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Impact of Financial Innovations and Demand for Money in Nigeria.

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INTRODUCTION

The rising importance of financial sector in the economic development of developing countries like Nigeria, as well as the rapid rate of innovation in that sector have generated an increasing research interest in financial innovations and the pattern of money demand. Gurley and Shaw (1960)[1] asserted that the paces of economic development of any developing countries are greatly influenced by their monetary conditions. In other words, a well functioning financial system is inevitable for sustainable economic growth and development. There have been immense developments in the banking sector, which lead to increase in branch banking and use of information technology. The increase in branch banking in Nigeria has occurred with the development of new technology to deliver services such as Automated Teller Machines (ATMs) Electronic Funds Transfer, Credit Cards, Debit Cards etc. These cost effective innovations and product that have become available, have the purpose of reducing the pressure on overtime counter services to bank customers.

Financial innovations may be defined as the emergence of new financial product or services, new organizational forms or new processes for a more developed and complete financial market that reduce cost and risks or provide an improved service that meets customers' particular needs Bilyk (2002)[2]. The centrality of finance in a modern economy and its importance in economic growth naturally raise the requirement for financial innovations. A significant rationale for this research derives from the Nigerian economic reforms beginning from the 80's but the

inference from work shall spell implications of the most recent financial sector reform.

The 2005 banks consolidation, exercise has changed the faces of banking in Nigeria. The emergent 25 banks have new challenges to face: the challenge of inter bank competition for customers and the challenges of new demands from their customers. Banks customers now demand for varieties, convenience and new services. They now want new services that can meet their individual needs. Also technological availability in the past decade has helped banks to respond to these challenges. Consequently, the transformation of the payment system for goods and services through the use of transaction cards, e-banking etc would have a large impact on the demand for cash and its role in the economy. The function of money demand is considered to be among the central behavioural relationship in macroeconomic theory. However, change in the structure of the financial sector can objectively change the reliability of monetary policy.

According to Solans (2003)[3], the main reason for this is the presence of financial innovations that introduce additional element of uncertainties to the economic environment in which the central bank operates. Financial innovations based on the following are necessary and useful element in forecasting money demand. However, for the facts that financial innovation and demand for money have not been empirically analyzed in Nigeria, informed the desired need to undertake this research work "Financial innovation and demand for money in Nigeria".

STATEMENT OF THE PROBLEM

The rapid diffusion of financial innovations: Automated teller machines (ATMs), credit cards, e-banking etc. Following the various economic reforms in the country may have changed the pattern of money demand.

Some innovations may change the way in which the economy reacts to some monetary policy or may affect information content of the indicators that the central bank regularly monitor and that serve as a basis for taking policy decisions. Hence,

any analysis of money demand that do not account for these developments may suffer from a potentially omitted variable problem.

Furthermore, financial innovation has raised serious problems in the definition and measurement of money. This study seeks to replicate empirical works carried out in the western world in Nigeria to see if financial innovation has had significant effects in altering the demand for money in Nigeria.

There is and has always been considerable disagreement among economists over what determines the levels and rates of growth of output, prices and unemployment. The appropriate tool for macro economic stabilization depends on the underlying theory in use. Keynesian, would go for fiscal policy while monetarists would clamor for monetary policy.

Monetary policy refers to the use of interest rates, money supply and credit availability to achieve macro-economic objectives. The use of monetary policy as a tool for macro-economic stabilization depends largely on the behaviour of the demand for money or real cash balances in the hands of economic agents. The instability of the previously stable money demand for money function has thrown up new studies at its various determinants and several other fronts have been explored by economist and econometricians alike. One of these fronts is financial innovations which has blurred the various definition, of money – m_1, m_2, m_3 etc.

Also, the problem of estimating a stable money demand function has thrown up a several lines of research.

RESEARCH QUESTIONS

This research work shall seek relevant answers to these posers otherwise referred to as the research question such as:

1. To what extent will financial innovations impacts on demand for money in Nigeria?
2. Is there any significant long run equilibrium relationship existing between financial innovation and demand for money in Nigeria?

OBJECTIVES OF THE STUDY

The primary objective of this study is to appraise the effect of financial innovations on demand for money in Nigeria.

However, specific objectives of the study which are to provide reasonable answers to the research questions shall be:

1. To determine the impact of financial innovation on demand for money in Nigeria.
2. To determine if there is any long run equilibrium relationship existing between financial innovations and demand for money in Nigeria.

RESEARCH HYPOTHESIS

This research shall be guided by the following hypothesis:

1. Financial innovation has no impact on demand for money in Nigeria.
2. There is no significant long run equilibrium relationship existing between financial innovations and demand for money in Nigeria.

SIGNIFICANCE OF THE STUDY

In this era in Nigeria economy that have witnessed wide proliferation in financial transactions technologies with various innovative ideas and instruments. This research work is extremely important.

It shall be found very helpful in the following ways;

- Since the effects of financial innovation, have never been investigated with respect to money demand in Nigeria, the findings of this work/study shall add to existing literature on money demand in Nigeria.
- The knowledge of the impact of financial innovation on monetary aggregates will also be useful in monetary policy implementation in Nigeria.
- This study will also be helpful to the Central Bank of Nigeria (CBN) in monitoring the movement of the monetary aggregates particularly with multiplicity of transactions technologies brought about by the banking sector reforms.
- Furthermore, members of the academic will find the study relevant as it will also form basis for further research and a reference tell for academic work.

SCOPE AND LIMITATIONS OF THE STUDY

The study covers the growth and innovations in financial sector and has been attested by financial innovations from the period of "1981 – 2014". Though the research would make reference to the related studies of other economies of the world with a view of reviewing related literature on subject matter.

Data for this work shall be only on Nigeria economy. Such variables shall include those related in existing literature to financial innovation and demand for money. Data for this study shall be secondary, majorly from government owned institution like the Central Bank of Nigeria (CBN).

REVIEW OF RELATED LITERATURE

THEORETICAL REVIEW

The relationship between the demand for money and its determinants is considered as a fundamental issue in most theories of macroeconomic behaviour. Stable function for money demand has long been seen as a critical component of rational use of monetary aggregated in monetary implementation. Stable relationship between money, real economy side variable and the set of assets representing the opportunity cost of holding money is preconditioned in answering the average growth-rate of money consistent with price stability[4].

Traditionally, most theories on the demand for money measure money demand with the following are determinants:

i. Price level and rate of price change
ii. Income
iii. Interest
iv. Wealth
v. Rate of return on bonds and equities.

On the basis of theories, many authors have contributed to literature on the estimation of money demand in the economy. Irvin Fisher, A.C Pigou, Jean Bodin, J.M Keynes etc have all made their contribution to this topic.

QUANTITY THEORY OF MONEY

This is Irvin Fisher's formulation. In this formulation, money only serve as a medium of exchange. He emphasized more on the transaction velocity of circulation of money. In his analysis, he used the fact that in every transaction, there is a buyer and a seller.

Thus, in aggregate total amount of sales must equal the amount of sales must equal the amount of money in circulation multiplied by the average number of times that it changes hand over that period. According to this theory, the amount of money the economy needs to hold to facilitates transaction can be regarded as bearing a fixed technical relationship to the level of money transaction.

CASH BALANCE THEORY

The Cambridge school represented by Alfred Marshal and A.C. Pigou took a different approach. They diverted their analysis to the amount of money that an individual wish to hold instead of the money an economy need to hold as fisher.

Money according to them could be held for its convenience in making purchases and sales and also for security. The amount held being a function of the volume of transaction and the returns available in alternative investment outlets in form of interests and dividends, capital gains and losses. The principal determinant of money holding by individuals is the fact that it is generally accepted in settlement for goods and services. This means that the more transaction an individual has to make, the more cash he would want to hold.

Apart from the level transaction, the demand for money varies with the level of wealth, opportunity cost of holding money, income forgone by not holding other assets, the price level and price expectations. They did not further work to establish the relationship between these variables.

They argued that the demand for money by individuals, corporate bodies, and the aggregates economy in nominal term is proportional to the nominal level of income hence

$Md = Kpy$ i.e. $Md = Ms$

Where:

Md = Quantity of money demanded

K = Constant Fraction of the value of all money transactions.

P = Prevailing price level

Y = Real output of goods and services

Ms = Quantity of money in circulation

This theory does not lay claim to the stability of money demand function but did not make suggestion regarding the source of instability.

KEYNES LIQUIDITY PREFERENCE THEORY

In the Keynesian model, money becomes much more than a medium of exchange, people demand money also for speculative purposes and as a security against unforeseen needs for cash reserves. The transaction demand for money is the need to hold money.

In this theory, the motive for holding money was broken down into three: Transactionary demand, precautionary demand and speculative motive. The first two depending on the level of income while the third (speculative) depends on interest rate.

Keynesian model of money demand became a function of income and interest rate i.e. $md = L_1, (y) + L_2 (r)$.

A major contribution of Keynes in this area is the explicit exposure of the instability of money demand function. He attributed the instability to the vagaries of speculative demand for money. While this position is expected, other factors other than the vagaries of speculative demand for money may have contributed to the instability. The theory thus postulates a stable demand for money function.

NIGERIA'S EXPERIENCE WITH FINANCIAL INNOVATIONS

Ever since the African banking corporation made it's debut on Nigeria financial market in 1892, no time has there been such a massive deployment of information technology as it is in the banking industry today; Forces often alluded to this change were the wind of deregulation of banking industry in 1986 which unleashed innovative and unprecedented competitive spirit among participants in

the sector. It was recognized though lately that information enable services could be relatively efficient and cost effective than traditional face-to-face banking[5],[6].

Succinctly put, it is an enabler that defines and refocuses competition such that its deployment in the right mix will alter quality and speed of service delivery. No doubt, this underscores customer's paradigm shift, while in the past they were contended with any services the banks preferred to offer; now they prescribe such services. Now customers are unlikely to adopt and adapt to so called mall-produced and mass marketing myopia, which characterized the pre-1986 banking period. Now they want bank products and services that meet their specifications.

TRENDS IN FINANCIAL INNOVATION IN NIGERIA

The researcher took upon himself the duty of investigating the trend of financial innovation to Nigeria through the construction of index of financial innovation.

This index of financial innovation has been constructed similar to the one developed by Holmes (2001)[7] and used by Bilyk (2006)[2]. First six major and most frequently used financial innovation of the banking sector in Nigeria (e.g. ATM, Credit card, Debit card, Wire transfer e-Banking). Secondly questionnaire on the financial products and instrument was developed. Third, this questionnaire has been distributed among top staff of Nigerian banks in order to determine the overall development of financial innovations in Nigeria, the factors constitution, the questionnaire have been treated equally.

The index has not been designed to measure the proportional contribution of the set of statistically independent variable to development of Nigeria banking during 1997 – 2006.

THE CASHLESS SYSTEM – AN OVERVIEW

Contrary to what is suggestive of the term, cashless economy does not refer to an outright absence of cash transactions in the economic setting but one in which the amount of cash-based transactions are kept to the barest minimum. It is an economic system in which transactions are not done predominantly in exchange for

actual cash. It is not also an economic system where goods and services are exchanged for goods and service (the barter system). It is an economic setting in which goods and services are bought and paid for through electronic media. It is defined as "one in which there are assumed to be no transactions frictions that can be reduced through the use of money balances, and that accordingly provide a reason for holding such balances even when they earn rate of return". In a cashless economy, how much cash in your wallet is practically irrelevant. You can pay for your purchases by any one of a plethora of credit cards or bank transfer. Some aspects of the functioning of the cashless economy are enhanced by e-finance, e-money, e-brokering and e-exchanges. These all refer to how transactions and payments are effected in a cashless economy.

In Nigeria, under the cashless economy concept, the goal is to discourage cash transactions as much as possible. The CBN had set daily cumulative withdrawal and deposit limits of N150,000 for individuals and N1,000,000 for corporate entities (now reviewed to N500,000 and N3million respectively). Penalty fees of N100 and N200 respectively (now reduced to 5% and 3% respectively) are to be charged per extra N1000.

It should be said that as at now there are already some forms of cashless transactions that are taking place in Nigeria. It is noted that: Today there are up to seven different electronic payment channels in Nigeria, Automated Teller Machines (ATM), points of sales terminals, mobile voice, web, inter-bank branch and kiosks. E-payment initiatives in Nigeria have been undertaken by indigenous firms and have been stimulated by improvement in technology and infrastructure. As noted above, the cashless economy does not imply an outright end to the circulation of cash (or money) in the economy but that of the operation of a banking system that keeps cash transactions to the barest minimum. The CBN had set daily limits of cumulative withdraws and lodgments of 150, 000 for individuals and 1,000,000 for corporate customers (now 500,000 and 3million respectively). The operation of the system does not mean the individual/corporations cannot hold cash in excess of 150,000/

N1million (now 500,000/N3million respectively) respectively at any single point in time but that their cumulative cash transactions with the bank must not exceed these limits over a period of one day. The system is targeted at encouraging electronic means of making payments, and not aimed at discouraging cash holdings. This policy on limits implies that an individual can actually have 5,000,000 (more than 150,000 now 500,000) under his pillow at home, buys goods and services with them but must not pay more than 500,000 into his bank in one day without attracting a fine of 5% per 1000 for the excess. What is anticipated by this policy is that instead of making large withdrawals to effect payment for goods and services, such monies will be kept in the banking system so that payments are made through "credit card-like means." In this system users are issued with electronic cards which can be slotted into special electronic machines in order to effect payments.

BENEFITS OF THE CASHLESS ECONOMY

Having seen how the system works, we would want to highlight the benefits of the system. So much criticism has been raised about the cashless system. The zenith of such criticism is that it has been labeled the "FORERUNNER OF THE MARK OF THE BEAST". However experts and government officials have continued to paint the system in very colourful tones. For instance, the World Bank says that "operating a cashless society in Nigeria was strategy for fast-tracking growth in the nation's financial sector". If the World Bank says so, one expects that to be true. Experts have pointed out specific areas in which the cashless economy will enhance the quality of life. These include:

1. Faster transactions – reducing queues at points of sales.
2. Improving hygiene on site – eliminating the bacterial spread through handling notes and coins.
3. Increased sales.
4. Cash collection made simple – time spent on collecting, counting and sorting cash eliminated.
5. Managing staff entitlements.

It is also noted that: It reduces transfer/processing fees, increases processing/ transaction time, offers multiple payment options and gives immediate notification on all transactions on customers' account. It is also beneficial to the banks and merchants; (there) are large customer coverage, international products and services, promotion and branding, increase in customer satisfaction and personalized relationship with customers, and easier documentation and transaction tracking. As a policy instrument, CBN has heaped a lot of praises on the cashless system. CBN has hinged economic development on the cashless system; it sees it as a tool for tackling corruption and money laundering. It has been pointed out that: "Among the reasons glibly advanced by the CBN for this policy include reducing the cost of cash management, making the Nigerian economy cashless, checking money laundering and the insecurity of cash in transit". Statistics show that cash management in 2009 cost N114.5 billion and this is projected to stand at N200 billion in 2020. In the same vein, the cashless system provides the opportunity of being able to "follow the money" and thus check money laundering across boarders. Added to this is the perceived impact on the Naira. The system will reduce the pressure on the Naira. This can only happen if there is effective and standard cross-boarder electronic transmittal's reporting system. Following from the above therefore, it is anticipated that the cashless system will bring with it transparency in business transactions. In the same token, the cashless economy will bring with it a leaning towards banking culture. It is seen that the effort is directed at ensuring 'cashless economy' and nurturing the culture of saving in the unbanked majority in the country". Most of Nigerians are still unbanked, and so we have large proportion of the citizenry not subject to such monetary policy instruments as are used in the banking system. This development will make CBN's policy tools more effective for achieving economic development and stability goals.

EMPIRICAL LITERATURE

While the effect of financial innovations on demand for money has received virtually no empirical attention in Nigeria. Some studies have been carried out to

determine the effect of financial innovation on demand for money elsewhere. These studies have immensely contributed to the understanding of money demand behaviour in the various countries where they were carried out. The findings of these studies shall form the bulk of the empirical literature review of the current work.

Nduka, Chukwu and Nwakaire (2013)[8] examine stability of demand for money function in Nigeria for the period of 1986 to 2011. The study uses CUSUM and CUSUMSQ tests for stability and reports that demand for money function is stable during the period reviewed.

Adam, Kessy, Nyella and O'Connell (2011)[9] study the demand for money (M2) function in Tanzania using quarterly data from 1998Q1 to 2011Q4. The study employs VAR and VEC approach. The variables employed are broad money demand (M2), real GDP, interest rate, inflation rate and rate of nominal exchange rate depreciation. The study reports that disaggregating currency and deposits, currency responds more strongly to expected inflation, and deposits to the interest rate spread vis-à-vis T-bills, than does overall M2. The results show the existence of a stable cointegrating relationship between real money balances and its determinants in Tanzania.

Halicioglu and Ugur (2005)[10] analyze the stability of the narrow money (M1) demand function in Turkey with annual data of national income, interest rate, and exchange rate for the period of 1950 to 2002. The study employs ARDL approach with the CUSUM and CUSUMSQ for stability tests. The results show that there exists a stable money demand function and suggests that it is possible to use the narrow money aggregate as target of monetary policy in Turkey.

Similarly, Sovannroeun (2008)[11] estimates the demand for money function in Cambodia with monthly data for the period of 1994:12 to 2006:12. The variables used are demand for money balances proxied by M1, real income, inflation rate, and exchange rate. The study employs ARDL approach of cointegration developed by Pesaran. (1996, 2001) and CUSUM and CUSUMSQ tests for stability. The estimated

coefficient of error correction term indicates that there is cointegration among variables in money demand function. The results also reveal that the estimated elasticity coefficients of real income and inflation are respectively positive and negative as expected. The exchange rate coefficient is negative which supports currency substitution symptom in Cambodia. The study concludes that the demand for money function is stable during the period covered in Cambodia.

In another study, Dritsakis (2011)[12] examines the demand for money in Hungary using quarterly data for the period of 1995Q1 to 2010Q1. The study uses the variables; money demand (M1), real income, inflation rate, and nominal exchange rate. The study employs ARDL cointegrating framework and CUSUM and CUSUMSQ stability tests. The results show that there is unique cointegrated and stable long-run relationship among M1, real income, inflation rate, and nominal exchange rate. Real income elasticity is positive, while the inflation rate elasticity and nominal excahange rate are negative. The CUSUM and CUSUMSQ tests show that narrow money demand function is stable over the period covered in Hungary.

Dagher and Kovanen (2011)[13] investigate the long-run stability of money demand for Ghana with quarterly data for the period of 1990Q1 to 2009Q4. The study Adopts ARDL approach and bounds test procedure developed by Pesaran. (2001) and the CUSUM and CUSUMSQ tests for stability. The variables used are broad money, real income, nominal effective exchange rate, domestic deposit interest rate, the cedi treasury bill interest rate, the US treasury bill interest rate, and the US dollar Libor interest rate. The results show that key determinants of money demand are real income and exchange rate, while other financial variables are found insignificant in the estimation. The study reports a stable long-run money demand function in Ghana.

In a similar study, Baba, Kenneth and Williams (2013)[14] examine the dynamics of money demand in Ghana with annual data for the period of 1980 to 2010. The study employs Dynamic Ordinary Least Squares (DOLS). The variables used are narrow money demand, GDP as a proxy for income, consumer price index

and, nominal exchange rate. The results show that apart from income, inflation and exchange rate elasticities are negative. The study reports a stable money demand function, and concludes that changes in past and current macroeconomic activity significantly affect money demand in Ghana.

In other studies conducted on Indian economy, Das and Mandal (2000)[15] considers M3 money supply and conclude that money demand function is stable in India. The study uses monthly data for the period of April 1981 to March 1998. The variables used are industrial production, short-term interest rates, wholesale prices, share prices, and real effective exchange rates. The results show that there is cointegrating vectors among M3 and the other variables.

In contrast, Inoue and Hamori (2008)[16] empirically analyze India's money demand function for the period of 1980 to 2007 with both monthly and annual data for the period from 1976 to 2007. The study employs dynamic OLS (DOLS) and carries out cointegration tests. The variables used are real demand for money balances (M1, M2, and M3) as dependent variable, interest rates and output as independent variables. The results show that when money supply is represented by M3, there is no long-run equilibrium, whereas there is long-run equilibrium when money supply is represented by M1 and M2 and the coefficients of interest rate and output are consistent with economic theory, respectively.

Hamori (2008)[17] analyzes the demand for money function in 35 Sub-Saharan African countries including Nigeria, for the period of 1980 to 2005 and adopts a non-stationary panel data analysis. The variables used are real money balances (M1); real money balances (M2); real GDP; interest rate, and inflation rate. The empirical results reveal that that there exists a cointegrating relation with respect to money demand in the Sub-Saharan African region over the period studied, regardless of whether M1 or M2 is used as the money supply measure. Thus, money supply (M1 and M2) is a reliable policy variable from the intermediate-target perspective.

In a similar study on eleven Euro countries, Hamori and Hamori (2008)[18] reveal that the money demand fuction is stable with respect to M3 money demand in Euro aria. The results of the panel estimation indicate that the output coefficient is positively related to M3, while the interest rate is negatively related to M3 in the eleven Euro countries. Felmingham and Zhang (2000)[19] investigate the long-run demand for broad money in Australia subject to regime shifts with monthly data over the period of 1976(3) to 1998(4). The study employs Gregory Hansen cointegration. It reveals some evidence for the presence of cointegration between broad money, non-money assets, and GDP. The results show a break date in 1991 coinciding with a deep recession and policy induced interest rate reductions in Australia during the period. The income elasticity of demand exceeds one,reacts positively to the interest spread and negatively to inflation.

Lungu, Simwaka, and Chiumia (2012)[20] study the demand for money function in Malawi using monthly data for the period of 1985 to 2010. The variables used are real money balances, prices, income, exchange rate, treasury bill, and financial innovation. The study employs VAR, VEC, and Granger causality approaches. The results show that the model is stable and adequate. It further shows that in the long-run real GDP, inflation, exchange rate, treasury bill rate, and financial depth all have significant impact on the demand for money, while in the short-run, it is financial innovation, exchange rate movements, and lagged money supply that display causality in money demand.

Suliman and Dafaalla (2011)[21] investigate the existence of a stable money demand function in Sudan using annual data for the period of 1960 to 2010. They employ the Johansen Maximum Likelihood procedure using real money balances, real GDP (as a scale variable), the rate of inflation and exchange rate (as opportunity cost of holding money balances variables). All variables are in logarithmic form, except inflation rate. The results reveal that there is a long-run relationship between real money balances and the explanatory variables. The study further shows that money demand function is stable between 1960 and 2010 in Sudan. The study

concludes that it is possible to use the narrow money aggregate as target of monetary policy in Sudan.

Similarly, Dahmardeh, Pourshahabi, and Mohmoudinia (2011)[22] empirically study the long-run relationship between money demand and its determinants in Iran with annual data for the period of 1976 to 2007. The study employs conditional ARDL model with economic uncertainty, money demand, real income, and real interest rate as the variables. The results show that economic uncertainty has a significant negative effect on money demand; real income has a positive and significant effect on money demand, while interest rate has a negative effect on money demand. Moreover, economic uncertainty measured by EGARCH (1,1) model of inflation rate, exchange rate, growth of GDP and terms of trade, has a negative and significant effect on money demand in Iran. The study, therefore reports that there exists a long-run relationship between M1 and its determinants in Iran.

Anoruo (2002)[23] investigates the stability of demand for money in Nigeria during the SAP period. Results from Johansen and Juselius (1990)[24] cointegration tests show that real broad money, economic growth, and real discount rate have a long-run relationship. The study employs Adebiyi (2006)[25] stability test and reports that demand for broad money is stable in Nigeria during the SAP period from 1986Q2 to 2000Q1.

In another study, Akinlo (2006)[26] examines the cointegrating property and stability of M2 money demand in Nigeria. The results reveal that M2 is cointegrated with income, interest rate and exchange rate. Moreover, the results show that income is positively related to demand for money, while interest rate is negatively related to demand for money.

Nwafor (2007)[27] examine the quantity theory of money via Keynesian liquidity preference theory in Nigeria using quarterly data from 1986Q3 to 2005Q4. The variables used are demand for money (M2), real income, real interest rate, and expected inflation rate. The study employs the ADF unit root and Johansen-Juselius cointegration tests. The results show that demand for money is positively related to

real income, real interest rate, and expected inflation rate, respectively in Nigeria. The study therefore concludes that there exists a longrun relationship among aggregate demand for money in accordance with the Keynesian liquidity preference theory.

Gbadebo (2010)[28] examines whether financial innovation affects the demand for money in Nigeria for the period from 1970 to 2004. The study employs OLS and Engle-Granger cointegration techniques. The variables used are broad money, nominal interest rate on time deposit, real GDP, nominal rate on treasury bills, dummy variable to capture SAP period, consumer price index and lag of broad money. The results suggest that financial innovations have not significantly affected the demand for money in Nigeria during the period studied.

Omanukwue (2010)[29] investigates the modern quantity theory of money with quarterly time series data from Nigeria for the period of 1990Q1 to 2008Q4. The study employs Engle- Granger two-stage approach for cointegration to examine the long-run relationship between money, prices, output, interest rate and ratio of demand deposits/time deposits. It employs also the granger causality to examine the causality between money and price. The study establishes the existence of weakening uni-directional causality from money supply to core consumer prices in Nigeria. The study also reports evidence of a long-run relationship between the variables. In all, the results indicate that monetary aggregates still contain significant, albeit weak, information about developments in core prices in Nigeria.

Kumar, Webber and Fargher (2010)[30] investigate the level and stability of money (M1) demand in Nigeria for the period of 1960 to 2008 with annual data. In addition to estimating the canonical specification, alternative specifications are presented that include additional variables to proxy for the cost of holding money. Results of Gregory-Hansen cointegration tests suggest that the canonical specification is well determined. The money demand relationship went through regime shift in 1986 and 1992 respectively, which slightly improved the scale of economies of money demand. The results further show that there is a cointegrating

relationship between narrow money, real income and nominal interest rate after allowing for a structural break. The study concludes that the demand for money was stable in Nigeria between 1960 and 2008 although there is evidence to suggest that it may have declined by a small amount around 1986.

Similarly, Chukwu, Agu and Onah (2010)[31] examine the evidence in the money demand function in the structural break framework with unknown break point for the period of 1986Q1 to 2006Q4 in Nigeria. The variables used are real money demand (M2) as dependent variable, real income, interest rate proxied by interest swap spread, and expected rate of inflation proxied by CPI as independent variables. The study employs the Gregory-Hansen approach for cointegration. The results show that real income and interest rate are positively related to real demand for money, whereas expected rate of inflation is inversely related to money demand. The results further show that there exists structural breaks in the cointegrating vectors of the Nigerian long-run money demand
function in 1994, 1996, and 1997.

Omotor (2011)[32] estimates an endogeneous structural break date of the money demand for Nigeria for the period from 1960 to 2008 with Gregory- Hansen cointegration approach. The variables employed are broad money, real GDP and nominal interest rate. The results suggest that there exists a stable long-run demand for money function in Nigeria during the period reviewed.

Bitrus (2011)[33] examines the demand for money in Nigeria with annual data on both narrow and broad money, income, interest rate, exchange rate, and the stock market for the period of 1985 to 2007. The study employs OLS technique and CUSUM stability test. The results show that money demand function is stable in Nigeria for the sample period and that income is the most significant determinant of the demand for money. It further shows that stock market variables can improve the performance of money demand function in Nigeria.

Similarly, Bassey (2012)[34] investigate the effect of monetary policy on demand for money in Nigeria with annual data for the period of 1970 to 2007. The

study employs OLS multiple regression technique and finds inverse relationship between money, domestic interest rate, expected rate of inflation and exchange rate.

Watson (2001)[35] studies the demand for money in Jamaica with quarterly data from 1976Q1 to 1998Q4. The study employs both restricted and unrestricted VAR models and structural cointegration. The variables used are money supply, national income, deposit price level, rate of interest, base money, deposit rate of interest and, interest on loans. The results show that there exists a stable long-run demand for money function in Jamaica over the period studied. The study concludes that the Error Correction form had satisfactory diagnosis while the Persistence Profiles, a useful tool for policy analysis purposes, are not at odds with the predictions of economic theory.

Nachega (2001)[36] applies VAR models analysis to investigate the behaviour of demand for money (M2) in Cameroon from 1963/64 to 1993/94. The cointegrated VAR analysis first describes an open-economy model of money, price, income, and a vector of rates of return, within which three steady state relations are identified: a stable money demand function, an excess aggregate demand relationship, and the uncovered interest rate relation under fixed exchange rates and perfect capital mobility. The results show a short-run stable demand for money in Cameroon over the period studied.

Bilyk (2006)[2] in his thesis "Financial innovation and demand for money in Ukraine" Using Ukrainian data between 1997 – 2005 made the assertion that failure to model financial innovation in money demand functions may yield unstable and mis-specification of functions.

Hester, Calcagnini and De Bonis (2001)[37], using data between 1991 and 1995 for 6 sample of large Italian banks find some evidence supporting the idea that ATMs reduce transaction cost and demand currency.

Blankson and Belnye (2004)[38] in their paper "The impact of financial innovation and demand for money in Ghana" modeled money demand function to include two different proxies for financial innovations: volume of cash cards

transaction and the ratio of m_2 to m_1 (i.e. m_2/m_1). Their result showed that there is a long run positive impact of financial innovation in demand for money in both cases. The results using ECM showed that changes in innovation enter the demand for money with significant and positive signs. This means that changes in innovations exert a positive influence on demand for narrow money. Hence, increase in innovation leads to an increase in the demand for narrow money in an economy.

Bilyk (2001)[2] found positive relationship, between financial innovation and demand for money in Ukraine. The study period covers nine years from January 1997 till December 2005. The empirical part of the thesis was conducted by means of error – correction model (UECM).

Bacao (2001)[39] estimated and tested an econometric model of demand for narrow money in Portugal. The error correction model was based on adjusted velocity of circulation. The timing of the shifts in the velocity of circulation does not appear to be relate financial innovation. Hence Bacao concluded that financial innovation though theoretically has some influence on demand for but its effect is not observable to warrant empirical investigation.

Emmanuel (2002)[40] examined the stability of the m_2 money demand function in Nigeria in the Structural Adjustment Programme (SAP) period. The result from the Johansen and Juselius Co integration test suggests that real discount rate, economic activity and real m_2 was co integrated.

Busart (2004)[41] using co integration and error correction approach on annual data for the period of 1970 – 2003 to examine Nigeria money demand function. In this study, he observed that demand for money in Nigeria this was stable and that reforms measures introduced in the mid 1980s seems not to have significantly altered the demand function for money in Nigeria.

Adebiyi (2006)[25] examined broad money demand, financial liberalization and currency substation in Nigeria using Error Correction Model (ECM). His result showed that long run demand for real balances in Nigeria depends upon real income on its own interest rate on government securities, inflation and expected exchange

rates. He finally concluded that money demand function in Nigeria was stable despite the economic reforms and financial crises.

Gibadepo and Adedapo (2008)[42] examined the impact of financial innovation on the stability of Nigeria money demand function using Johanson ECM and they found that financial innovation has impact but not a significant impact

In summary, the above empirical review indicates that most of the works mentioned were studies of other countries. Those of Nigeria were either weak due to fewer numbers of years covered in the study or suffer from inadequacies that the study extends its scope to 2014 from 1981.

RESEARCH METHODOLOGY

RESEARCH DESIGN AND METHODOLOGY

The research design to be employed in this work is the ex-post facto or multiple regression method, based on ordinary least square. The choice for the ex-post facto stems from its major objective which is to explore the relationship between financial innovations and demand for money in Nigeria. The Ex-post facto methodology is considered most appropriate for a research of this sort for the following reasons: This research design tries to dig out the cause and effect relationships where causes already exists and cannot be manipulated. The ex-post facto or causal comparative research design makes use of what already exists and looks backwards to explain why it is so and. It provides a means to measure the effects of the independent variables on the dependent variable.

Multiple regressions involving the ordinary least square method of estimation shall be employed in this research.

The choice of this method is based on the “BLUE” property that is Best Linear Unbiased Estimation. This is because it helps to ascertain quantitatively the impact of certain factors on a given phenomenon under study. According to Koustsyianis (1977) states that in attempting to study any relationship between variables, it is important to express the relationship in mathematical form.

MODEL SPECIFICATION

The model specification will be

$$DM = F(FI, INT, LR) \quad (1)$$

Where;

DM is the demand for money

FI is financial innovations

INT is interest rate

LR is the liquidity ratio.

DM, demand for money is the dependent variables while financial innovation; interest rate and liquidity ratio are the independent variables. To show the impact financial innovations and demand for money in Nigeria of will be,

$$DM = \beta_O + \beta_1 FI + \beta_2 INT + \beta_3 LR + U_t \quad (2)$$

Where Ut are those variables that can affect the DM which are not stated in the model specification.

ESTIMATION PROCEDURE

Prior to running a regression to obtain the ordinary least square (OLS) estimates and the non linear component of the system using the state space model (SSM), the entire series shall be subjected to some econometric and deterministic examinations.

UNIT ROOT TEST

The unit root test is utilized to test for the stationary of time series data. Since most of the macroeconomic time series are non-stationary (Nelson and Plosser, 1982) and are prone to spurious regression, the first step in any econometric or time series analysis is always to test for stationary. The widely used augmented dickey fuller (ADF) test statistic shall be used to test for stationarity. It shall be compared with the critical values at 5% level of significance. If the ADF test statistic is at any level, greater than the critical values with consideration on their absolute values, the data at the tested order is said to be stationary. Augmented Dickey-fuller test relies on rejecting a null hypothesis of stationary. The tests are conducted with and without a deterministic trend (t) for each of the series. For the purpose of this research, an augmented dickey-fuller (ADF) test shall be conducted by carrying out a unit root test based on the following structure: s

$$\Delta x_t = k + a_t + \theta x_{t-1} + \Sigma_{t=I} \Phi \Delta_{t-1} + e_t \qquad (3)$$

Where X is the variable under consideration, Δ is the first difference operator, t captures time trend, at is a random error, and n is the maximum lag length. The optimal lag length is identified so as to ensure that the error term is white noise. K, a, θ and Φ are the parameters to be estimated. If we cannot reject the null hypothesis that θ=o, then we conclude that the series under consideration has a unit root and is therefore non-stationary. On the assumption of unit root for all the variables employed, we would proceed to test for co integration.

CO INTEGRATION TEST

The whole series shall at this stage be tested for co integration to further ensure that the entire model is not spurious. A series is co integrated if all the variables in the model present a unit root or are stationary even if one or all the variables are individually non stationary (Gujarati, 2009)[43]. Granger (1969)[44], recommends the test for co integration when he noted that tests for co integration are pre tests to avoid spurious regression situations. If dependent and independent variables are co integrated according to Gujarati (2009)[43], the implication is that

there exists a relationship between the short and long run equilibrium. The co integration test is useful in determining if there is any long run relationship between the variables in model. The focal point of this study shall be to know if a long run equilibrium relationship exists between financial innovations and demand for money in Nigeria. The econometric framework used for analysis in this study is the Johansen (1998) and Johansen and Juselius (1990)[45],[24] maximum likelihood co integrating vectors. This multivariate co-integration test can be expressed as:

$$Z_t = k_1 z_{t-1} + k_2 z_{t-2} + \ldots\ldots\ldots\ldots + k_k\text{-}1 z_{t-k} + u_t + v_t \qquad (4)$$

Where zt (DM, FI, INT and LR) is an n^x1 vector of the variables, DM, FI, INT and LR are proxy representing demand for money, financial innovation, interest rate and liquidity ratio respectively. The constant vector is represented by u_t while v_t is a vector of normally and independently distributed error term. To determine the number of co-integrating vectors, Johansen developed two likelihood ratio tests: trace test (λtrace) and maximum eigenvalue test (λmax). This study shall depend on the trace statistic in taking decisions about the number of co integrating vectors. If co integrating vector(s) is or are identified, we proceed to develop and estimate vector error correction model (VECM).

VECTOR AUTO REGRESSION (VAR)

The Vector Autoregression (VAR) model is one of the most flexible and effective models for the examination of multivariate time series. The VAR model was presented into practical econometrics by Koutsoyiannis (1977)[46]. It is a natural generalisation and an addition of the nivariate autoregressive model to dynamic multivariate time series. The vector autoregression (VAR) model has confirmed to be very valuable for forecasting and for describing the dynamic behaviour of economic variables and financial time series and for forecasting. It often offers better forecasts than those from univariate time series models. In general, the VAR models can be made conditional on potential future paths of specified variables and are often seen to provide a more flexible forecast. Additionally, in order to provide data description and forecasting, the VAR model could be employed for policy analysis

and structural inference. Typically, the imposition convinced assumption about the causal structure of the data under investigation is vital to summarize the causal effects of innovations and unforeseen shocks on the variables in the model.

SOURCES OF DATA

Data is obtained from secondary sources. All the variables to be employed in the empirical estimation and analysis shall be sourced from various issues of the Central Bank of Nigeria.

PRESENTATION AND ANALYSIS OF RESULTS

The attempt to study the impact of financial innovations and demand for money in Nigeria led the researcher to subject the data collected to Unit Root, Co integration, and Vector Auto Regression VAR Test. The variables considered in this research work are: Demand for money (DM) (dependent variable) and the independent variables include: financial innovations (FI), interest rate (INT) and liquidity ratio (LR). The empirical results are presented below:

UNIT ROOT TEST

In other to test for the presence or absence of unit root in the data used for the empirical analysis, Augmented Dickey-Fuller (ADF) test was employed and the test result is as presented below:

TABLE1: AUGMENTED DICKEY FULLER UNIT ROOT TEST AT LEVEL (TREND AND INTERCEPT)

Variables	ADF @ Level	1st difference	2ND Difference	Critical value (5%)	Critical value (10%)	Order of integration	Remarks
D(DM)	-0.600702	-5.424532	-	-4.273277	-3.557759	I(1)	Stationary
D(FI)	-2.216232	-5.294050	-	-4.273277	-3.557759	I(1)	Stationary
D(INT)	-2.992615	-6.036610	-	-4.284580	-3.562882	I(1)	Stationary
D(LR)	-3.179814	-6.057269	-	-4.273277	-3.557759	I(1)	Stationary

SOURCE: Researcher own compilation

From the result above, all the variables, that is, Demand for money (DM), Financial innovations (FI), Interest rate (INT) and Liquidity ratio (LR) exhibited

stationarity at first difference. The stationarity is achieved by comparing their respective ADF test statistics with the 5% critical values; it is observed that their respective test statistics are greater than the critical values in absolute terms. Thus, the series are stationary.

CO-INTEGRATION RESULT

To test for the presence of long run relationship among the variables, the researcher adopted the econometric method of Johansson co integration and the result from the test is shown in the table below.

Series: LDM LFI INT LR				
Lags interval (in first differences): 1 to 2				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.497912	40.43526	47.85613	0.2073
At most 1	0.294089	19.07690	29.79707	0.4874
At most 2	0.210651	8.280625	15.49471	0.4359
At most 3	0.030108	0.947695	3.841466	0.3303
Trace test indicates no cointegration at the 0.05 level				

The results of the co-integration in the table above indicated that the trace statistics is lesser than the critical value at 5 percent level of significance in all of the hypothesized equations. This confirms that there is no cointegration relationship among the various variables used to model the relationship between financial innovations and demand for money in Nigeria for the period under investigation. Specifically, the results of the cointegration test suggested Demand for money (DM) had equilibrium relationship with Financial innovations (FI), Interest rate (INT) and Liquidity ratio (LR) which kept them in equilibrium to each other in the short run. Also, its Eigenvalue was insignificantly lesser than one.

The normalized co-integrating coefficients for 1 cointegrating equation given by the short run relationship is

DM = -0.824094F1 + 0.663738INT + 0.302255LR

Where demand for money (DM) is the dependent variable, -0.824094 is the coefficient of financial innovations (FI), 0.663738 is the coefficient of interest rate (INT) and 0.302255 is the coefficient of liquidity ratio (LR). The sign borne by the adjusted coefficient estimates of FI is negative, while INT and LR is positive. This implies that in the short run, the relationship that will exist between FI and GDP will be negative, while INT, LR and GDP will be positive.

VECTOR AUTO REGRESSION (VAR)

The Vector Auto regression (VAR) model is one of the most flexible and effective models for the examination of multivariate time series. The VAR model was presented into practical econometrics Nelson and Plosser (1982)[47]. It is a natural generalisation and an addition of the nivariate autoregressive model to dynamic multivariate time series. The vector auto regression (VAR) model has confirmed to be very valuable for forecasting and for describing the dynamic behaviour of economic variables and financial time series and for forecasting. It often offers better forecasts than those from univariate time series models.

Vector Autoregression Estimates	
Date: 11/08/16 Time: 01:45	
Sample (adjusted): 1982 2014	
Included observations: 33 after adjustments	
Standard errors in ( ) & t-statistics in [ ]	
	LDM
LDM(-1)	0.910003
	(0.11367)
	[8.00539]
LFI(-1)	0.055421
	(0.09463)
	[0.58569]
INT(-1)	0.050430
	(0.01985)
	[2.53997]
LR(-1)	0.006295
	(0.00788)
	[0.79863]
C	-0.689861
	(0.48977)

	[-1.40855]

Source: Own Computation (See Appendix)
$R^2 = 0.979195$

The result is significant since the coefficient of multiple (0.979195) determination is greater than zero. From the result of the estimation using VAR Test presented above, the coefficient of the constant term is -0.689861 implying that when other variables are kept constant demand for money (DM) decreased by 0.689861 units. The coefficient of FI(-1) is 0.055421 implying that a unit change in financial innovations brought about a 0.055421 unit increase in DM. Similarly, the coefficient of INT is 0.050430 implying that a unit change in interest rate brought about a 0.050430 unit increase in DM. At the same time, LR has a coefficient of 0.006295, meaning that a unit increase in liquidity ratio brought about a 0.006295 unit increase in DM.

The above result indicates that the R^2 is 0.979195 indicating that the explanatory variables explain about 97.91% of the total variations in DM during the period under consideration while other variables not captured in the model accounted for about the remaining 2.09 percent.

TEST OF HYPOTHESES

HYPOTHESES ONE

$H_{o:}$ There is no long run relationship between financial innovations and demand for money in Nigeria.

$H_{1:}$ There is long run relationship between financial innovations and demand for money in Nigeria.

To test the null hypothesis stated above, the researcher made use of the Johansson Cointegration analysis and the result is presented below.

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.497912	40.43526	47.85613	0.2073

At most 1	0.294089	19.07690	29.79707	0.4874
At most 2	0.210651	8.280625	15.49471	0.4359
At most 3	0.030108	0.947695	3.841466	0.3303
Trace test indicates no cointegration at the 0.05 level				

The results of the co-integration in the table above indicated that the trace statistics is lesser than the critical value at 5 percent level of significance in all of the hypothesized equations. This confirms that there is no cointegration relationship among the various variables used to model the relationship between financial innovations and demand for money in Nigeria for the period under investigation. Specifically, the results of the cointegration test suggested Demand for money (DM) had equilibrium relationship with financial innovations (FI), Interest rate (INT) and Liquidity ratio (LR) which kept them in equilibrium to each other in the short run. Also, its Eigenvalue was insignificantly lesser than one. In other words, the null hypothesis of no cointegration among the variables is accepted.

HYPOTHESES TWO

H_o: Financial innovations do not impact on demand for money in Nigeria.

H_1: Financial innovations do impact on demand for money in Nigeria.

From the relationship existing between financial innovations and demand for money in Nigerian as was revealed by the VAR analysis, we observed that there is a positive relationship between financial innovations and demand for money and as such we reject the null hypothesis and conclude that financial innovations do impact on demand for money in Nigeria.

IMPLICATION OF THE STUDY

The VAR result indicated that there was a positive relationship between financial innovations and demand for money. This does conform to a priori expectation. A positive relationship was expected to exist among financial innovation and demand for money. Hence the positive relationship between financial innovations and demand for money could be attributed to the fact that government in recent years had employ more resources into the financial sectors leading to substantial development which tends to impact in the country's general

development and also fostering international partnership with other countries. Interest rate and liquidity ration from the results showed that they had no impact on DM compared to FI and as such, it is advised that interest rate of financial sectors should be lowered in other to increase the amount of money or loan demanded by investors for substantial development in the financial sector and the economy at large. The analysis also shows that for the atmosphere to be conducive for the effective use of monetary policies, financial innovations should be made to affect the demand for money significantly; there is still a place for monetary policy as a macroeconomic stabilization measure. The implication of the result is that an increased financial innovation in conjunction with lowered interest rate and liquidity ratio will continue to improve the Nigerian economy[48].

SUMMARY, CONCLUSION AND RECOMMENDATION

SUMMARY OF FINDINGS

The study investigated empirically the relationship between financial innovations and demand for money in Nigeria for the period between 1981 and 2014 employing various techniques of econometric analysis. In the course of the study, the main objective was to investigate the impact of financial innovations and demand for money in Nigeria for the period under review. The variables used for the empirical analysis in this study are; demand for money (DM), financial innovations (FI), interest rate (INT) and liquidity ratio (LR).

On the application of advanced econometric techniques (Augmented Dickey Fuller, Johansen Cointegration Test, and Estimation of Toda-Yamamoto using VAR Test), the following information were extracted;

- All the variables (DM, FI, INT and LR) became stationary at first difference using augmented dicey fuller unit root test application; this means they all have unit roots which necessitates the application of Johansson cointegration test to test for long run relationship.
- The cointegration result indicated that the variables had short run relationship with no cointegrating equations. Hence, there exists a short-run

equilibrium relationship between financial innovations and demand for money in Nigeria.

- To ascertain the impact of financial innovations and demand for money in Nigeria, the study made use of Vector Auto Regression Test. From the result of the VAR presented above, there exist a positive relationship between demand for money (DM), financial innovations (FI), interest rate (INT) and liquidity ratio (LR). The positive relationship between DM and FI does conform to a priori expectations.

Finally, the regression result indicated that the coefficient of determination (R^2) was 0.979195. This indicates that the explanatory variables explain about 97.91% of the total variations in GDP during the period under consideration while other variables not captured in the model accounted for about the remaining 2.09 percent.

CONCLUSION

This study has looked at the demand for money and how it has been affected by financial innovations in the financial sector of Nigeria arising out of the Structural Adjustment Programme (SAP) of 1986. The term financial innovation refers to anything which ensures greater access to information, quicker means of carrying out transactions and greater ease of liquidity with lower risk. This study investigated the impact of financial innovations and demand for money in Nigeria between 1981 and 2014. From the findings, having seen that financial innovation is statistically significant, we therefore reject the hypothesis that there is no impact between financial innovations and demand for money in Nigeria.

RECOMMENDATION

1. Since the stability of money demand function is crucial to the formulation of monetary policy, the monetary authority must be free to use its instruments to attain broad target consistent with stabilization policy objectives.

2. A precondition for efficient liberalized financial sector is a stable macroeconomic environment during the time of the financial sector reforms. Thus,

in order to ensure effective financial development and savings mobilizations, the government and monetary authority should use monetary instruments that will stabilize the macroeconomic environment. This will create an environment conducive to financial deepening and savings mobilizations.

3. The monetary policy strategy of the CBN should also be structured to deal with the growing challenges posed by financial innovation.

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APPENDIX I

DATE FOR REGRESSION

YEARS	DM (N'Billions)	FI (N'Billions)	INT (%)	LR (%)
1981	19.4	304.8	6	38.5
1982	20.3	215.0	8	40.5
1983	18.7	397.9	8	54.7
1984	16.3	256.5	10	65.1
1985	13.8	316.6	10	65.0
1986	25.0	497.9	10	36.4
1987	26.7	382.4	12.75	46.5
1988	56.2	850.3	12.75	45.0
1989	54.8	610.3	18.5	40.3
1990	57.8	225.4	18.5	44.3
1991	124.9	242.1	14.5	38.6
1992	170.2	491.7	17.5	29.1
1993	205.4	804.4	26	42.2
1994	310.2	985.9	13.5	48.5
1995	466.6	1,838.8	13.5	33.1
1996	406.3	6,979.6	13.5	43.1
1997	391.9	10,330.5	13.5	40.2
1998	1,198.6	13,571.1	14.31	46.8
1999	1,413.1	14,072.0	18	61.0
2000	2,095.5	28,153.1	13.5	64.1
2001	2,256.4	57,683.8	14.31	52.9
2002	2,325.7	59,406.7	19	52.5
2003	8,928.4	120,402.6	15.75	50.9
2004	10,996.0	225,820.0	15	50.5
2005	13,915.4	262,935.8	13	50.2
2006	16,492.1	470,253.4	12.25	55.7
2007	28,111.2	1,076,020.4	8.75	48.8
2008	43,357.4	1,679,143.7	9.81	44.3
2009	29,391.0	685,717.0	7.44	30.7
2010	19,675.5	799,911.0	6.13	30.4
2011	22,302.6	638,925.7	9.19	42.0
2012	7,461.6	808,991.4	12.00	38.5
2013	7,674.9	2,350,875.7	12.00	48.25
2014	7,269.0	1,334,783.1	12.50	51.0

SOURCE: CBN STATISTICAL BULLETIN. 2014

REGRESSION RESULT
UNIT ROOT TESTS
LDM @ LEVEL

Null Hypothesis: LDM has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 0 (Automatic - based on SIC, maxlag=1)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-0.600702	0.9723
Test critical values:	1% level		-4.262735	
	5% level		-3.552973	
	10% level		-3.209642	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LDM)				
Method: Least Squares				
Date: 11/08/16 Time: 01:33				
Sample (adjusted): 1982 2014				
Included observations: 33 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LDM(-1)	-0.069810	0.116214	-0.600702	0.5525
C	0.449453	0.278282	1.615098	0.1168
@TREND(1981)	0.011023	0.032480	0.339374	0.7367
R-squared	0.040488	Mean dependent var		0.179579
Adjusted R-squared	-0.023480	S.D. dependent var		0.446035
S.E. of regression	0.451241	Akaike info criterion		1.332877
Sum squared resid	6.108550	Schwarz criterion		1.468923
Log likelihood	-18.99247	Hannan-Quinn criter.		1.378652
F-statistic	0.632943	Durbin-Watson stat		1.880674
Prob(F-statistic)	0.53797			

	0			

LDM @ 1ST DIFFERENCE

Null Hypothesis: D(LDM) has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 0 (Automatic - based on SIC, maxlag=1)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.424532	0.0006
Test critical values:	1% level		-4.273277	
	5% level		-3.557759	
	10% level		-3.212361	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LDM,2)				
Method: Least Squares				
Date: 11/08/16 Time: 01:34				
Sample (adjusted): 1983 2014				
Included observations: 32 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDM(-1))	-1.002146	0.184743	-5.424532	0.0000
C	0.349285	0.183176	1.906823	0.0665
@TREND(1981)	-0.009435	0.008885	-1.061888	0.2971
R-squared	0.504187	Mean dependent var		-0.003115
Adjusted R-squared	0.469993	S.D. dependent var		0.630270
S.E. of regression	0.458846	Akaike info criterion		1.368856
Sum squared resid	6.105654	Schwarz criterion		1.506269
Log likelihood	-18.90170	Hannan-Quinn criter.		1.414405
F-statistic	14.74490	Durbin-Watson stat		2.010200

Prob(F-statistic)	0.000038			

LFI @ LEVEL

Null Hypothesis: LFI has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 0 (Automatic - based on SIC, maxlag=1)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.216232	0.4655
Test critical values:	1% level		-4.262735	
	5% level		-3.552973	
	10% level		-3.209642	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LFI)				
Method: Least Squares				
Date: 11/08/16 Time: 01:34				
Sample (adjusted): 1982 2014				
Included observations: 33 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LFI(-1)	-0.224784	0.101426	-2.216232	0.0344
C	1.009241	0.421651	2.393546	0.0231
@TREND(1981)	0.078880	0.034608	2.279209	0.0299
R-squared	0.147774	Mean dependent var		0.254080
Adjusted R-squared	0.090959	S.D. dependent var		0.540152
S.E. of regression	0.515001	Akaike info criterion		1.597210
Sum squared resid	7.956767	Schwarz criterion		1.733257
Log likelihood	-23.35397	Hannan-Quinn criter.		1.642986
F-statistic	2.60096	Durbin-Watson		1.8001

	6	stat		03
Prob(F-statistic)	0.090849			

LFI @ 1ST DIFFERENCE

Null Hypothesis: D(LFI) has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 0 (Automatic - based on SIC, maxlag=1)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.294050	0.0008
Test critical values:	1% level		-4.273277	
	5% level		-3.557759	
	10% level		-3.212361	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LFI,2)				
Method: Least Squares				
Date: 11/08/16 Time: 01:35				
Sample (adjusted): 1983 2014				
Included observations: 32 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LFI(-1))	-1.018270	0.192342	-5.294050	0.0000
C	0.241151	0.211238	1.141609	0.2630
@TREND(1981)	0.002108	0.010826	0.194688	0.8470
R-squared	0.497244	Mean dependent var		-0.006781
Adjusted R-squared	0.462571	S.D. dependent var		0.757735
S.E. of regression	0.555492	Akaike info criterion		1.751134
Sum squared resid	8.948566	Schwarz criterion		1.888547
Log likelihood	-25.01815	Hannan-Quinn criter.		1.796683
F-statistic	14.3410	Durbin-Watson		1.8591

	2	stat		66
Prob(F-statistic)	0.000047			

INT @ LEVEL

Null Hypothesis: INT has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 0 (Automatic - based on SIC, maxlag=1)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.992615	0.1493
Test critical values:	1% level		-4.262735	
	5% level		-3.552973	
	10% level		-3.209642	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(INT)				
Method: Least Squares				
Date: 11/08/16 Time: 01:36				
Sample (adjusted): 1982 2014				
Included observations: 33 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
INT(-1)	-0.402206	0.134400	-2.992615	0.0055
C	6.214205	2.114246	2.939206	0.0063
@TREND(1981)	-0.047862	0.059106	-0.809770	0.4244
R-squared	0.239649	Mean dependent var		0.196970
Adjusted R-squared	0.188959	S.D. dependent var		3.587839
S.E. of regression	3.231129	Akaike info criterion		5.270049
Sum squared resid	313.2059	Schwarz criterion		5.406095
Log likelihood	-83.95580	Hannan-Quinn criter.		5.315824
F-statistic	4.72773	Durbin-Watson		2.2054

	6	stat		04
Prob(F-statistic)	0.016414			

INT @ 1ST DIFFERENCE

Null Hypothesis: D(INT) has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 1 (Automatic - based on SIC, maxlag=1)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-6.036610	0.0001
Test critical values:	1% level		-4.284580	
	5% level		-3.562882	
	10% level		-3.215267	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(INT,2)				
Method: Least Squares				
Date: 11/08/16 Time: 01:37				
Sample (adjusted): 1984 2014				
Included observations: 31 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INT(-1))	-1.746801	0.289368	-6.036610	0.0000
D(INT(-1),2)	0.355210	0.179965	1.973773	0.0587
C	1.585825	1.428137	1.110415	0.2766
@TREND(1981)	-0.073410	0.070868	-1.035880	0.3094
R-squared	0.688700	Mean dependent var		0.016129
Adjusted R-squared	0.654111	S.D. dependent var		5.893465
S.E. of regression	3.466083	Akaike info criterion		5.443841
Sum squared resid	324.3707	Schwarz criterion		5.628872
Log likelihood	-80.3795	Hannan-Quinn criter.		5.504157

	4			
F-statistic	19.91102	Durbin-Watson stat		1.942759
Prob(F-statistic)	0.000001			

LR @ LEVEL

Null Hypothesis: LR has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 0 (Automatic - based on SIC, maxlag=1)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.179814	0.1058
Test critical values:	1% level		-4.262735	
	5% level		-3.552973	
	10% level		-3.209642	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LR)				
Method: Least Squares				
Date: 11/08/16 Time: 01:37				
Sample (adjusted): 1982 2014				
Included observations: 33 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LR(-1)	-0.496332	0.156088	-3.179814	0.0034
C	24.18660	7.989827	3.027175	0.0050
@TREND(1981)	-0.056868	0.155012	-0.366860	0.7163
R-squared	0.252282	Mean dependent var		0.378788
Adjusted R-squared	0.202434	S.D. dependent var		9.461782
S.E. of regression	8.449991	Akaike info criterion		7.192716
Sum squared resid	2142.071	Schwarz criterion		7.328762
Log likelihood	-115.679	Hannan-Quinn criter.		7.238491

	8			
F-statistic	5.061034	Durbin-Watson stat		1.833792
Prob(F-statistic)	0.012766			

LR @ 1ST DIFFERENCE

Null Hypothesis: D(LR) has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 0 (Automatic - based on SIC, maxlag=1)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-6.057269	0.0001
Test critical values:	1% level		-4.273277	
	5% level		-3.557759	
	10% level		-3.212361	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LR,2)				
Method: Least Squares				
Date: 11/08/16 Time: 01:38				
Sample (adjusted): 1983 2014				
Included observations: 32 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LR(-1))	-1.118071	0.184583	-6.057269	0.0000
C	0.567484	3.740482	0.151714	0.8805
@TREND(1981)	-0.011622	0.188964	-0.061504	0.9514
R-squared	0.558646	Mean dependent var		0.023438
Adjusted R-squared	0.528208	S.D. dependent var		14.36193
S.E. of regression	9.864800	Akaike info criterion		7.504883
Sum squared resid	2822.114	Schwarz criterion		7.642295
Log likelihood	-117.078	Hannan-Quinn criter.		7.550431

	1			
F-statistic	18.35343	Durbin-Watson stat		1.995671
Prob(F-statistic)	0.000007			

JOHANSEN COINTEGRATION ESTIMATE

Date: 11/08/16 Time: 01:39				
Sample (adjusted): 1984 2014				
Included observations: 31 after adjustments				
Trend assumption: Linear deterministic trend				
Series: LDM LFI INT LR				
Lags interval (in first differences): 1 to 2				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.497912	40.43526	47.85613	0.2073
At most 1	0.294089	19.07690	29.79707	0.4874
At most 2	0.210651	8.280625	15.49471	0.4359
At most 3	0.030108	0.947695	3.841466	0.3303
Trace test indicates no cointegration at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.497912	21.35837	27.58434	0.2552
At most 1	0.294089	10.79627	21.13162	0.6676
At most 2	0.210651	7.332931	14.26460	0.4505
At most 3	0.030108	0.947695	3.841466	0.3303
Max-eigenvalue test indicates no cointegration at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):				
LDM	LFI	INT	LR	
0.394569	-0.325162	0.261909	0.119260	
-2.304251	1.704742	0.155147	-0.018753	
-1.708007	1.428216	0.398703	-0.127959	
-1.933799	1.905265	0.246283	-0.014673	

Unrestricted Adjustment Coefficients (alpha):				
D(LDM)	0.238154	0.095901	0.076678	-0.009315
D(LFI)	0.205504	-0.119113	0.036512	-0.055570
D(INT)	-1.242553	0.904655	-0.135503	-0.287845
D(LR)	-2.733803	-0.587878	3.169971	-0.221545
1 Cointegrating Equation(s):		Log likelihood	-209.3323	
Normalized cointegrating coefficients (standard error in parentheses)				
LDM	LFI	INT	LR	
1.000000	-0.824094	0.663785	0.302255	
	(0.20197)	(0.21362)	(0.08197)	
Adjustment coefficients (standard error in parentheses)				
D(LDM)	0.093968			
	(0.02973)			
D(LFI)	0.081085			
	(0.03848)			
D(INT)	-0.490273			
	(0.23070)			
D(LR)	-1.078674			
	(0.65599)			
2 Cointegrating Equation(s):		Log likelihood	-203.9342	
Normalized cointegrating coefficients (standard error in parentheses)				
LDM	LFI	INT	LR	
1.000000	0.000000	-6.486035	-2.574006	
		(1.90087)	(0.74976)	
0.000000	1.000000	-8.675980	-3.490212	
		(2.54940)	(1.00556)	
Adjustment coefficients (standard error in parentheses)				
D(LDM)	-0.127013	0.086049		
	(0.16924)	(0.12564)		
D(LFI)	0.355553	-0.269880		
	(0.21974)	(0.16312)		
D(INT)	-2.574826	1.946235		
	(1.28658)	(0.95510)		
D(LR)	0.275944	-0.113252		
	(3.87508)	(2.87670)		

3 Cointegrating Equation(s):		Log likelihood	-200.2677	
Normalized cointegrating coefficients (standard error in parentheses)				
LDM	LFI	INT	LR	
1.000000	0.000000	0.000000	-0.829441	
			(0.31587)	
0.000000	1.000000	0.000000	-1.156611	
			(0.41157)	
0.000000	0.000000	1.000000	0.268973	
			(0.09775)	
Adjustment coefficients (standard error in parentheses)				
D(LDM)	-0.257979	0.195561	0.107825	
	(0.20393)	(0.15831)	(0.03533)	
D(LFI)	0.293189	-0.217732	0.049901	
	(0.27116)	(0.21050)	(0.04698)	
D(INT)	-2.343386	1.752707	-0.239107	
	(1.59108)	(1.23516)	(0.27567)	
D(LR)	-5.138389	4.414152	0.456663	
	(4.36127)	(3.38565)	(0.75563)	

LAG LENGTH CRITERIA

VAR Lag Order Selection Criteria						
Endogenous variables: LDM LFI INT LR						
Exogenous variables: C						
Date: 11/08/16 Time: 01:45						
Sample: 1981 2014						
Included observations: 30						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-296.4460	NA	5874.188	20.02973	20.21656	20.08950
1	-207.4328	148.3554 *	45.75186 *	15.16219 *	16.09632 *	15.46102 *
2	-196.2184	15.70008	67.07943	15.48123	17.16267	16.01913
3	-189.3904	7.738410	146.4182	16.09269	18.52144	16.86967
4	-171.8740	15.18093	190.0998	15.99160	19.16765	17.00764
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						
FPE: Final prediction error						
AIC: Akaike information criterion						
SC: Schwarz information criterion						
HQ: Hannan-Quinn information criterion						

VECTOR AUTO REGRESSION

Vector Autoregression Estimates				
Date: 11/08/16 Time: 01:45				
Sample (adjusted): 1982 2014				
Included observations: 33 after adjustments				
Standard errors in ( ) & t-statistics in [ ]				
	LDM	LFI	INT	LR
LDM(-1)	0.910003	0.329785	0.088475	-3.503918
	(0.11367)	(0.14418)	(0.89490)	(2.33294)
	[8.00539]	[2.28739]	[0.09887]	[-1.50194]
LFI(-1)	0.055421	0.736309	-0.270452	2.824720
	(0.09463)	(0.12002)	(0.74494)	(1.94200)
	[0.58569]	[6.13509]	[-0.36305]	[1.45454]
INT(-1)	0.050430	-0.006383	0.578862	0.471902
	(0.01985)	(0.02518)	(0.15631)	(0.40747)
	[2.53997]	[-0.25348]	[3.70341]	[1.15812]
LR(-1)	0.006295	0.012396	-0.071545	0.432908
	(0.00788)	(0.01000)	(0.06205)	(0.16176)
	[0.79863]	[1.23995]	[-1.15298]	[2.67617]
C	-0.689861	0.065016	10.88040	16.98132
	(0.48977)	(0.62118)	(3.85571)	(10.0515)
	[-1.40855]	[0.10466]	[2.82189]	[1.68943]
R-squared	0.979195	0.978826	0.451368	0.322656
Adj. R-squared	0.976223	0.975801	0.372992	0.225893
Sum sq. resids	4.686795	7.539412	290.4732	1974.059
S.E. equation	0.409128	0.518907	3.220876	8.396554
F-statistic	329.4577	323.5934	5.759011	3.334485
Log likelihood	-14.62095	-22.46498	-82.71253	-114.3321
Akaike AIC	1.189149	1.664544	5.315911	7.232247
Schwarz SC	1.415892	1.891288	5.542655	7.458991
Mean dependent	6.729670	9.579111	13.13455	46.39848
S.D. dependent	2.653256	3.335737	4.067593	9.543343
Determinant resid covariance (dof adj.)		27.43689		
Determinant resid covariance		14.22038		
Log likelihood		-231.1020		
Akaike information criterion		15.21831		
Schwarz criterion		16.12528		

SYSTEM EQUATION ESTIMATE

System: UNTITLED		
Estimation Method: Least Squares		
Date: 11/08/16 Time: 01:47		
Sample: 1982 2014		

Included observations: 33				
Total system (balanced) observations 132				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.910003	0.113674	8.005387	0.0000
C(2)	0.055421	0.094625	0.585686	0.5593
C(3)	0.050430	0.019854	2.539975	0.0125
C(4)	0.006295	0.007882	0.798630	0.4262
C(5)	-0.689861	0.489767	-1.408549	0.1617
C(6)	0.329785	0.144175	2.287388	0.0241
C(7)	0.736309	0.120016	6.135094	0.0000
C(8)	-0.006383	0.025182	-0.253481	0.8004
C(9)	0.012396	0.009997	1.239947	0.2176
C(10)	0.065016	0.621184	0.104665	0.9168
C(11)	0.088475	0.894902	0.098865	0.9214
C(12)	-0.270452	0.744943	-0.363050	0.7173
C(13)	0.578862	0.156305	3.703410	0.0003
C(14)	-0.071545	0.062052	-1.152983	0.2514
C(15)	10.88040	3.855713	2.821891	0.0057
C(16)	-3.503918	2.332935	-1.501935	0.1359
C(17)	2.824720	1.942004	1.454538	0.1486
C(18)	0.471902	0.407474	1.158117	0.2493
C(19)	0.432908	0.161764	2.676166	0.0086
C(20)	16.98132	10.05152	1.689427	0.0939
Determinant residual covariance		14.22038		
Equation: LDM = C(1)*LDM(-1) + C(2)*LFI(-1) + C(3)*INT(-1) + C(4)*LR(-1) + C(5)				
Observations: 33				
R-squared	0.979195	Mean dependent var		6.729670
Adjusted R-squared	0.976223	S.D. dependent var		2.653256
S.E. of regression	0.409128	Sum squared resid		4.686795
Durbin-Watson stat	2.370440			
Equation: LFI = C(6)*LDM(-1) + C(7)*LFI(-1) + C(8)*INT(-1) + C(9)*LR(-1) + C(10)				
Observations: 33				
R-squared	0.978826	Mean dependent var		9.579111

Adjusted R-squared	0.975801	S.D. dependent var		3.335737
S.E. of regression	0.518907	Sum squared resid		7.539412
Durbin-Watson stat	2.085294			
Equation: INT = C(11)*LDM(-1) + C(12)*LFI(-1) + C(13)*INT(-1) + C(14)*LR(				
-1) + C(15)				
Observations: 33				
R-squared	0.451368	Mean dependent var		13.13455
Adjusted R-squared	0.372992	S.D. dependent var		4.067593
S.E. of regression	3.220876	Sum squared resid		290.4731
Durbin-Watson stat	2.169167			
Equation: LR = C(16)*LDM(-1) + C(17)*LFI(-1) + C(18)*INT(-1) + C(19)*LR(				
-1) + C(20)				
Observations: 33				
R-squared	0.322656	Mean dependent var		46.39848
Adjusted R-squared	0.225893	S.D. dependent var		9.543343
S.E. of regression	8.396554	Sum squared resid		1974.059
Durbin-Watson stat	1.778772			

LM TEST OF SERIAL CORRELATION

VAR Residual Serial Correlation LM Tests		
Null Hypothesis: no serial correlation at lag order h		
Date: 11/08/16 Time: 01:48		
Sample: 1981 2014		
Included observations: 33		
Lags	LM-Stat	Prob
1	15.11452	0.5163
Probs from chi-square with 16 df.		