with johanse co-integration test, ADF unit root test, stability test. They find that there $M_2$ is stable, and that there exists log-run relationship among the variables used.

Darrat,(1986) examines money demand function in petroleum rich countries namely Nigeria, Lidya and Saudi Arabia. The study employed stability test by Chow, Gupta, Farlry and Hinichi to confirm the stability of money demand function in three oil rich and exporting countries.

Ajayi (1977) investigates the Nigeria money demand function using the OLS. The study employed annual series from 1960-1970. Ajayi's finding that $M_2$ is greatly influenced by real income and real interest rate led to yhe conclusion that money demand function is not unstable.

### 2.2.1 The CBN New Approach in Liquidity Credit Allocation to Sectors

The word "liquidity" is often used to describe very different thing. Liquidity is mostly used in the financial market to describe the characteristics of an asset, Allen, Franklin (2007), it is the "degree of ease and certainty of value with which an asset or security can be converted to cash. In the work of

CBN, Akanji, (2009) say's that liquidity is characterized by a high level of trading activity. Akanji in her conclusion stated that "in response to the financial crisis and the "Sanusi Tsunami", the CBN instituted a series of new lending to sectors that could impact the real sector of the economy. The lending increased the liquidity of the participating banks portfolios without simultaneously increasing the total supply of liquidity in the financial market. By so doing, the CBN departed significantly from the historic practice of relying on traditional tools of Open market operations and discount window lending to provide liquidity to the real sector of the economy. Beside, the question is "why CBN chose this unconventional approach to monetary policy is the question of "how effective it is". However, oftentimes, the achievement of the set goals is associated with problems. First, simultaneous achievement of all the ultimate goals necessarily involves some trade-offs. Second, it is generally difficult to establish the impact of monetary policy on a set of macro-economic variables. Thirdly, it is usually difficult to establish a direct link between monetary policy instruments and the ultimate goals. To Mordi (2009), the way to overcome these lacks of direct linkage is the adoption or use of intermediate targets such as a quantity or a price, to him, inefficient and under-developed money markets, quantity-targeting framework can be very useful since quantity (change in quantities) play dominant role in the transmission of monetary policy. Similarly, in situations of high inflation and subsequent disinflation period, quantity –targeting framework is a potent tool.

Furthermore, in under-developed markets, capital restrictions and financial regulations still abound, and this, could most probably be responsible for the relative stability of the money multiplier and money demand. These characterizations to Mordi are the reason why CBN being one of the developing countries apex bank mainly target quantity variables. Monetary targeting involves the use of quantities (monetary aggregates) as operating target to influence the ultimate objectives its final objective is price stability. According to Hoggarth and Reidhill (2003), Broad Money (M2) is the usual choice in developing countries, which Nigeria is one among, particularly in situations of high inflation and where the link between the growth of a monetary aggregate and inflation is close quick. Often, the typical source of money creation is central bank credit to government, or banking sector. To Tobin (2005), sanctioning inflation requires reversing base money growth.

Meanwhile, Small etd (2005), states that CBN chose to enact a series of new lending programs rather than using its existing tools of open market operations and the discount window is unclear. To him, it seems that the inadequacy of securities for the market made sectoral lending approach much more appealing to the regulatory authority for immediate impact.

To David H, it seems that CBN desire was not to increase total liquidity in the economy which could aggravate inflationary pressure but to provide liquidity to the real sector through participating banks to lend for productive

purposes and avoid the inefficient liquidation of assets that were temporarily illiquid.

However, when the money multiplier fluctuates and undermines the link between base money and the monetary aggregate, short-term interest rates are the preferred operating target. Under money target, inflation target is not defined and central bank intervention is on the money market. To Tobin, monitoring is by analysis of short-term deviations from target. The problem with this framework is stated by Mordi is that it is a block box, not understood by the public and cast a shade on the transparency and credibility of central banks actions.

**Table 1: Summary of the Review**

| Author's | Methodology | Findings | Limitations |
|---|---|---|---|
| Emery (1996) | Ganger – Causality and variance decomposition recursive regression. | That that variables were outline of the data. | (1) Short period of observation (1980-1995), 15year,<br>(2) No test of stationality in the study. |
| Black et al (2000) 1995-2000<br>Hafer and Kutan (1997), 1980-1997<br>Uganda and Nachenge (2001) 1989-2000<br>Bahmani, (2000). | Auto regression (AR), Absolute Percentage Errors (MAPEs) and ADF unit root test. | They observed that money improves the forecasts of inflation rate.<br>Stationary, and that money is useful as a monetary policy guide<br>That the first lag of growth in money supply is significant as well as the treasury bill rate. | (1) The made use of tow independent variables (i.e inflation rate and output against money supply).<br>(2) And only one year lag which is not fit for good forecasts (i.e predicting failure)<br>(3) Short period of observations. |
| Durevall and Ndungu (2001), 1974 to 1996<br>Ajayi (1974), 1960-1970,<br>Adebiyi (2004), 1986 to 2002,<br>Anoruo (2002), 1986:1 to 200:4<br>Nwaobi (2002), 1960 to 1995<br>Fielding (1994), 1970 to 1992, | OLS, with ADF and PP unit root Test,<br>Error Correction Model,<br>Johansen and Juselius (1990) Co-integration Test,<br>Brown Stability Test, Hansen(1992) CUSUM and CUSUMQ Test,<br>Ganger – Causality Test. | There exist stationary of the variables used,<br>Log-run relationship as well as significant log speed of adjustment ( negative ECM),<br>And stable $M_2$.<br>Meanwhile, the author's below finds<br>That there exist stationary of the variables used after the first difference,<br>Log-run relationship as well as significant short | (1) Unable to add foreign interest rate as independent variables in the model,<br>(2) most of the author's employed interpolations of date in order to obtained quarterly data<br>(3) unable to use chow test for indication of structural effect within the period of their observations<br>(4) Short periods of their observations (i.e their observations where not up to 30year for good fit of stationary test rules). |

| | |
|---|---|
| Arinze and Lott (1986), 1965 to 1984,<br>Okechukwu (2010), 1986:1 to 2006:4,<br>Oluwole et al (2010),1986: to 2001:4,<br>Darrat,(1986), 1970-1985. | speed of adjustment ( negative ECM),<br>Absence of structural breaks effect and stability of M2 in Nigeria. |

Previous studies are characterized by certain features. First, they investigated the stability of the demand for money function in the context of co-integration analysis. Second, these studies did not address the issue that co-integration relationship may have a structural break during the sample period. Fundamentally, we pose three puzzles in this study. First, is there a long-run equilibrium relationship for Nigerian broad money demand? Second are there structural breaks in the Nigerian long-run demand for broad money equilibrium relationship. Third, is there causality among broad money demand, GDP and inflation in the economy during the period? These are what we need to know about the Nigerian money demand function which at present we do not know. This study departs from previous Nigerian studies in four respects. First, the study employed standard test like Augmented Dickey Fuller (ADF) and Philips-Perron and stability test. Second, unlike existing studies, this study applies chow-test procedures in order to capture the endogenous structural break effect in the co-integration vectors. Third, the Granger causality test in order to capture the causality among the variables. Interest rate effect enters the model through the spread between deposit rate and lending rate. Fourth, we will employ annual time series data from 1970 to 2010.

# CHAPTER THREE

# METHODOLOGY

## 3.1 Research Design

This is the plan and structure of investigating that guides the researchers. It is a logical model of proof that permits the research to draw a reference about the casual relationship between the variables under study, to also define the extent of generalization of the research findings. In effect, it constitutes the blueprint for the collection, measurement, and analysis of data and it is the research question that determines the type of design to adopt and not the other way round. This is quite different from research Methodology which refers to the methods, techniques, and procedures that are employed in implementing a research plan (design). For this study, causal comparative or ex post facto research design is adopted. This is because the study attempts to explore cause and affect relationships where causes already exist and cannot be manipulated.

Ex-post facto research is systematic empirical inquiry in which the scientist does not have direct control of independent variables because their manifestations have already occurred or because they are inherently not manipulated. Inherences about relations among variables are made, without direct intervention, from commitment variables of independent and dependent variables. It has been the overall pattern of framework of the project that stipulate what information is to be collected accurately and economically, for,

which sources and by what means. This research work is fundamentally analytical and descriptive as it embraces the use of secondary time series data in examining the stability of the Nigeria money demand function from 1970-2010.

## 3.2 Model Specification

Model is an abstraction form of reality drawn in such a way to reveal the relevant aspect of the subject under consideration. Therefore, to empirically study this work (i.e. the stability of $M_2$ demand function on Nigeria economy), the researcher postulates the following models. To begin, the function is represented as mathematical function such that:

**Modal 1**

$(M2/P)t = F (RGDPt, DIRt, IFRt, EERt, FIRt)$ …(1)

**Explicitly**

$$\Delta Iog (M_2/P)_t = \beta_0 + \beta_1 \Delta logRGDP_t + \beta_2 logDIR_t + \beta_3 IogIFR_t + \beta_4 IogEER_t + \beta_5 logFIR_t + \mu_t \quad \ldots (2)$$

Where Iog = natural logarithm

$M_2$ = the nominal $M_2$ money stock

P = the domestic price level

$M_2/p$ = the real $M_2$ money balance

$RGDP_t$ = the real gross domestic product

$DIR_t$ = the domestic interest rate (the own rate of return)

$IFR_t$ = the inflation rate

$EER_t$ = effective exchange rate

$FIR_t$ = the foreign interest rate

$\mu$ = white noise disturbance term, while t in the model represents at current period time $\beta_0$, $\beta_1$…, $\beta_5$ are the parameters of the coefficient.

The above specified model postulate that the real broad money $M_{2t}$ is explained by the real income $RGDP_t$, the spread between interest rates on lending and deposit $DiR_t$ and rate of inflation IFRt and Effective Exchange Rate $EER_t$, with foreign interest rate $FIR_t$. The 'a priori' expectation about the signs of parameters to be estimated in the model above shows that as real income improves, money demand rises ($\beta_1 > 0$). An increase in interest rate boosts the demand for money ($\beta_2 > 0$). Conversely, as inflation rates rises, the demands for money increases thereby decrease the value of money ($\beta_3 > 0$). Increase in effective exchange rate will decrease the demand for foreign currency ($\beta_4 < 0$) while increase in o foreign interest rate will ($\beta_5 > < 0$).

### 3.2.1 Justification of Variables

According to Handa's (2000), the domestic rate of interest and the expected exchange rate depreciation are two important variables to include in the modified long-run real money demand function, and the failure to include foreign interest rate "would make it difficult to capture the substitution between domestic currency and foreign bonds, which is an element of capital mobility rather than of the substitution of the liquidity services of the foreign

currency for the domestic ones". Furthermore, it is important to point out that it is unusual to include inflation rate as an explanatory variable in the money demand function. Some studies use current inflation rate and others use expected inflation rate as explanatory variable. This is so because the inflation generating process is not universal, but more importantly, the expectations of inflation vary across developed and developing countries. With respect to developing countries, monetary and non-monetary factors contribute to the inflation process. For example, in the study of money demand in the inflation process in Brazil, the expected inflation is determined simultaneously with equilibrium real balances and real government debt. In the case of Nigeria, monetary factors and macro monetary policy announcements are major determinants of the inflation generating process. With every policy announcements, economic agents form there expectations about price accordingly. In other words, in economies such as Nigeria where prices adjust almost instantaneously due to policy announcements, one can therefore assume that there is no difference between current inflation and expected inflation.

Meanwhile, the domestic interest ate ("own" rate of return) is proxy by the three-month inter-bank rate. The US three-month Treasury bill rate and the Nigeria naira/US dollar exchange rate are used as the foreign interest rate and the effective exchange rate, respectively.

However, the variable in the real broad money demand model in equation (1) above, tend to move together in the long-run as predicted by economic theory. In the short-run, deviations from this relationship could occur due to shocks to any of the variables in addition, the dynamics governing the short-run behavior of real broad money demand are different from those in the long-run. Due to these differences and trend, the short-run equation and adjustments to long-run equilibrium are very important because of the policy implications. However, the Chow test and other preliminary tests will be duly specifies below and observed in this study for best achievement.

### 3.3 Method of Evaluation

The estimation of this work will employ the ordinary least square (OLS) technique and other four-step procedure in order to determine the stability of the Nigerian money demand function. E-views econometric software package will be used in estimating the data. These procedures are:

#### 3.3.1 The Chow Test Estimation procedures

According to Chow test procedures, the hypothesis say that regressing on the pool observation of 40 years periods means that there is no difference between the two time periods and money demand function $M_2$ has not changed much over the span of 40 years periods, even as policies changed. Therefore estimating the relationship stated above for the entire time period, assumes that the intercept as well as the slope coefficient remains the same

over the entire period, (that is there is no structural change), if this is in fact the situation, then $\beta_1 = \lambda_1$, $\alpha_1$ and $\beta_2 = \alpha_2$, $\lambda_2$. Thus, we specified below:

1970 – 1990,

$\log (M2/P)_t = \beta_0 + \beta_1 IogRGDP_t + \beta_2 logDIR_t + \beta_3 IogIFR_t + \beta_4 IogEER_t +$

$\beta_5 IogFIR_t + \mu_{1t} \ldots n_1 = 20$ …equation……. (1)

1991 – 2010,

$Iog(M2/P)_t = \alpha o + \alpha_1 IogRGDP_t + \alpha_2 logDIR_t + \alpha_3 IogIFR_t + \alpha_4 IogEER_t +$

$\alpha_5 IogFIRt + \mu_{2t} \ldots n_2 = 19$ ……. (2)

1970 – 2010,

$Iog(M2/P)_t = \lambda o + \lambda_1 IogRGDP_t + \lambda_2 loglDIR_t + \lambda_3 IogIFR_t + \lambda_4 IogEER_t +$

$\lambda_5 IogFIR_t + \mu_{3t} \ldots N = (n_1 + n_2) = 40$ …equation……..(3)

Equation (1) and (2) in model (2), assume that the regressions in the two time period are different, that is the intercept and the slope coefficients are different, as indicated by the subscripted parameters. In the above model, the μ's represent the error terms and the N's represent the number of observations.

### 3.3.2 Granger Causality Test:

Granger Causality test will be carried in this study. Since time does not run backward. That is if event A happens before event B then it is possible that A is causing B and not possible that event B causing A. In other word, event in the past can cause event to happen today Gujarati (2005). To explain the Granger test, we will consider the often asked question in macro-

economics: Is it RGDP that "causes" the money supply $M_2$ (RGDP ← $M_2$) or the money supply $M_2$ that causes y ($M_2$ →RGDP) and also if ($M_2$ →IFR) or (IFR →$M_2$) where the arrow points to the direction of causality. Engle and Granger (1987), assumes that the information relevant to the prediction of the respective variables, RGDP and $M_2$ is contained solely in time series data on these variables. The Granger test involves estimating the following pairs of regression

(RGDP→$M_2$)

$$RGDP_t = \sum_{i=1}^{n} \alpha_i M2_{t-1} + \sum_{j=1}^{n} \beta_j RGDP_{t-1} + \mu_{1t}$$

($M_2$←RGDP)

$$M2_t = \sum_{i=1}^{n} \lambda_i M2_{t-I} + \sum_{j=1}^{n} \alpha_j RGDP_{t-1} + \mu_{2t}$$

(IFR → M2)

$$IFR_t = \sum_{i=1}^{n} \alpha i M2_{t-I} + \sum_{j=1}^{n} \beta_I IFR_{t-1} + \mu_{1t}$$

(M2 → IFR)

$$M2_t = \sum_{i=1}^{n} \lambda_i M2_{t-I} + \sum_{j=1}^{n} \alpha_j IFR_{t-1} + \mu_{2t}$$

The coefficients of model (2) and granger equations have the same signs as those in model (1) and the meaning is as stated above

### 3.3.3 Unit Root Test

We will employ Augmented Dickey Fuller (ADF) and Philip Peron test for the order of integration. The purpose of this test is to eliminate the presence of autocorrelation and spurious results in the model by adding the lagged value of the dependent variable $\Delta M_2$. ADF unit root test is specified as:

$$\Delta (M_2/P)_t = \beta_1 + \beta_2^t + \delta M_{2t-1} + \alpha_{i\ i=1\sum m} \Delta M_{2t-1} + \varepsilon_t$$

Where: $M_{2t-1}$ = Variables in the model, $\Delta M_{2t-1} = (M_{2t-1} - M_{2t-2})$, that is change.

$\beta_1$, $\beta_2$ and $\alpha$ = parameters in the model, $\varepsilon_t$ = is a pure white noise error term

### 3.3.4 Co-integration Test

In this section, we will determine whether the variables are integrated and identify the long-run relationship. A VAR-based co-integration test will be employed using johansen methodology.

This VAR based model can be specified as:

$$(M_2/P)_t = \beta_o + \beta_1 IRGDP_t + \beta_2 IDIR_t + \beta_3 IFR_t + \beta_4 EER_t + \beta_5 FIR_t + \mu_{1t}$$

Where:

$(M_2/P)_t$ =K-Vector of non-stationary, 1 (1)

$RGDP_t$, $IDIR_t$, $IFR_t$, $IEER_t$, and $FIR_t$ = d- vector of deterministic variables while

$\mu_{1t}$ = vector of innovation

### 3.3.5 Error Correction Model (ECM)

Having stated the co-integration which we wish to test; that is, if there is a log–run or equilibrium, relationship between the dependent and the

independent variables. Of course, in the short-run there may be disequilibrium. Therefore, we can now treat the error term in the above model (3.3.3) as the "equilibrium error". And use this error term to tie the short-run behavior of the dependent variable ($M_2$) to its log-run value (Sargan, 1984). The error correction model is specified as:

$\Delta(M_2/P)_t = \alpha_o + \alpha_1\Delta RGDP_t + \alpha_2\Delta IDIR_t + \alpha_3\Delta IFR_t + \alpha_4\Delta EER_t + \alpha_5\Delta FIR_t + \alpha_6\mu_{t-1} + \varepsilon_t$.

Where:

$\Delta(M/P)_t$ = change in individual variable in the model, $\mu_{t-1}$ is the random innovations, $\varepsilon_t$ = the random error term.

### 3.3.6 Stability Test

Stability test was employed to utilize the cumulative recursive sum of residual (CUSUM) and cumulative sum of recursive residual squares (CUSUMSQ) procedures by (Brown, Durbin and Evans1975). Both the CUSUM and the CUSUMSQ procedures are updated recursive and plotted against the break points. Parameter stability is indicated when the plots of the CUSUM and the CUSUMSQ stay within the 5 percent significance level. However, the parameters and hence the variance are unstable if the plots of the CUSUM and the CUSUMSQ move outside the 5 percent critical lines.

## 3.4 Data Description

The money demand model specified above was estimated using annual time series data from 1970 to 2010. The data were obtained from Central Bank of Nigeria Statistical Bulletin via CBN annual report and journals 2010.

# CHAPTER FOUR

## FINDINGS

This chapter deals with the presentation and interpretation of the empirical results, derived from the models specified in the previous chapter with a view to shedding some light in the relationship that exists among the variables indicated.

Having well stated the models to be estimated and its methodology in the previous chapters, data on Real Money M2 Demand function, Real Income represented by (RGDP), Domestic Interest Rata (DIR), Inflation Rate (IFR), Effective Exchange Rate (EER), and Foreign Interest Rate (FIR), are used for the empirical findings, of which are multiple regression with prediction equations. Bearing in mind the objectives and hypothesis of the study, the researcher, employed the aid of computer in the estimation of the models for reliable results.

## 4.1 Unit Root Test Results

The Augmented Dickey- fuller Test Unit root

Sample 1977 – 2009

Trend and Intercept

**Table 2: Included Observation: 29 after Adjustment**

| Variables | ADF Test At Level | ADF Test At first Difference | ADF Test At Second\ Difference | 5% critical Value | 10% critical values | Lag |
|---|---|---|---|---|---|---|
| **$DM_2$** | -3.572819 | -7.497053 | -9.775469 | -3.5279 | -3.1949 | 1 |
| **DRGDP** | 3.364575 | -1.663113 | -4.201346 | -3.5279 | -3.1949 | 1 |
| **DDIR** | -4.772805 | -7.129652 | -9.046023 | -3.5279 | -3.1949 | 1 |
| **DEER** | -1.348055 | -3.329175 | -6.039531 | -3.5279 | -3.1949 | 1 |
| **DIFR** | -1.617127 | -2.506336 | -6.022863 | -3.5279 | -3.1949 | 1 |
| **DFIR** | -1.526084 | -4.028967 | -6.735742 | -3.5279 | -3.1949 | 1 |

**Source:** E-views 3.1 Estimate results output.

**Phillips–perron (PP) Unit Root Test. Trend and intercept**

**Table 3: Included Observation: 30 after Adjustment**

| Variables | PP-Test At Level | PP-Test At First Difference | PP-Test At Second Difference | 5% critical Value | 10% critical Value | Lag |
|---|---|---|---|---|---|---|
| **$DM_2$** | -5.720133 | -14.86089 | -24.98375 | -3.5247 | -3.1949 | **1** |
| **DRGDP** | 3.715080 | -4.526614 | -14.64596 | -3.5247 | -3.1949 | **1** |
| **DDIR** | -3.676151 | -6.309402 | -10.39698 | -3.5247 | -3.1949 | **1** |
| **DEER** | -1.251156 | -4.784749 | -10.33931 | -3.5247 | -3.1949 | **1** |
| **DIFR** | -2.376992 | -3.032822 | -6.135539 | -3.5247 | -3.1949 | **1** |
| **DFIR** | -1.513184 | -5.990691 | -12.41506 | -3.5247 | -3.1949 | **1** |

**Source:** E-views 3.1 Estimate results output



The results shows in table 2 and 3 respectively tested the hypothesis that the variables used in the model are non stationary. The variables were tested at different differences with both ADF and PP Test. Viewing the table above; we could see that $DM_2$ series is stationary even at level, as will as at first and second difference with the both ADF and PP Unit root test

applications. The DRGDP series is not stationary both at level and at first difference, but became stationary at the second difference with the application of ADF test, while with the application of PP-test, DRGDP results shows non-stationary at level but was stationary after the first and the second difference. The DDIR (domestic own interest rate) series is stationary even at level, as will as at first and second difference with the both ADF and PP Unit root test applications. The coefficient of DEER (effective exchange rate) is Non-stationary even at level and at first difference; the DEE was stationary at second difference only, with ADF test. Thus, the DEE is stationary after the first and second difference and not at level with the application of PP- test. However, the DIFR ( inflation rate) series is non-stationary both at level and at the first difference, but was stationary after the second difference with the application of ADF and the pp-Unit root test in table 2 and 3 above. The coefficient of DFIR (foreign interest rate) series has the same direction of outcome with the ADF and PP test result. The both table shows that at level, the DFIR is non-stationary but become stationary at the first and at the second difference with ADF and PP test.

However, form above results, we are expected to reject the null hypothesis since all the variables were stationary at the second difference with ADF and PP Application. It was found from the results that both ADF and PP tested with trend and intercept indicated that the time series are integrated of the same order 1(2) for all the variables. The linear combination of series

integrated of the same order is said to be co integrated. Since all the series were statistically significant at 5 and 10 percent level of critical value. This implies that all the variables which suffer from spurious regressions achieve stationary in their second difference.

## 4.2 Regression Results Model 1 using ordinary least Squares technique

**Table 4: Estimates of $M_2$ Demand Function**

| Variables | Estimated Coefficient | Standard Error | t-statistic | P- value |
|---|---|---|---|---|
| C | -2.730713 | 1.514547 | -1.802990 | 0.0800 |
| Log(RGDP) | 1.101049 | 0.146955 | 7.492404 | 0.0000 |
| Log(DIR) | -0.050922 | 0.048393 | -1.052262 | 0.2999 |
| Log(EER) | 0.092021 | 0.041624 | 2.210785 | 0.0337 |
| Log(IFR) | 0.092701 | 0.154110 | 0.601526 | 0.5514 |
| Log(FIR) | -0.129514 | 0.128481 | -1.008040 | 0.3204 |

**Source: E-views 3.1 Estimate results output**

$R^2$ = 0.980326

t- Critical value at $\alpha = 0.05$ level of significant with n-k degree of freedom, where n= number of observation which is 41year, and k= number of parameters estimated in the model.

:.41n – 6k = 35 degree of freedom. Thus, $t_{\alpha/2} = t_{0.025} = 1.697$

f- Statistic = (6, 41) 348.7986, f- critical =1.37

D.W statistic = 1.835848

The above table estimated Real Broad Money Demand ($M_2$), on Real Income (RGDP), Domestic Interest Rate (“own” rate of return, DIR), Effective Exchange Rate (EER), Inflation Rate (IFR) and Foreign Interest Rate (FIR).

The coefficient of the constant term shows negative; this implies that at zero performance of all the independent variables, Nigeria's real money demand ($M_2$) will stand at -2.730713 percent. The coefficient of real income RGDP has a positive sign; this implies a positive relationship between real broad money Demand $M_2$ and real income RGDP. In other words, if real income increases, real money demand M2, is likely to increase by 1.101049%. This sign agree with the a-priori expectation. The t- value of RGDP shows that the coefficient is statistically significant at 5 percent.

The coefficient of Domestic interest rate ("own" rate of return) has negative relationship with the $M_2$. This means that if own rate of return increases, Real money demand $M_2$ will decreases by -0.050922%. This is not in line with the a priori expectation and the result is statistically insignificant to the study at 5 percent level.

The inflation rate coefficient show positive relationship with the dependent variable ($M_2$). The implication is that if inflation rate rises, the demands for money will increase thereby decrease the value of money by 0.092701 percent. But a unit fall in inflation rate, the demands for money will decrease thereby increases the value of money by 0.092701 percent. This conforms to the a priori expectation and also statistically insignificant to the study at 5 percent level of significance.

The effective exchange rate coefficient has a positive sign. This implies that if the exchange rate appreciates, the real money $M_2$ demand will increases

by 0.092021. The result is in line with initial expectation but statistically significant to the study at 5 percent level of significance.

However, the foreign interest rate shows that there exist a negative relationship between (FIR) and the ($M_2$). This implies that if foreign interest rate declined the ratio of M2 demand mobility will increase by -0.129514%. The result is statistically insignificant to the study at 5 percent level, but in line with a-priori expectation according to Handa's (2000).

Having examined the a-priori assumption relationship between the dependent variable and the independent variables, we then turn to evaluate the statistics and econometrics, a-priori certain of the results in table 4.2.1 b above.

The $R^2$ square result is very high and strong showing = 0.980326 percent. The implication is that total variation in real $M_2$ demand could be explained up to 0.98 percent by the variables in the right hand side of the equation. While 2% out of 100% percent of variation in real broad $M_2$ demand in Nigerian were explained by other variables not included in the model. It is clear that the model has a food fit.

The f- ratio, (the joint influence of all the parameter estimated in the model) is statistically significance at 5 percent. The calculated value of f- ratio stood at 348.7986 percent, greater than the Tabulated or f- critical value at 1.37 percent.

The test for incidence of serial correlation or autocorrelation (Durbin-Watson) stood at 1.835848%. This shows the presence of first order autocorrelation in the model. In other word, some of the causes of low real broad $M_2$ demand in Nigeria between 1970 -2010 are due to economic factors such as low domestic production, high level of importation, and capacity underutilization in industries etc.

## 4.3 T-statistic Results.

**Table 5: T-statistic Observation**

| Variables | T-cap | T-tab 5% level | Observation | Decision Rule |
|---|---|---|---|---|
| Log RGDP | 7.492404 | 1.697 | T-cap > T-tab | Statistically Significant |
| Log DIR | -1.052262 | 1.697 | T-cap < T-tab | Statistically Insignificant |
| Log EER | 2.210785 | 1.697 | T-cap > T-tab | Statistically Significant |
| Log IFR | 0.601526 | 1.697 | T-cap < T-tab | Statistically Insignificant |
| Log FIR | -1.008040 | 1.697 | T-cap < T-tab | Statistically Insignificant |

**Source:** E-views 3.1 Estimate results output

T-test which was used to test for the statistical significance of the individual estimated parameters is employed in this study. Using 5% level of significance at 35 degree of freedom, the tabulated t-value is 1.697 while calculated t-value for the regression coefficients are; LOG (RGDP) is 7.492404, LOG (DIR) is -1.052262, LOG (EER) is 2.210785, LOG (IFR) is 0.601526 and LOG (FIR) is -1.008040. The calculated t- values of most

variables were less than the tabulated t- value at 5% level of significance; we therefore conclude that RGDP and EER are the only significant independent variable while others are insignificant to this study.

## 4.4 Chow-Test. Results

Theoretically, chow-test is used to check if structural changes have in fact occurred in the relationship between the regressed ($M_{2)}$ and the repressor (RGDP, DIR, IFR EER and FIR). By structural change, we mean that the values of the parameter in the three equations, does not remain the same both in the sub period and the entire period.

**Table 6: Chow-Test. Results**

| Periods | C | logGDP | logDIR | logEER | logIFR | logFIR | RSS | $R^2$ |
|---|---|---|---|---|---|---|---|---|
| 1970-1991 | -1.767695 | 0.896570 | 0.244218 | 0.256021 | 0.461172 | -0.134696 | 0.439854 | 0.989045 |
| $n_1$= 22 | (-0.575709) | (4.812796) | (1.032176) | (0.773884) | (1.643308) | (-0.344021) | | |
| 1992-2010 | -0.757879 | 0.857006 | 0.028318 | 0.228963 | 0.604695 | -0.001252 | 0.232306 | 0.991870 |
| $n_2$ =19 | (-0.303470) | (5.687982) | (0.126968) | (0.855062) | (2.588328) | (-0.003842) | | |
| 1970-2010 | -2.730713 | 1.101049 | -0.050922 | 0.092021 | 0.09270 | -0.129514 | 6.479747 | 0.980328 |
| $N_1$ 41 | (-1.802990) | (7.492404) | (-1.05226) | (2.210785) | (0.601526) | (-1.008040) | | |

**Source:** E-views 3.1 Estimate results output

Therefore, the F- value formula:-

$$\mathbf{F^x = \frac{(RSS_r - RSS_{ur})\ K = f\ (k(\ n_1 + n_2 - 2k\ ))}{RSS_{ur}/(n_1 + n_{2-\ 2k})}}$$

Where the

$\mathbf{F^x}$ = f value computed from the result in the Model,

$RSS_r$, = Residual sum of squares restricted form the results of the pull observation (1970-2010) with degree of freedom (6- 41) = 35.

$RSS_{ur}$ = Residual sum of square obtained from $RSS_1$ +$RSS_2$ sub period (i.e. 1970 - 1991 $Rss_1$ and 1992 – 2010 $Rss_2$), with degree of freedom $(n_1+n_2– 2k) = (6, 41) = 35$.

Where,

$n_1 + n_2 –2k$ = is the number of observation from the sub period, i.e. $n_1 = 22$ and $n_2 = 19$.

2k = two multiplied by k,

k = is the number of parameter's in the model = 6.

However, recall that we have chosen 5 percent level of significance. Therefore, from the results presented above, following the Formula stated above, its analysis is as follows:-

$RSS_R$ = 6.479747

$RSS_1$ = 0.439854

$RSS_2$ = 0.232306

K = 6

$n_1$ = 22, $n_2$ = 19

**Therefore**,

$$F = \frac{(6.479747 – 0.672154)/6}{0.672154/\ 22 +19 - 2(6)}$$

$$F^X = \frac{(6.479747 – 0.672154)/6}{0.672154/\ 41 - 12}$$

$$F^x = \frac{(5.807593)/6}{0.672154/(29)}$$

$$F^x = \frac{0.967932166}{0.02317724}$$

$$\mathbf{F^x} = \mathbf{41.762}$$

he F-critical ratio = 1.37 (6, 35) df.

**Decision Rule**:-

The rule stated that the null hypothesis of no structural change should be rejected if the computed $f^x$ – value greater than the critical f- ratio at the chosen level of significance. Therefore, we agree that $f^x$ > f-tab (i.e. f- value computed is = 41.762), is greater than the f–value tabulated that stood at (1.37). We then reject the null hypothesis that said no structural changes and accept the alternative hypothesis that there exist structural changes. The second test of this hypothesis in the chow-test is that the sample population error terms $u_{1t}$ and $u_{2t,}$ are independently distributed.

Where,

$u_{1t}$ = the error term in equation one having the period from 1970 - 1991.

$u_t$ = the error term in equation two having the period from 1992 – 2010.

Then we test the hypothesis that say's:-

1. $H_O$: $б^2_1 = б_2^2$ that is, the variances in the subpopulation is the same.

   $H_1 = б_2^1 \neq б_2^2$ that is, the variances in the subpopulation are not the same.

However, the two true error variance is not observable; thus, we use their estimated value to compute their variance below

$б_1^2 = \underline{RSS_1} = \underline{0.439854}$

$n_1 - 6 = 22 - 6$

$б_2^2 = \underline{RSS_2} = \underline{0.232306}$

$n_2 - 6 = 19 - 6$

Where $б_1^2$ and $б_{2,}^2$ stands for the estimated variance. $Rss_1$, $Rss_2$ and $n_{1,}$ $n_2$, remain the same thing in meaning. Thus, $F^x = б_1^2/б_2^2$

Therefore, $б_1^2 = 0.439854 / 16 =$, $\mathbf{б_1^2 = 0.027490875}$

$б_2^2 = 0.232306 / 13 =$ $\mathbf{б_2^2 = 0.017869692}$

Here, the larger value of variance assumed the numerator while the small value of the estimated variance assumed the demodulator.

Therefore, $б_1^2/б_2^2 = 0.027490875 / 0.017869692$

$\mathbf{F^x = \underline{1.538}}$

With the degree of freedom (6, 35), the F - critical value at 5 percent stood at 1.37. Therefore $F^x$ - value of variance computed = 1.538, is greater than the F- critical value 1.37. We then reject the null hypothesis and accept the alternative hypothesis which said that the subpopulations are not the same.

The purpose of this model is to check if structural change occurred in Nigerian economy with reference to our topic. However, from the results and decision on the hypothesis above, we could see that the entire null hypotheses three of this study were rejected. In other word, there is a structural change in

the Nigeria economy during the period under review (19970-2010). The second purpose of this chow test to our research is to find out the point at which the break in the underlying relationship might have occurred. This point is called point of break which from the results is located around 1992 and 1993 as find in the test.

However, in testing the null hypothesis one of this study, we employed stability test of cumulative recursive sum of residual (CUSUM) and cumulative sum of recursive residual squares (CUSUMSQ) procedures by (Brown, Durbin and Evans1975). Thus, the results of this test are presented below.

**Figure 1a: Stability Test Results**

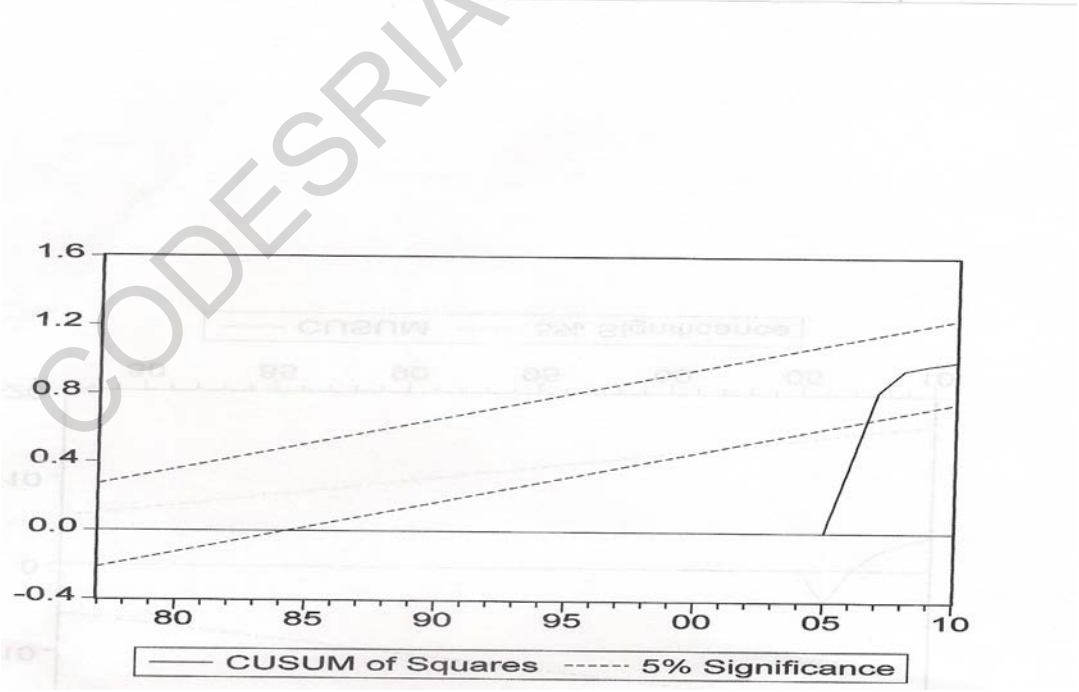
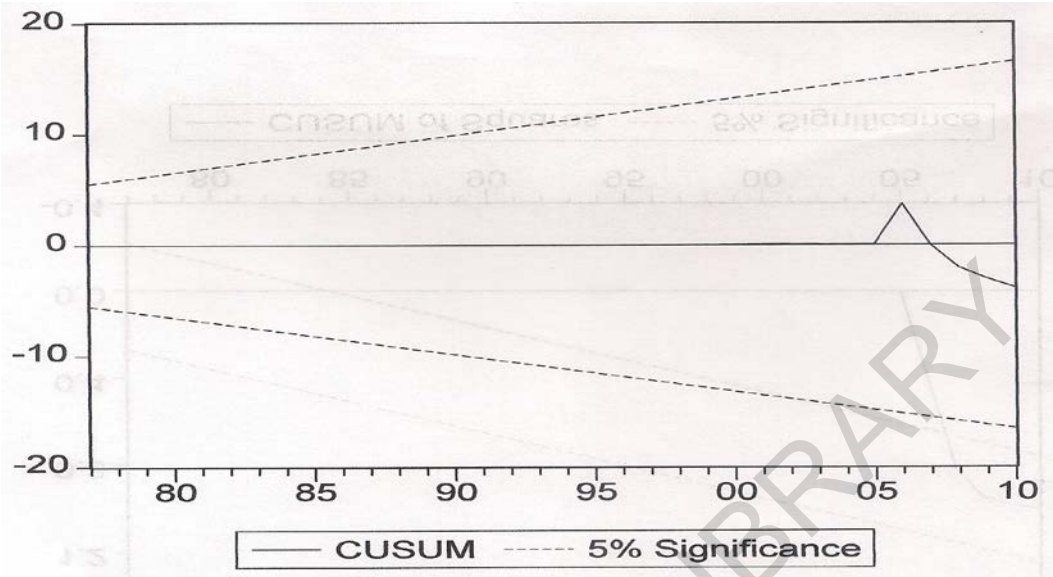


**Figure 1b: Stability Test Results**






In this section, the central issue for empirical analysis here is the stability of real $M_2$ demand equation, which we reported in figure 1 and 2. It is now a standard practice to incorporate short-run dynamics in testing for demand equation. To this end, we follow Brown, Durbin and Evans (1975) to apply the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) to residuals of chow test. The CUSUM and CUSUMSQ test statistic are updated recursively and plotted against break points in the data. For stability of short-run dynamics and the log-run parameters of real $M_2$ demand function, it is important that CUSUM and CUSUMSQ statistic should stay within the 5 percent critical bound line, represented by two straight lines. The test finds parameter instability if the

CUSUM and CUSUMSQ go outside the area between the two critical lines. In other word, the significance of any departure from the zero line is assessed by referencing to a pair of 5 % significance lines; these plots were shows in Figure 1 and Figure 2.

However, form the results (plots) above, it is clear that only the cumulative recursive sum of residual (CUSUM) plotted is significant and has the right picture in Figure 1 above. While the cumulative sum of recursive residual squares (CUSUMSQ) Figure 2 is statistically insignificant at 5% level of significance. This means that the parameter ($M_2$) is unstable during this period of observation (1970-2010). The outcome of these results may be affected by the presence of the structural change effect as we found with the chow test result above. Thus, since there is a structural change effect during this period of review, it will be very difficult for the broad money demand to be stable throughout these periods of observation. Therefore, we accept the null hypothesis one of this study that side that there has been no stability of money ($M_2$) demand function in Nigeria from 1970-2010 and reject the alternative hypothesis that there has been stability of broad money demand function in Nigeria over the period of (1970-2010).



### 4.5 Granger Causality Test Results.

The attempt to study stability of the money Demand function in Nigeria, led the researcher to subject the relationship between the $M_2$ the

dependent variable, real income (GDP) and inflation rate (IFR) explanatory variables for test of causality. The aim of this test is to test the hypothesis two of this study as stated in chapter one. (I.e. to check which of the variables Granger causes the direction and movement of the dependent variable $M_2$).

**Table 7: Granger Causality Test Results**

| Direction of causality | Number of Lag | f- computed value | Decision | f- critical value at (6, 39) |
|---|---|---|---|---|
| RGDP→ $M_2$ | 2 | 12.16.56 | Reject $H_o$: | 1.37 |
| $M_2$ → RGDP | 2 | 1.01316 | Accept $H_o$ | 1.37 |
| IFR → $M_2$ | 2 | 9.14386 | Reject $H_o$: | 1.37 |
| $M_2$ → IFR | 2 | 0.13307 | Accept $H_{0:}$ | 1.37 |

**Source: E-views 3.1 Estimate results output**

From the Table 7 above, we used the Granger test to find out if there exist causal relation between the stated variables and the nature of causality that could exist between real incomes (RGDP), inflation, and real broad $M_2$ demand in Nigerian economy, from periods of 1970 – 2010, at two lags value. The arrows in table 7 denote the direction of the null hypothesis, suggesting that the variable in the left side does not Granger causes the variable in the right side. However, form the results we compare the computed $F^x$ – value with reference to the critical f -ratio at 5 percent level of significance for final Decision.

These results suggest that real income RGDP, do granger causes real money demand $M_{2.}$ Since the RGDP estimated coefficient is 12.1656 different form zero and statistically significant at 5 percent level of critical value 1.37. While the estimated coefficient of $M_2$ is 1.01316, suggest that $M_2$ does not

granger causes RGDP. The implication is that change in the pass value of the real income (RGDP) will impact a positive significant change on the present and future value of the real broad money demand by 12.1656. While on the other round, the pass value of the real broad money demand will not in any way impact neither positive nor negative significant change on the present value of the real income (RGDP) since the results shows statistically insignificant at 1.37 critical value.

Thus by decision rule, we then reject the null hypothesis and accept the alternative hypothesis that there is causality or that RGDP, granger causes $M_2$ but $M_2$ does not granger causes RGDP. In other word, the result implies unidirectional nature of causality between RGDP and $M_2$.

The estimated coefficient value of inflation rate (IFR) is 9.14386 while the coefficient value of $M_2$ is 0.13307. The results suggest that IFR do granger causes real money demand $M_2$, while $M_2$ does not granger causes change on real income (RGDP). However, since the IFR estimated coefficient stood at 9.14386, different form zero and statistically significant at 5 percent level of critical value 1.37 thus by decision rule, we reject the null hypothesis and accept the alternative hypothesis that there is causality or that IFR, granger causes $M_2$ but $M_2$ does not granger causes IFR. In other word, it means that the IFR and $M_2$ result has also a unidirectional nature of causality.

## 4.6 Johansen Co-integration Test Results

**Table 8: Panel A, D(M2,2) D(RGDP,2) D(DIR,2) D(EER,2) D(IFR,2) D(FIR,2)**

| Eigenvalue | Likelihood Ratio | 5 percent Critical Value | 19 percept Critical Value | Hypothesis No.of CE(s) |
|---|---|---|---|---|
| 0.992913 | 531.5783 | 94.15 | 103.18 | None [xx] |
| 0.979706 | 353.3945 | 68.52 | 76.07 | At most1[xx] |
| 0.907966 | 213.0879 | 47.21 | 54.46 | At most 2[xx] |
| 0.797339 | 127.2064 | 29.68 | 35.65 | At most 3[xx] |
| 0.732985 | 69.74246 | 15.41 | 20.04 | At most 4[xx] |
| 0.460352 | 22.20618 | 3.76 | 6.65 | At most 5[xx] |

**Source: E-views 3.1 Estimate results output**

x (xx) denotes rejection of the hypothesis at 5% significance level.

L.R test indicate 6 Co-integration equation(s) at 5% significance level. Form the results above; the eigenvalue statistic determines whether co-integrated variables exist under Johansen's method. Co-integration is said to exist if the values of computed statistics are significantly different from zero. The likelihood Radio is higher than 5 percent critical value. This implies that the likelihood Radio of $D(M_{t2},2)$, $D(RGDP_t,2)$, $D(DIR_t,2)$, $D(IFR_t,2)$, $D(EER_t,2)$ and $D(FIR_t,2)$ are greater than the critical values at 5 percent and 1 percent level of significance. In other word, the null hypothesis of no co-integration among the variables is rejected. Since the Johansen co integration test, shows that at least six equations are co-integrated. The result also shows that there exists Long-run Equilibrium relationship in five co-integrating equations, at 5 percent significance level. This implies that Nigeria $M_2$ stability is affected by Long-run Equilibrium relationship in these independent

variables. Thus, the economic interpretation of the Long–run broad money demand function can be obtained by the normalized estimated of the unconstrained co-integrating vector on the real $M_2$. The results below are the Long- run elasticity of the co-integrating vector for the Long-run broad money demand function.

**Table 9: Panel (B) Log -run Co-Integrating Equations**

| Variables | Coefficients | Prop |
|---|---|---|
| C | 14042.75 | 1.000000 |
| D(RGDP,2) | -6.951257 | 0.78833 |
| D(DIR,2) | -3355.972 | 171.740 |
| D(EER,2) | 141982.5 | 17935.1 |
| D(IFR,2) | 154317.6 | 82333.7 |
| D(FIR,2) | -217248.6 | 20617.5 |
| Log-likelihood | -1926.332 | |

**Source: E-views 3.1 Estimate results output**

Normalized Co-integration Coefficient: 1counteracting Equating(s)

The result in panel B shows a negative and statistically significant relationship between the demands for real broad money and real income during this period of study. This result is inconsistent with economic theory. This suggests that in log-run, economic agents (i.e. house-hoods) held more money as their income decreased. Importantly, the coefficient of Johansen co-integration on real income RGDP, indicate that the long-run income elasticity for real broad money is -6.951257, the high coefficient of the long-run income elasticity may appear to contradict the hypothesis of economics of scale in money holding predicted by the transaction and precautionary theories, however, as we may recall, we use a broader definition of money ($M_2$) which

includes some asset such as saving balance and time deposits because they provide liquidity service after the deregulation of the Nigerian economy in 1986. These assets component of $M_2$ reflect portfolio demand instead of $M_1$ which is dominated by current transaction needs, therefore, the portfolio demand components $M_2$ could make them a superior good for household for whose assets are viable. This implies that the lower the RGDP and DIR, the higher the households demand for real broad money ($M_2$) by (-6.951257) respectively. On the other hand, inflation is positively related to real money demand in the log-run. This means the higher the rate of inflation on the alternative asset, the higher the demand for money and thus the lower the value of money in the economy by (154317.6).

The coefficient of the foreign interest rate is negative and statistically significant. These results highlight the importance of foreign effects in explaining the demand for money holdings in Nigeria during the sample period. The statistically significant negative coefficient of the foreign interest rate variable supports the argument of capital mobility effect with respect to the portfolio balance and implies that in the log-run, capital mobility effect with respect to $M_2$, ranked (-217248.6%). The exchange rate depreciation exist a positively relationship with the real money demand. This indicates that in log-run, the higher exchange rate the higher the demand for money by (141982.5%). But more importantly, the statistically significant positive

coefficient of the effective exchange rate appreciation indicates the existence of the currency substitution depreciation in Nigeria economy.

However, the results show the direction and strength of relationship between the explanatory variables and dependent variable in the Long- run. The constant value shows 14042.75, these indicate that the average level of Real money demand $M_2$ in Nigeria approximately is 140 units if other variables are held constant. The sign of the constant value is positive which means that the proportion in the Real money demand $M_2$ in Nigeria tends to increase, if other variables are held constant in the Long- run.

**Table 10: Error Correction Model Result**

| Variables | Coefficient | Std. error | t –statistic |
|---|---|---|---|
| C | -888704.2 | 1623022 | -0.547561 |
| RGDP | 0.464388 | 0.242065 | 1.918445 |
| DIR | -356.3668 | 390.1985 | -0.913296 |
| EER | 9781.500 | 19327.65 | 0.506088 |
| IFR | 34250.06 | 29149.51 | 1.174979 |
| FIR | -20462.53 | 40934.16 | -0.499889 |
| ECM(-1) | -0.300897 | 0.168217 | -1.788743 |

**Source:** E-views 3.1 Estimate results output

R squared 0.492787

F, statistic 5.343574

The result shows that the short-run changes in D(RGDP), D(EER), D(IFR), has a positive impact on short-run change in real broad money demand D($M_2$,). While the short-run change in D(DIR) and D(FIR) has a

negative influence on the short-run real broad money demand D($M_2$,). Therefore, we can interpret the above changes value in D(RGDP), D(DIR), D(IFR), D(FER),D(FIR), as the short-run value, while the value in the co-integration result are called their long-run value.

The examination of the econometric results shows that the overall fit is satisfactory with an R-squared of 0.49. Thus 49% of the systematic variation in the real broad money ($M_2$) is explained by the ECM. The F-statistic of 5.343 is also significant at the 5% level. The coefficient of ECM is significant at the 3% level and it is negative. Thus, it will rightly act to correct any deviations in the dependent variable ($M_2$) from its log-run equilibrium value. Statistically, the equilibrium error term is different from zero (-0.300897), suggesting that $M_2$ will adjust to changes in these independent variables in next three year. This result can be subjected to be used for economics policies and forecasting decisions.

# CHAPTER FIVE

# DISCUSSION

This study intended to x-ray the stability of money demand function in Nigeria and the extent to which it has functioned. Based on the results of the previous chapter (four), we discuss the following findings.

## 5.1 Unit Root Results

The unit root test results examined in the previous chapter suggest that the series are random walk processes at their levels as it was presented in table 2 and 3. This suggested that variables were non-stationary at their level form except RGDP and $M_2$ with the applications of ADF and PP unit root test results. However, from the result, we found that RGDP, EER, IFR, and FIR exhibit random walk behaviour after first difference, while $M_2$ and DIR exhibit non-random walk behaviour after first difference in the ADF test. Thus in the PP-unit root test result, all the variables were non-random walk behaviour after first difference expect IFR. Thus, all the series qualified to be included in the model to be estimated having exhibited the fundamental time series feature of mean reversion after the second difference with the ADF and the PP-unit root test results in table 2 and 3 of chapter four. The modeling implication is the elimination of the danger of estimating a model with spurious results. Obviously, the model estimated is free from miss leading information and can be use for forecast and good policy. The (OSL) results findings bring to a limelight some variables that determine real money

demand function in Nigeria; such are RGDP, DIR, and IFR, EER, FIR. The estimated coefficient of RGDP, FIR, EER and FIR has the right sign in accordance with the economic theories or expectation. Thus, the implications of this right sign of the above variables is that a unit (change) increase in any of them will bring a (change) increase to the dependent variable ($M_2$). The reason for this right sign could be attributed to a change in how fast people path with money and rate on how people want to pay for things in Nigeria economy and finally how effectively monetary policy has been conducted in Nigeria. While the estimated coefficients of DIR alone, is not in accordance of the expectation. Thus, this clued be attributed to the level of linkage and discriminations of interest rate charges to economic sectors in Nigeria during the period under review. In terms of statistical relevance of these variables to this study, ‘‘own’’ rate of return (DIR) foreign interest rate, (FIR) and inflation rate (IFR) were statistically insignificance to the study while RGDP, and EER were statistically significance to this study. The implication is that RGDP and EER have a strong impact to $M_2$ money demand function in Nigeria economy, while DIR, IFR and FIR have weak impact to the study. This confirmed the linkages and instability movement in these monetary variables. On this point, this proves that $M_2$ choice by CBN during the periods is not a viable monetary policy instrument in Nigeria since most of the variables used during the period were insignificant at 5% level of significance,

meaning that those variables could allow the real economic sectors to operate normal.

The coefficient of determination ($R^2$) rank 0.98% very high, The $R^2$ ratio implies that the variation in $M_2$ in Nigeria economy since 1970 - 2010, is explained by the independent variables and that just 2% out of 100% of the variation are those factors not including in the model but were captured by the error term in the model and this shows a good fit. In other words, any change in either of the variables, will likely have a strong effect on Nigeria real money demand function. The F-ratio stood at 348% is very high meaning that t-statistic of those series was significant. Thus, the D.W stood at 1.83% showing little presence of autocorrelation among the explanatory variables. However, these results related to some earlier findings; such are study carried by Muhd-Zulkhibri and Majid, (2004), Emmanuel Anoruo (2002). Meanwhile, the objectives and hypothesis of this study were properly carried out and its discussion is as follows:

## 5.2 Long-run Real Money Demand Function in Nigeria

The objective, hypothesis one of this study was tested using johansen co-integration test and Brown, Durbin and Evans (1975) stability test of cumulative recursive sum of residual (CUSUM) and cumulative sum of recursive residual squares (CUSUMSQ) procedures. The co-integration test found that at least six equations were co-integrated. This result suggested that there exists long-run equilibrium relationship in five co-integrating equations

tested. Importantly, the coefficient of Johansen co-integration on real income RGDP, and domestic interest rate DIR indicate that the long-run income elasticity and domestic interest rate for real broad money were negative and ranked (-6.951257,-3355.972) respectively. The high coefficient sign of the long-run income elasticity is small and may appear to contradict the hypothesis of economics of scale in money holding predicted by the transaction and precautionary theories, however, as we may recall, we use a broader definition of money ($M_2$) which includes some asset such as saving balance and time deposits, because they provide liquidity service after the deregulation of the Nigerian economy in 1986. These assets component of $M_2$ reflect portfolio demand instead of $M_1$ which is dominated by current transaction needs, therefore, the portfolio demand components $M_2$ could make them a superior good for household for whose assets are viable. This implies that the lower the RGDP and DIR, the higher the households demand for broad money. On the other hand, inflation rate elasticity is positively large, rising up to (154317.6%) related to real money demand log-run. This means the higher the rate of inflation on the alternative asset, the higher the demand for money and also the lower the value of money in the economy.

The coefficients of the foreign interest rate and effective exchange rate appreciation were with the right signs (i.e negative and positive) and statistically significant. These results highlight the importance of foreign effects in explaining the demand for money holdings in Nigeria during the

sample period. The statistically significant negative coefficient of the foreign interest rate variable supports to the argument of capital mobility effect with respect to the portfolio balance, but more importantly, the statistically significant positive coefficient of the effective exchange rate appreciation indicates the absence of the currency substitution in Nigeria.

However, the results show the direction and strength of relationship between the explanatory variables and dependent variable in the long- run. The constant value shows 14042.75, these indicate that the average level of Real money demand $M_2$ in Nigeria approximately is 140 units if other variables held constant. With this, we conclude that it was found in objective one, that there is long-run real money demand function in Nigeria. But on the other hand, the (CUSUM) and (CUSUMSQ) stability test of $M_2$ coefficient was found to be unstable. The central massage for this objectives and hypothesis one of the study is the stability of real $M_2$ demand function which was reported in figure 1 and 2. The (CUSUM) plotted was significant and has the right picture in Figure 1 chapter four. While the cumulative sum of recursive residual squares (CUSUMSQ) Figure 2 was statistically insignificant at 5% level of significance. The significance of this result is that the broad money ($M_2$) demand function is unstable during this period of observation (1970-2010). The outcome of these results (Figures) is affected by the presence of the structural breaks effect as we found with the chow test result chapter four. Thus, since there is a structural changes effect during this

period of review, it will be very difficult for the independent or the determinants variables of broad money demand to be stable throughout these periods of observation and since the rule of the above test stated that for the stability of dependent coefficient ($M_2$) both plotted graph must be within inside the 5% line otherwise is instability. Based on these findings above, we accept the null hypothesis one that said “There has been no stability of money ($M_2$) demand function in Nigeria since 1970-2010 and reject the alternative hypothesis.

This finding disagreed with some of the earlier reaschers whom study on the relate subject matter. Such researchers were; Oluwole & Olugbenga (2010), Okechukwu, Agu and Onah (2006) and Akpa (2008) were Nigerian researchers while Muhd-Zulkhibri & Majid.A.(2004), and Katafono (2001) researchers from Fiji, and Malaysia. They found $M_2$ demand function in those countries to be stable in the absence of structural breaks effect while log-run equilibrium function (co-integration) was found with respect to the variable used in those countries. The reason to this disagreement of the findings could be that first, they made use of quarterly data, secondly, they failed to include foreign interest rate, and year of observation is not less than 30year. This could contribute to their failure to capture currency substitution and the element of capital mobility in their studies, although the sample observation is not the same.

## 5.3 Causal Relationships between $M_2$, and Real Gross Domestic Product, Inflation Rate and the Nigeria Broad ($M_2$) Money

The objective, hypothesis two of this study was tested using granger causality test. We found that there is causality or that RGDP, IFR granger causes $M_2$ but $M_2$ does not granger causes RGDP and IFR. In other word, the result implies unidirectional nature of causality between RGDP, IFR and $M_2$. The implication is that change in the pass value of the real income (RGDP) and inflation rate (IFR) will impact a positive significant change on the present value of the real broad money demand by (12.1656, 9.14386) While on the other round, the pass value of the real broad money demand will not in any way impact neither positive nor negative significant change on the present value of the real income (RGDP) and inflation rate (IFR) since the results shows statistically insignificant at 1.37 critical value. The reason to the above results (unidirectional nature of causality between RGDP, IFR and $M_2$) is as a result of $M_2$ demand function been instable and also the effect of the structural breaks in the economy during the period under review (1790-2010). Based on the results, we reject the null hypothesis two of this study and accept the alternative hypothesis that said that there is causality or that RGDP, IFR granger causes $M_2$ but $M_2$ does not granger causes RGDP and IFR in Nigeria from 1970-2010. However, this result is in agreement with some researcher in Nigeria, such are Okechukwu , Agu and Onah (2006), Carlos J. G. (2010),

Akpa (2008) although the sample observation is not the same, but the same annual date.

## 5.4 Presence of Structural breaks in the Nigerian Long-run Demand for Broad Money Equilibrium Relationship from 1970 - 2010.

Form the chow test, we found that there is the presence of structural breaks effective in Nigeria form 1970 to 2010, and the points of this structural breaks is found to be around/between 1992 and 1993. Having followed the step or the procedure and the lay down rule of this test (chow test), we found that the two f-computed value were greater than the f-critical value, and that the parameters in the three equations were not the same, we rejected the hypothesis three and accepted the alternative hypothesis that said there is structural break effect on Nigeria money demand equilibrium relationship during this period under review (1970-2010). The implication of this results is that the effect of the of the Nigeria civil war (Biafra war ended 1970), structural adjustment programme (SAP 1986), in stability in government (from military regime to civilian government), twenty five billion reserve (CBN financial institution reformation in 2004) and the economic melt-down of the 2007, and so on can not be easily wipe or removed in the Nigerian economic system. The reason is that these factors represent and act like random walk variables effect. Thus, the results is in line with some Nigerian researchers like; Mbutor .M. (2009), and Olayinka .I. (2009).

Finally, the Error correction model result and its implication to this study were also discussed. From the result, it we found that the ECM is negative. This is in line with the decision rule and expectation of the ECM. This implies that change in $M_2$ demand function in Nigeria is above the equilibrium value and will start falling by (-0.30) % in the next three period to correct the equilibrium error. Statistically, the equilibrium error term is different from zero (-0.300), suggesting that $M_2$ will adjust to changes in these independent variables in the next three periods. However, the result suggests a low speed of adjustment of M2 to its disequilibrium (i.e. the gap between the log-run and the short-run period). The overall fit is satisfactory as the $R^2$ squared shows 0.492787. Thus, 49 % of the systematic variations in the real money demands ($M_2$) are explain by the ECM. The significance is that the model has a good fit and will act rightly to correct the disequilibrium in the $M_2$ demand function with low speed of adjustment of 3 per cent. However the negative result of ECM is in line with the work done by Okechukwu, Agu and Onah (2006), but the speed of adjustment (ECM) result was very high at 98% although the variables and period of observation was not the same. Another study that was in agreement with the (ECM) result of this study was the work of Oluwole & Olugbenga (2010). The researchers made use of the same variables but not the same period of observation, and not annual but quarterly data.

# CHAPTER SIX

# SUMMARY, CONCLUSION AND RECOMMENDATIONS

## 6.1 Summary

This study examines the stability of the money demand function in Nigerian, using 1970 2010 time frame. The study covers six chapters.

The first chapter being the introduction covers the background of the study, statements of the problems, objectives of the study, significance of the study, hypothesis, scope and limitation of the study. A review of relevant literature as it relates to the Nigerian economy was the focus of chapter two. An overview of the theoretical and empirical analysis of the subject matter was considered. Chapter three is research methodology, research design, model specification and method of evaluation. The fourth chapter includes presentation of regression results and analysis of results. While discussion of findings, is the focus of chapter five. A general review of chapter one to five is summarized here in chapter six in line with it summary, conclusion and recommendations, which were based on the observations of the study.

Thus, the null hypothesis one of this study which said that "There has been no stability of money ($M_2$) demand function in Nigeria since 1970-2010 was accepted while the alternative hypothesis was rejected after the evaluation of Johannes co-integration test and Brown, Durbin and Evans (1975) stability test of cumulative recursive sum of residual (CUSUM) and cumulative sum of

recursive residual squares (CUSUMSQ) procedures. Because the (CUSUMSQ) stability test of $M_2$ coefficient was found to be unstable.

However, the null hypothesis two of this study on the other hand was rejected with the evaluation of granger causality test. We found that there is causality or that RGDP, and IFR granger causes $M_2$ but $M_2$ does not granger causes RGDP, and IFR. form the chow test, we found that there is the presence of structural breaks effective in Nigeria form 1970 to 2010, and the points of this structural breaks was found to be around/between 1992 and 1993. We rejected the hypothesis three and accepted the alternative hypothesis that said there is structural break effect on Nigeria money demand equilibrium relationship during this period under review (1970-2010).



## 6.2 Conclusion

The study examined the validity of the choice of $M_2$ as an intermediate target by modeling and testing for the stability of the money demand function in Nigeria during the period 1970 – 2010. In this empirical study, we employed ordinary least square, chow- test, stability test, Granger causality test, unit root, error correction model, and co- integration procedure which shows that there is a long- run relationship between real broad money ($M_2$), real income (RGDP), inflation rate (IFR). The statistical significance of the exchange rate in the equation modeled suggested that currency substitution does not exist in Nigeria. The foreign interest rate results revealed that the

Nigerian economy is not susceptible to external shocks through capital mobility/ flight. As a result of structural changes effect experienced in the economy which occurred during the period of 1992/1993, the parameters of the real $M_2$ demand equation tested with stability test of Brown (1975), remained unstable over the entire period of the study analyses.

However, the instability of money demand function in Nigeria can be said not to support the CBN choice of $M_2$ as an intermediate target for monetary policy. However, it is important to note that the fact that currency mobility and substitution exerts tremendous pressure from the foreign interest rate exchange rate, and this may reduces the CBN ability to assert control over money supply. Furthermore, it was reveal from the study that CBN chose of $M_2$ as the appropriate intermediate target for monetary policy during the SAP and after, was the inappropriate one and was not strongly committed to control some of the monetary linkages and its trend in the economy. This could be explained by the coefficient of error correction result that stood at (0.3) % adjustment gap and the sub-population variance of the break point that shows 1.538 percents.

The ability to stick to trends resulted in severe deviations, which impacted the real RGDP growth and inflation rate adversely. This could be seen by causality nature of the variables. Base on these findings, the researcher concluded that the stability of broad money ($M_2$) demand function as an intermediate target was the not right choice since it was found to be

unstable. Therefore, CBN should commit exchange rate value, inflation rate and domestic interest rate as targets to minimize the deviations of $M_2$ or currency instability in the Nigeria money demand function.

## 6.3 Policy Recommendations.

In our first model, inflation rate and Domestic interest rate by theory seem to be the most active moving variables of Real money $M_2$ demand function in any economy, but these shows statistically insignificant to this study. Therefore, there is need for effective, efficient and realizable macro policies management for Nigeria's currency toward interest rate "own return" and price level. The implication is that, an appreciating and depreciation position of Domestic own rate return and inflation rate respectively in Nigeria currency, will induces real income and real money balance which likely will reflect to portfolio demand and investment expansion in the county, thereby reduces the rate of unemployment, increase the domestic product, self reliance and reduction in poverty level in Nigeria since interest rate is a transmission mechanisms variable in economics. It is therefore recommended that policies that can effectively improve the value of the own rate return (DIR) and inflation rate (IFR) in Nigerian Domestic and international market should be implemented, such policy package should include:

(i) Effective interest rate on credit and money transmission mechanism channels. Since for developing country we Nigeria need a tolerable

interest rate i.e. an interest rate (neither higher and nor low) that will allowed the economic activities to be operational.

(ii) **Interest rate discrimination to sector's:** There is need to implement a policy that will assign a given percent of interest rate on sector's credit allocation from commercial Bank and other financial institution. Whereby higher interest rate should go for unproductive sector's that cannot pay back the principle and interest. While lower interest rate for productive or real sector that can produce and as well pay back the principle and interest charged.

2. Apart from the variables identified, estimated and discussed, the foreign interest rate results reveal that Nigeria economy is not susceptible to external shocks through capital flight. Since over 40 percent of Nigerian international trade is conducted with United States, the US three month Treasury bill and Nigeria naira /US dollar exchange rate are used as foreign interest rate. There is need for effective and efficient function for Nigerian domestic industries, foreign direct investment, and import and export management. The implication is that, there will be Expansion, Effective and Efficient in domestic industries such as, the Nigeria oil and Gas sector (refinery), mining and materials such as cement industry e.t.c. On the other hand Effective and Efficient management in export and import such that encourage domestic prouder will improve the level of gross domestic product thereby, generating increase in Real money demand, reduction in unemployment, foreign shock

control and capital flight. It is recommended that policy that can effectively improve the function of our refineries and other industrial value of the country in international market should be articulated and implemented. Such policy package should include:

(i) Export promotion: this will energize local producer, thus, as soon as export is greater than import, more money will be coming into the economy rather than going out. Export promotion will resuscitate our industries to produce at full capacity, reduce unemployment and alleviate poverty.

(ii) Import Reduction: One of the problems of developing economies like Nigeria is the level of importation. Almost everything is imported. This does not portend well for the exchange rate and foreign interest rate from our co- integration results; this implies that policy for exchange rate stabilization should attract a regime of import reduction, especially of luxurious goods.

3. It is also recommended that Nigeria should make serious policies that will improve Real income/output through private investment, and properly minimization of unrealistic projects by so called politicians, such as youth empowerment project and others.

As the real income RGDP from the estimate stood at 1.10 percent, it is very low. This implies that Nigeria government must be realistic in policies

and project they make in order to achieve macroeconomic objective. These policies that need serious implementation are:

i. Income or salary scale for the country.

ii. Good conditions for private participation

iii. Reeducation in high cost of administration in the Nigerian government. These lead to income inequality that reflects on demonstration demand, economic data linkages and money flight.

4. Finally to achieve the desired economic goals, the CBN should not accommodate excessive monetary expansions, which would allowed the actual $M_2$ growth rates to exceed or deviate from the stable levels at future or current period, since the rate of adjustment is very short (3%, that is in next three period as we observed from the Error Correction model). The level of public and private investment should be very high. Conducive environment for domestic and foreign sector's need serious attention. This will include the right policy framework, conducive socio/political environment and corruption free society.

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## GLOSSARY

**(1) Policy Target:** These are variables for which the government seeks desirable values and are the intermediate goals of macro economic policies.

**(2) Gross Domestic Product (GDP**): This is one of the main measures of economic activity. Gross indicates that it is capital consumption, while domestic, measures activities located in the home country regardless of their ownership. It thus includes activities carried on in the country by foreign owned companies and excludes activities of firms owned by residents but carried on abroad. Product indicates that it measure real output produced rather that output absorbed by residents. GDP is reported at both current and constant prices.

**(3) Demand for Money**: The amount of money people wish to hold or the function determining this. Thus, some economists have referred to the demand for transaction, speculative and precautionary balances but money held for one purpose can always be used for another so it seems more sensible to think in terms of different motives affecting the amount of money holding people want.

**(4) Real Balances**: The money supply divided by a suitable price index. This gives the amount of real goods and services which could be obtained by spending it, changes in real balances are a function of changes in the

money supply and changes in the price level. Real balances rise if the money supply increases proportionally faster than the price level.

**(5) Choice of Inflation Target**: Another relevant term or point to note is the appropriate target to monitor the price level or inflation rate. A price level target sets the path for the price level so that inflation, if above or below the target rate needs to adjust along the line to achieve the price level target in contrast to an inflation target which has the problem of base drift.

**(6) Exchange Rate:** The price of one currency in terms of another. This can be quoted either way round: if one naira is worth two dollars, one dollar is worth of fifty naira.

**(7) Rate of Interest**: The cost of credit. Any borrower normally has to pay the lender more than the principal originally received, the excess is interest. The rate of interest is the interest which has to be paid for a period loan, as a percentage of the principal.

# APPENDICES

## APPENDIX A

| YEAR | $M_2$ | RGDP | DIR | IFR | EER | FIR |
|---|---|---|---|---|---|---|
| 1970 | 978.2 | 5,281.10 | 4 | 0.2 | 99.87 | 0.7143 |
| 1971 | 1,041.80 | 6,650.90 | 4 | 0.2 | 100.93 | 0.6955 |
| 1972 | 1,214.90 | 7,187.50 | 4 | 0.3 | 100.97 | 0.6579 |
| 1973 | 1,522.50 | 8,630.50 | 4 | 0.3 | 94.25 | 0.6579 |
| 1974 | 2,352.30 | 18,823.10 | 4 | 0.3 | 100.78 | 0.6299 |
| 1975 | 4,241.20 | 21,475.20 | 4 | 0.4 | 100.38 | 0.6159 |
| 1976 | 5,905.10 | 26,655.80 | 3.5 | 0.5 | 107.77 | 0.6265 |
| 1977 | 7,898.80 | 31,520.30 | 3.5 | 0.6 | 102.55 | 0.6466 |
| 1978 | 7,985.40 | 34,540.10 | 5.5 | 0.7 | 101.03 | 0.606 |
| 1979 | 10,224.60 | 41,974.70 | 5.5 | 0.7 | 98.22 | 0.5957 |
| 1980 | 15,100.00 | 49,632.30 | 6.5 | 0.8 | 106.28 | 0.5464 |
| 1981 | 16,161.70 | 47,619.70 | 6.5 | 1 | 110.39 | 0.61 |
| 1982 | 18,093.60 | 49,069.30 | 8 | 1.1 | 109.86 | 0.6729 |
| 1983 | 20,879.10 | 53,107.40 | 8 | 1.3 | 109.84 | 0.7241 |
| 1984 | 23,370.00 | 59,622.50 | 10 | 1.8 | 113.2 | 0.7649 |
| 1985 | 26,277.60 | 67,908.60 | 10 | 1.9 | 99.9 | 0.8938 |
| 1986 | 27,389.80 | 69,147.00 | 15.8 | 2 | 51.89 | 2.0206 |
| 1987 | 33,667.40 | 105,222.80 | 14.3 | 2.2 | 14.72 | 4.0179 |
| 1988 | 45,446.90 | 139,085.30 | 21.2 | 3.5 | 12.97 | 4.5367 |
| 1989 | 47,055.00 | 216,797.50 | 23 | 5.3 | 8.88 | 7.3916 |
| 1990 | 68,662.50 | 267,550.00 | 20.1 | 5.7 | 7.72 | 8.0378 |
| 1991 | 87,499.80 | 312,139.70 | 20.5 | 6.4 | 6.34 | 9.9095 |
| 1992 | 129,085.50 | 532,613.80 | 28.02 | 9.2 | 3.74 | 17.2984 |
| 1993 | 198,479.20 | 683,869.80 | 15 | 14.5 | 3.97 | 22.0511 |
| 1994 | 266,944.90 | 899,863.20 | 13.55 | 22.8 | 2.96 | 21.8861 |
| 1995 | 318,763.50 | 1,933,211.60 | 14.27 | 39.4 | 0.74 | 21.8861 |
| 1996 | 370,333.50 | 2,702,719.10 | 13.55 | 50.9 | 0.78 | 21.8861 |
| 1997 | 429,731.30 | 2,801,972.60 | 7.43 | 56.3 | 0.81 | 21.8861 |
| 1998 | 525,637.80 | 2,708,430.90 | 10.09 | 60.7 | 0.81 | 21.8861 |
| 1999 | 699,733.70 | 3,194,015.00 | 14.3 | 64.8 | 0.2 | 92.6934 |
| 2000 | 1,036,079.50 | 4,582,127.30 | 10.44 | 69.2 | 0.2 | 102.1052 |
| 2001 | 1,315,869.10 | 4,725,086.00 | 10.09 | 82.3 | 81.25 | 111.9433 |
| 2002 | 1,599,494.60 | 6,912,381.30 | 15.57 | 92.9 | 88.94 | 120.9702 |
| 2003 | 1,985,191.80 | 8,487,031.60 | 11088 | 106 | 100.62 | 129.3565 |
| 2004 | 2,263,587.90 | 11,411,066.90 | 12021 | 121.9 | 107.06 | 133.5004 |
| 2005 | 2,814,846.10 | 14,572,239.10 | 8.68 | 143.6 | 106.57 | 132.147 |
| 2006 | 40,279,017 | 18,564,594.70 | 8.26 | 155.5 | 105.03 | 128.6516 |
| 2007 | 5,809,826.50 | 20,657,317.70 | 9.49 | 163.8 | 106.41 | 125.8331 |
| 2008 | 9,166,835.30 | 24,296,329.29 | 11.95 | 182.8 | 100.31 | 121.9045 |
| 2009 | 10,767,377.80 | 24,794,238.66 | 13.23 | 205.4 | 121.54 | 150.0124 |
| 2010 | 11,034,940.93 | 29,205,782.96 | 6.52 | 15.8 | 96.75 | 150.6503 |

**Data on Broad Money Demand (M2), Real Gross Domestic Product (RGDP), Domestic Interest Rate (DIR), Inflation Rate (IFR), Effective Exchange Rate (EER), Foreign Interest Rate (FIR).**

**Source: Central Bank of Nigeria statistical bulletin, and CBN Annual Report Statement of Account December, 2010**

# APPENDIX $B_1$

## Augmented Dickey-Fuller Unit Root Test

## ADF Test Result on M2 at Level

| | | | |
|---|---|---|---|
| **ADF Test Statistic** | **-3.572819** | **1% Critical Value*** | **-4.2092** |
| | | **5% Critical Value** | **-3.5279** |
| | | **10% Critical Value** | **-3.1949** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Augmented Dickey-Fuller Test Equation**
**Dependent Variable: D(M2)**
**Method: Least Squares**
**Date: 05/11/12 Time: 09:41**
**Sample(adjusted): 1972 2010**
**Included observations: 39 after adjusting endpoints**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| M2(-1) | -0.824713 | 0.230830 | -3.572819 | 0.0011 |
| D(M2(-1)) | -0.119628 | 0.168496 | -0.709974 | 0.4824 |
| C | -3067767. | 2241479. | -1.368635 | 0.1798 |
| @TREND(1970) | 242139.2 | 105231.7 | 2.301009 | 0.0275 |
| R-squared | 0.476346 | Mean dependent var | | 282920.5 |
| Adjusted R-squared | 0.431462 | S.D. dependent var | | 8277002. |
| S.E. of regression | 6240981. | Akaike info criterion | | 34.22809 |
| Sum squared resid | 1.36E+15 | Schwarz criterion | | 34.39871 |
| Log likelihood | -663.4477 | F-statistic | | 10.61269 |
| Durbin-Watson stat | 2.031573 | Prob(F-statistic) | | 0.000041 |

**Source:** E-views (Vision 3.1) Regression output

## ADF Test Result on M2 at First Difference

| | | | |
|---|---|---|---|
| **ADF Test Statistic** | **-7.497053** | **1% Critical Value*** | **-4.2165** |
| | | **5% Critical Value** | **-3.5312** |
| | | **10% Critical Value** | **-3.1968** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Augmented Dickey-Fuller Test Equation**
**Dependent Variable: D(M2,2)**
**Method: Least Squares**
**Date: 05/11/12 Time: 09:47**
**Sample(adjusted): 1973 2010**
**Included observations: 38 after adjusting endpoints**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(M2(-1)) | -2.095064 | 0.279452 | -7.497053 | 0.0000 |
| D(M2(-1),2) | 0.366351 | 0.159593 | 2.295539 | 0.0280 |
| C | -629112.5 | 2458840. | -0.255857 | 0.7996 |
| @TREND(1970) | 56479.18 | 102081.1 | 0.553277 | 0.5837 |
| R-squared | 0.797978 | Mean dependent var | | 7036.580 |
| Adjusted R-squared | 0.780153 | S.D. dependent var | | 14679263 |
| S.E. of regression | 6882797. | Akaike info criterion | | 34.42625 |
| Sum squared resid | 1.61E+15 | Schwarz criterion | | 34.59863 |
| Log likelihood | -650.0987 | F-statistic | | 44.76618 |
| Durbin-Watson stat | 2.186232 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $B_2$

## ADF Test Result on M2 at Second Difference

| | | | |
|---|---|---|---|
| **ADF Test Statistic** | **-9.775469** | **1% Critical Value*** | **-4.2324** |
| | | **5% Critical Value** | **-3.5386** |
| | | **10% Critical Value** | **-3.2009** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Augmented Dickey-Fuller Test Equation**
**Dependent Variable: D(M2,3)**
**Method: Least Squares**
**Date: 05/11/12 Time: 04:23**
**Sample(adjusted): 1974 2010**
**Included observations: 36 after adjusting endpoints**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(M2(-1),2) | -2.964800 | 0.303290 | -9.775469 | 0.0000 |
| D(M2(-1),3) | 0.767227 | 0.170962 | 4.487694 | 0.0001 |
| C | 1698520. | 3490826. | 0.486567 | 0.6299 |
| @TREND(1970) | -105907.2 | 147569.3 | -0.717678 | 0.4782 |
| R-squared | 0.902326 | Mean dependent var | | -48794.47 |
| Adjusted R-squared | 0.893169 | S.D. dependent var | | 27673675 |
| S.E. of regression | 9045153. | Akaike info criterion | | 34.97780 |
| Sum squared resid | 2.62E+15 | Schwarz criterion | | 35.15374 |
| Log likelihood | -625.6003 | F-statistic | | 98.53987 |
| Durbin-Watson stat | 2.166260 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

**ADF Test Result on RGDP at Level**

| | | | |
|---|---|---|---|
| **ADF Test Statistic** | **3.364575** | **1% Critical Value*** | **-4.2092** |
| | | **5% Critical Value** | **-3.5279** |
| | | **10% Critical Value** | **-3.1949** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Augmented Dickey-Fuller Test Equation**
**Dependent Variable: D(GDP)**
**Method: Least Squares**
**Date: 05/11/12 Time: 09:51**
**Sample(adjusted): 1972 2010**
**Included observations: 39 after adjusting endpoints**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(RGDP(-1) | 0.111311 | 0.033083 | 3.364575 | 0.0019 |
| D(RGDP(-1)) | -0.111467 | 0.189582 | -0.587963 | 0.5603 |
| C | -383833.3 | 308597.1 | -1.243801 | 0.2218 |
| @TREND(1970) | 36088.91 | 17320.28 | 2.083622 | 0.0446 |
| R-squared | 0.661480 | Mean dependent var | | 748695.7 |
| Adjusted R-squared | 0.632464 | S.D. dependent var | | 1269160. |
| S.E. of regression | 769425.4 | Akaike info criterion | | 30.04159 |
| Sum squared resid | 2.07E+13 | Schwarz criterion | | 30.21221 |
| Log likelihood | -581.8110 | F-statistic | | 22.79707 |
| Durbin-Watson stat | 1.913449 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $B_3$

**ADF Test Result on RGDP at First Difference**

| | | | |
|---|---|---|---|
| **ADF Test Statistic** | **-1.663113** | **1% Critical Value*** | **-4.2165** |
| | | **5% Critical Value** | **-3.5312** |
| | | **10% Critical Value** | **-3.1968** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Augmented Dickey-Fuller Test Equation**
**Dependent Variable: D(RGDP,2)**
**Method: Least Squares**
**Date: 05/11/12 Time: 09:54**
**Sample(adjusted): 1973 2010**
**Included observations: 38 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| D(RGDP(-1)) | -0.267227 | 0.160679 | -1.663113 | 0.1055 |
| D(RGDP(-1),2) | -0.832543 | 0.151653 | -5.489781 | 0.0000 |
| C | -318990.7 | 276147.2 | -1.155147 | 0.2561 |
| @TREND(1970) | 28849.39 | 15214.95 | 1.896122 | 0.0665 |
| R-squared | 0.657365 | Mean dependent var | | 116079.2 |
| Adjusted R-squared | 0.627132 | S.D. dependent var | | 1062402. |
| S.E. of regression | 648733.7 | Akaike info criterion | | 29.70273 |
| Sum squared resid | 1.43E+13 | Schwarz criterion | | 29.87511 |
| Log likelihood | -560.3519 | F-statistic | | 21.74361 |
| Durbin-Watson stat | 1.574042 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

## ADF Test Result on RGDP at Second Difference

| | | | |
|---|---|---|---|
| **ADF Test Statistic** | **-4.201346** | **1% Critical Value*** | **-4.2242** |
| | | **5% Critical Value** | **-3.5348** |
| | | **10% Critical Value** | **-3.1988** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Augmented Dickey-Fuller Test Equation**
**Dependent Variable: D(RGDP,3)**
**Method: Least Squares**
**Date: 05/11/12 Time: 09:57**
**Sample(adjusted): 1974 2010**
**Included observations: 37 after adjusting endpoints**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(RGDP(-1),2) | -1.515300 | 0.360670 | -4.201346 | 0.0002 |
| D(RGDP(-1),3) | -0.302679 | 0.221885 | -1.364125 | 0.1818 |
| C | -48406.60 | 251868.9 | -0.192190 | 0.8488 |
| @TREND(1970) | 6765.294 | 10450.20 | 0.647384 | 0.5219 |
| R-squared | 0.879505 | Mean dependent var | | 105749.4 |
| Adjusted R-squared | 0.868551 | S.D. dependent var | | 1837442. |
| S.E. of regression | 666182.1 | Akaike info criterion | | 29.75832 |
| Sum squared resid | 1.46E+13 | Schwarz criterion | | 29.93247 |
| Log likelihood | -546.5289 | F-statistic | | 80.28991 |
| Durbin-Watson stat | 1.881035 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $B_4$

## ADF Test Result on DIR at Level

| | | | |
|---|---|---|---|
| **ADF Test Statistic** | **-4.772805** | **1% Critical Value*** | **-4.2092** |
| | | **5% Critical Value** | **-3.5279** |
| | | **10% Critical Value** | **-3.1949** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Augmented Dickey-Fuller Test Equation**
**Dependent Variable: D(DIR)**
**Method: Least Squares**
**Date: 05/11/12 Time: 09:58**
**Sample(adjusted): 1972 2010**
**Included observations: 39 after adjusting endpoints**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| DIR(-1) | -0.799770 | 0.167568 | -4.772805 | 0.0000 |
| D(DIR(-1)) | 0.400982 | 0.156483 | 2.562470 | 0.0149 |
| C | -523.1643 | 741.2800 | -0.705758 | 0.4850 |
| @TREND(1970) | 47.87383 | 32.55134 | 1.470718 | 0.1503 |
| R-squared | 0.394507 | Mean dependent var | | 0.064615 |
| Adjusted R-squared | 0.342607 | S.D. dependent var | | 2654.517 |
| S.E. of regression | 2152.276 | Akaike info criterion | | 18.28335 |
| Sum squared resid | 1.62E+08 | Schwarz criterion | | 18.45398 |
| Log likelihood | -352.5254 | F-statistic | | 7.601367 |
| Durbin-Watson stat | 1.865049 | Prob(F-statistic) | | 0.000484 |

**Source:** E-views (Vision 3.1) Regression output

## ADF Test Result on DIR at First Difference

| | | | |
|---|---|---|---|
| **ADF Test Statistic** | **-7.129652** | **1% Critical Value*** | **-4.2165** |
| | | **5% Critical Value** | **-3.5312** |
| | | **10% Critical Value** | **-3.1968** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Augmented Dickey-Fuller Test Equation**
**Dependent Variable: D(DIR,2)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:01**
**Sample(adjusted): 1973 2010**
**Included observations: 38 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| D(DIR(-1)) | -1.502655 | 0.210761 | -7.129652 | 0.0000 |
| D(DIR(-1),2) | 0.497455 | 0.148773 | 3.343723 | 0.0020 |
| C | 164.7139 | 869.2987 | 0.189479 | 0.8508 |
| @TREND(1970) | -7.653130 | 36.02135 | -0.212461 | 0.8330 |
| R-squared | 0.625039 | Mean dependent var | | -0.176579 |
| Adjusted R-squared | 0.591954 | S.D. dependent var | | 3810.205 |
| S.E. of regression | 2433.900 | Akaike info criterion | | 18.53168 |
| Sum squared resid | 2.01E+08 | Schwarz criterion | | 18.70406 |
| Log likelihood | -348.1019 | F-statistic | | 18.89204 |
| Durbin-Watson stat | 2.007008 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $B_5$

## ADF Test Result on DIR at Second Difference

| | | | |
|---|---|---|---|
| **ADF Test Statistic** | **-9.046023** | **1% Critical Value*** | **-4.2242** |
| | | **5% Critical Value** | **-3.5348** |
| | | **10% Critical Value** | **-3.1988** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Augmented Dickey-Fuller Test Equation**
**Dependent Variable: D(DIR,3)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:12**
**Sample(adjusted): 1974 2010**
**Included observations: 37 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| D(DIR(-1),2) | -2.001670 | 0.221276 | -9.046023 | 0.0000 |
| D(DIR(-1),3) | 0.596391 | 0.139731 | 4.268131 | 0.0002 |
| C | 0.397861 | 1179.432 | 0.000337 | 0.9997 |
| @TREND(1970) | -0.023888 | 48.23057 | -0.000495 | 0.9996 |
| R-squared | 0.759628 | Mean dependent var | | -0.215946 |
| Adjusted R-squared | 0.737776 | S.D. dependent var | | 6117.017 |
| S.E. of regression | 3132.389 | Akaike info criterion | | 19.03879 |
| Sum squared resid | 3.24E+08 | Schwarz criterion | | 19.21294 |
| Log likelihood | -348.2175 | F-statistic | | 34.76245 |
| Durbin-Watson stat | 2.206568 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

## ADF Test Result on EER at Level

| | | | |
|---|---|---|---|
| **ADF Test Statistic** | **-1.348055** | **1% Critical Value*** | **-4.2092** |
| | | **5% Critical Value** | **-3.5279** |
| | | **10% Critical Value** | **-3.1949** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Augmented Dickey-Fuller Test Equation**
**Dependent Variable: D(EER)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:04**
**Sample(adjusted): 1972 2010**
**Included observations: 39 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| EER(-1) | -0.085490 | 0.063418 | -1.348055 | 0.1863 |
| D(EER(-1)) | 0.256709 | 0.175616 | 1.461761 | 0.1527 |
| C | 3.661418 | 8.407514 | 0.435494 | 0.6659 |
| @TREND(1970) | 0.084190 | 0.268471 | 0.313590 | 0.7557 |
| R-squared | 0.105964 | Mean dependent var | | -0.107179 |
| Adjusted R-squared | 0.029333 | S.D. dependent var | | 17.83385 |
| S.E. of regression | 17.57035 | Akaike info criterion | | 8.667217 |
| Sum squared resid | 10805.10 | Schwarz criterion | | 8.837839 |
| Log likelihood | -165.0107 | F-statistic | | 1.382776 |
| Durbin-Watson stat | 2.010347 | Prob(F-statistic) | | 0.264159 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $B_6$

## ADF Test Result on EER at First Difference

| | | | |
|---|---|---|---|
| **ADF Test Statistic** | **-3.329175** | **1% Critical Value*** | **-4.2165** |
| | | **5% Critical Value** | **-3.5312** |
| | | **10% Critical Value** | **-3.1968** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Augmented Dickey-Fuller Test Equation**
**Dependent Variable: D(EER,2)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:09**
**Sample(adjusted): 1973 2010**
**Included observations: 38 after adjusting end points**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| D(EER(-1)) | -0.745092 | 0.223807 | -3.329175 | 0.0021 |
| D(EER(-1),2) | -0.087186 | 0.181744 | -0.479720 | 0.6345 |
| C | -4.247081 | 6.689108 | -0.634925 | 0.5297 |
| @TREND(1970) | 0.188095 | 0.280032 | 0.671692 | 0.5063 |
| R-squared | 0.391019 | Mean dependent var | | -0.653421 |
| Adjusted R-squared | 0.337286 | S.D. dependent var | | 22.36945 |
| S.E. of regression | 18.21036 | Akaike info criterion | | 8.741159 |
| Sum squared resid | 11274.98 | Schwarz criterion | | 8.913536 |
| Log likelihood | -162.0820 | F-statistic | | 7.276994 |
| Durbin-Watson stat | 1.906098 | Prob(F-statistic) | | 0.000675 |

**Source:** E-views (Vision 3.1) Regression output

## ADF Test Result on EER at Second Difference

| | | | |
|---|---|---|---|
| **ADF Test Statistic** | **-6.039531** | **1% Critical Value*** | **-4.2242** |
| | | **5% Critical Value** | **-3.5348** |
| | | **10% Critical Value** | **-3.1988** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Augmented Dickey-Fuller Test Equation**
**Dependent Variable: D(EER,3)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:11**
**Sample(adjusted): 1974 2010**
**Included observations: 37 after adjusting endpoints**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(EER(-1),2) | -1.798849 | 0.297846 | -6.039531 | 0.0000 |
| D(EER(-1),3) | 0.241539 | 0.180085 | 1.341251 | 0.1890 |
| C | 1.891039 | 7.789424 | 0.242770 | 0.8097 |
| @TREND(1970) | -0.095772 | 0.318735 | -0.300475 | 0.7657 |
| R-squared | 0.718639 | Mean dependent var | | -1.061081 |
| Adjusted R-squared | 0.693060 | S.D. dependent var | | 37.32363 |
| S.E. of regression | 20.67808 | Akaike info criterion | | 8.997832 |
| Sum squared resid | 14110.24 | Schwarz criterion | | 9.171985 |
| Log likelihood | -162.4599 | F-statistic | | 28.09564 |
| Durbin-Watson stat | 2.007566 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $B_7$

## ADF Test Result on IFR at Level

| | | | |
|---|---|---|---|
| **ADF Test Statistic** | **-1.617127** | **1% Critical Value*** | **-4.2092** |
| | | **5% Critical Value** | **-3.5279** |
| | | **10% Critical Value** | **-3.1949** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Augmented Dickey-Fuller Test Equation**
**Dependent Variable: D(IFR)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:16**
**Sample(adjusted): 1972 2010**
**Included observations: 39 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| IFR(-1) | -0.321788 | 0.198987 | -1.617127 | 0.1148 |
| D(IFR(-1)) | -0.827635 | 1.553585 | -0.532726 | 0.5976 |
| C | -14.75260 | 13.52849 | -1.090483 | 0.2830 |
| @TREND(1970) | 1.588601 | 0.888094 | 1.788775 | 0.0823 |
| R-squared | 0.152234 | Mean dependent var | | 0.400000 |
| Adjusted R-squared | 0.079568 | S.D. dependent var | | 31.95672 |
| S.E. of regression | 30.65900 | Akaike info criterion | | 9.780644 |
| Sum squared resid | 32899.11 | Schwarz criterion | | 9.951266 |
| Log likelihood | -186.7226 | F-statistic | | 2.094991 |
| Durbin-Watson stat | 1.294001 | Prob(F-statistic) | | 0.118586 |

**Source:** E-views (Vision 3.1) Regression output

## ADF Test Result on IFR at First Difference

| | | | |
|---|---|---|---|
| **ADF Test Statistic** | **-2.506336** | **1% Critical Value*** | **-4.2165** |
| | | **5% Critical Value** | **-3.5312** |
| | | **10% Critical Value** | **-3.1968** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Augmented Dickey-Fuller Test Equation**
**Dependent Variable: D(IFR,2)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:18**
**Sample(adjusted): 1973 2010**
**Included observations: 38 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| D(IFR(-1)) | -3.925314 | 1.566157 | -2.506336 | 0.0171 |
| D(IFR(-1),2) | 1.261794 | 1.674516 | 0.753527 | 0.4563 |
| C | -8.724298 | 14.11588 | -0.618049 | 0.5407 |
| @TREND(1970) | 1.124579 | 0.893209 | 1.259033 | 0.2166 |
| R-squared | 0.220701 | Mean dependent var | | -4.992105 |
| Adjusted R-squared | 0.151940 | S.D. dependent var | | 34.72080 |
| S.E. of regression | 31.97445 | Akaike info criterion | | 9.867052 |
| Sum squared resid | 34760.43 | Schwarz criterion | | 10.03943 |
| Log likelihood | -183.4740 | F-statistic | | 3.209655 |
| Durbin-Watson stat | 1.136296 | Prob(F-statistic) | | 0.035128 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $B_8$

## ADF Test Result on IFR at Second Difference

| | | | | |
|---|---|---|---|---|
| **ADF Test Statistic** | **-6.022863** | **1% Critical Value*** | | **-4.2324** |
| | | **5% Critical Value** | | **-3.5386** |
| | | **10% Critical Value** | | **-3.2009** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Augmented Dickey-Fuller Test Equation**
**Dependent Variable: D(IFR,3)**
**Method: Least Squares**
**Date: 05/11/12 Time: 04:30**
**Sample(adjusted): 1974 2010**
**Included observations: 36 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| D(IFR(-1),2) | -1.520316 | 0.252424 | -6.022863 | 0.0000 |
| D(IFR(-1),3) | 0.464234 | 0.181489 | 2.557914 | 0.0155 |
| C | -0.441687 | 1.377765 | -0.320582 | 0.7506 |
| @TREND(1970) | 0.056090 | 0.058033 | 0.966514 | 0.3410 |
| R-squared | 0.593399 | Mean dependent var | | 0.102778 |
| Adjusted R-squared | 0.555280 | S.D. dependent var | | 5.383280 |
| S.E. of regression | 3.589964 | Akaike info criterion | | 5.498601 |
| Sum squared resid | 412.4110 | Schwarz criterion | | 5.674547 |
| Log likelihood | -94.97481 | F-statistic | | 15.56709 |
| Durbin-Watson stat | 2.103711 | Prob(F-statistic) | | 0.000002 |

**Source:** E-views (Vision 3.1) Regression output

## ADF Test Result on FIR at Level

| | | | |
|---|---|---|---|
| **ADF Test Statistic** | **-1.526084** | **1% Critical Value*** | **-4.2092** |
| | | **5% Critical Value** | **-3.5279** |
| | | **10% Critical Value** | **-3.1949** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Augmented Dickey-Fuller Test Equation**
**Dependent Variable: D(FIR)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:22**
**Sample(adjusted): 1972 2010**
**Included observations: 39 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| FIR(-1) | -0.107946 | 0.070734 | -1.526084 | 0.1360 |
| D(FIR(-1)) | 0.046848 | 0.168325 | 0.278321 | 0.7824 |
| C | -6.577250 | 5.129193 | -1.282317 | 0.2082 |
| @TREND(1970) | 0.691227 | 0.327324 | 2.111755 | 0.0419 |
| R-squared | 0.121392 | Mean dependent var | | 3.844995 |
| Adjusted R-squared | 0.046082 | S.D. dependent var | | 12.26268 |
| S.E. of regression | 11.97680 | Akaike info criterion | | 7.900735 |
| Sum squared resid | 5020.535 | Schwarz criterion | | 8.071357 |
| Log likelihood | -150.0643 | F-statistic | | 1.611910 |
| Durbin-Watson stat | 2.006360 | Prob(F-statistic) | | 0.204159 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $B_9$

## ADF Test Result on FIR at First Difference

| | | | |
|---|---|---|---|
| **ADF Test Statistic** | **-4.028967** | **1% Critical Value*** | **-4.2165** |
| | | **5% Critical Value** | **-3.5312** |
| | | **10% Critical Value** | **-3.1968** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Augmented Dickey-Fuller Test Equation**
**Dependent Variable: D(FIR,2)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:23**
**Sample(adjusted): 1973 2010**
**Included observations: 38 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| D(FIR(-1)) | -0.989076 | 0.245491 | -4.028967 | 0.0003 |
| D(FIR(-1),2) | -0.017286 | 0.179361 | -0.096378 | 0.9238 |
| C | -1.957045 | 4.509604 | -0.433973 | 0.6670 |
| @TREND(1970) | 0.273213 | 0.196571 | 1.389898 | 0.1736 |
| R-squared | 0.499736 | Mean dependent var | | 0.017776 |
| Adjusted R-squared | 0.455595 | S.D. dependent var | | 17.00331 |
| S.E. of regression | 12.54568 | Akaike info criterion | | 7.995931 |
| Sum squared resid | 5351.402 | Schwarz criterion | | 8.168309 |
| Log likelihood | -147.9227 | F-statistic | | 11.32138 |
| Durbin-Watson stat | 1.986904 | Prob(F-statistic) | | 0.000027 |

**Source:** E-views (Vision 3.1) Regression output

## ADF Test Result on FIR at Second Difference

| | | | |
|---|---|---|---|
| **ADF Test Statistic** | **-6.735742** | **1% Critical Value*** | **-4.2242** |
| | | **5% Critical Value** | **-3.5348** |
| | | **10% Critical Value** | **-3.1988** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Augmented Dickey-Fuller Test Equation**
**Dependent Variable: D(FIR,3)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:25**
**Sample(adjusted): 1974 2010**
**Included observations: 37 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| D(FIR(-1),2) | -1.986954 | 0.294987 | -6.735742 | 0.0000 |
| D(FIR(-1),3) | 0.316496 | 0.176829 | 1.789839 | 0.0827 |
| C | 0.193888 | 5.567723 | 0.034824 | 0.9724 |
| @TREND(1970) | 0.013633 | 0.227945 | 0.059807 | 0.9527 |
| R-squared | 0.768573 | Mean dependent var | | -0.743449 |
| Adjusted R-squared | 0.747535 | S.D. dependent var | | 29.41105 |
| S.E. of regression | 14.77786 | Akaike info criterion | | 8.325943 |
| Sum squared resid | 7206.705 | Schwarz criterion | | 8.500096 |
| Log likelihood | -150.0299 | F-statistic | | 36.53128 |
| Durbin-Watson stat | 2.116350 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $C_1$

## PHILLIPS-PERRON UNIT ROOT TEST

### PP Test Result on M2 at Level

| | | | |
|---|---|---|---|
| **PP Test Statistic** | **-5.720133** | **1% Critical Value*** | **-4.2023** |
| | | **5% Critical Value** | **-3.5247** |
| | | **10% Critical Value** | **-3.1931** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Lag truncation for Bartlett kernel: 3 ( Newey-West suggests: 3 )**
**Residual variance with no correction** **3.48E+13**
**Residual variance with correction** **3.95E+13**

**Phillips-Perron Test Equation**
**Dependent Variable: D(M2)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:34**
**Sample(adjusted): 1971 2010**
**Included observations: 40 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| M2(-1) | -0.931029 | 0.164272 | -5.667608 | 0.0000 |
| C | -3076377. | 2038671. | -1.509011 | 0.1398 |
| @TREND(1970) | 254866.1 | 93263.62 | 2.732749 | 0.0096 |
| R-squared | 0.465413 | Mean dependent var | | 275849.1 |
| Adjusted R-squared | 0.436517 | S.D. dependent var | | 8170320. |
| S.E. of regression | 6133093. | Akaike info criterion | | 34.16834 |
| Sum squared resid | 1.39E+15 | Schwarz criterion | | 34.29500 |
| Log likelihood | -680.3667 | F-statistic | | 16.10618 |
| Durbin-Watson stat | 2.016525 | Prob(F-statistic) | | 0.000009 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $C_2$

## PP Test Result on M2 at First Difference

| | | | |
|---|---|---|---|
| **PP Test Statistic** | **-14.86089** | **1% Critical Value*** | **-4.2092** |
| | | **5% Critical Value** | **-3.5279** |
| | | **10% Critical Value** | **-3.1949** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Lag truncation for Bartlett kernel: 3 ( Newey-West suggests: 3**
**Residual variance with no correction 4.77E+13**
**Residual variance with correction 1.85E+13**

**Phillips-Perron Test Equation**
**Dependent Variable: D(M2,2)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:33**
**Sample(adjusted): 1972 2010**
**Included observations: 39 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| D(M2(-1)) | -1.533345 | 0.140991 | -10.87545 | 0.0000 |
| C | -425119.0 | 2437273. | -0.174424 | 0.8625 |
| @TREND(1970) | 40727.41 | 102353.0 | 0.397911 | 0.6930 |
| R-squared | 0.766651 | Mean dependent var | | 6858.962 |
| Adjusted R-squared | 0.753687 | S.D. dependent var | | 14484828 |
| S.E. of regression | 7188805. | Akaike info criterion | | 34.48775 |
| Sum squared resid | 1.86E+15 | Schwarz criterion | | 34.61572 |
| Log likelihood | -669.5112 | F-statistic | | 59.13773 |
| Durbin-Watson stat | 2.390685 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $C_3$

## PP Test Result on M2 at Second Difference

| | | | |
|---|---|---|---|
| **PP Test Statistic** | **-24.98375** | **1% Critical Value*** | **-4.2165** |
| | | **5% Critical Value** | **-3.5312** |
| | | **10% Critical Value** | **-3.1968** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Lag truncation for Bartlett kernel: 3 ( Newey-West suggests: 3 )**
**Residual variance with no correction 1.12E+14**
**Residual variance with correction 2.52E+13**

**Phillips-Perron Test Equation**
**Dependent Variable: D(M2,3)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:40**
**Sample(adjusted): 1973 2010**
**Included observations: 38 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| D(M2(-1),2) | -1.681267 | 0.123764 | -13.58442 | 0.0000 |
| C | -2455.393 | 3945140. | -0.000622 | 0.9995 |
| @TREND(1970) | 1776.069 | 163461.8 | 0.010865 | 0.9914 |
| R-squared | 0.840574 | Mean dependent var | | -35081.29 |
| Adjusted R-squared | 0.831464 | S.D. dependent var | | 26915458 |
| S.E. of regression | 11049641 | Akaike info criterion | | 35.34935 |
| Sum squared resid | 4.27E+15 | Schwarz criterion | | 35.47863 |
| Log likelihood | -668.6377 | F-statistic | | 92.26881 |
| Durbin-Watson stat | 2.716675 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $C_4$

## PP Test Result on RGDP at Level

| | | | |
|---|---|---|---|
| **PP Test Statistic** | **3.715080** | **1% Critical Value*** | **-4.2023** |
| | | **5% Critical Value** | **-3.5247** |
| | | **10% Critical Value** | **-3.1931** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Lag truncation for Bartlett kernel: 3 ( Newey-West suggests: 3 )**
**Residual variance with no correction 5.25E+11**
**Residual variance with correction 5.68E+11**

**Phillips-Perron Test Equation**
**Dependent Variable: D(RGDP)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:42**
**Sample(adjusted): 1971 2010**
**Included observations: 40 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| RGDP(-1) | 0.102112 | 0.026164 | 3.902843 | 0.0004 |
| C | -316071.0 | 280083.7 | -1.128488 | 0.2664 |
| @TREND(1970) | 31589.97 | 15667.09 | 2.016326 | 0.0511 |
| R-squared | 0.659644 | Mean dependent var | | 730012.5 |
| Adjusted R-squared | 0.641246 | S.D. dependent var | | 1258344. |
| S.E. of regression | 753698.0 | Akaike info criterion | | 29.97541 |
| Sum squared resid | 2.10E+13 | Schwarz criterion | | 30.10208 |
| Log likelihood | -596.5082 | F-statistic | | 35.85487 |
| Durbin-Watson stat | 2.149880 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $C_5$

## PP Test Result on RGDP at First Difference

| | | | |
|---|---|---|---|
| **PP Test Statistic** | **-4.526614** | **1% Critical Value*** | **-4.2092** |
| | | **5% Critical Value** | **-3.5279** |
| | | **10% Critical Value** | **-3.1949** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

| | |
|---|---|
| **Lag truncation for Bartlett kernel: 3** | **( Newey-West suggests: 3 )** |
| **Residual variance with no correction** | **7.03E+11** |
| **Residual variance with correction** | **8.80E+11** |

**Phillips-Perron Test Equation**
**Dependent Variable: D(RGDP,2)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:43**
**Sample(adjusted): 1972 2010**
**Included observations: 39 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| D(RGDP(-1)) | -0.746840 | 0.176447 | -4.232658 | 0.0002 |
| C | -742368.4 | 328515.3 | -2.259768 | 0.0300 |
| @TREND(1970) | 63340.56 | 17366.14 | 3.647361 | 0.0008 |
| R-squared | 0.343572 | Mean dependent var | | 113081.4 |
| Adjusted R-squared | 0.307104 | S.D. dependent var | | 1048497. |
| S.E. of regression | 872773.0 | Akaike info criterion | | 30.27054 |
| Sum squared resid | 2.74E+13 | Schwarz criterion | | 30.39851 |
| Log likelihood | -587.2756 | F-statistic | | 9.421139 |
| Durbin-Watson stat | 2.077106 | Prob(F-statistic) | | 0.000512 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $C_6$

## PP Test Result on RGDP at Second Difference

| | | | |
|---|---|---|---|
| **PP Test Statistic** | **-14.64596** | **1% Critical Value*** | **-4.2165** |
| | | **5% Critical Value** | **-3.5312** |
| | | **10% Critical Value** | **-3.1968** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Lag truncation for Bartlett kernel: 3 ( Newey-West suggests: 3 )**
**Residual variance with no correction 4.07E+11**
**Residual variance with correction 4.73E+11**

**Phillips-Perron Test Equation**
**Dependent Variable: D(RGDP,3)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:46**
**Sample(adjusted): 1973 2010**
**Included observations: 38 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| D(RGDP(-1),2) | -1.975167 | 0.128194 | -15.40759 | 0.0000 |
| C | -69533.00 | 237637.1 | -0.292602 | 0.7716 |
| @TREND(1970) | 9225.790 | 9845.118 | 0.937093 | 0.3551 |
| R-squared | 0.872705 | Mean dependent var | | 103012.3 |
| Adjusted R-squared | 0.865431 | S.D. dependent var | | 1812521. |
| S.E. of regression | 664898.5 | Akaike info criterion | | 29.72831 |
| Sum squared resid | 1.55E+13 | Schwarz criterion | | 29.85760 |
| Log likelihood | -561.8379 | F-statistic | | 119.9760 |
| Durbin-Watson stat | 1.636306 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $C_7$

## PP Test Result on DIR at Level

| | | | |
|---|---|---|---|
| **PP Test Statistic** | **-3.676151** | **1% Critical Value*** | **-4.2023** |
| | | **5% Critical Value** | **-3.5247** |
| | | **10% Critical Value** | **-3.1931** |

***MacKinnon critical values for rejection of hypothesis of a unit root**

**Lag truncation for Bartlett kernel: 3 ( Newey-West suggests: 3 )**
**Residual variance with no correction 4815511.**
**Residual variance with correction 4217866.**

**Phillips-Perron Test Equation**
**Dependent Variable: D(DIR)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:51**
**Sample(adjusted): 1971 2010**
**Included observations: 40 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| DIR(-1) | -0.566520 | 0.149214 | -3.796691 | 0.0005 |
| C | -285.1494 | 741.8674 | -0.384367 | 0.7029 |
| @TREND(1970) | 30.16145 | 32.54942 | 0.926636 | 0.3601 |
| R-squared | 0.280638 | Mean dependent var | | 0.063000 |
| Adjusted R-squared | 0.241753 | S.D. dependent var | | 2620.264 |
| S.E. of regression | 2281.657 | Akaike info criterion | | 18.37523 |
| Sum squared resid | 1.93E+08 | Schwarz criterion | | 18.50190 |
| Log likelihood | -364.5046 | F-statistic | | 7.217222 |
| Durbin-Watson stat | 1.655166 | Prob(F-statistic) | | 0.002257 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $C_8$

## PP Test Result on DIR at First Difference

| | | | |
|---|---|---|---|
| **PP Test Statistic** | **-6.309402** | **1% Critical Value*** | **-4.2092** |
| | | **5% Critical Value** | **-3.5279** |
| | | **10% Critical Value** | **-3.1949** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Lag truncation for Bartlett kernel: 3 ( Newey-West suggests: 3 )**
**Residual variance with no correction 6862881.**
**Residual variance with correction 3421370.**

**Phillips-Perron Test Equation**
**Dependent Variable: D(DIR,2)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:53**
**Sample(adjusted): 1972 2010**
**Included observations: 39 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| D(DIR(-1)) | -1.003440 | 0.166665 | -6.020688 | 0.0000 |
| C | 99.49938 | 924.4562 | 0.107630 | 0.9149 |
| @TREND(1970) | -4.734950 | 38.80244 | -0.122027 | 0.9036 |
| R-squared | 0.501721 | Mean dependent var | | -0.172051 |
| Adjusted R-squared | 0.474039 | S.D. dependent var | | 3759.737 |
| S.E. of regression | 2726.681 | Akaike info criterion | | 18.73336 |
| Sum squared resid | 2.68E+08 | Schwarz criterion | | 18.86133 |
| Log likelihood | -362.3005 | F-statistic | | 18.12434 |
| Durbin-Watson stat | 2.003429 | Prob(F-statistic) | | 0.000004 |

**Source:** E-views (Vision 3.1) Regression output

## APPENDIX $C_9$

## PP Test Result on DIR at Second Difference

| | | | |
|---|---|---|---|
| **PP Test Statistic** | **-10.39698** | **1% Critical Value*** | **-4.2165** |
| | | **5% Critical Value** | **-3.5312** |
| | | **10% Critical Value** | **-3.1968** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Lag truncation for Bartlett kernel: 3 ( Newey-West suggests: 3 )**
**Residual variance with no correction 13224563**
**Residual variance with correction 3744061.**

**Phillips-Perron Test Equation**
**Dependent Variable: D(DIR,3)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:55**
**Sample(adjusted): 1973 2010**
**Included observations: 38 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| D(DIR(-1),2) | -1.253872 | 0.163493 | -7.669272 | 0.0000 |
| C | 0.440680 | 1352.889 | 0.000326 | 0.9997 |
| @TREND(1970) | -0.028312 | 56.05497 | -0.000505 | 0.9996 |
| R-squared | 0.626936 | Mean dependent var | | -0.210263 |
| Adjusted R-squared | 0.605618 | S.D. dependent var | | 6033.788 |
| S.E. of regression | 3789.208 | Akaike info criterion | | 19.39336 |
| Sum squared resid | 5.03E+08 | Schwarz criterion | | 19.52264 |
| Log likelihood | -365.4738 | F-statistic | | 29.40887 |
| Durbin-Watson stat | 2.302814 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $C_{10}$

## PP Test Result on EER at Level

| | | | |
|---|---|---|---|
| **PP Test Statistic** | **-1.251156** | **1% Critical Value*** | **-4.2023** |
| | | **5% Critical Value** | **-3.5247** |
| | | **10% Critical Value** | **-3.1931** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Lag truncation for Bartlett kernel: 3 ( Newey-West suggests: 3 )**
**Residual variance with no correction 287.7701**
**Residual variance with correction 425.4047**

**Phillips-Perron Test Equation**
**Dependent Variable: D(EER)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:58**
**Sample(adjusted): 1971 2010**
**Included observations: 40 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| EER(-1) | -0.058593 | 0.061081 | -0.959271 | 0.3436 |
| C | 0.293765 | 7.821110 | 0.037560 | 0.9702 |
| @TREND(1970) | 0.174129 | 0.249335 | 0.698373 | 0.4893 |
| R-squared | 0.047678 | Mean dependent var | | -0.078000 |
| Adjusted R-squared | -0.003799 | S.D. dependent var | | 17.60470 |
| S.E. of regression | 17.63811 | Akaike info criterion | | 8.650039 |
| Sum squared resid | 11510.80 | Schwarz criterion | | 8.776705 |
| Log likelihood | -170.0008 | F-statistic | | 0.926198 |
| Durbin-Watson stat | 1.523005 | Prob(F-statistic) | | 0.405044 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $C_{11}$

## PP Test Result on EER at First Difference

| | | | |
|---|---|---|---|
| **PP Test Statistic** | **-4.784749** | **1% Critical Value*** | **-4.2092** |
| | | **5% Critical Value** | **-3.5279** |
| | | **10% Critical Value** | **-3.1949** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Lag truncation for Bartlett kernel: 3 ( Newey-West suggests: 3 )**
**Residual variance with no correction 291.4389**
**Residual variance with correction 305.9411**

**Phillips-Perron Test Equation**
**Dependent Variable: D(EER,2)**
**Method: Least Squares**
**Date: 05/11/12 Time: 10:59**
**Sample(adjusted): 1972 2010**
**Included observations: 39 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| D(EER(-1)) | -0.809151 | 0.170588 | -4.743317 | 0.0000 |
| C | -4.185524 | 6.135019 | -0.682235 | 0.4995 |
| @TREND(1970) | 0.189157 | 0.259831 | 0.728002 | 0.4713 |
| R-squared | 0.386101 | Mean dependent var | | -0.662821 |
| Adjusted R-squared | 0.351996 | S.D. dependent var | | 22.07323 |
| S.E. of regression | 17.76867 | Akaike info criterion | | 8.666554 |
| Sum squared resid | 11366.12 | Schwarz criterion | | 8.794520 |
| Log likelihood | -165.9978 | F-statistic | | 11.32079 |
| Durbin-Watson stat | 1.940586 | Prob(F-statistic) | | 0.000153 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $C_{12}$

## PP Test Result on EER at Second Difference

| | | | |
|---|---|---|---|
| **PP Test Statistic** | **-10.33931** | **1% Critical Value*** | **-4.2165** |
| | | **5% Critical Value** | **-3.5312** |
| | | **10% Critical Value** | **-3.1968** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Lag truncation for Bartlett kernel: 3 ( Newey-West suggests: 3 )**
**Residual variance with no correction 393.4324**
**Residual variance with correction 222.7726**

**Phillips-Perron Test Equation**
**Dependent Variable: D(EER,3)**
**Method: Least Squares**
**Date: 05/11/12 Time: 11:02**
**Sample(adjusted): 1973 2010**
**Included observations: 38 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| D(EER(-1),2) | -1.463372 | 0.161556 | -9.057993 | 0.0000 |
| C | 0.943271 | 7.382679 | 0.127768 | 0.8991 |
| @TREND(1970) | -0.062825 | 0.306093 | -0.205248 | 0.8386 |
| R-squared | 0.702012 | Mean dependent var | | -1.184211 |
| Adjusted R-squared | 0.684984 | S.D. dependent var | | 36.82362 |
| S.E. of regression | 20.66773 | Akaike info criterion | | 8.970681 |
| Sum squared resid | 14950.43 | Schwarz criterion | | 9.099964 |
| Log likelihood | -167.4429 | F-statistic | | 41.22717 |
| Durbin-Watson stat | 2.127428 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $C_{13}$

## PP Test Result on IFR at Level

| | | | |
|---|---|---|---|
| **PP Test Statistic** | **-2.376992** | **1% Critical Value*** | **-4.2023** |
| | | **5% Critical Value** | **-3.5247** |
| | | **10% Critical Value** | **-3.1931** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Lag truncation for Bartlett kernel: 3 ( Newey-West suggests: 3 )**
**Residual variance with no correction 832.4171**
**Residual variance with correction 824.2093**

**Phillips-Perron Test Equation**
**Dependent Variable: D(IFR)**
**Method: Least Squares**
**Date: 05/11/12 Time: 11:04**
**Sample(adjusted): 1971 2010**
**Included observations: 40 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| IFR(-1) | -0.369168 | 0.154174 | -2.394486 | 0.0218 |
| C | -11.85058 | 12.11838 | -0.977901 | 0.3345 |
| @TREND(1970) | 1.353085 | 0.787834 | 1.717475 | 0.0943 |
| R-squared | 0.141992 | Mean dependent var | | 0.390000 |
| Adjusted R-squared | 0.095614 | S.D. dependent var | | 31.54442 |
| S.E. of regression | 29.99851 | Akaike info criterion | | 9.712211 |
| Sum squared resid | 33296.68 | Schwarz criterion | | 9.838877 |
| Log likelihood | -191.2442 | F-statistic | | 3.061578 |
| Durbin-Watson stat | 1.284703 | Prob(F-statistic) | | 0.058828 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $C_{14}$

## PP Test Result on IFR at First Difference

| | | | |
|---|---|---|---|
| **PP Test Statistic** | **-3.032822** | **1% Critical Value*** | **-4.2092** |
| | | **5% Critical Value** | **-3.5279** |
| | | **10% Critical Value** | **-3.1949** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Lag truncation for Bartlett kernel: 3 ( Newey-West suggests: 3 )**
**Residual variance with no correction 906.5958**
**Residual variance with correction 926.2460**

**Phillips-Perron Test Equation**
**Dependent Variable: D(IFR,2)**
**Method: Least Squares**
**Date: 05/11/12 Time: 11:18**
**Sample(adjusted): 1972 2010**
**Included observations: 39 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| D(IFR(-1)) | -3.285494 | 1.293340 | -2.540318 | 0.0155 |
| C | -5.366758 | 12.49132 | -0.429639 | 0.6700 |
| @TREND(1970) | 0.847237 | 0.777493 | 1.089704 | 0.2831 |
| R-squared | 0.207770 | Mean dependent var | | -4.861538 |
| Adjusted R-squared | 0.163757 | S.D. dependent var | | 34.27060 |
| S.E. of regression | 31.33920 | Akaike info criterion | | 9.801420 |
| Sum squared resid | 35357.23 | Schwarz criterion | | 9.929386 |
| Log likelihood | -188.1277 | F-statistic | | 4.720675 |
| Durbin-Watson stat | 1.275384 | Prob(F-statistic) | | 0.015112 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $C_{15}$

## PP Test Result on IFR at Second Difference

| | | | |
|---|---|---|---|
| **PP Test Statistic** | **-6.135539** | **1% Critical Value*** | **-4.2242** |
| | | **5% Critical Value** | **-3.5348** |
| | | **10% Critical Value** | **-3.1988** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Lag truncation for Bartlett kernel: 3 ( Newey-West suggests: 3 )**
**Residual variance with no correction 13.42740**
**Residual variance with correction 7.691761**

**Phillips-Perron Test Equation**
**Dependent Variable: D(IFR,3)**
**Method: Least Squares**
**Date: 05/11/12 Time: 04:39**
**Sample(adjusted): 1973 2010**
**Included observations: 37 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| D(IFR(-1),2) | -1.024433 | 0.172220 | -5.948381 | 0.0000 |
| C | -0.526722 | 1.388098 | -0.379456 | 0.7067 |
| @TREND(1970) | 0.054637 | 0.059307 | 0.921260 | 0.3634 |
| R-squared | 0.510229 | Mean dependent var | | 0.094595 |
| Adjusted R-squared | 0.481419 | S.D. dependent var | | 5.308219 |
| S.E. of regression | 3.822587 | Akaike info criterion | | 5.597336 |
| Sum squared resid | 496.8137 | Schwarz criterion | | 5.727951 |
| Log likelihood | -100.5507 | F-statistic | | 17.71008 |
| Durbin-Watson stat | 2.008027 | Prob(F-statistic) | | 0.000005 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $C_{16}$

## PP Test Result on FIR at Level

| | | | |
|---|---|---|---|
| **PP Test Statistic** | **-1.513184** | **1% Critical Value*** | **-4.2023** |
| | | **5% Critical Value** | **-3.5247** |
| | | **10% Critical Value** | **-3.1931** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Lag truncation for Bartlett kernel: 3 ( Newey-West suggests: 3 )**
**Residual variance with no correction 126.5321**
**Residual variance with correction 136.9172**

**Phillips-Perron Test Equation**
**Dependent Variable: D(FIR)**
**Method: Least Squares**
**Date: 05/11/12 Time: 11:23**
**Sample(adjusted): 1971 2010**
**Included observations: 40 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| FIR(-1) | -0.096890 | 0.065911 | -1.470001 | 0.1500 |
| C | -5.633603 | 4.635578 | -1.215297 | 0.2320 |
| @TREND(1970) | 0.640151 | 0.301817 | 2.120989 | 0.0407 |
| R-squared | 0.116511 | Mean dependent var | | 3.748400 |
| Adjusted R-squared | 0.068755 | S.D. dependent var | | 12.11986 |
| S.E. of regression | 11.69579 | Akaike info criterion | | 7.828373 |
| Sum squared resid | 5061.286 | Schwarz criterion | | 7.955039 |
| Log likelihood | -153.5675 | F-statistic | | 2.439699 |
| Durbin-Watson stat | 1.919757 | Prob(F-statistic) | | 0.101094 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $C_{17}$

## PP Test Result on FIR at First Difference

| | | | |
|---|---|---|---|
| **PP Test Statistic** | **-5.990691** | **1% Critical Value*** | **-4.2092** |
| | | **5% Critical Value** | **-3.5279** |
| | | **10% Critical Value** | **-3.1949** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Lag truncation for Bartlett kernel: 3 ( Newey-West suggests: 3)**
**Residual variance with no correction 137.2976**
**Residual variance with correction 136.9174**

**Phillips-Perron Test Equation**
**Dependent Variable: D(FIR,2)**
**Method: Least Squares**
**Date: 05/11/12 Time: 11:24**
**Sample(adjusted): 1972 2010**
**Included observations: 39 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| D(FIR(-1)) | -1.005417 | 0.167818 | -5.991097 | 0.0000 |
| C | -1.832636 | 4.15415 | -0.441157 | 0.6617 |
| @TREND(1970) | 0.271351 | 0.180563 | 1.502801 | 0.1416 |
| R-squared | 0.499437 | Mean dependent var | | 0.016838 |
| Adjusted R-squared | 0.471628 | S.D. dependent var | | 16.77809 |
| S.E. of regression | 12.19586 | Akaike info criterion | | 7.913874 |
| Sum squared resid | 5354.606 | Schwarz criterion | | 8.041840 |
| Log likelihood | -151.3205 | F-statistic | | 17.95950 |
| Durbin-Watson stat | 1.987602 | Prob(F-statistic) | | 0.000004 |

**Source:** E-views (Vision 3.1) Regression output

## APPENDIX $C_{18}$

## PP Test Result on FIR at Second Difference

| | | | |
|---|---|---|---|
| **PP Test Statistic** | **-12.41506** | **1% Critical Value*** | **-4.2165** |
| | | **5% Critical Value** | **-3.5312** |
| | | **10% Critical Value** | **-3.1968** |

***MacKinnon critical values for rejection of hypothesis of a unit root.**

**Lag truncation for Bartlett kernel: 3 ( Newey-West suggests: 3)**
**Residual variance with no correction 208.0609**
**Residual variance with correction 103.0371**
**Phillips-Perron Test Equation**
**Dependent Variable: D(FIR,3)**
**Method: Least Squares**
**Date: 05/11/12 Time: 11:36**
**Sample(adjusted): 1973 2010**
**Included observations: 38 after adjusting endpoints**

| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
|---|---|---|---|---|
| D(FIR(-1),2) | -1.530896 | 0.151154 | -10.12804 | 0.0000 |
| C | 0.065938 | 5.368937 | 0.012281 | 0.9903 |
| @TREND(1970) | 0.016037 | 0.222731 | 0.072002 | 0.9430 |
| R-squared | 0.746112 | Mean dependent var | | -0.722400 |
| Adjusted R-squared | 0.731604 | S.D. dependent var | | 29.01117 |
| S.E. of regression | 15.02979 | Akaike info criterion | | 8.333603 |
| Sum squared resid | 7906.315 | Schwarz criterion | | 8.462886 |
| Log likelihood | -155.3385 | F-statistic | | 51.42809 |
| Durbin-Watson stat | 2.281076 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $D_1$

## Regression Results by OLS Method

**Dependent Variable: M2**
**Method: Least Squares**
**Date: 04/26/12 Time: 05:23**
**Sample: 1970 2010**
**Included observations: 41**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | -878974.7 | 1649894. | -0.532746 | 0.5976 |
| RGDP | 0.465484 | 0.246138 | 1.891149 | 0.0669 |
| DIR | -340.0491 | 396.6736 | -0.857252 | 0.3971 |
| EER | 9576.127 | 19485.10 | 0.491459 | 0.6262 |
| IFR | 26800.61 | 29334.29 | 0.913627 | 0.3672 |
| FIR | -13482.06 | 41428.49 | -0.325430 | 0.7468 |
| R-squared | 0.445184 | Mean dependent var | | 2231335. |
| Adjusted R-squared | 0.365925 | S.D. dependent var | | 670344. |
| S.E. of regression | 5337875. | Akaike info criterion | | 33.95301 |
| Sum squared resid | 9.97E+14 | Schwarz criterion | | 34.20378 |
| Log likelihood | -690.0368 | F-statistic | | 5.616800 |
| Durbin-Watson stat | 2.586487 | Prob(F-statistic) | | 0.000667 |

**Source:** E-views (Vision 3.1) Regression output

**Dependent Variable: LOG(M2)**
**Method: Least Squares**
**Date: 04/26/12 Time: 05:24**
**Sample: 1970 2010**
**Included observations: 41**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | -2.730713 | 1.514547 | -1.802990 | 0.0800 |
| LOG(RGDP) | 1.101049 | 0.146955 | 7.492404 | 0.0000 |
| LOG(DIR) | -0.050922 | 0.048393 | -1.052262 | 0.2999 |
| LOG(EER) | 0.092021 | 0.041624 | 2.210785 | 0.0337 |
| LOG(IFR) | 0.092701 | 0.154110 | 0.601526 | 0.5514 |
| LOG(FIR) | -0.129514 | 0.128481 | -1.008040 | 0.3204 |
| R-squared | 0.980326 | Mean dependent var | | 11.54856 |
| Adjusted R-squared | 0.977515 | S.D. dependent var | | 2.869473 |
| S.E. of regression | 0.430274 | Akaike info criterion | | 1.285669 |
| Sum squared resid | 6.479747 | Schwarz criterion | | 1.536436 |
| Log likelihood | -20.35622 | F-statistic | | 348.7986 |
| Durbin-Watson stat | 1.835848 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $E_1$

## CHOW TEST RESULTS

**Dependent Variable: M2**
**Method: Least Squares**
**Date: 05/11/12 Time: 12:01**
**Sample: 1970 1991**
**Included observations: 22**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | -3416.829 | 19252.49 | -0.177475 | 0.8614 |
| RGDP | 0.451709 | 0.116252 | 3.885602 | 0.0013 |
| DIR | 1172.252 | 1114.863 | 1.051476 | 0.3087 |
| EER | -3.391667 | 147.8964 | -0.022933 | 0.9820 |
| IFR | -6391.775 | 8236.864 | -0.775996 | 0.4491 |
| FIR | -4082.470 | 3454.322 | -1.181844 | 0.2545 |
| R-squared | 0.974655 | Mean dependent var | | 21498.55 |
| Adjusted R-squared | 0.966735 | S.D. dependent var | | 23042.44 |
| S.E. of regression | 4202.635 | Akaike info criterion | | 19.75181 |
| Sum squared resid | 2.83E+08 | Schwarz criterion | | 20.04937 |
| Log likelihood | -211.2699 | F-statistic | | 123.0592 |
| Durbin-Watson stat | 1.300644 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

**Dependent Variable: LOG(M2)**
**Method: Least Squares**
**Date: 05/11/12 Time: 12:07**
**Sample: 1970 1991**
**Included observations: 22**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | -1.767695 | 3.070464 | -0.575709 | 0.5728 |
| LOG(RGDP) | 0.896570 | 0.186289 | 4.812796 | 0.0002 |
| LOG(DIR) | 0.244218 | 0.236605 | 1.032176 | 0.3173 |
| LOG(EER) | 0.256021 | 0.330826 | 0.773884 | 0.4503 |
| LOG(IFR) | 0.461172 | 0.280636 | 1.643308 | 0.1198 |
| LOG(FIR) | -0.134696 | 0.391534 | -0.344021 | 0.7353 |
| R-squared | 0.989045 | Mean dependent var | | 9.281679 |
| Adjusted R-squared | 0.985622 | S.D. dependent var | | 1.382740 |
| S.E. of regression | 0.165804 | Akaike info criterion | | -0.529024 |
| Sum squared resid | 0.439854 | Schwarz criterion | | -0.231467 |
| Log likelihood | 11.81927 | F-statistic | | 288.9071 |
| Durbin-Watson stat | 1.663703 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $E_2$

**Dependent Variable: M2**
**Method: Least Squares**
**Date: 05/11/12 Time: 12:03**
**Sample: 1992 2010**
**Included observations: 19**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | -9189.429 | 9720.326 | -0.945383 | 0.3617 |
| RGDP | 0.227268 | 0.049749 | 4.568329 | 0.0005 |
| DIR | 731.2922 | 481.9710 | 1.517295 | 0.1531 |
| EER | 52.31876 | 77.75878 | 0.672834 | 0.5128 |
| IFR | 3829.241 | 3378.111 | 1.133545 | 0.2775 |
| FIR | -846.2393 | 2145.057 | -0.394507 | 0.6996 |
| R-squared | 0.988905 | Mean dependent var | | 14197.42 |
| Adjusted R-squared | 0.984638 | S.D. dependent var | | 12700.55 |
| S.E. of regression | 1574.140 | Akaike info criterion | | 17.81289 |
| Sum squared resid | 32212909 | Schwarz criterion | | 18.11114 |
| Log likelihood | -163.2225 | F-statistic | | 231.7479 |
| Durbin-Watson stat | 1.786559 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

**Dependent Variable: LOG(M2)**
**Method: Least Squares**
**Date: 05/11/12 Time: 12:05**
**Sample: 1992 2010**
**Included observations: 19**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | -0.757879 | 2.497378 | -0.303470 | 0.7663 |
| LOG(RGDP) | 0.857006 | 0.150670 | 5.687982 | 0.0001 |
| LOG(DIR) | 0.028318 | 0.223033 | 0.126968 | 0.9009 |
| LOG(EER) | 0.228963 | 0.267773 | 0.855062 | 0.4080 |
| LOG(IFR) | 0.604695 | 0.233624 | 2.588328 | 0.0225 |
| LOG(FIR) | -0.001252 | 0.325801 | -0.003842 | 0.9970 |
| R-squared | 0.991870 | Mean dependent var | | 8.995869 |
| Adjusted R-squared | 0.988743 | S.D. dependent var | | 1.259942 |
| S.E. of regression | 0.133677 | Akaike info criterion | | -0.934684 |
| Sum squared resid | 0.232306 | Schwarz criterion | | -0.636440 |
| Log likelihood | 14.87950 | F-statistic | | 317.2062 |
| Durbin-Watson stat | 1.594678 | Prob(F-statistic) | | 0.000000 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $F_1$

## Johansen Co-Integration Test

**Date: 0/11/12 Time: 05:42**
**Sample: 1970 2010**
**Included observations: 36**
**Test assumption:**
**Linear deterministic trend in the data**
**Series: D(M2,2) D(RGDP,2) D(DIR,2) D(EER,2) D(IFR,2) D(FIR,2)**
**Lags interval: 1 to 1**

| Eigenvalue | =Likelihood Ratio | 5 Percent Critical Value | 1 Percent Critical Value | Hypothesized No. of CE(s) |
|---|---|---|---|---|
| 0.992913 | 531.5783 | 94.15 | 103.18 | None ** |
| 0.979706 | 353.3945 | 68.52 | 76.07 | At most 1 ** |
| 0.907966 | 213.0879 | 47.21 | 54.46 | At most 2 ** |
| 0.797339 | 127.2064 | 29.68 | 35.65 | At most 3 ** |
| 0.732985 | 69.74246 | 15.41 | 20.04 | At most 4 ** |
| 0.460352 | 22.20618 | 3.76 | 6.65 | At most 5 ** |

*(**) denotes rejection of the hypothesis at 5%(1%) significancelevel
L.R. test indicates 6 cointegrating equation(s) at 5% significance level

Unnormalized Cointegrating Coefficients:

| D(M2,2) | D(RGDP,2) | D(DIR,2) | D(EER,2) | D(IFR,2) | D(FIR,2) |
|---|---|---|---|---|---|
| -1.23E-08 | 8.55E-08 | 4.13E-05 | -0.001747 | -0.001899 | 0.002673 |
| -2.77E-08 | 7.17E-08 | -3.11E-05 | -0.000411 | 0.004718 | 0.001142 |
| 5.82E-09 | -1.87E-07 | -6.19E-06 | -0.004544 | 0.029148 | 0.009575 |
| 2.22E-08 | 4.35E-07 | -6.53E-06 | 0.003519 | -0.042290 | 0.006523 |
| 1.19E-08 | 7.83E-10 | -1.40E-05 | -0.012424 | -0.020494 | -0.009275 |
| 4.70E-09 | 2.57E-07 | 2.55E-05 | -0.001575 | 0.042072 | -0.004186 |

= Normalized Cointegrating

| | | | | | | |
|---|---|---|---|---|---|---|
| Coefficients: 1 Cointegrating Equation(s) | | | | | | |
| D(M2,2) | D(RGDP,2) | D(DIR,2) | D(EER,2) | D(IFR,2) | D(FIR,2) | C |
| 1.000000 | -6.951257 | -3355.972 | 141982.5 | 154317.6 | -217248.6 | 14042.75 |
| | (0.78833) | (171.740) | (17935.1) | (82333.7) | (20617.5) | |
| = Log likelihood | =-1926.332 | | | | | |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $G_1$

## ECM RESULT

**Dependent Variable: M2**
**Method: Least Squares**
**Date: 05/11/12 Time: 05:45**
**Sample(adjusted): 1971 2010**
**Included observations: 40 after adjusting endpoints**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | -888704.2 | 1623022. | -0.547561 | 0.5877 |
| RGDP | 0.464388 | 0.242065 | 1.918445 | 0.0637 |
| DIR | -356.3668 | 390.1985 | -0.913296 | 0.3677 |
| EER | 9781.500 | 19327.65 | 0.506088 | 0.6162 |
| IFR | 34250.06 | 29149.51 | 1.174979 | 0.2484 |
| FIR | -20462.53 | 40934.16 | -0.499889 | 0.6205 |
| ECM(-1) | -0.300897 | 0.168217 | -1.788743 | 0.0828 |
| R-squared | 0.492787 | Mean dependent var | | 2287094. |
| Adjusted R-squared | 0.400567 | S.D. dependent var | | 6779207. |
| S.E. of regression | 5248671. | Akaike info criterion | | 33.94248 |
| Sum squared resid | 9.09E+14 | Schwarz criterion | | 34.23803 |
| Log likelihood | -671.8495 | F-statistic | | 5.343574 |
| Durbin-Watson stat | 2.127226 | Prob(F-statistic) | | 0.000604 |

**Source:** E-views (Vision 3.1) Regression output

# APPENDIX $H_1$

## Pairwise Granger Causality Tests

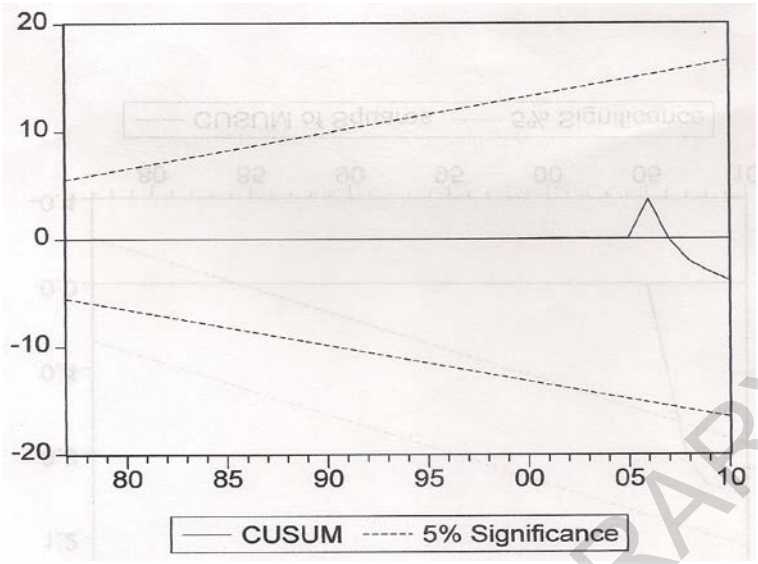
**Pairwise Granger Causality Tests**
**Date: 05/11/12 Time: 12:59**
**Sample: 1970 2010**
**Lags: 2**

| Null Hypothesis: | Obs | F-Statistic | Probability |
|---|---|---|---|
| RGDP does not Granger Cause M2 | 39 | 12.1656 | 0.00010 |
| M2 does not Granger Cause RGDP | | 1.01316 | 0.37377 |
| IFR does not Granger Cause M2 | 39 | 9.14386 | 0.00066 |
| M2 does not Granger Cause IFR | | 0.13307 | 0.87586 |

**Source:** E-views (Vision 3.1) Regression output

## APPENDIX $I_1$

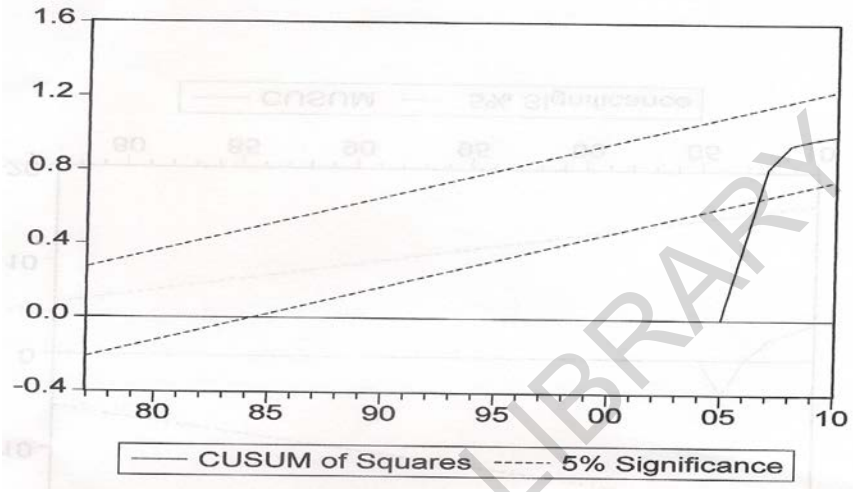
### Stability Test Results




**Source:** E-views (Vision 3.1) Regression output

**Figure 1a: Stability Test Results**

## APPENDIX $I_2$




**Source:** E-views (Vision 3.1) Regression output

**Figure 1b: Stability Test Results**