AN ANALYSIS OF FOREIGN EXCHANGE RESERVE TREND, ADEQUACY AND THEIR RELATIONSHIP WITH SELECTED MACROECONOMIC VARIABLES IN NIGERIA: 1980-2014

JOSEPH BHOLLA TSENKWO
B.Sc., M.Sc. (JOS)
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DECLARATION

I hereby declare that this work is the product of my own research efforts, undertaken under the supervision of Dr. James H. Landi and that it has not been presented elsewhere for the award of a degree or certificate. All sources have been duly distinguished and appropriately acknowledged.

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JOSEPH BHOLLA TSENKWO
(UJ/2012/PGSS/0848)

DATE----------

CERTIFICATION

This is to certify that the research work for this thesis and the subsequent preparation of this thesis by Joseph Bholla.M Tsenkwo (PGSS/UJ/0369/06) were carried out under my Supervision.

_____ _____

DR. JAMES H LANDI **DATE**
Supervisor

_____ _____

DR .GIDEON G. GOSHIT **DATE**
Head, Department of Social Sciences

_____ _____

PROF. ALANANA C. ABIMIKU **DATE**
Dean, Faculty of Social Sciences

_____ _____

PROF. TIMOTHY O. OYETUNDE **DATE**
Dean, School of Postgraduate Studies

DEDICATION

I dedicate this work to almighty God, the giver of knowledge, and in memory of my late parents, Mr and Mrs Tsenkwo Joseph Mairiga. Also wish to dedicate the work to my wife Mrs Njara Tsenkwo and our children: Master Lenaan and Miss Menbuet Tsenkwo for their endless support, prayers, and having to endure with my absence as a result of this research.

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ABSTRACT

Due to the increasing uncertainty as a result of globalisation, economies of developed and developing nations maintained adequate level of foreign exchange reserve to protect and achieve general stability in an economy. Nigeria has witnessed an intermittent rise and fall in the level of its foreign exchange reserve without proportional effects in some key macroeconomic variables. Instead, persistent problems like exchange rate volatility, and general macroeconomic instability continuous to prevailed even in periods of a fall or a rise in the level of foreign exchange reserve. The specific objectives of this study were to establish the causal relationship between the trend in foreign exchange reserve with the selected macroeconomic variables, and also to identify the related macroeconomic variables associated with the observed fluctuating trend in foreign exchange reserve. To achieve these objectives, the two- stage- least square (2SLS), granger causality and error correction techniques were used to estimate the specified model of the study. The results from these estimations produced strong evidences of interrelationships among the variables in the model for the study period particularly from the causality analysis. The findings of the study further revealed that external variables showed significant positive interactions with the observed fluctuating trend in foreign exchange reserve. This is because oil revenue, exchange rate flexibility and net export were instrumental in explaining the behaviour of the target variable (foreign exchange reserve) than the rest of the variables in the model. However the size of the economy proxy by GDP previously found to influence foreign exchange reserve positively by past studies, interacted negatively with the trend in foreign exchange reserve for the period of this study. These findings are reflections of the export led growth strategy often known as mercantilist motive and also the pursuance of self insurance or precautionary motives of holding foreign exchange reserves in Nigeria. In view of these findings, it was recommended that the policy of export diversification, particularly in the area of non-oil sectors, to broaden the supply base of foreign exchange, also to protect the economy from external disturbances as well. Also, there would be a need for government to reduce the

over-reliance on the oil sector which often exposes the economy to external shocks and other internal consequences such as corruption, environmental challenges, and owing to its non-renewable nature. There should also be a deliberate attempt to deploy the oil revenue into the stabilisation and sovereign wealth fund (meant for future generations in the event of depletion) against the practice of outright sharing of the proceeds of oil revenue among the three tiers which often mount further pressures on foreign exchange reserve. The study also suggested a policy for efficient and effective foreign exchange allocation to channel it particularly to small and medium scale industries that needed the foreign exchange to obtain imported inputs to boost production and continue operations.

CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND TO THE STUDY

The early post-war reflections on the problems of developing countries led to the identification of insufficient capital stock as the cause of low income. Among the economists who made such prognoses are Hans Singer and Ragnar Nurkse. In the words of Singer (1949), less developed countries suffer from "a dominant vicious cycle of low production," no surplus for economic development, which leads to low tools and equipment and in turn causes low standard of production. Nurkse (1953:12) insists that the problem of these countries was that:

> There is small capacity to save resulting from low level of real income. The low level of real income is a reflection of low productivity, which in turn is due largely to the lack of capital, the lack of capital is a result of small capacity to save.

Given the need for larger capital stock and the inadequacy of domestic saving to finance investment that would make development possible, it was concluded that domestic saving should be supplemented by foreign resources and capital. This shifted the issue from whether external resources are useful to developing countries, and how much was sufficient to help them achieve effective macroeconomic performance and growth potential. Foreign capital has significant role in every national economy, regardless of its level. It is necessary to consolidate development in the developed world, and to accelerate the pace of development for developing countries. It is used to increase accumulation and rate of investment to create a condition for more intensive economic growth. For the transition economies, it is useful to carry out reforms, open the economy, and create a condition for sustainable gross domestic product (GDP) growth, as well as integrating into the world economy.

The traditional macroeconomic rationale for foreign capital relates to its ability to augment domestic savings. Some commonly observed effect of foreign capital inflows are the generation of foreign exchange reserve, real exchange rate appreciation, monetary expansion, as well as its effect on production and consumption (Goudazi and Ramanaryana, 2010). The problem of capital formation in less developed economies involves three basic types of shortages, as conceived by Ellsworth and Leith (1975). These are the shortage of savings in the financial sense, when the average propensity is too low to provide sufficient funds to finance development programmes of the desired proportion. Secondly, there is shortage of savings in the real sense. The third has to do with the domestic resources that are inadequate to produce the needed capital which must be obtained from abroad. At infant and developmental stage, a constrained economy would need such resources for the importation of both physical and human capital needed for development.

The study dwelt strictly on the relationship and effect of foreign exchange reserves on macroeconomic performance in Nigeria. Foreign exchange is the relationship of the domestic currency with that of other countries currencies, and foreign exchange reserves designated as (FERs) in this study, are deposits of these currencies over a period of time that is held by the Central Bank of that country. However, if Gold, Special Drawing Rights (SDR) and International Monetary fund (IMF), reserves positions are included in the foreign exchange; the term is usually called International Reserves (IR). They are used for the purpose of keeping the domestic currency value stable in relation to other foreign currencies, and as a tool for exchange rate, and monetary policy management. It also facilitates the payment of external debt and liability. Dhakal (2007) enumerated the roles of foreign reserve that have traditionally served for transaction purposes, primarily to include:

(i) Ensure the financing of imports over a certain periods.

(ii). Service foreign debt repayment (particularly short term debt)

(iii). Ensure a sustained flow of short term capital, and

(iv). Stabilize monetary and exchange rate policies of the economy

A comfortable level of foreign exchange reserves reduces the risk of speculative attack (Cruz and Walters, 2008). There has been a debate whether to maintain a high or low level of reserves, this argument becomes more interesting especially in developing countries like Nigeria, where there are compelling needs. Osabubuolhien and Egwakhe (2008) opined that keeping scarce resources in foreign exchange reserves when there are several issues to be attended to domestically, like infrastructural and investment human development, may not be a wise decision. In the same vein, some have argued that reserves position determines the country's rating in the global market. In other words, these proponents hold the view that a robust level of foreign exchange reserve will make such country appear financially responsible and creditworthy in the eyes of other countries, creditors and donors.

The decision to accumulate or deplete the stock of foreign exchange reserve should be anchored on the state of development of the economy and the nature of its external trade. This consideration is fundamental as far as developing economies are concerned. However, it is often seen as a deviation from the traditional norm of using foreign exchange reserves. The wisdom behind the developing countries addressing their developmental needs using reserve is seen as a matter of necessity instead of the conventional use of reserve. However, the only time to maintain convention is when considerable development is recorded, and then adherence to the global practice will no longer be a problem (Moghadam, 2010).

Effective management of foreign reserve is very important to achieve tolerable inflation, macroeconomic stability, and a desired level of economic growth of a country. Deciding on the level of foreign exchange reserve has important implication for

macroeconomic stability and would among other things maintain a country's capacity to intervene in the foreign exchange market, to cope with internal and external shocks and to preserve the value of national wealth (Edwards 2004). Global foreign reserves accumulation grew from $1.2 trillion in January 1995 to more than $4.0 trillion in September 2005, and stood at $7.12 trillion in 2006 achieving 180 percent growth rate (Setzer and Mengatti, 2007). This phenomenon as explained by the International Relation Committee Task Force, IRC (2006) exhibits five distinct features. Firstly world reserve grew by 85% (or 91%) in the first eight months at a pace three times faster than 1999-2001. Secondly, monetary authorities of Asia including Japan until March 2004 accounted for the bulk of this accumulation, and eight of them are currently among the ten largest holders (IMF and Noyer, 2001). Thirdly, fewer official creditors held an increasing larger proportion/share of the local accumulation.

The top five reserve accumulating central banks have increased their share to more than 68% of the total world accumulation in 2004, China and Japan accounted for 50% of this increase, (Rodrick, 2006). A fourth and equally important development is that of the oil exporting countries, whose combined current account surpluses are estimated to have exceeded that of the Asian economies and have emerged as a new group of net capital exporters in the world economy (Rodrick, 2006). They have not only accumulated this asset in the form of traditional reserve, but have channelled such into the oil funds or what is popularly known as the Sovereign Wealth Fund, (SWF). The major factors for the global increases in foreign exchange reserve as enunciated by Borio, Galati, and Health, (2008) included self insurance against crisis (financial), and high commodity prices. It also includes the need to intervene in foreign exchange market in response to upward pressure on exchange rates.

On all, developing countries are trapped particularly on the continent of Africa where more than 60% of the foreign exchange reserves are held by Algeria, Libya and

Nigeria (Bird and Raja 2003; Oshikoya & Adewale, 2008). In these countries, such accumulation is the result of foreign exchange generated from crude oil production and exportation (Oshikoyo, 2008). According to Adewale (2008), about 90% of the foreign exchange earnings in Nigeria is from the revenues of crude oil production and exportation, and was reported to be capable of financing 13.8 months of imports in the event of capital flow reversal. Most countries have maintained the accumulation of foreign exchange reserves over time with impressive performance in their macroeconomic indices. Nigeria has however witnessed a downward trend by more than 50% from 2008 and 2010, alongside unstable and unpredictable source of foreign exchange earnings, from the hitherto position of a vibrant source of foreign exchange earnings and a relatively stable and promising macroeconomic performance in the late seventies and early eighties (Waheed & Abudllateef, 2010).

For most emerging market, reserve coverage has risen to high levels, relative to traditional norm reaching almost 10 months of imports and 475 percent of short term external debt in 2008 (Moghadam, 2010). The reserves have climbed to almost 30% of developing countries GDP (Arunachalam, 2010). In the past, reserve served as a source of liquidity for the management of exchange rate policy. The purposes for which foreign exchange reserve are held have changed over the year, as macroeconomic policy and the exchange rate regime have changed (Aizenman & Lee, 2005). The importance of reserve in preventing crisis is secondary to that of a responsible and credible macroeconomic policy aimed at achieving economic and financial stability. Alfaro and Kanczuk (2007) reported that developing countries have accounted for more than 80% of global reserve and 20% of GDP in low and middle income countries. .These countries are motivated not just for insurance purpose, but for political and economic purposes such as desired spending in public works, and that also suggest the explanation for the contrast between theoretical prediction and actual behaviour.

Foreign exchange reserve normally comes into a country in the form of investments, payment for export, loan and bilateral aid, among other things. It goes out as payments for imports, payment for interest, repayment of loans and repatriation of investments and profits. The existing literature assigns various objectives for holding foreign exchange reserve. These motives are broadly divided into two parts: precautionary and mercantile motives (Sharma & Sehgal, 2008). Precautionary motive reflects the desire for self protection against possible future and sudden shocks in the external sector, and it covers both crisis prevention and crisis management (Aizenman and Marion, 2003). Kim (2005) recognized three broad reasons for precautionary demand:

(i) The ability to finance underlying payment imbalances;

(ii) The ability to provide liquidity in the face of currency exhaustion; and

(iii) The prevention functions of reducing the probability of the 'runs' on currency.

Some economists recognized political reasons behind the mercantile motive especially in the case of China where the motive behind promoting export and FDI through reserve accumulation comes also under the mercantile motive (Calvo and Reinhar, 2002; Rajan 2002; Dooley, 2003; Lindsay, 2003, Aizenman and Lee, 2005). Reserve stock can be used to keep the exchange rate favourable for export growth and it may have positive impact on domestic output and employment (Sehgal and Sharma, 2008). Nigeria's total external reserve position which stood at a modest US$ 2.84 million in 1986 rose to a significant US$ 42.30 billion in 2006, increased to US$51.33billion in 2007, and further to US$ 63.1 billion as at November, 2008.(CBN, 2007). The phenomenal growth in the foreign exchange reserve was as a result of the following factors:

The first was the huge earnings from the consistently high crude oil prices in the international market. Secondly, there was prudent use of external reserves by the

monetary authorities, while the third factor has to do with the gross reduction of Nigeria's external debt within the period that has accounted for the quantum and steady accretion of the reserves. Nigeria's foreign reserves position as at December 31st 2010, stood at USD32.35bn, compared with US$42.41bn as at December 31st 2009 (CBN 2007; Waheed and Abdullateef 2010; Sanusi, 2011).

The country's level of foreign exchange reserve from US$0.45billion in the early 1980s rose by less than a decade to US$51billion in 2007. In 2008, it stood at US$53billion, but dropped to US$42bn, US$32bn and US$33billion in 2009, 2010, and 2011 respectively. This fluctuating trend according to Shuaibu and Mohammed (2014) was attributed to the movement in crude oil prices, volume of trade, import and debt servicing and exacerbated by contemporaneous foreign exchange interventions due to exchange rate volatility. Within the period of five years beginning from 2007, Nigeria's foreign exchange reserve witnessed a dwindling trend of about 15.53%, 1.58%, 19.71%, 23.72%, and 5.47%, in 2007, 2008, 2009, 2010 and 2011 respectively, while related macroeconomic variables like exchange rate performed in the opposite direction. For instance it showed an unstable position of about 8.03%, 12.37%, 12.84%, 0.72%, 0.77%, and inflation exhibited the following trend, 22.35%, 128.78%, 17.88%, 4.84%, 10.17%, in 2007, 2008, 2009, 2010, and 2011, respectively, (CBN, 2007; Obaseki, 2007; Waheed and Abdullateef 2010; Sanusi, 2011). There is also the seeming return to the era of debt accumulation from the barest level of US$3.3billion in 2006 considered the lowest in 30 years, and almost equivalent to US$3.4billion in 1976. The observed trends in some macroeconomic stability variables for the period of foreign exchange fluctuation cannot be said without any empirical investigation to know whether these variables have some form of association with one another. In providing reason(s) to the fluctuation, Okorie (2007) explained that inadequacy of receipts, exchange rate volatility, coupled with huge fiscal spending occasioned by huge import payments(e.g. oil subsidy), and pressure on

the country's payment obligation are the likely causes of the fluctuations. However, macroeconomic indices continue to show a worsening performance. The concern of this study is to investigate the interaction as well as the performance of macroeconomic stability variables with the stock and changes in foreign exchange reserves in Nigeria.

1.2 STATEMENT OF THE PROBLEM

An adequate and stable level of foreign exchange reserve is a precondition for the attainment of macroeconomic performance. This objective is pursued on behalf of government by monetary authorities at all times. Foreign exchange reserve assets are traditionally used for intervention in the foreign exchange market, and can be used to finance trade, development and as a source of income in developing countries. It is used to protect the economy from exchange rate volatility, finance import requirement, service national debt, boost credit worthiness of the economy and provide incentives to attract foreign direct investment as well as cushioning the effects of external shock. Over the years, the level of Nigeria's foreign exchange reserve has witnessed unprecedented high and low growth rate. This uneven growth can hardly be associated with any form of performance (impressive or weak) in key macroeconomic variables. For instance, from a value of US$5.4 billion in 1999 it rose to US$53 billion in 2006, and attained a level high of US$65.40 billion in 2008 and 2009 respectively, making it the twenty fourth largest reserve holder in the world (Irefin and Yaaba, 2012). However, this position was not sustained as the level suddenly dropped to US$44.3 and US$30.44 billion respectively in 2013, with a strong indication of dropping further because of the continuous fall in crude oil price. It is important to note that even in period impressive, moderate and low levels growth in the level of foreign exchange reserves, related macroeconomic variables have not responded in a proportional manner. This study investigates the form of relationship in the observed mismatch between the seeming fluctuations in foreign exchange reserve and selected macroeconomic variables

performance in Nigeria. This aspect has not been given adequate attention in previous empirical studies.

1.3 RESEARCH QUESTIONS

In a research work like this, certain questions are pertinent, and in this regard, the study has attempted to provide answers to the following research questions:

1) What is the trend and adequacy of the level of foreign exchange reserve for the period of this study?
2) What is the causal relationship between the level of foreign exchange reserve and the selected macroeconomic variables in Nigeria?
3) Which macroeconomic variable(s) can best explain the observed trend in foreign exchange reserves in Nigeria?
4) To what extent can the relationship between the level of foreign exchange reserve and the selected macroeconomic variables achieve long run equilibrium?

1.4 OBJECTIVES OF THE STUDY

The main aim of the study was to establish the relationship between the fluctuating trend in foreign exchange reserve and the performance of selected macroeconomic variables in Nigeria. The specific objectives were:

1) examine the trend and adequacy in the level of foreign exchange reserve for the period of study.
2) establish the causal relationship between foreign exchange reserve and the selected macroeconomic variables performance for the period of study.
3) identify the related macroeconomic variables associated with the movement in foreign exchange reserve for the period of study.
4) determine the rate of adjustment towards long equilibrium, if disequilibrium occurs in the relationship between foreign exchange reserve and macroeconomic variables performance for the period of the study

1.5 HYPOTHESES

The following null hypotheses are evaluated in this study:

1. Ho: There is no significant relationship between the fluctuating trend of foreign exchange reserves and the performance of selected macroeconomic variables in Nigeria.

   H_i: There is significant relationship between changes in the level of foreign exchange reserve and changes in selected macroeconomic variables in Nigeria.

2. Ho: There is no causal relationship between changes in foreign exchange reserve and changes in selected macroeconomic variables in Nigeria.

   H_i: There is causal relationship between changes in foreign exchange reserve and changes in selected macroeconomic variables in Nigeria.

1.6 SIGNIFICANCE OF THE STUDY

Most studies on the issue of foreign exchange reserve in Nigeria have concentrated on the study of the determinants of the build-up of foreign exchange reserve, without due attention given to the dynamics of it. This study is update and also an attempt to provide further empirical evidences of the determinant of changes in foreign exchange reserve in Nigeria. The justification of this study is therefore based on its relevance to contemporary economic issues. It will also be of relevance to scholars by improving their general perception on salient and emerging issues of foreign exchange reserve and macroeconomic reforms.

The findings will provide additional empirical knowledge and a clear guide to the future study of foreign exchange reserve, as an important economic variable, particularly with respect to international payment obligations, fiscal constraints and stabilizing the foreign exchange environment, all of which are viewed as important signals to the efficacy of policy actions. The knowledge gained will be beneficial to the larger society and mainly, the academic community and policy makers, in their choice of wide ranging

measures to address the burden associated with the adjustment in foreign exchange reserve in Nigeria. The empirical analysis aspect of the study should point to several areas requiring additional research efforts aimed at further development of economic model.

The study was also justifiable on the following:

1) The dearth of research in this area, especially in addressing reserve accretion and depletion at the same time.
2) The rationale of the study was hinged on the general macroeconomic objectives for holding external reserve, which basically was to act as buffer to cushion shocks arising from exchange rate volatility as well as instability in foreign exchange earnings in the current globalised world.
3) Studies in this area in the past have mostly been concentrated on the factors that are responsible for reserve accumulation and, mostly, on the Asian economies, but not much has been done in the Nigeria's case
4) The unfolding global events that saw emerging economies like Nigeria experiencing crises warrant the need for a study in this area.
5) The ideas raised in this work will form a springboard for further research in the diverse issues involved.
6) Policy makers and scholars will find it as a useful tool in their future work.

1.7 SCOPE OF THE STUDY

The study is limited in scope to the empirical analysis of the performance of macroeconomic variables and the continuous dwindling foreign exchange reserve in Nigeria within the period of 1980-2013.This period of the study is remarkable for its major economic thrust in Nigeria's political and economic development. For instance, it was this time that the country experienced the oil boom of the early 1980's, the Economic Stabilization Act (ESA) that ushered in austerity measures in Nigeria in 1982,

the Structural Adjustment Programme (SAP) that affected the exchange rate and hence foreign exchange reserve, it also covers issues regarding the dynamic trend in foreign exchange reserve as it relates the performance of some selected macroeconomic aggregates in Nigeria, and, more recently, the global financial crisis coupled with the unstable prices at the international oil market.

CHAPTER TWO
LITERATURE REVIEW

2.1 CONCEPTUAL FRAMEWORK

2.1.1 The Concept of Foreign Exchange Reserves

The subject matter of foreign exchange reserves may broadly be classified into two interlinked areas, namely, the theory of reserve and the management of reserve. Theory of reserves encompasses issues relating to institutional and legal arrangements to holding of reserves assets, conceptual and definitional aspect, objectives of holding reserves assets, and conceptualization of appropriate level of foreign reserve. On the other reserves management is mainly guided by the portfolio management consideration taking into cognise the tripartite objectives of liquidity, safety, and return.

Conceptually, a unique definition of foreign exchange reserve may appear very difficult, because there have been divergence of items, ownership of assets, liquidity assets and the need for distinction between owned and non owned reserve.(Cruz and Walter, 2008). Nonetheless, for policy and operational purposes, most countries have adopted the definition suggested by IMF (Balance of payment manual and guidelines on foreign exchange reserves management, 2001), which defines reserve as external assets that are readily available to and controlled by monetary authorities for direct financing of external payment imbalances, for indirectly regulating the magnitude of such imbalance through intervention in exchange rate market and or for other purposes.(IMF, 2003). The approach for measuring international reserve taking into account the numerous international reserve assets by the monetary authorities, the foreign currency and the securities held by the public, including the bank and corporate bodies are not accounted for by the definition of official holding of international reserve. Furthermore, the general definition of foreign reserve usually encompasses a broad perspective that includes the following components:

1) the gold component
2) foreign currency asset components
3) reserve position with the IMF
4) the special drawing rights

It has been reported in Dhakal (2007) that many economies have lowered the proportion of their special drawing rights and, consequently, reduced the level of reserves in terms of their position with IMF. In addition, the amount of their gold holdings has remained fairly constant, which suggests that the foreign currency assets represent a large portion of their reserve assets usually dominated in dollars. Thus, for the purpose of this study, foreign exchange reserve is defined as stock of foreign currencies received from export of goods and services and may also include remittances from nationals of a country abroad. If, however, the term is modified to include gold, Special Drawing Rights (SDR) and the IMF reserve position in the foreign exchange, the term is usually referred to as "International reserve (Amarcy, 2009). Therefore, the use of the term refers to the former in this research.

Aluko, Obaseki, Tella, and Soludo (2007) have conceived foreign exchange reserve simply as foreign currency deposits held by the Central Bank and Monetary authorities. A fascinating and purposeful definition is that provided in the Columbian foreign reserves Law No.31, of 1992, article 14, and in tune with the objectives of this study (i.e. influence on the domestic economy) thus:

> The Central Bank will administer the foreign reserve in accordance with public interest, in support of the domestic economy and with the objective of facilitating the external payment of the country. The administration of the reserves will involve its management, investment, custody and disposition of the assets; its investment will follow the criteria of safety, liquidity and returns in assets dominated in freely convertible reserve currencies as gold (Columbian Law, 1992:40).

Meanwhile, to allow for flexibility in application, Rasheed (2007) added a dimension to the definition as an expected role to be performed by reserve as "An asset readily availability to, and managed by the Central Bank of Nigeria (CBN) for government expenditure and intervention.

The above definition shed light on how reserve can be put to use and the consideration of the economic uniqueness of the country in question. The definition is a little deviation from the traditional and rigid conceptualization of reserve usually provided by IMF. In what can be linked to the above is the submission by Abeng (2007:7), where he states that reserves could also be used in the financing of growth inducing projects. According to him, India, for instance, dedicated its reserve to finance infrastructures. In the case of Nigeria, owing to the fact that oil, the major foreign exchange reserve (FER) earner, is an exhaustible or non renewable resource whose prices are volatile and exogenously determined, investing FER in the other viable sectors of the economy would further ensure the continuous flow of the reserves. The provision of social, cultural and economic infrastructures would boost productivity as well as diversify and expand the export base of the economy. Thus, returns from such public investment would by far outweigh current earnings from investment of the traditional reserve investment as long as they are allocated efficiently.

Obaseki (2007) viewed it as the stock of savings from foreign exchange transaction between resident of an economy and the rest of the world during a given period of time, which are held and controlled by the monetary authorities. The net of the receipts and expenditure of foreign exchange through the official sector adds to the stock of reserve or depletes the stock depending on whether a net inflow has occurred. When exchange receipts exceed payment an accretion in reserves is recorded. On the other hand, when net inflow occurs reserves are drawn down.

Foreign reserve can be enhanced by storing more and more of international currencies, and this can be through the following ways:

(i) By increasing exports

(ii) Through remittances

(iii) By taking official loans

If foreign reserves are increasing due to export and remittances, then the growth of reserve is positive, but if it is increasing because of loans then the growth is negative.

2.1.2 The Concept of Macroeconomics Variables

Macroeconomic variables are indicators of the performance of the economy. They are referred to as variables because they are aggregate items on national accounting that are subjected to variation as a result of time and activity carried out in the economy, and can assume any value with successive period. Macroeconomic variables are sometimes used interchangeably with macroeconomic indicators; in this case they are used as yardstick to gauge the performance of the economy. Desirable rates are expected to be maintained so as to determine stability also of the economy. According to Maastricht criteria in Kolawole (2013) and Lawong (2014), stability is measured by five macroeconomic indicators/variables with benchmark values namely inflation, interest rate, debt, deficit, and exchange rate. The five Maastricht criteria as defined in article 121 of the treaty establishing the European Community addressing all the political and economic issues of the union of European Community were for the purpose of European community only.

The benchmark values in the Maastricht Criteria fixed inflation rate at 3%, interest rate at 2.5%, and debt at 60% of GDP, and permitted fluctuation of 2.5% at most. The variables identified and threshold assigned to them in the above criteria are only akin to European Community and are not achievable by emerging economies like Nigeria. Therefore, any variable peculiar to a country and has national outlook is

considered as macroeconomic variable. In the context of this study therefore, macroeconomic variable(s) are taken to mean aggregate measure of the overall level of economic activities. They also measure the level and rate of economic activities and can explain the problems of recessions, depressions and inflation (Dornbuch, Fisher & Startz, 2008).

2.1.3 The Concept of Reserve Adequacy/Norms

Though the adequacy of foreign exchange reserves is closely related to capital flows and the extent of foreign borrowing, and foreign borrowing can be an important method of rebuilding reserve, it cannot be a substitute to autonomous inflows based on the proceed of export of goods and services, and Foreign Direct Investment (FDI). However, borrowing to supplement foreign reserve is an appropriate method of solving out difficulties if those difficulties are just short term. If the difficulties are chronic, then foreign borrowing will not be sustainable in the long term. Reserve adequacy/norm simply means the "optimal level" of foreign exchange reserve a country is expected to hold for a given period of time which is expected to insulate the economy against external shocks. As rule of thumb, reserves should be enough to finance imports for three months for developed economies and six months for developing economies in the event of sudden stop or reversal of capital flow (Grubel, 1971; Borio, Gabriel and Health, 2008).

Keynes (1963) during the great depression advocated import ratio to reserve as the basis to mitigate external vulnerability. This argument was further extended and supported by Iriffin (1947) who stated that demand for foreign reserve grew with trade in a linear form and promoted the use of reserves/imports ratio as a measure of reserve adequacy. These earlier arguments ignited several studies on the adequacy of foreign exchange reserve and produced quite other measures. Greenspan (1999) observed that it is necessary to take into account the increased capital inflows for emerging market economies and relate the size of their foreign reserve to short term external debt.

According to him, the ratio appears to be the most relevant since indicator of reserve adequacy for countries that borrow in the international financial market is higher.

The International Monetary Fund (IMF) (2002) objected to use of reserve to import as a measure of foreign reserve adequacy during the currency crisis of 1990's, regarding it as being inadequate. This is in addition to the size and structure of external debt and export bills, and instead positioned that the ratio of reserve to base money or other monetary aggregates as major indicator of reserve adequacy. The institution noted that lower levels of reserves have the potentials of creating risks of capital flight and lower investor's confidence in the economy.

Aizenman and Marion (2004) focused on the magnitude and speed of the reversal of capital flows from 1992 – 1998 crises and observed that accumulating international resources could be viewed as a precautionary adjustment process reflecting the desire for self – insurance against exposure to future shock. However, to obtain an optimum level of reserve will require a detailed model and information on the assessment of the probability and output cost of shocks as well as the opportunity cost of holding external reserve. In their view exposure of developing countries to external shocks and reversals of hot money as well as growing trade openness are accountable for the observed increase in reserve/GDP ratio by developing countries.

In a related work, Drummond and Dhasmana (2008) considered the foreign exchange reserve adequacy in sub-Saharan Africa. They used a two good endowment economy model for countries facing terms of trade and aid shocks to derive the optimal level of reserves. Their result confirmed that optimal level of reserve in those countries depended on the size of trade and aid shocks; their probability and output cost.

In all of the above, adopting an appropriate ratio would to some extend depend on the countries in question and the prevailing economic condition in place. No yardstick is superior to the other, what is paramount is the current situation prevailing at that time to

prompt a particular ratio to use. Greenspan (1999) proposed using short-term debt, which is debt with less than one year maturity as a measure of reserve adequacy. Accordingly, reserves must be sufficiently adequate to offset short-term liabilities so as to instil confidence in external creditors and attract foreign investments.

2.2 THE MOTIVES FOR HOLDING FOREIGN EXCHANGE RESERVE

Countries build up foreign exchange reserve to take care of seasonal variation in capital inflows. Developing countries with seasonal export for instance would need Foreign Exchange Reserves (FER) stock to finance imports during off season periods. Thus, a stable level of reserves is a prerequisite smoothen the seasonal variation. In the same vein, the execution of major capital intensive projects requires adequate threshold of foreign exchange reserves. In another perspective noted by Abeng (2007), a healthy Foreign Exchange Reserves (FER) is a precondition for steady exchange rate that would not only boost capital inflows, but ensure the achievement of overall macroeconomic stability. Developed countries bother less about the stock of hard currencies because it is not influenced by the quantum of reserve, rather by economic fundamentals like corporate indicators, and capital market moving. Acharya, (2002) asserts that the major objectives of holding reserve may include the following

i. enhancing capacity to intervene in the foreign exchange markets
ii. limiting external vulnerability by maintaining foreign currency liquidity to absorb shocks during times of crisis, including national disaster or emergencies;
iii. Providing confidence to the markets, especially credit rating agencies that external obligations can always be met, thus reducing the overall cost at which foreign exchange resources are available to all the market participants, by demonstrating the backing of domestic currency by external assets.

Goseline and Parent (2005), Osorio (2007) state that there is a relatively stable long run reserve demand for funds that depends on five factors, which include:

(i) The size of the economy: Higher economic growth rates will increase the size and growth rates of the tradable sector. Therefore, the monetary authority's demand for foreign assets will increase in response to the augmented size of the trade transactions that require liquidity back up in cases of market distress. Both the level and growth rate of output are expected to influence reserve accumulation.

(ii) The current account vulnerability: Economies with a large degree of trade activities will require liquidity requirement to cover transaction in the events of market distress.

(iii) The degree of flexibility of exchange rate regime, economies with more flexible assets to undertake intervention activities.

(iv) The capital account vulnerability: Given that, economies with large degree of financial openness are more prone to experience sudden stops; their central banks will tend to demand more foreign assets.

Although, economists seem to have reached a consensus about the main driver of demand for reserves, there are still several debates regarding the appropriate level of assets that the central bank of each economy should hold. In this regard, the economic analysis perceives these in two parentheses. The first one is the theoretical model that seeks to establish a format for finding the optimum level of reserve, as they are superior for trying to measure optimum reserves as the amount that balances its cost and benefits. The second focuses on building external vulnerability indicators and defining benchmarks for those indicators. These benchmarks according to Osorio (2007), are reference for what the adequate level of reserves should be.

Broadly, the motives of holding reserve can be grouped into precautionary and mercantile motives. However, Sehgal, and Sharma (2008) and Roger (1993) identified three distinct motives, which are: transaction demand, an intervention related precautionary demand and wealth related or portfolio demand. Of these, precautionary

motives loom large in decision to build-up reserve by most countries (Marion 2004, Aizenman and Lee 2005; Plosz 2007; Kim, Rajan, Willet 2004).

2.2.1 The Transaction and Stabilization Motives

Reserve may be held for financing readily foreseeable foreign exchange demand of either public or private sector. This use of reserve is generally considered to be fairly of minor importance for developed economies with good access to international capital markets but may be significant for developing countries. Many of these limited accesses to external borrowing do experience marked seasonability in their foreign exchange earnings or outlays. The transaction demand motive may particularly be important where extensive exchange control leads to a high proportion of the country's foreign transaction to be channelled through the Central Bank.

2.2.2 Intervention and Precautionary Motives

Precautionary motive reflects the desire for self-protection against sudden shocks in the external sectors and it covers both crisis prevention and crisis management periods. Kim, Aizenman and Lee (2005) recognized three broad reasons for the arising precautionary demand, which include:

i. The ability to finance and provide liquidity in the face of currency run, while the motive to promote export and FDI through reserve accumulation comes under the mercantile motive (Calvo and Reinhart., 2002., Rajan, 2002; Dooley 2003; Aizenman and Lee 2005).

ii. The ability to finance underlying payment imbalances.

2.2.3 Wealth Diversification Motive

The philosophy under wealth motive is the maintenance of Credit worthiness before the creditors. Rogers (1993) noted that wealth consideration is too important in influencing the levels of reserve, but they are relevant mainly for decision regarding the composition of reserve. A far more plausible argument behind Reserve accumulation in

emerging economies is that which stems from a deep-rooted mercantilist desire by regional central banks to maintain undervalued exchange rates. Mercantilism may also have an important political dimension. As the former chairperson on National Council to President Bush once noted about China that:

> The objective of mercantilism is fundamentally not economic in nature but political. It is designed to enhance the power of the state. The Chinese state not only, has the same vested interest in mercantilism as Louis XIV, it also has the same interest as exporters generally as elements of the state, particularly, the army" (Lindsay, 2003:9).

2.3 THEORETICAL FRAMEWORK

2.3.1 Export-Led Growth Model

Expectedly the role of exports in economic performance of developing countries has become one of the more intensively studied topics in recent years. The major impetus for most studies on this relationship was that of the Export Led Growth (ELG) hypothesis. This is a framework that seems to capture the potential of development in poor countries which increasingly represents a dominant explanation in this context. According to Idowu (2005), the Export Led Growth (ELG) postulates that exports are the main determinant of overall economic growth. The theoretical rationale for this hypothesis hinges on a number of arguments which include the following:

First, that the export sector may generate positive externalities on non-export sector through efficient management styles and improved production techniques

Second, export expansion will increase productivity by offering potential for scale economies (Feder, 1982) Helpman and Krugman, 1985; Krugman, 1997).

Third, exports are likely to alleviate foreign exchange constraints, and thereby provide greater access to international market (Esfahani, 1991). The important variables usually included in the discussion of this hypothesis are investment, imports and exchange rates. Other justification is that it is possible for import of inputs to meet domestic demand, and also enhance output expansion.

In a theoretical formulation, Taban and Aktar (2008) incorporated the export component in the Cobb—Douglas production function as:

$Y = f(K, L, X)$ ……. (1)

Where Y is output; K is capital; L is labour; and X is the export variable to represent the export of goods and services. The expected sign in the model would be positive for all three variables because they are expected to have a positive effect on the overall output. The positive sign expected for the export variable is derived from the assumption that export yields externalities that result in high output by the export sector.

2.3.2 The Gap Models

The traditional macroeconomic rationale for foreign capital relates to its ability to supplement domestic saving, foreign exchange, and government revenue, thereby contributing to higher economic growth (Waheed, 2004). The process presumes a simple Harrod-Domar context in which growth is driven by physical capital formation. In a Harrod-Domar model, output depends upon the saving rate and the productivity of investment. Savings finance investment, and in an open economy, total savings equal to the sum of domestic and foreign savings. A saving gap exists if domestic saving alone is insufficient to finance the investment required to attain a target rate of growth (Harrod, 1939).

In addition to saving gap, there is also trade gap and foreign exchange gap, which are based on the assumption that all investment goods are produced domestically. Hence, a certain level of imports is required to attain the desired level of investment and ultimately economic growth. This import is financed with either export earnings or foreign capital inflows (Pugel & Lindert, 2000). If exports are not sufficient to finance imports requirement (in the case of developing countries), then foreign exchange shortages become the binding constraint on economic growth. These two gaps are combined in the two gap model mainly associated with Chenery and Strout (1966).

Over the years, a number of gaps have been proposed, such as the technology gap, the food gap, the gender gap, and the environmental gap. More closely related to the two gaps model is the third one "Fiscal" gap between the government revenue and expenditure as illustrated by the three-gap model by Bacha, and Taylor (1990). Although, the Fiscal gap is a subset of the saving-gap, the former may be binding constraints if there is some limit on public spending. Gap models predict a positive role of foreign capital, whereby it supplements domestic savings, increases foreign exchange earnings, and government revenue, and hence promote economic growth. The overall effect of foreign capital on economic growth in most empirical studies revealed positive relationships. Where the effect shows negativity it is due, mainly to the methodological issues or data limitations.

2.3.3 The Mundell-Fleming (MF) Model

Recent studies into the potency of an open economy policy that utilizes "postulated macroeconomic relationships are readily recognizable as being based upon development and extension of the Mundell-Fleming (MF) model.(Busari,2004).The Mundell-Fleming (MF) model constitute an open economy version of the Hicksian ISLM model. However, the version that is been considered here is a more complete three model, that is made up of the domestic product market, the money market, and the foreign exchange market (Pudel & Lindert, 2000). In other words, the theoretical framework focuses on the standard of IS (investment equals savings), LM (Money demand L equals money supply or the liquidity preference), and the FF schedule (foreign exchange market), all are schedules which depict the equilibrium in the bond market. This is a perfect substitutability between the domestic and foreign currency. The framework captures both the behaviour in the goods, money and the international market.

The assumptions that underscore the working of this tool are:

(i) Capital mobility,

(ii) Fixed and floating exchange rate,

(iii) Monetary and fiscal policy.

With relatively immobile capital, the overall tendency of the effect of balance of payment is deficit; while with capital mobility, the overall tendency will be towards surplus. However, what happens next depends on the type of exchange rate regime that the authority operates. With fixed exchange rate, and low capital mobility, the balance of payment (BOP) will result to loss of foreign exchange reserve and this will make the LM curve to shift backward, i.e. to the left, except, authorities engage in a sterilization policy. With fixed exchange rate and high capital mobility, the balance of payment (BOP) surplus will result in the accumulation of foreign exchange reserve and in the absence of successful sterilization; the LM curve will shift to the right, meaning an increase in money supply.

On the other hand, with floating exchange rate, and low capital mobility, embarking on fiscal policy expansion will result in the loss of foreign exchange reserve and will be replaced by exchange rate depreciation. This will make the IS schedule to move further to the right through the operation of the Marshall-Lerner condition (Busari, 2004).With floating exchange rate and high capital mobility, fiscal expansion will appreciate the foreign exchange value of the domestic currency, resulting in the loss of international competition that will eventually reduce net export, which makes the IS schedule to shift to the left.

2.3.4 The Stochastic Inventory Control Model

Following the models by Kim (1985), and Shiva and Bahmani – Oskooee (1998), a variant of the Girton – Roper Model is outlined below.

M^D = Kpy …… (1)

M^S = A(R+D) …… (2)

P = EP* …… (3)

M^D = M^S …… (4)

Equation 1 represents the demand for nominal balance where P is standard for domestic price level and Y is real income; k is a fraction of nominal income that people want to hold as cash. Equation 2 is a nominal money supply equation. The Money Supply is the sum of the net foreign asset (R), the foreign component of the monetary base and the domestic asset (D), the domestic component of monetary base multiplied by the Money multiplier (A = M^2/Monetary base) Equation 3, represents the purchasing power parity condition, where E is the nominal exchange rate, which is defined as the domestic currency per unit of foreign currency. P* is the foreign price level. Equation 4 represents money market equilibrium identity where money demands equal money supply. Substituting 1 and 2 equations 4 we have;

Kpy = A (R + D) …… (5)

Replacing P by EP*, we get

K (EP*) Y = A (R + D) …… (6)

Taking a percentage change and rearranging terms equation 6 can be rewritten as

r – e = d + p* + y – a …… (7)

Where:

r = the percentage change in international reserves

e = the percentage change in the nominal change in the Nominal exchange rate depreciation

d = the percentage change in domestic real income and

a = the percentage change in the money multiplier

Equation (7) states that an increase in the exchange market pressure (EMP) due to an increase in the domestic credit decreases EMP either by reserve depletion or by currency

depreciation. However, an increase in domestic real income or foreign price level or money multiplier also increases the exchange rate market pressure (EMP).

According to Abeng (2007), the monetary base consists of two main components, the domestic component (D) and the foreign component (R). The former consists of domestic claims on government by the Central Bank, and the later is made up of the net foreign asset. Girton and Roper; Connoly and Silveria (1979); and Shira and Bahmani Oskooee (1998) redefined the ratio of (e/r) with a coefficient Q to see whether the monetary authority response to absorb exchange market pressure either of the exchange rate depreciation or reserve depletion. A significant and positive coefficient Q implies that monetary authority absorbs more pressure by exchange rate depreciation while a significant and negative Q implies that more pressure is absorbed by reserves losses. An insignificant coefficient implies that the monetary authorities are not sensitive to the component of EMP. The coefficient Q is important in the sense that it allows us to see whether a country follows a traditional monetary approach to balance of payment or exchange rate determination model, or the Girton and Roper's model (where they use the sum of the growth rate of nominal exchange and the growth rate of international reserves as an EMP variable.

2.3.5 The Buffers Stock Model

One economic linkage that involves reserve volatility is through the transaction models of demand used to determine the optimal size of a country's international reserve. The buffer stock model of Frankel and Jovanovic (1981) stipulates that central bank chooses an optimal level of reserve with the opportunity cost of holding reserves. The optimal stock of reserve yields the optimal combination of being able to finance a deficit by drawing on reserves and of having to adjust in the face of a deficit by reducing expenditures relative to income. Higher reserve volatility means that reserve hit their

lower amount and tolerates greater opportunity to incur the adjustment cost less frequently.

2.4 FOREIGN EXCHANGE RESERVE MANAGEMENT BASED THEORETICAL FOUNDATION

In what appeared to be the rationale of foreign exchange reserve accumulation, Olokoye, Evants, Osabuohein, and Salami (2008) identified the following as a theoretical foundation of reserve accumulation based on reserve management guideline:

2.4.1 Self Insurance Theoretical Model

Wijnbergen's (1990) pioneered the work on self-insurance theory examined the cash/debt buyback in the context of missing terms of trade contingent instrument in international capital market coupled with differences in risk aversion between commercial creditors and developing country's borrowers. The author argued that the price of debt in the secondary market does not adequately reflect the insurance value of reserves to debtors. In bad state, (i.e. a debt default of the debt buy back is of little use as no debt can be service. Hence, self-insurance theory demonstrates how foreign reserve ensures that policy makers have some additional options during the bad state. Thus the recent accumulation of reserve in developing countries has thus been interpreted as a form of self insurance precipitated by the high level of global economic and financial instability and the absent of an adequate international system for crisis management (Stiglitz, 2006, Elhiraika & Ndikumana, 2007).

2.4.2 Mercantilist Theoretical Model

The mercantilist model posits that many countries accumulate foreign reserve as a means for effective exchange rate management and as a tool for maintaining lower exchange rates in order to promote trade and international competitiveness (Durdu 2007). On this model, Yeyati (2008) also noted that the reason for the recent surge in the stock of foreign reserve in developing countries is to prevent real exchange appreciation from rising as a result of capital inflows either due to the 'mercantilist' objective of

competitiveness or to avoid a potential overvaluation of currency that may eventually downsize risks.

2.4.3 Macroeconomic Stability Theoretical Model

Macroeconomic stabilization remains at the core of national economic policy making in order to aid conditionality in developing countries especially in Africa. This has induced African countries to hold reserve to allow monetary authorities to intervene in markets to influence the exchange rate and inflation. (Lapavitsas, 2007 Elhiraika and Ndikumana, 2007) Many African countries including Nigeria argued that adequate foreign reserves may allow them to borrow abroad, attract foreign capital and promote domestic private investment as a result of strengthening external position and reduced vulnerability to external shocks. Thus, it was believed that maintaining adequate reserves can boost investor's confidence and enhance investment and growth (Elhiraika and Ndukumana, 2007).

The various expositions in the above sampled theoretical framework clearly show the dynamic issues in the working of foreign exchange reserve in the economy. All have attempted to incorporate the element of foreign exchange reserve, directly or indirectly. However as important as they are, the author lends credence to the first-three above. This is because countries will want to be as competitive as possible and to avoid appreciation so as to boost export and earn the needed foreign exchange. While doing this, they also are mindful of the interrelationship in the economy.

2.5 APPROACHES TO OPTIMAL CURRENCY COMPOSITION OF RESERVES

There are basically three approaches to determining the optimal currency composition of foreign reserves (Soludo 2007; Roger 1993). The Mean variance approach; the transaction based approach and the intervention oriented approach. All the three may be useful in reaching and evaluating decisions on the composition of reserve assets as well as foreign currencies liabilities. Indeed, empirical evidence suggests that

no single approach has been widely predominant at least since the mid 1970 (Roger, 1993).

2.5.1 The Mean-Variance Approach

The mean variance approach to analyzing the composition of reserve was an adaptation of the traditional Markowitz Portfolio Models widely used in the theory of finance. Essentially, the model treats reserve as a store of wealth and central bank as an investor wishing to maximize the value of the portfolio while minimizing its riskiness, within this framework. The basic analytical task was to find the set of investment portfolio that is, the different combination of currencies in reserve which offer the greatest return for any given degree of risk. This set is known as the efficient frontier, since any other portfolio of currency mix will yield a lower return for the risk involved. In principle, optimizing central bank should always pick a currency portfolio somewhere along the efficient frontier, as long as the risk and return on the portfolio are their sole concern (Scott, 1993).

An important difference between the traditional portfolio analysis and that of the central bank is that in the traditional analysis, the investor is assumed to focus on the mean and variance of the portfolio returns in domestic currency terms. In contrast, the Central bank is usually regarded as focusing on the mean and variance of its return on its reserve in terms of a "basket" of either foreign currencies or imported goods and services. Since this basket will differ from one country to the next, consequently, even if two central banks have identical preferences in terms of the trade-off that they are willing to take risk on return on their reserve, they will still select different currency mix of their own reserves. This conforms with Greenspan's (1999) postulation that the general principle is that monetary authorities' reserve only those currency they believe are as strong as or stronger than their own. Thus, central bank reserve balance sheet

accepts in special circumstances and holds no weak currencies. Other than the standard, transactions balances are not viewed as store of values.

2.5.2 The Transaction Based Approach

In an important contribution to the reserve management literature, Dooley (1987) suggested that the composition of foreign exchange reserve may depart from efficient portfolio mix for sound reasons unrelated to the practical problems associated with applying the mean-variance framework. The basic thrust of Dooley's argument is that the mean-variance framework is most logically applied to the net foreign assets of the authorities, rather than gross reserve alone. From this perspective, an efficient portfolio of net assets can be obtained by manipulating the composition of gross assets, gross liabilities or both. An implication which follows is that even if the currency composition of the net asset portfolio is efficient in a mean-variance sense, there is no reason to expect that the currency composition of either gross assets or gross liabilities examined as isolation will represent efficient portfolios.

The fact that the currency composition of net revenues can be optimized on either the assets or the liabilities side may give the authorities an extra degree of freedom to pursue other objectives. Dooley (1987) suggests that a logical way to use this freedom is for the central bank to place a relatively high weight on transaction cost or liquidity consideration in selling the composition of reserve asset while mean-variance consideration with respect to net portfolio is given a fairly heavy weight in the makeup of liabilities.

Nonetheless, Dooley (1987) readily acknowledged that institutional arrangement may well preclude portfolio optimization with respect to the currency composition of net foreign exchange assets. This is particularly likely if reserve assets are managed quite separately from liabilities. In addition, the ability to manage foreign currency position may be much more constrained on the liabilities side than on the assets side if foreign

currency borrowing decisions are highly decentralized. Where liabilities are typically in instruments with longer maturity than assets or where foreign lender constrains the currency denomination of liabilities. Finally, foreign exchange transaction costs, at least among the major currencies may be fairly low. After an examination of ninety three (93) developing countries, observation underscores the argument that the mean-variance approach is most vividly applied at the individual country level. Applying it to a group of countries may produce spurious results. Any other observations from Dooley's experiment suggest that the composition of reserve was significantly influenced by transaction consideration, that is, it reflects exchange rate movement.

The above analysis suggests that transaction consideration does not necessarily dominate decisions regarding the currency composition of reserve at least as well as the portfolio model. Dooley, Lizondo, and Mathreson (1989) thereafter referred to as DLM estimate a transaction based model of currency composition of reserve for a group of 58 countries over the period 1976 – 85. In essence, the analysis is an update and a refinement of the study by Heller and Knight (1978). To the extent that the transaction consideration are important, DLM argued that the proposition of reserve held in a particular currency tend to increase with the proportion of the country's external transaction in that currency.

2.5.3 An Intervention-Oriented Approach

The third approach in currency composition of reserve is the intervention-oriented approach. In contrast with the mean-variance optimization and transaction approaches, the intervention-oriented approach focuses on the implications for reserve composition of the timing of reserve use, whether in pursuit of balance of payments or exchange rate objectives. The basic idea is essentially similar to that underlying the consumption–based capital asset pricing Model (CAPM). Breeden (1979) and Stalz (1985) posited that investors will tend to draw on their portfolios at times when their

income is low, and low in value when their income was high that is, negatively correlated with income and which may be preferable to the ideal mean-variance portfolio, that was fairly stable in value at all times. Adapting this approach to reserve management would lead a country holding reserve for the purpose of current account financing to favour reserve assets which tend to be high in value vis-à-vis basket of imports when its current account position was weakest and lowest in value when its current account position is strongest.

The "intervention" approach of course, suffers from many of the same problems as the mean-variance approach since its potential usefulness also depends on the ability of the authorities to forecast the means, variances and co-variances of returns in different currencies. It also requires a clear idea of the circumstances in which reserve is likely to be used. The second issue concerns the character of the intervention response to exchange rate movements. Some countries for example, may intervene in proportion say to the deviation of their exchange rate from some target level; while others may intervene only with respect to rapid or "disorderly" rates of change in the exchange rate. The point here is that the pattern of correlations and covariance will vary somewhat according to the particular form of a country's intervention "rules".

With regard to the currency composition of foreign reserve, all the three may be useful in reaching and evaluating decision on the composition of reserve assets as well as foreign currency liabilities. Indeed, on empirical evidence, no single approach has been widely predominant at least since the mid- 1970 (Dooley, 1993). In part this may reflect the fact that reserves are generally held for a variety of motives – as a strive of wealth; as a means of financing current account transactions and for the purpose of exchange market intervention – and that each motive calls for a somewhat different approach.

2.6 EMPIRICAL LITERATURE

Abeng (2007) opined that though the management of foreign exchange reserve of a country is the exclusive responsibility of central bank, the quantum of reserves to be held is a function of several exogenous factors, depending on its objectives and the prevailing economic management challenges. According to Williams (2005), such factors range from the structure and vibrancy of the economy to the split between the traded and non- traded sectors, the level and rate of capital flows and outflows, the attractiveness of returns offered in other currencies. Aizenman and Marion (2003) attributed foreign exchange reserve (FER) demand principally to two factors. The first being government's desire to "smooth consumption" (i.e. to spread out over time, the cause of such shocks, such as sudden outflows of international capital, when it faces difficulty raising funds either through international capital markets or through domestic tax collection), and secondly for the "loss aversion" (i.e. the tendency of people in the economy to be more sensitive to the reduction in their consumption than to increase). In their view, government would choose to hold smaller reserves stocks if the populace is indifferent to the reductions or increases in their consumption, while it will choose to hold a much larger stock if it believes the populace is loss averse.

Hussain (2002) stated that reserve is demanded as a tool for exchange rate and monetary policy management. Adequate reserve according to him does not only ensure a realistic exchange rate, but also help maintain competitiveness of export goods. In addition, central bank's ability to intervene in the market with the view to influencing the exchange rate as well as boosting confidence in the currency is principally determined by the level of reserves stock. Countries thus hold foreign exchange reserve (FER) to enable them intervenes to reduce the volatility or better still maintain a target exchange rate. Reserve affects the domestic money market balance and, by implication domestic interest rate through the buying and selling of domestic currency at the inter-bank

market. Reserves also provide funds in foreign currencies for servicing of debt and liabilities. Gradual accumulation of reserve through non-debt creating means to a sufficiently comfortable level avoids panic in the market and precludes the need for contracting additional debt for a country. A high level of reserves provides implicit guarantee to the creditors that the country would be able to meet its obligations, as at and when due.

According to Gosselin and Parent (2005), there is a relatively stable long-run reserve demand function that depends on five categories of explanatory variables; economic size, current account vulnerability; capital account vulnerability, exchange rate flexibility and opportunity cost. Elhiraika and Ndikumana (2007) asserted that macroeconomic stabilization remains the forefront of national economic policy making and aid conditionality especially in Africa where foreign exchange reserve have substantially been accumulated consequent upon their resource endowment, high commodity export, as well as aid flows. According to them countries, particularly African countries, need to understand the determinant and the economic cost of reserves fluctuation (accumulation and depletion) and to design optimal reserve management strategies in order to derive the benefits and minimize the cost from the level of this asset. In their opinion, adequate reserve will allow monetary authorities to intervene in market to influence the exchange rate and inflation. Also a given level of reserves is a determinant for countries to borrow abroad to hedge against instability and uncertainty of external capital flows.

Empirical findings in this area are numerous, but such findings are however tilted to only the investigation of the determinant of foreign reserve accumulation on the economy. These studies are mostly concentrated on the Asian economies, while few studies were done in the sub-Saharan Africa countries' economies. Hussain, Mohammad and Ali (2009) have established a positive relationship between foreign exchange reserve

with remittances and stock exchange market in a study of the impact of reserve and stock market performance in Pakistan. When remittances are used as reverse flow, they are made available for long term capital investment of any developing countries.

Korsu (2009) conducted a study on the effect of exchange rate on the trade balance in Sierra Leone; his finding from the equation of foreign exchange reserve shows that the interest rate, inflation and nominal exchange rate variables have direct effect on Foreign exchange reserve. While nominal exchange rate has positive effect, interest rate and inflation rates were negative. The implication of the study clearly indicates that the foreign reserve policy objective was that of the mercantilist and the self insurance options intended to stabilize that domestic currency and to boost export.

Sehgal and Sharma (2008) conducted a study on the adequacy, cost and determinant of international reserves in India, and included variables such as reserve, external debt and export etc; using vector autoregressive model and the counterpart of vector error correction methodology. Their result revealed the evidence of precaution and mercantile motive behind holding reserve. In other words, they established precautionary, self insurance and mercantile motives as a measure to shield the economy. The mercantilist motive was anchored on the philosophy of undervalued exchange rates to boost export and built reserve stock. Their variables were however, examined at a different lag length, which would yield a heterogeneous result. Some countries keep reserves in order to undervalue their currencies with the view to maintaining external competitiveness, attract foreign direct investment (FDI), and boost export. This was done by buying foreign currencies in the market, and building foreign exchange reserve at the same time. Meanwhile in developing countries like Nigeria, intervention is often undertaken to mitigate the political and credit risk of steep depreciation of the local currency.

Choi and Baek (2004) analyzed the effect of exchange rate system on international reserve holding in 137 countries, and included the variables such as GDP, trade openness measured as the ratio of export plus import GDP; financial openness defined as the ratio of gross private flows to GDP; interest which means lending interest rates as a proxy for the opportunity cost of holding reserve; volatility defined as export volatility and a Dummy that represented exchange rate regimes. Their results however failed to conform to their *a priori* expectation, particularly in signs of the coefficient and statistical significant. The weakness of their work was it's inability to treat the time series data and possibly look at the lag effect of the past values on the current values.

Using Pedroni's Panel Cointegration and error correction model, Gosseline and Parent (2005) estimated the long run reserve demand function in a panel of eight Asian emerging economies, and variables incorporated in their model were economic performance measured as GDP, and GDP per capita; current and capital account vulnerability measured in terms of share of imports or export to output; financial openness as a ratio of capital flows or broad money to GDP; short term external debt and foreigners equity position; exchange rate flexibility measured as volatility of exchange rate; and opportunity cost (interest rate differentials all as the determinants and variables respectively. Their findings showed that all variables included were significant in explaining the demand function in these countries. Their results are however suspected to be spurious because instead of acknowledging that the data are integrated of the order I (1), they rather used unadjusted standard errors.

Elhiraika and Ndikumana (2007) attempted a study on twenty one (21) African countries using panel data to examine the causes and economic implication of reserve accumulation with a focus on the impact on the exchange rate, inflation, and public and private investment. The empirical analysis showed that the reserves accumulation cannot only be explained by portfolio choice motive (in terms of returns to assets) or

stabilization objectives but in exchange appreciation with little benefit in terms of public and private investment. The assumption of the same of parameters in the cross sectional unit under the panel data might result in an unimpressive result. IMF (2003) examined the demand for foreign exchange reserve in emerging economies in the 1980s and 1990s. The result of the study revealed that more than 90 percent of the variation in reserve is explained by economic size, current account vulnerability, exchange rate flexibility and opportunity cost. This finding was consistent with transaction motive of holding reserve as against protecting the domestic economy as the case with developing countries. Similarly, a high ratio of import to GDP, high trade to GDP, and high current account deficit to GDP may lead to current account vulnerability and this may in turn induce high reserve demand. In a similar study, Alfaro and Kanczuk (2007) argued that developing countries are also motivated to hold reserve not just for insurance reason, but for political consideration as for desired spending in public works and that suggest the contrast between theoretical and actual behaviour.

Waheed and Abdullateef (2010) conducted an empirical study on the impact of changes in external reserves position in Nigeria on domestic investment, inflation and exchange rate as explanatory variables, using the Ordinary Least Square (OLS), and Vector Error Correction Model (VECM). Their result invalidated most findings that reserve was not influenced by opportunity cost, but by other determinants such as exchange rate stability, and current account variability. Further evidences from their work were that changes in foreign exchange reserve have positive influence on the growth of foreign direct investment and exchange rate appreciation in the country but no such influence was observed on domestic investment and inflation rate. They advocated for maximization of the gains from oil export revenues by utilizing more of these resources to boost domestic investment. While we found their study an addition to the empirical work in this area, it was however inadequate because they failed to carry out

an impulse response function (IRF), to clearly separate the response of the dependent variable as a result of a shock emanating from any of the explanatory variable, since their study was an impact analysis.

Usman and Ibrahim (2010) investigated the impact of changes in external reserves positions in Nigeria on domestic investment, inflation and exchange rate using a vector error correction (VECM) method. It was observed that changes in external reserve in the country only influences foreign direct investment (FDI) and exchange rate and no influence was found on domestic investment and inflation. Fukuda and Kon (2010) investigated the long run macroeconomic impacts of accumulation in foreign exchange reserves in many developing countries (134 countries) using unbalanced panel and obtained the coefficient estimate by pooled OLS. They included variables such as GDP, investment consumption. Their results revealed significant relationship among the variables. The drawback of the work that could hamper their result was the missing information owing to adoption of imbalance panel analysis. A study by Rodrik (2006) revealed that reasonable spreads between the yield on reserves and the cost of foreign borrowing led to an income loss of nearly one percent of GDP in developing countries that have rapidly increased foreign exchange reserve.

Olokoyo, Evants, Osabuohien and Salami (2009) conducted an econometric analysis of foreign exchange reserve and some macroeconomic variables in Nigeria. The macroeconomic variables considered were the economic size, GDP, trade, level of capital flow (KFL), exchange rate (EXR), inflation rate, etc, using the methodology of cointegration test, vector error correction, (VEC), within the framework of autoregressive distributed lags (ARDL), on an annual time series secondary data between (1970-2007).Their results revealed the following: the existence of a long run relationship between the variable and two cointegrating equations; and the possibility of convergence of the variables from the short run to the long run with slow speed of adjustment. They

finally concluded that accumulation of large foreign reserves is not very productive in Nigeria due to its inability to reduce some of the macroeconomic variables instability.

In theory, the volume of international financial transaction and foreign exchange reserve holdings are expected to increase with economic size. Also, GDP and GDP per capita have been used as indicators of economic size in the literature. The vulnerability of the current account can be captured by some measure of trade openness and trade volatility (Olokoyo Evants Osabuohien and Salami, 2009). In the long run, central bank will increase their reserves in response to a greater exposure to external stocks. Thus, the level of foreign exchange reserve could be positively correlated with increase in both export, and imports. Capital account vulnerability increases with financial openness and potential for resident-based capital flight from domestic currency. Consequently, reserves could be positively correlated with some variables like the ratio of capital flows to GDP, Exchange rate flexibility and import. In a pegged exchange regime, the demand for foreign exchange reserve is reduced, since Central Bank no longer need a large stockpile of reserve.

In a study on external reserve accumulation and the estimation of the adequacy level for Nigeria spanning from the period 1990 -2009, Oputa and Ogunleye (2010) adopting Scherbacker model which estimated the level of international reserve adequacy alongside the drivers of external reserve, found that there have been shortfalls in the level of reserve over the years. In a related work, Englama, Duke, and Ogunleye (2010) used cointegration and Vector Error Correction Model (VECM) to examine the short and long run relationship of oil price and exchange rate volatility in Nigeria, included as the explanatory variables were oil price volatility, foreign reserves, demand for exchange rate and exchange volatility respectively. Their finding showed not only a direct link, but also a strong and positive long and short relationship among the variables involved in the study.

Based on peculiarity, Irefin and Yaaba (2011) extended the buffer stock model of Frenkel and Jovanovic and incorporate other macroeconomic variables to study the determination of reserves holding in Nigeria. These variables considered were Gross domestic product (GDP), import monetary policy rate and exchange rate using autoregressive distributed lag (ARDL). Their results debunked the existence of buffer stock for reserve accumulation and provided strong evidence in support of income as the major determinant of reserve holding in Nigeria. The practice from these two findings provided a great impetus in the modelling approach in this study.

Abiola and Adebayo (2013) examined the accumulation of foreign exchange reserve in Nigeria as result of the impressive price of crude-oil and the channel of utilization of the reserve in alternative investment outlets. Using the cost-effective propositions and the theory of demand for international reserve, based on the three motives, their study observed that the level of reserves to import satisfies the international benchmark. They put forward the recommendation that there is the need to split foreign reserves into four portfolios namely: the liquidity portfolio; long term or investment portfolio; immunization portfolio; and the petroleum fund buffer or sovereign wealth fund.

The international Relation Committee Task Force (IRC, 2006) identified other uses of foreign exchange reserve that necessitate its accumulation and management by Central Bank as payment for the importation of goods and services, the national external debt and the finance of fiscal expenditure. Another important area in this study of recent was the issue of currency diversification. The currency diversification of external reserve involves the shift on the part of central bank from holding their reserve in the traditional gold reserve assets to a basket of foreign currencies and securities. According to Aputa (2006), in considering a basket of currency to hold, the monetary authorities of most countries are influenced by historical, economic and political fundamentals. The general

economic objective of currency composition of reserve is investment in foreign currencies, and securities by central bank to maximize returns on financial resources. The monetary authorities more often than not, play down on the probability aspect and concentrate on their liquidity needs especially if they are experiencing balance of payment disequilibrium. Blackman (1982) opined that countries prefer to maintain their reserve in currencies that assure relative stability in international market, and on the whole, the relative share of the United State Dollar in the currency assets has continued to be on the increase in the world. Oputa (2006) declared that by 1976, Nigeria's foreign reserve were completely diversified into several strong currencies, with the American Dollar taking the lead, followed in that order by the Pound Sterling. The perception was that Central Bank worldwide gain from the advantage of being able to invest in the foreign money market bills that are highly liquid and interest earning. This motive was closely followed by Nigeria in 2001, to ensure prompt and timely settlement of the country's external obligations, while ensuring capital appreciation.

Oputa (2006) empirically examined the determinants of currency composition of external reserve in Nigeria using the multiple regression models, including exchange rate; interest rate trade flows currencies of creditor's nation (external indebtedness); and political consideration a dummy as the determinant of currency composition in Nigeria. He found that exchange rate variation largely influenced currency composition in Nigeria. The finding of the study revealed that the main factors influencing the currency composition of foreign reserve in Nigeria are summarized as international trade transactions and currencies composition of external debt, reserve adequacy aided by the diversification. While, exchange rate and interest rate were significant in the findings, this study found their work important, but deficient in the sense that instead of treating the data to achieve the same level of measurement, they were taken in their absolute value, suspecting the result to be spurious.

Chinaemerem and Ebiringa (2012) in their study of the analysis of the effect of external reserve management on macroeconomic stability in Nigeria using the Granger causality and vector autoregession (VAR) methodology reported that Gross Domestic Product (GDP),exchange rate; capital and non capital goods were the most influential factors in determining the current value of foreign reserve in Nigeria, their study was appropriate particularly where the variables considered were endogenous in character and the methodology applied was that of the dynamic technique. However, what was not clear was the absence of the cointegration analysis to further justify the use of the methodology.

2.7 EXISTING GAP IN THE LITERATURE

This study recognized the intellectual works of earlier scholars in this field, but however realized the following as gaps in the literature.

There is vast literature on this subject matter, studies like those of Bankole, Olaniyan, Oyeranti, and Shuabu (2011) on demand for international reserve in Nigeria; Abdul-lateef and Waheed (2010) studied external reserve holdings: implication for investment, inflation and exchange rate in Nigeria; Usman and Ibrahim (2010) investigated the strategic management of Nigeria's foreign exchange reserve. Obaseki (2007), worked on sources currency composition and use of external reserve; Ball and Reyes (2006), international reserve holding: interest matters; Elhiriaka and Ndikumana, (2007), reserve accumulation in Africa: sources motivation and effects; Goseline and Parent (2005), reserve accumulation in Africa: sources motivation and effects; Goseline and Parent; Aizenman and Lee (2005), international reserve: precautionary vs. mercantilist views, theory and evidences. All have limited their studies extensively only on the demand determinants and rationale for foreign reserve and modelled the nexus between foreign exchange reserve and macroeconomic stability performance. These studies have viewed foreign reserve as stock and paid little or no attention on the

fluctuating trend in the level of foreign exchange reserve and to relate same with the key macroeconomic variables responsible. Also these studies have restricted the consideration of explanatory variables within the conventional macroeconomic variables without attention paid particularly to the country's specific framework in foreign exchange reserve modelling. For instance no analysis on the trend of foreign exchange reserves in Nigeria is without the mention of oil revenue that has strong influence and at the same time reported to be the major sources of foreign exchange reserve variability in Nigeria, was ignored or hardly mentioned.

1. Previous studies carried on Nigeria concentrated on the use of conventional variables mostly employed in an econometrics analysis of foreign exchange reserve and macroeconomic variables. These variables are economic size, current and capital vulnerability, exchange flexibility and opportunity cost e.t.c. These studies hardly paid attention to factors peculiar to country concern in the formulation of macro-econometric models to include variable(s) that captures these "specifics" conditions when making their investigation. The consideration of variables by these studies rather followed the band wagon effect and thereby ignoring the very factors peculiar to a given country. For instance a study on the fluctuation in foreign exchange reserve in Nigeria must take into account the central role of crude oil revenue, because Nigeria is an oil exporting country.
2. Studies in the past mainly conceptualised foreign exchange reserve as a stock rather than a flow variable. As a result, these studies paid little attention to the changes or fluctuating trend in country's foreign exchange reserve vis-à-vis the performance of macroeconomic variables. The Nigerian foreign exchange reserve has witnessed rapid changes owing largely to the combined internal and external factors. This study considers Nigeria's foreign exchange reserve as flow variable.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 SOURCES OF DATA

The study used secondary data from the periods 1980-2013), obtained from various sources. Relevant data information was collected from the publications of the Statistical Bulletin of Central Bank of Nigeria (CBN), information from National Bureau of Statistic (NBS), Annual Reports and Statement of Account (various issues) and the Debt Management Office, as well as data from the International Financial institutions (IFS). The secondary data was decided because the study is on national research, thus data variables considered are available mostly in their secondary form.

3.2 THE APRIORI EXPECTATION OF THE VARIABLES

3.2.1 Foreign Exchange Reserve and GDP (Economic Size)

The relationship between the stock of foreign exchange reserve and economic size proxy by GDP or per capita income as the case may be, is expected to be positive. The growth in size of the economy can occur as a result of an increased transaction of a country with the rest of the world (trade). This will result in massive inflows and acquisitions of foreign assets including foreign exchange reserve. Therefore, the apriori expectation of this relationship is $CFER = \beta_0 + \beta_1 GDP$ - - 9

Where, $\beta 0>0$;

3.2.2 Foreign Exchange Reserve and Exchange Rate Flexibility or Volatility (EXRV)

Exchange rate is the price of one currency with another. When the price of domestic currency is low in relation to a foreign currency, export of goods will expand leading to an inflow of foreign currency. Export in this case determines the relative stability of exchange rate, which in turn determines foreign exchange reserve, and leads to its variation. This study expects a positive relationship of exchange rate with changes in foreign exchange reserve if the variation foreign exchange causes trade to change positively. The boost in foreign exchange reserve is intended to protect the volatile

exchange rate market because of the seasonality in the supply of exchange rate peculiar with commodity export economies. The objective in this perspective is the protection of the domestic currency. Therefore, the expected relationship here is positive.

CFER= $\gamma_0 + \gamma_1$EXRV + ui; where $\gamma_{1 < 0.}$ - - - - (10)

3.2.3 Foreign Exchange Reserve and Trade Openness (TOPEN)

A high ratio of total export to GDP is a good sign of a large open economy. The more an economy is open, the more the inflow of foreign resources, *ceteris paribus.* Thus, it is expected that this relationship will be positive. The form of this relationship is given as CFER= $\alpha_0 + \alpha_1$TOPEN + ui: where $\alpha_1 > 0$ - - - (11)

3.2.4 Foreign Exchange Reserve and Net Export (NEXPT)

The country's net export is the most appropriate measure of export performance of the country. This will give an acceptable representation of the country's capacity in terms of its ability to generate external resources from its exportable products taking into account its import. This study expects a positive sign of net export with the trend of foreign exchange reserves in Nigeria for the period of the review.

Thus $\psi_0 + \psi_1$NEXPT + ui : where $\psi_1 > 0$ - - - - (12)

3.2.5 Foreign Exchange Reserve and Oil Revenue (OILREV)

Oil revenue account for 40 percent of Nigeria's gross domestic product (GDP), 70 percent of government revenue, and 90 percent of foreign exchange earnings,. Invariably, oil revenue constitutes the major source of Nigeria's foreign exchange reserve and has significant impact on the stock and the variability of foreign exchange reserve. We expect a positive relationship between oil revenue and foreign exchange reserves.

Thus, $\varphi_0 + \varphi_1$OILREV + ui ; where $\varphi_1 > 0$ - - - - (13)

3.2.6 Foreign Exchange Reserve and Debt Servicing (DBTSERV)

There are various measures of reserves adequacy to external debt and servicing. These are used as measures of country's resilience to international crises. Thus, "Alan Greenspan and Guidiotti rule" suggested an adequacy level of reserves that can cover the period of twelve months without a resort to international borrowing and in the event of reversal or sudden stop in foreign capital inflow (Cruz and Walters, 2008). So it is expected that foreign exchange reserves will show negative relationship with debt servicing. $\psi_0 + \psi_1 DBTSERV + ui : \psi_1 > 0$ - - - -(14)

3.3 MODEL SPECIFICATION

From the foregoing, the implicit functions of model for changes foreign exchange reserve fluctuation (CFER) and macroeconomic stability variables is given as

CFER = f (GDP, EXRV, TOPEN, NEXPT, OILREV DBTSERV) - - -15

Where:

FER = Changes in foreign exchange reserve representing the dwindling in the stock of nominal foreign exchange reserves

GDP = Gross domestic product, used as proxy for economic size.

EXRV = Exchange rate flexibility or volatility

TOPEN = Trade Openness of the economy

NEXPT = Net export

OILREV= Oil revenue

DBTSERV= debt servicing

The model is an adoption and a modification of Abdllateef and Waheed (2010) model on foreign reserve holding in Nigeria. This modification done is in term of the measurement of the foreign exchange reserve to reflect changes, and the inclusion of key variables considered being peculiar and central to explaining foreign reserve fluctuation in Nigeria for the period under study. Specifically, the study included oil revenue and

index of openness to capture the extent to which external economic environment affected the Nigerian foreign exchange reserve movement.

Though in IMF (2003) more than 90 percent of the variation in reserve was accounted for by economic size, current and capital account vulnerability, exchange rate flexibility, opportunity cost, and with large competitive economies, mainly those with extensive volume of trade transactions. But Nigeria appeared to be weak in some of variables mentioned and therefore appropriate variables are used to capture its true feature. Therefore the study operationalized and a stochastic form of the equations in mathematical forms is specified as follows:

$$CFER = \beta_0 + \beta_1 GDP + \beta_2 EXRV + \beta_3 TOPEN + \beta_4 NEXPT + \beta_5 OILREW + B_6 DBTSERV + \varepsilon \quad - - - - - - - - - - - - \quad 16$$

Where:

β_0 and β_1 = the intercept and coefficient of the respective variables i = 1-6
ε = error term

All the variables are as earlier defined in equation 15

3.3.1 Dependent Variables

The endogenous (dependent) variable for the study is changes in foreign exchange reserve (FER). The focus on this variable is the variation that constantly occurred over time.

3.3.2 The Independent Variables

The exogenous variables were identified from the surveyed theoretical and empirical literatures. The key variables identified relating to the observed trend pattern of Foreign exchange Reserve in Nigeria are Gross domestic product (GDP), a proxy for economic size, Trade openness (TOPEN), Exchange flexibility (EXRV), and Oil revenue (OILREV). Debt servicing (DBTSERV), Net export (NEXPT),

3.3.3 Variables Measurement

FER = foreign exchange reserve, representing the nominal stock of foreign currency assets component of reserves. The variable is recomputed to account for change.

GDP = Gross domestic product (in absolute value) as a measure of economic size or in some instances per capita income of a country is used in some empirical studies in this area if the objective is examine the effect on development.

EXRV = Exchange rate flexibility or volatility which is derivable from the nominal exchange rate as the price of currency versus the other (say the Naira versus the dollar)

TOPEN = Called trade openness (TOPEN), or index of openness computed as the sum of total export to total import to GDP. It is also termed as trade intensity, which shows the ease with which capital flow in and out of a given country by investors. Given that Nigeria is small open economy and because of the dominance of single commodity, an appropriate measure of openness will be a ratio of the non-oil export and import to GDP.

NEXPT = Net export, which is total export less import

OILREV = Annual proceeds from oil export

DBTSERV= Public sector debt servicing, this represents the periodic financing of yield on external debt.

3.4 MODEL TRANSFORMATION

The model in equations 16 is transformed in logarithm form to minimize the scale effect inherent in data measurement. The reasons for doing this, is to interpret the estimated coefficients in terms of elasticities. Taking log is also important because it eliminates the differences in the unit of measurement, (proliferation effect). Since the unit of measurement for the variables are different across board, some data are in million or billion Naira unit. Generally, for estimation purposes, Sultan (2011) argued that the choice between linear or log linear is very important because the functional form affects the explanatory power of the variables. Bera and McAleer (1977), Boylan (1980), Kmenta (1986) and Doroodian (1994) are of the view that log linear model should be preferred over linear because of the advantages of interpreting the coefficient of the dependent variable directly as elasticities with respect to the independent variables.

Doroodian (1994), Adenikinju and Busari (2009) together agreed that log-linear model accommodates the problem of heterosscedasticity. Also Gafar (1988) argued that log-linear models take care of the problem of multicollinearity.

Based on the above justification therefore, our earlier model (equations 9,) is further re-specified in their log-linear form as

$$\log CFER = \beta 0+\beta_1 \log(GDP)+\beta_2 \log(EXRV) +\beta_3 loog(TOPEN) +\beta_4 \log(NEXPT) +\beta_5 \log(OILREV) + \beta_6 \log(DBTSERV) + \varepsilon_i \quad - \quad - \quad - \quad 17$$

Where: ε_i is the stochastic term that captures all the shocks of the missing variables in the model.

All other variables are as earlier defined. The above equation is tested in their current and lagged period to examine the contemporaneous and dynamic effect of exogenous variables on the endogenous variable. Hyenman (1997) noted that unlike monetary variables, macroeconomic variables sometimes operate with long and sometimes unpredicted lags. We therefore compare the performance of the static and that of the dynamic result to see which can perform better. The dynamic approach in this case is the partial adjustment process of modelling, where only one period lag will be considered. This aspect is addressed in the error correction analysis.

3.5 TECHNIQUES OF DATA ANALYSIS

3.5.1 Pre-estimation Test

The determination of the stochastic properties of macroeconomic time series data is an important first step in any econometric analysis. This is to ensure that the results obtain are reliable in terms of the parameters performance. Unit root and cointegration test are pre-test instruments designed to investigate whether variables are integrated and also cointegrated in the long run. The refusal to conduct this basic step in an econometrics analysis is likely to produce results that are misleading and not reliable. Prior to the estimation of the model to determine the long run relationship of this study, unit root and cointegration were conducted.

3.5.2 Unit Root Test

When data exhibit random walk their respective mean and variances are not constant over time. In that circumstance, they are said to contain unit root (Madalla, 1992). This has serious implications on the results obtain in a quantitative econometric analysis, like producing results that are spurious with the high goodness of fit figure yet not efficient. This study adopted the technique of Phillip Perron popularly designated as PP hereinafter in the study to test for stationarity of variables. The PP technique for unit root test was decided because it has been found to adjust appropriately to the occurrence of serial correlation. (Iyoha & Ekanem, 2002)

3.5.3 Cointegration Test

A test of cointegration is a test for the existence of long run equilibrium among non-stationary variables. Usually the results obtained from unit root test are precondition for conducting cointegration test. Because where variables that are found to be stationary after differencing, means that there is an implied long run equilibrium relationship in their combinations. This study make used of the multivariate Johansen cointegration technique to ascertain the dynamics long run equilibrium in the long run. It provides an effective framework for the estimation and also testing of models to determine the dynamic long run economic relationships. To identify the number of the cointegration vector, Johansen cointegration methodology uses the trace and the maximum eigenvalue test statistic.

.3.5.4 Granger Causality Test

The Granger causality test instrument was used in the study to address one of the objectives in the study. This objective was to determine the causal relationship among the variables being investigated. This test is considered important because it can tell the interrelationship among the variables in the study, considered to be important also for forecasting .The direction of causality results may include unidirectional (one way);

feedback or bidirectional (two way) causality. We specify the Granger causality tests in line with study's variable is specify as:

$$FERt = \alpha + \sum_{i=1}^{n} \alpha Xt - 1 + \sum_{i=0}^{n} \beta iFERt - 1 + \mu it \quad - \quad - \quad -18$$

$$Xt = \beta + \sum_{i=1}^{n} \beta Xt - 1 + \sum_{i=0}^{n} \lambda iFERt - 1 + \mu it \quad - \quad - \quad - \quad -19$$

Where:

FERt = Foreign exchange reserves (the endogenous variables)

Xt = Vector of the exogenous variables.

3.5.5 TWO STAGE LEAST SQUARE (2SLS) TECHNIQUE

The two stage least square (2SLS) analytical technique employed a multivariate regression framework to obtain the numerical estimates of parameters for the model in the study. This technique is an extension of the ordinary least square (OLS) method in the classical linear regression model used in the analysis of structural equations. The justification for the use of this tool is informed by its ability to address simultaneity bias in the model, thereby overcome the drawback associated with ordinary least square linear regression the often produce biased and inconsistent estimates. The general concept of two stage least square is that of the instrumental variable estimator, instrumental variable methods allow consistent estimation when the explanatory variables are corralled (covariates) with each other and or with the error terms of a regression relationship. Such correlation may occur when the dependent variable cause at least one of the covariates (reverse causation)

3.5.6 Error Correction Model

The pre-condition for conducting the error correction analysis for this study follows the decision reach from the results of unit root and cointgeration. Where unit root determination of variables found to be stationary only after differencing, and the combinations of the variable found to be cointegrated, then error correction analysis

becomes necessary. There is a tight linkage between cointegration and error correction analysis that stems from the Granger representative theorem (Granger, 1983., Engle and Granger, 1987). The error correction model is specified in a distributed lag process where the parsimonious result can be obtained from its over-parameterised version. The appropriate number of lags in the model is usually determined by the optimal lag selection criterion in a vector autogressive process; making error correction models a dynamic model. The theoretical representation of ECM is given as:

$$\Delta Y_1 = \alpha_1 + \rho_1 \Delta Z_{t-1} - \delta i ECT_{t-1} + \varepsilon_t \quad - \quad - \quad - \quad - \quad 20$$

Where:

Δ, represent the first change of the variable.

ρ_1 are the coefficients of impact multipliers (short run effect), that measures the immediate impact of changes in explanatory variables that will have on the dependent variable, While, $\delta_i ECT_{t-1}$ is the coefficient of lagged error term derived from the long run static result or feedback effect which corrects for the disequilibrium created. The specification relates short run changes in the dependent variable to short run changes in the independent variables, (impact effect), but ties the change to the long run proportionality between the dependent and explanatory variables,(the long run effect) through a feedback mechanism. In doing so, it allows for the exploitation of information on the equilibrium relationship between non-stationary series if equilibrium exists within stationary and therefore consistent model. It is compatible with long run equilibrium behaviour. Equilibrium here refers to the situation in which the variables hypothesized to be linked and should not diverge from each other in the long run. The variables may drift apart in the short run for several reasons such as seasonal effects, price shocks e.t.c, but in the long run they should be able to converge and return back to the long run behaviour or said to be stable (Osorio, 2007).

The error correction model consists of two components. First, the error correction term with one period lag (ECT_{t-1}), which is the coefficient of error term and it represents the adjustment of the dependent variable to its equilibrium position caused by any one of the regressors (Feedback effect). It measures the speed of adjustment to long run equilibrium condition, i.e. to the extent that disequilibrium created in the previous period is corrected in the current period. Second, the first differenced lagged regressors with coefficient α and β_{1-n} etc are impact multiplier (short term effect) that measures the immediate impact of changes in regressors on the dependant variable. ε_i is the white noise error term. In the context of this study, our earlier structure model of equation 13, and 14 are further re-specified in a dynamic over-parameterised error correction model (ECM) as

$$\Delta \log CFER_{t-i} = \alpha_0 + \alpha_1 \Delta \log GDP_{t-i} + \alpha_2 \Delta \log EXRV_{t-i} + \alpha_3 \Delta \log TOPEN_{t-i} +$$

$$\alpha_4 \Delta \log NEXPT_{t-i} + \alpha_5 \Delta \log OILREV_{t-i} + \alpha_6 \Delta DBTSERV_{t-i} + \lambda_7 ECM_{t-i} + \gamma_i \quad - \quad 21$$

Where:

Δ, signifies change that denote first difference of the variables

All other variables are as earlier defined.

γ_i is the parameters of the ECM term measuring the correction mechanism that drives the foreign exchange reserve and explanatory variables to their long run equilibrium relationship in equations 13 and 14 respectively. The value of error correction coefficient is expected to be negative and statistically significant so as to support the existence of cointegration. Its magnitude defines the feedback mechanism among the cointegrating variables. In the context of cointegration and error correction model, Foreign exchange reserve and macroeconomic performance are hypothesized to be linked in theory. In the short run however, it is possible that fluctuations will occur in both foreign exchange reserve and macroeconomic variables as a result of oil price

fluctuation, seasonal variation in production, and exchange rate, export and import volatility. Therefore for the purpose of policy implication, it is important to consider the process through which short run interactions and the adjustment to long run occurs, hence the need for the choice of the methodological approach of this study.

While ECM is consistent with large parameters in a small data base; the vector error correction (VECM) is used where the data is large with few parameters to be estimated in a vector form. They further observed that the fact that variables are co-integrated it is usually inappropriate to use vector autoregressive model (VAR), but rather the correct empirical procedure is vector error correction model.

The co-integration technique confronts spurious regression associated with unit root problems, the error correction model to restore the short run disequilibrium as a result of differencing the data to achieve stationary.

3.6 RESEARCH HYPOTHESIS

To test the hypotheses of this research, the wald-F-statistic test was utilized to guide in taking our decision with respect to hypothesis. The F- statistic test is a joint test of the overall significance designed to test the null hypothesis that contains multiple hypotheses about a group of coefficient (Olubusoye, 2011).The fit of the equation is compared with the general F-statistic. This test has the following theoretical form:

$$F = \frac{\left(R^2/(K-1)\right)}{\left(1-R^2/N-K-1\right)} \quad - \quad - \quad - \quad - \quad (22)$$

Where:

R^2 = coefficient of determination.

K = Number of parameters

N = Number of observation or the sample size

3.6.1 Decision Rule

The decision to accept or reject the null hypothesis is hinge of the value of F-statistic. If the calculated F- Statistic (or F-ratio) is greater than the critical value, then the estimated equation parameters is statistically significant, in that case the null hypothesis that says the estimated regression coefficients are equal to zero, and hence no effect will be rejected, and the alternative hypothesis is accepted. In which case the estimated regression coefficients are not equal to zero, and therefore there is an effect. The F-statistic has two types of degree of freedom, numerator, & number of constraints implied by the null hypothesis. The denominator: N-K-1 is the degree of freedom in the regression equation.

CHAPTER FOUR
RESULTS AND DISCUSSION

4.1 DATA ANALYSIS

4.1.1 Descriptive Analysis

Trend graphs were used for the descriptive analysis to illustrate the pattern of growth rate, adequacy and behaviours for some selected macroeconomic variables. Consequently, nominal values were converted to percentage growth rate to make it easy and give clarity to the graphical presentation for the study. The use of graphs gives vivid presentation of the movement of variables over time and allows for the tracking of the ups and down in the issue being addressed. This section also complements other quantitative techniques used for this work.

In Figure 1, the growth rate of foreign exchange reserves is plotted for the period of the study (1980-2013). It can be observed that the graph did not follow a regular pattern, rather in a dwindling form and shows that Nigeria's foreign exchange reserves movement did not maintain a steady growth pattern, but instead a fluctuating one. The graph commenced on a low growth rate in foreign exchange reserves from 1980-1982 and coincided with the period of external indebtedness, and subsequently fall in foreign exchange reserves, owing to increased out flow in external payment. Following the introduction of economic stabilization Act in 1982 and the structural adjustment programme (SAP) of 1986, there were also measures like the ban on imports and foreign exchange rationing, which provided an impetus to the growth in the level of reserves, hence the positive position of the graph in 1983-1987.

There was yet another low level in the early part of 1988 to 1989 with little improvement in 1990 and was low again in 1991-1993 corresponding to the period of high external debt era and its attendant debt servicing obligations. Foreign exchange reserve witnessed an upward trend from 1994 to 1995, as a result of the gulf war which affected major oil exporting countries in the Middle East. This has caused a reduction in

world oil supply thereby raising price of oil and saw Nigeria benefiting from it. Another phenomenal trend was in 2004-2006, this was the period of liberalization policies and some commitment to reform in the wake of democratic rule, couple with favourable crude oil price and the granting of debt relief by external creditors. All combined to have positive impact on the level of foreign reserve and hence the picture on the graph. In the period 2008-2010, there was a marked reduction in the level of foreign exchange reserves as a result of the decline in the international oil prices, from US$147 per barrel to US$73 per barrel in August 2009. The price has continued to decline to the present position of US$53 per barrel giving rise to the downward trend towards the last part of the graph. The last phase of the graph witnessed a low and gradual fluctuating trend occasioned by a drastic drop in the price of the country's major export and source of foreign exchange reserve the oil and the depreciation in the value of the naira, thereby putting pressures on the existing stock of the reserves.

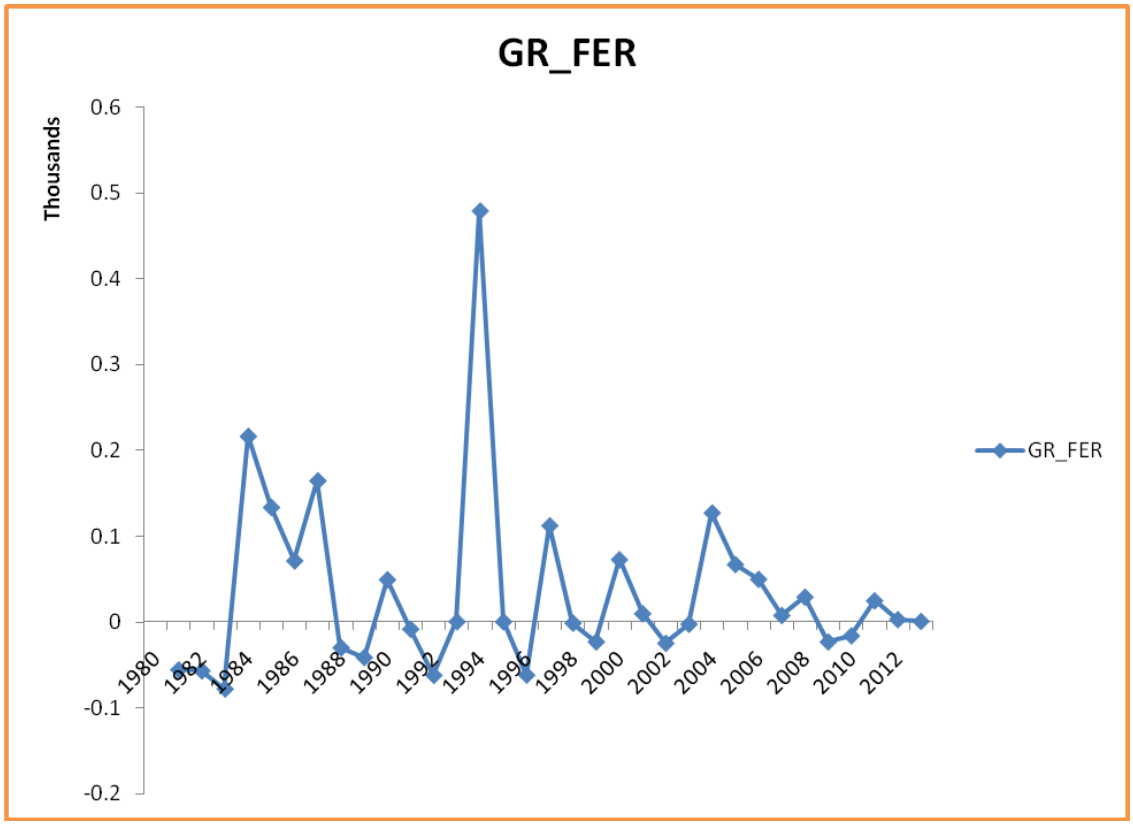

Figure 1: Growth Rate of Foreign Exchange Reserve in Nigeria (1980-2013)
SOURCE: Author's computation from Microsoft Excel

Figure 2 depicts the ratio of oil revenue to foreign exchange reserves for the period of the study. This variable was reported to be one of the variables that influenced the rate and direction of movement in the level of foreign exchange reserves in Nigeria. Therefore, it was singled out to check if actually crude oil revenue accounted largely for the major sources of Nigeria's foreign exchange reserves and was plotted to further affirm the statement that oil revenue accounted for the bulk of the source of foreign exchange reserves growth in Nigeria. The graph showed an increasing rate of oil revenue to foreign exchange reserves for the period of the study. The graph took-off from a low level of 1.53% in 1980, and increased marginally to 5.51% in 1992, before attaining its peak of about 105.5% in 1993. There was also a decreasing trend thereafter when in 1994; it dropped to 17.99%, before rising once again to 95.3% in 1996. From 1999 to 2002, the trend witnessed another rising pattern of 59.60%, and reaching its second highest point at 222.30%. In 2003 to 2010, the ratio stood at 164.82% and dropped to 85.44% respectively, and continued on an increasing rate to 205.84% in 2013. The fluctuating pattern of the graph was indicative of how exports and the revenue from oil dominated the growth in the level of foreign exchange reserves in Nigeria for the period of the study.

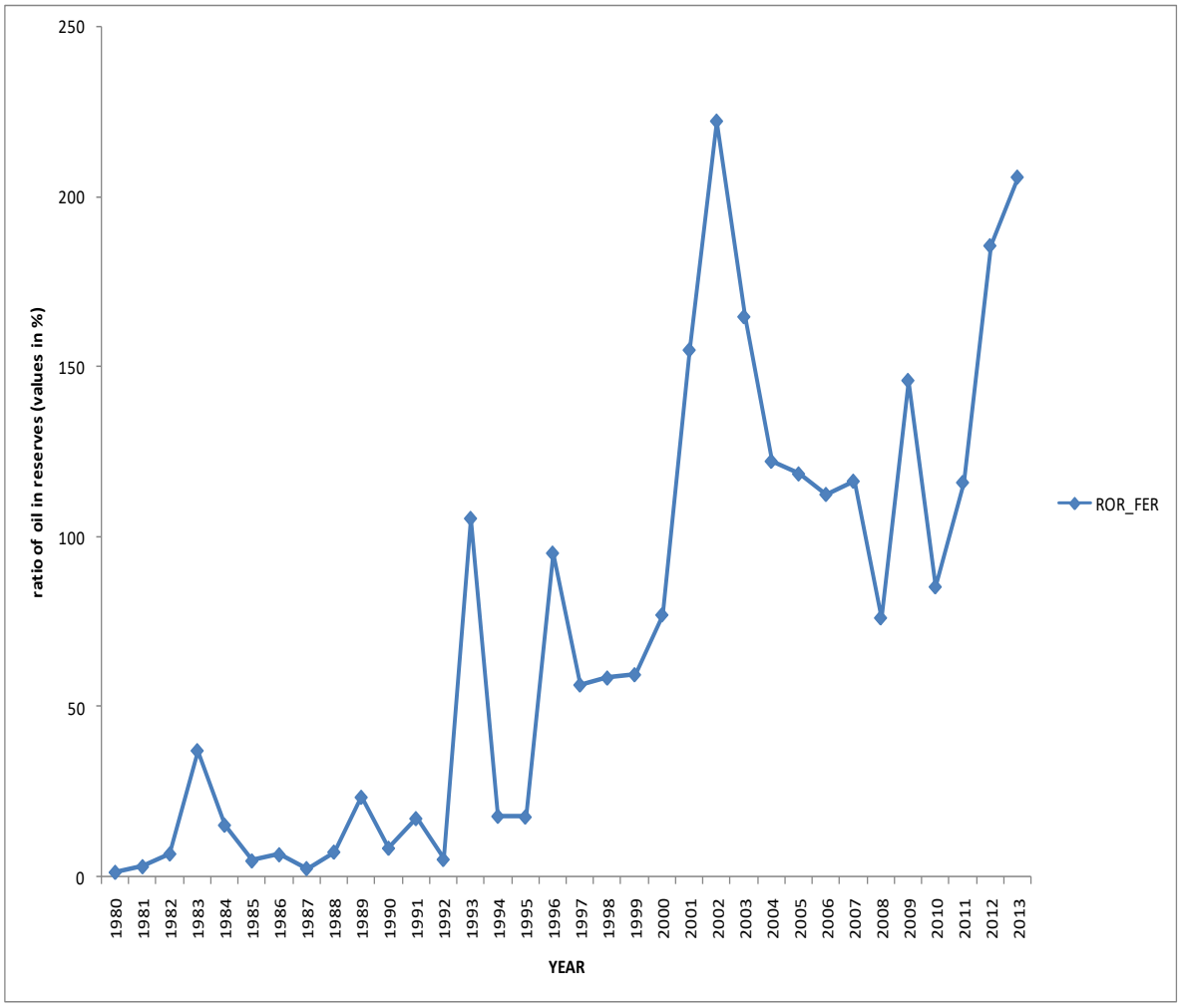

Figure 2: Trend graph on the Ratio of Oil Revenue to Foreign Exchange Reserve (1980-2013)
Source: Author's computation

Since the graph of the ratio of oil revenue to foreign exchange reserve showed an increasing trend in the level of foreign reserves, plotting the two graphs side by side will further reveal important insights to the form of relationship between the two graphs for clear understanding. This is demonstrated in figure 3 depicting the relationship between the growth rate of foreign exchange reserve and oil revenue to check the form of movement between the two variables. Splitting the period of the study into two in line with graph shows that, from 1980 to 1999, the trend movement in the two graphs was in opposite direction. While from 2000 to 2014, there was form of co- movement pattern in the graph. In instance, the growth rate of foreign exchange reserve (GR_FER) was 133.4%, while the growth rate in oil revenue was -25.78%. In 1989, the growth rate of oil revenue (GR_OR) was 83.71% and growth rate of foreign exchange reserve was -45.56%. From these, it was obvious that there was an inverse relationship between the growth rate of foreign exchange reserve and oil revenue. Signifying that within the first five year of the study period, it was possible that not only oil that accounted for the level of foreign exchange reserve accumulation, but other non-oil sources as well were contributing to the built-up of reserve. On the other hand, the movement for the two graphs from 1998 towards the end period of the study was a systematic co-movement between the growth rate of foreign exchange reserve and oil revenue graph, because both graphs were moving in the same direction implying that for more than two decades of the study period, oil revenue accounted largely for the source of foreign exchange reserve in Nigeria.

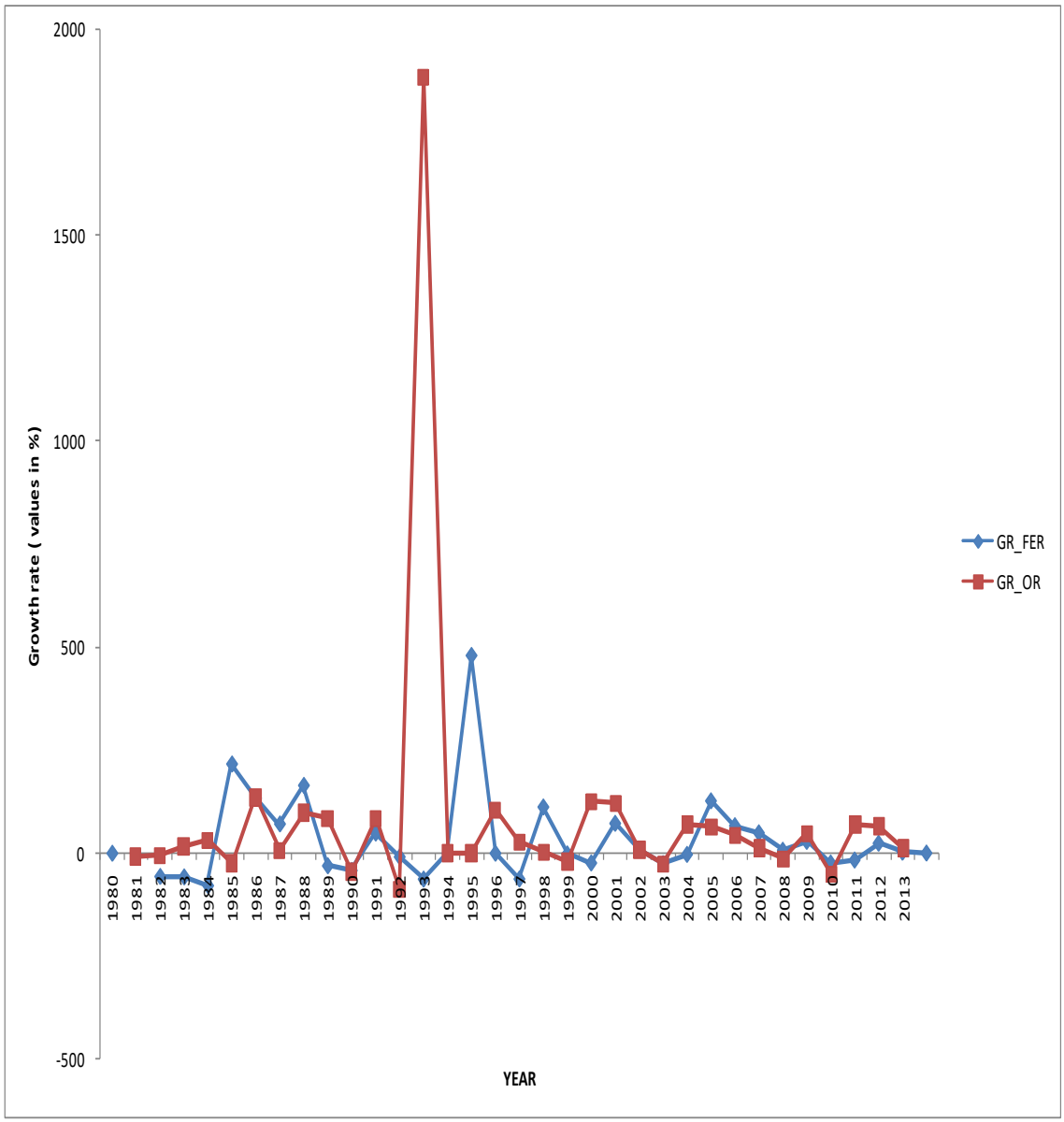

Figure 3: Growth Rate of Foreign Exchange Reserve and Oil Revenue in Nigeria (1980-2013)
Source: Author's computation

Figure 4 is a graph of foreign exchange reserve adequacy in proportion to GDP from 1980 to 2013. The prescribed growth rate of foreign exchange reserve to GDP is 10% to support growth in any country, while the adequacy of foreign exchange reserve n terms of months of imports is three (3) months as the rule of thumb (Abiola and Adebayo, 2013). In figure 4, it can be seen that from the period 1980 to 1988 of the study, the proportion of foreign exchange reserve to GDP was below the minimum rate of 10% threshold; instead it stood at 4.1%. But the rest of the periods, the ratio of foreign exchange reserve to GDP was adequate except for the periods between 2002 and 2004, where the rate stood at 9.9 and 9.3%, respectively. This means that the rates were adequate to support growth process in the economy.

For the ratio of reserves to import indicator, the year 1981-1988; 1992–1993 and 1998 were periods of foreign exchange reserve inadequacies in terms of the months of import, while the rest of the periods as indicated on the graph showed that the ratio was adequate. In comparison, adequacy of foreign exchange reserve in terms of its proportion to GDP may seem adequate, but in terms of the months of import they were inadequate to meet up with minimum the prescribed three (3) months of imports coverage in the event of any capital flow reversal or financial crisis. This finding substantiates the growth rate in foreign exchange reserve earlier established in figure one. The periods of the inadequacies correspond with when the economy was said to be exposed to external payment obligations. Thus, from the foregoing, the bulk of these periods in the study, close to two and half decades notably from 1989 to 2013 were characterized by periods of excess foreign exchange reserve judging from the months of imports ratio. In this case, scholars like Adams and Leonce (2007) have suggested that countries that are in need of developmental finance, once they have attained the prescribed level of foreign exchange reserve, any excess should be re-invested in productive ventures like the industrial sectors and infrastructures to further attract investments in the economy.

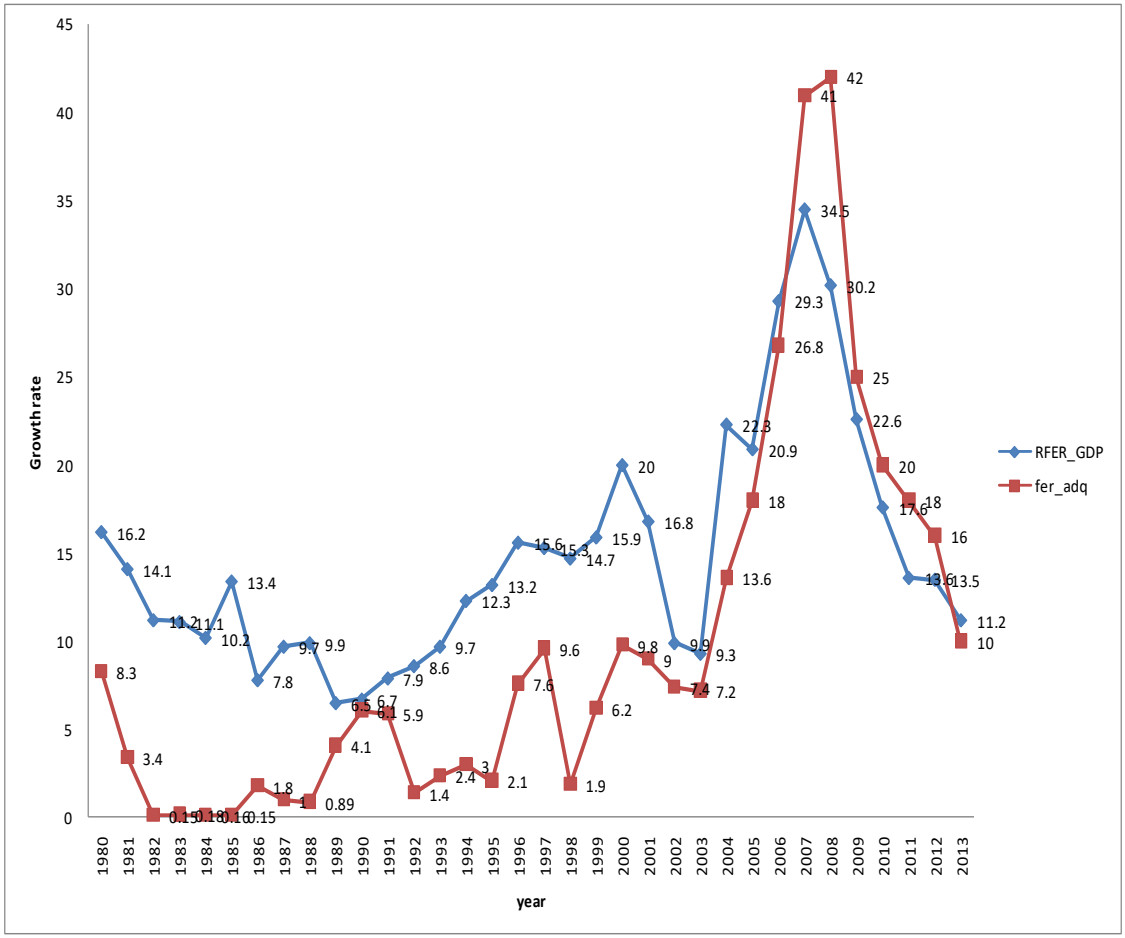

Figure 4: Trend Analysis of Foreign Exchange Reserves Adequacy and its Proportion to GDP (1980-2013)
Source: Author's computation from Excel

4.2 QUANTITATIVE ANALYSIS

4.2.1 Unit Root Test Result

The analysis of data for this study was based on macroeconomic time series, thus the need for the determination of their stability status to avoid misleading inferences was very important. Prior to the model estimation, stationary properties of the variables often associated with the use of macroeconomic time series, was tested using Phillip–Perron (PP) unit root test approach. The summarised result of the unit root test result is presented in table 1, while the detailed results output is attached in the appendix A.1.).

The PP results presented in table 1 revealed that all the variables; economic size proxied by gross domestic product (GDP), exchange rate vulnerability (EXRV), trade openness (TOPEN), net export (NEXPT), oil revenue (OILREV) and debt servicing (DEBTSERV), respectively, were not stationary at level both for intercept and trend. This implies that the time series variable means and variances systematically vary over time or are non-mean reverting at level and do not converge to their long run equilibrium at level. However, after first differencing, they were structurally stable in means and variances, and therefore were integrated of the order one, that is I (1), see result on Table 1.

Table 1: Phillip-Perron (Pp) Test for Stationarity

SERIES	LEVEL	1st Difference	Critical value	Order Of Integration
FER		-4.87950	-2.957110	I(1)
GDP	-0.04847	-7.24196	-562880	I(1)
EXRV	-3.01201	-10.2044	-5.62882	I(1)
TOPEN	-1.749140	-6.61445	-3.56288	I(1)
NEXPT	-2.902457	-4.25491	-3.55775	I(1)
OILREV	-1.2416626	-8.06216	-3.56288	I(1)
DEBTSERV	-2.505830	-5.74205	-3.56288	I(1)

Source: Author's computation from Eviews 7.1

Note: A variable is stationary at a given level when the PP value is greater than the critical value

Where:

FER = in foreign exchange reserve

GDP = Gross Domestic Product, a proxy for economic size

EXRV = Exchange rate vulnerability

TOPEN =Trade openness

NEXPT =Net export

OILREV = Oil Revenue

DEBTSERV =Debt Servicing

All the variables in the model were found to be integrated of the order one, i.e. I (1), it therefore means that there is an implied long run equilibrium convergence among the variables in the equation, thus necessitate the need to conduct cointegration analysis.

4.2.2 Cointegration Analysis Test Results

Cointegration analysis is premised on the long run co-movement that existed between non trended economic data. Thus, there was a common equilibrium relationship for the given time series to revert to, even when disequilibrium occurs in the short run. This study utilised the two likelihood ratio test statistics of maximal eigen-value and trace statistic in Johansen Multivariate cointegration to determine the number of cointegrating vectors. The trace test results for the changes in level of foreign exchange reserves with selected macroeconomic variables model presented in Table 2, while the maximum eigen-value test result presented is given in Table 3.

Table 2: Multivariate Johansen Cointegration Trace Test

Null hypothesis	Alternative hypothesis	Eigen value	Trace statistic	0.05% Critical value	Probability value**
r=0*	r≥1	0.962738	293.8445	125.6154	0.0000
r≤1*	r≥2	0.934752	195.1509	95.75366	0.0000
r≤2*	r≥3	0.813384	113.2641	69.81889	0.0000
r≤3*	r≥4	0.705405	62.90305	47.85613	0.0011
r≤4	r≥5	0.470491	26.23839	29.79707	0.1217
r≤5	r≥6	0.133569	7.164258	15.49477	0.5586
r≤6	r≥7	0.091024	2.863089	3.841466	0.0909

Source: Author's computation

Note: Maximum Eigen Value Yield 4 Co integration Equations at 5% level

r, indicates the number of co integrating vector.

*Denote the rejection of the Null hypothesis at 5% level of significance

** Mackinnon-Haug-Michelis (1999) P-values

Table 3: Multivariate Johansen Cointegration Maxi-Eigen value Test

Null hypothesis	Alternative hypothesis	Eigen value	Trace statistic	0.05% Critical value	Probability value**
r=0*	r≥1	0.962738	293.8445	125.6154	0.0000
r≤1*	r≥2	0.934752	195.1509	95.75366	0.0000
r≤2*	r≥3	0.813384	113.2641	69.81889	0.0000
r≤3*	r≥4	0.705405	62.90305	47.85613	0.0011
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Source: Author's computation

Note: Maximum Eigen Value Yield 4 Co integration Equations at 5% level

r, indicates the number of co integrating vector.

*Denote the rejection of the Null hypothesis at 5% level of significance

** Mackinnon-Haug-Michelis (1999) P-values

From the cointegration results, the procedure to determine the number of cointegrating vectors began with the first column stating the null hypothesis, followed by the alternative hypothesis in the second column. Upon examination of the Johansen cointegration results of table 2, the result suggested that the trace test gives the indication that the null hypothesis of no cointegrating equation for ($r=0$ to $r\leq3$) was rejected in favour of the alternative hypothesis of ($r \geq1$ to $r \geq 4$).This is because the trace statistic value of column 4, is greater than the critical value of column 5, implying that there are 4 cointegrating vectors at 5% significant level amongst the variables.

Conversely, the Johansen cointegrating (Maximum Eigen value statistic) result of table 5 also presented a similar outcome with the trace statistic results. In this result, the null hypothesis of no cointegrating equation for ($r=0$ to $r\leq3$) in the maximum Eigen value was also rejected in favour of the alternative hypothesis for ($r \geq1$ to $r \geq 4$) giving rise to 4 cointegrating vectors. Thus the two likelihood ratios produced equal numbers of cointegrating equations. This is an indication of a strong sign of long run dynamic relationship among the variables in the model specified. For this reason, obtaining the long run estimate using these variables will resolve the spurious and inconsistent parameter often associated with unit root as noted in Olofin, Busari, and Adenikinju, (2009). With the establishment of the cointegration among the variables, error correction mechanism (ECM) must be adopted. This is in line with Granger representation theorem that the existence of cointegrating relationship among the variables implies that the factors responsible for changes in foreign exchange reserve are most efficiently represented by an Error Correction Model (ECM) specification. According to Engle and Granger (1974) when variables are cointegrated, there exists an error correction model describing their relationship, implying that cointegration between variables was a precondition for the error correction model. Based on the above provisions, error correction model was estimated as part of the analysis in this study to meet with the

condition of cointegration that the variables will converge in the long run. The extent to which this convergence can be achieved can only be determined by the error correction analysis.

4.2.3 Causality Test Result

This study also employed causality analysis to investigate causal relationship among the variables in line with one of the study's objective; this is to ascertain the causal link between changes in foreign exchange reserve and selected macroeconomic variables. The Paire-wise Granger causality test was conducted and the result presented in table 4. The bolded values under probabilities column provide the guide to the decision made at 5% level, followed by the summary of the affected portion. While comprehensive results are presented in appendix A.3. The direction of causality between the variables is important to establish the interrelationship (interdependence) between variables and also provide further guide on the appropriate technique to be used. The causality results in table 4 and its subsequent summary of the relevant portion showed that the null hypothesis of the result in respect of foreign exchange reserve (FER) and economic size (GDP) is rejected since "GDP does not granger caused FER". This means that the alternative hypothesis holds that GDP granger cause FER. This result produces a two-way (reversal or bidirectional) causality between GDP (economic size) and FER.

In the result also, net export (NEXPT) showed unidirectional causality with foreign exchange reserves (FER). Net export is a good sign of the country's current account position. By this result, it goes to show that the country's terms of trade (TOT) was important in explaining the direction of foreign exchange reserve. The variable of oil revenue (OILREV) indicated bidirectional causality with foreign exchange reserve (FER).

Table 4: Pairwise Granger Causality Test Results

Null Hypothesis	Obs	F-Statistic	Prob-stat	Decision
FER does not Granger Cause GDP	31	4.53033	**0.0205**	**Reject. Ho**
GDP does not Granger Cause FER		3.51995	**0.0444**	**Reject Ho**
EXRV does not Granger Cause FER	32	6.18018	**0.0062**	**Reject Ho**
FER does not Granger Cause EXRV		0.20714	0.8142	Accept Ho
TOPEN does not Granger Cause FER	30	1.16343	0.3288	Accept Ho
FER does not Granger Cause TOPEN		0.26846	0.7667	Accept Ho
NEXPT does not Granger Cause FER	32	17.0431	**0.0000**	**Reject Ho**
FER does not Granger Cause NEXPT		1.38363	0.2679	Accept Ho
OILREV does not Granger Cause FER	32	5.86482	**0.0077**	**Reject Ho**
FER does not Granger Cause OILREV		9.53642	**0.0007**	**Reject Ho**
DBTSERV does not Granger Cause FER	32	2.27234	0.1224	Accept Ho
FER does not Granger Cause DBTSERV		0.1.95283	0.1614	Accept Ho

Source: Author's computation from Eviews-7.1

Summary of Causality Results

Direction of Causality	Nature of Causality
GDP ⟺ FER	Bidirectional Causality
EXRV ⇒ FER	Unidirectional Causality
NEXPT ⇒ FER	Unidirectional Causality
OILREV ⟺ FER	Bidirectional Causality

Source: Author's computation from eviews 7-1

NOTE: ⇒ Indicates one way directional Causality

⟺ Indicates two way directional Causality.

4.3 MODEL ESTIMATION

4.3.1 Two Stage Least Square Result

To obtain the numerical values for the parameters of the model earlier specified in chapter three of this work, the study relied on the model of two stage least square. The choice of the econometric tool to measure the relationship and obtain the quantitative effects of the variables on the dependent variable was based on the granger causality result that produces some bidirectional relationships. This therefore means that some of the explanatory (exogenous) variables are endogenously determined. Under these circumstances, applying the standard ordinary least square (OLS) would result in inconsistent estimates and misleading results. To avoid this problem, the study therefore applies the two stage least square method.

4.3.2 Long Run and Fitted Regression Results

Table 5 and the fitted line results that followed immediately show that the estimated two stage least square (2SLS) result outcome produced for the model was satisfactory from the view point of *apriori* expectations. The magnitude of the coefficient values and the statistical inferences of the variables, were generally within the range.

Table 5: Long Run 2SLS Result. Dependent Variable: FER

VARIABLE	COEFFICIENT		Std Error	t-statistic	Prob-value
C	C	6.698692	2.358426	2.840223	0.0088*
ln(gdp)	β_1	-0.234267	0.323134	-0.724985	0.4752
ln(exrv)	β_2	0.022495	0.167076	0.134641	0.8940
ln(topen)	β_3	0.476642	0.545673	0.873492	0.3907
ln(nexpt)	β_4	0.000388	0.000224	1.734365	0.0952***
ln(oilrev)	β_5	0.420141	0.235689	1.782608	0.0868***
ln(dbtserv)	β_6	0.049157	0.148376	0.331302	0.7432

R-squared	0.791661	Mean dependent var	8.779588
Adjusted R-squared	0.741660	S.D. dependent var	1.333118
S.E. of regression	0.677586	Sum squared resid	11.47809
F-statistic	15.83279	Durbin-Watson stat	1.342905
Prob(F-statistic)	0.000000	Second-Stage SSR	11.47809
J-statistic	0.000000	Instrument rank	7

*Notes: ***, **, and* denotes 10%, 5%.and 1% significance level respectively.*

SUMMARY OF TWO STAGE (2SLS) REGRESSION RESULT

FITTED REGRESSION LINE RESULT

ln (FER) = 6.698694 - 0.0234*lnGDP* +0.0224*lnEXRV* +0.4766*lnTOPEN*+0.0004*lnNEXPT*+ 0.4201*lnOILREV* +0.0492*lnDBTSERV*

S.E.E. =	(2.358426)	(0.323134)	(0.167076)	(0.545673)	(0.000224)	(0.235689)	(0.148376)
t* =	[2.840223]	[-0.724985]	[0.134641]	[0.873492]	[1.7343365]	[1.782608]	[0.331302]
Prob, =	{0.0088*}	{0.4752}	{0.8940}	{0.3907}	{0.0952***}	{0.0868***}	{0.7432}

R^2 = 0.791661, adj R^2 = 0.741660, F-statistic = 15.83279, Prob (F-Statistic) = 0.000000, DW =1.342905

*Note: ***, **.and * denotes 10%, 5%, and 1%; Standard error in parenthesis; t-ratios in square bracket; probability value.*
ln- Natural log

Where:

CFER = changes in foreign exchange reserves
GDP = Gross domestic product a proxy for economic size
EXRV = Exchange Rate Vulnerability
TOPEN = Trade Openness
NEXPT = Net Export
OILREV = Oil Revenue
DBTSERV = Debt Servicing

4.3.3 Discussion of Results

In the two- stage- least square (2SLS) result on table 5 and the subsequent fitted line regression result, the parameter estimations were done after taking the natural logarithm of the variables to eliminate the effect of differentials in the unit of measurement. In the result, the coefficient of constant (autonomous) variable is positive with the magnitude value of 6.698692 and statistically significant at 1% level with the probability statistic value at 0.0088, less than 5% significant level. This means that there are significant numbers of variables that can as well explain the dependent variables other than the ones included in the model.

The coefficient of Gross Domestic Product (GDP), a proxy variable to capture economic size and to also account growth process, exerted a negative influence on the level of foreign exchange reserves in Nigeria for the period of the study. In the result, a 1% unit change in GDP led to a 2.4% reduction in the level of foreign exchange reserves. This finding negates the apriori expectation as far as the study of the relationship between growth and foreign exchange reserve was concerned. The economic implication of the result is that within the period of the study, the size of the economy was not geared towards export to have an influence on foreign exchange reserve. Also, if the portion of the reserve meant for some government agencies like energy and Nigeria National petroleum corporation (NNPC) not use in the sector, results like the one obtained is likely to happen. This is so because the federal government owned component of foreign exchange reserve that consists of funds belonging to some government agencies like NNPC, PHCN and are usually dedicated for the development of this sector like power, railroad and public works generally to improve the infrastructural facilities that would bring about economic growth in the long run. Though expectation on this variable was not met on the basis of 2SLS, nonetheless the study drew its inference from the Granger

causality result which produced the expected result with respect to the variable, and conclusion drawn from there.

In the same manner, the coefficient of exchange rate vulnerability (EXRV) investigated shows the evidence of self insurance or precautionary motive of foreign exchange reserve interacted positively with the level of foreign exchange reserve. The magnitude of the coefficient is 0.022495 and the probability value given as 0.8940. This shows that a 1% increase in exchange rate vulnerability will result in a 2% positive increase in the level of foreign exchange reserve. In other words, the more the flexibility in exchange rate, the more changes in the level of foreign exchange reserve. This finding is contrary to *apriori* expectation in the case of developed countries, but was consistent with developing economies like Nigeria. Because the overriding objective of developing countries in the context of foreign exchange reserve rest on the protection of domestic currency. Theoretically, exchange rate vulnerability (EXRV) reduces the level of foreign exchange reserve, due to constant intervention in the exchange market, the reserves level have to be depleted over time to stabilise it. Nigeria has persistently implemented fixed or partial flexible exchange rate policy, therefore continues to use foreign exchange reserve to maintain a stable rate. This was to protect the economy from external shock. This is a reflection of the self insurance), than the transaction motives. Jebuni and Tutu (1999) stated that the motive of accumulating foreign reserve for developing countries is to mitigate the volatile exchange rate caused by the terms of trade and the vulnerability of financial openness.

The inclusion of trade openness was to account for the volume of trade into Nigeria given the economic, political and institutional environment .The coefficient of Trade Openness (TOPEN) positively influenced on the level of foreign exchange reserve in Nigeria. An increase in the index of trade openness by 1%, led to an increase in the level of foreign exchange reserves by 47%. This result agrees with the *apriori*

expectation of this variable. Theoretically, it is expected that the higher the degree of openness, the higher the inflow of foreign capital and hence a positive change in foreign exchange reserve.

Openness measures the ratio of international trade transaction to GDP. It also measures the extent to which an economy is open to other part of the globe. The integration of financial sector to the global world exposes it to all forms of capital inflows and outflows. In that process, foreign reserve levels will be affected positively. This means that openness during the period of this study enhances trade flows and the ultimate dynamics in foreign exchange reserve in Nigeria.

The coefficient of Net export (NEXPT) is found to be positive in relation to level of foreign exchange reserve with the coefficient magnitude of 0.000038 and statistically significant too at 10% level. This shows that a 1% increase in net export, led to a positive change in the level of foreign exchange reserve, though the magnitude of the coefficient was weak but was positive, statistically. It complied with the *apriori*-expectation and the theory of export led growth. The result is attributed to export performance in the non-oil and majorly with oil export and policies that encourage economic growth, particularly now that Nigeria has embraced the tenets of democratic governance which is in line with global best practices. The implication of this position is that an export driven economy was seen to be generating enormous foreign reserves/exchange resources that is largely motivated by export performance .This was the position of the proponent of export-led growth theory, that the performance of an economy can be enhanced through export, thereby generating the needed foreign exchange to help in the importation of capital inputs for further production.

The estimated coefficient of oil revenue as it relates to the fluctuating level of foreign exchange reserve was put at 42% which is highly impressive. The performance of the variable was not only positive, but statistically significant as well. The result

substantiates and was consistent in explaining the level of foreign exchange reserve with the other analyses (descriptive, causality and now the two stage analysis).Most importantly; the relative impact of the variable on the dependent variable was the highest (46%) in the model (2SLS result). Since the coefficient value is 0.420141, it means that 42% of the variation in the level of foreign exchange reserve was positively influenced by the variation in oil revenue for the period of study. Technically, it means that 1% increase in oil revenue led to 42% increase in the level of foreign exchange reserve. The result is consistent with apriori expectation; since oil revenue is Nigeria's source of foreign exchange earnings and foreign exchange reserve.

The sign of the coefficient of Debt Servicing (DBTSERV) is positive and not statistically significant. The coefficient value is 0.049157, implying that 1% increase in debt servicing is accompanied by an increase in the level of foreign exchange reserve. Though this finding negates the study's *apriori*- expectation, the outcome was however not unexpected because of the debt relief granted in 2005 that lessens the burden of debt servicing and therefore increased the foreign capital inflows and, hence, the positive position of foreign reserve.

The explanatory power of the regression line (the coefficient of multiple determination), denoted by R^2 and adjusted-R^2 are 0.791661 and 0.741660 respectively, which is very high, about 74%. This high value implies a strong goodness of fit and therefore it can be said that the model has captured the critical variables relevant in explaining the variation in the dependent variable.

4.3.4 Evaluation of Hypothesis

The study employed F-test to guide its decision regarding the study's hypothesis. The F- test is a joint statistical test to test the overall statistical significance of the variables in the model. The estimated F-ratio of this study is given as 15.83279 with its corresponding probability F statistic value at 0.00000 less than 5%, signifying that the

value was statistically significant at 1% and therefore all the included macroeconomic variables were jointly statistically significant in explaining the movement in the level of foreign exchange reserve in Nigeria during the period of the study. In this case, the study's first null hypothesis which states that there is no significant relationship between the level of foreign exchange reserve and macroeconomic variables was rejected and the alternative hypothesis accepted and concluded that there is a significant relationship between foreign exchange reserve variation and the selected macroeconomic variables included in the study in Nigeria.

In the study's second hypothesis, the empirical result from the Pair-wise Granger causality led to the rejection of the null hypothesis and the acceptance of the alternative hypothesis and concluded that there is a significant causal link between changes in foreign exchange reserve and the macroeconomic variables in Nigeria. The causal relationship result produced a form of unidirectional link between exchange rate volatility (EXRV), net export (NEXPT) and foreign exchange reserve and bidirectional causality between economic size proxied by GDP, oil revenue (OILREV) and foreign exchange reserve. This shows existence of interdependence among the variables in the model. The value of the Durbin Watson (DW) statistic is 1.34205, this lies within the negative serial correlation of the result. Thus it can be said to be free of the problem of serial correlation. The general empirical results and particularly the one obtained from the two stage least square, the first order diagnostic represented by the coefficient of determination (Adj R^2), F-statistic test value, and Durbin Watson all attest to the desirability of the result obtained in the study and can be relied upon for forecast.

4.4 ERROR CORRECTION RESULTS

4.4.1 Short Run Error Correction Results

The result of the cointegration test earlier established in this study confirmed the existence of more than one cointegrating relationship among the variables included in the model. Specifically, the result of the cointegration test suggested a dynamic relationship

between foreign reserve and the selected macroeconomic and kept it stable relationship in the long run. The existence of cointegrating vectors among the variables in the study meant that the spurious correlation was ruled out, and the attainment of long run equilibrium was possible among the variables in the equation, even when distortion occurred in the short run. For this reason, the process of attaining this long run was investigated. When cointegration exists among series, the next step is to construct and estimate error correction mechanism to model dynamic relationship. The study conducted the error correction analysis using the Engle Granger single equation error technique found to be most appropriate for small sample size observations, and with large sufficient variables to achieve goodness of fit. Thus the residuals from the estimated two stage least square (2SLS) equation were generated and included as series, termed as the error correction term. In the error correction specification, just like in the classical least square equation, the right hand side (RHS) variables of the error correction equation was treated as being exogenously determined, in contrast to the endogenous nature in vector error correction Model (VECM), where all variables are treated as endogenous.

The method of error correction model was adopted because the variables are stationary at first difference and was cointegrated. The error correction model restore the valuable information lost while differencing the data to achieve stationarity, in line with the Granger representation theorem, which states that if variables are cointegrated in an equation, there must be a valid error correction term, and on the other hand, when error correction is established in an equation, the variables are said to be cointegrated (Alogoskoutis and Smith, 1991; Gujarati, 2004; Amarcy, 2009). It also produced the short run dynamic estimates and the speed of adjustment to restore the long run equilibrium, and long run from the earlier two stage least square and cointegration results. To obtain the parsimonious (ECM) results, the over parameterised (ECM) result

was first estimated in a distributive lag structure adopting a one period lag drawn from the optimal lag length determination rule obtained from (Akaike information criterion (AIC); Schwarze information criterion (SIC) Hannan- Quin (HQIC); and final prediction error (FPE), information criteria, as presented in the table 5. On the var lag length structure, the stability of the model was investigated and the result shows that the roots of the polynomial variables of no root lies outside the unit circle, hence, var satisfies the stability condition (see appendix A.7). Also, it is evident from the inverse root of AR characteristic polynomial that all the dotted points are within the circle giving rise to the stability of the model.

The result of table 6 was derived from the over-parameterised result (see appendix A.5), using the general to specific approach and the summary of the parsimonious (preferred) obtained in table 6. The over-parameterised result is an all-inclusive result and cannot be interpreted in its form because of its complexity. But the parsimonious result obtained from the over-parameterised result was through a stepwise reduction of the relatively and highly insignificant parameters using consistent value before it is interpreted. This result is a fundamental principle in the Box-Jenkins approach. Box and Jenkins have argued that parsimonious models produce better forecast than the over-parameterized models. Thus, after the re-examination of the relative performance of the variables in the over parameterised results presented (by carefully knocking out the highly insignificant variables), using the general to specific approach, an appropriate model was reached and is termed as the parsimonious result. This result was produced after the following variables; GDP, EXRV (-1) Nexpt(-1), Topen(-1); Dbtserv, were dropped. This version of the result is considered appropriate and adequate for interpretation because the expected sign of the error correction complied with theoretical expectation which was negative and consistent with the minimum values of the criterion, and the result is presented in table 6, followed by the equation line result.

Table 6: Short Run Parsimonious Error Correction Results

Dependent variable Δln(FER)

Variable	Coefficient		Std Error	t-statistic	Prob-value
Constant	*C*	-055289	0.146598	-0.377150	0.7098
Δln(GDP(-1))	β_1	-0.378780	0.569062	-0.665622	0.5129
Δln(EXRV)	β_2	0.279906	0.146475	1.910948	0.0698*
Δln(TOPEN)	β_3	0.952244	0.324297	2.936330	0.0079*
Δ(NEXPT)	β_4	0.000130	0.000167	0.782190	0.4428
Δln(OILREV)	β_5	0.442901	0.145746	3.038858	0.0062*
Δln(OILREV(-1))	β_{10}	0.413909	0.139072	2.976216	0.0072*
Δln(DBTSERV(-1))	β_{11}	-0.141259	0.094205	-1.499489	0.1486
ECT(-1)	β_{12}	-0.652936	0.172723	-3.780238	0.0011*

R-squared	0.659091	Mean dependent var	0.098213
Adjusted R-squared	0.529221	S.D. dependent var	0.695025
S.E. of regression	0.476880	Sum squared resid	4.775702
F-statistic	5.075001	Durbin-Watson stat	1.640388
Prob(F-statistic)	0.001314	Second-Stage SSR	4.775022
J-statistic	3.08E-45	Instrument rank	9

Source: Author's Computation from E-views 7.1

Notes: ***, **, and* denotes 10%, 5%.and 1% significant level respectively. d=denotes first difference.
Single Equation Regression Line

SUMMARY OF ERROR CORRECTION REGRESSION RESULT

SHORT RUN PARSIMONOUS REGRESSION LINE RESULT

Δln(CFER)= **-0.553 - 0.378Δlngdp(-1)+0.279Δlnexrv +0.952Δlntopen(-1) +0.1Δ(nexpt +0.442Δlnoilrev + 0.414Δlnoilrev(-1) -0.141Δlndbtserv-0.653Δecm(-1)**

S.E. =	(-0.147)	(0.569062)	(0.146)	(0.324)	(0.00016)	(0.14575)	(0.139)	(0.094)	(0.173)
t*	= [-0.377]	[-0.66562]	[1.911]	[2.936]	[0.78219]	[3.03886]	[2.976]	[-1.500]	[-3.780]
Prob,	= {0.709}	{0.5129}	{0.070*}	{0.008*}	{0.4428}	{0.0062*}	{0.072*}	{0.148}	{0.0011*}

R^2 = 0.65909, **adj R^2** = 0.529221, **F-statistic =5.075001 Prob (F-Statistic) = 0.001314, DW =1.640388**

Note: ***, **.and * denotes 10%, 5%, and 1%; Standard error in parenthesis; t-ratios in square bracket; probability value.

ln- Natural log
Δ = first difference
(-1, -2) = variables in their lag form
Where:

FER = Foreign exchange reserves (measured in percentage growth rate)

GDP = Gross domestic product a proxy for economic size

EXRV = Exchange Rate Vulnerability

TOPEN = Trade Openness

NEXPT = Net Export

OILREV = Oil Revenue

DBTSERV = Debt Servicing

A critical examination of the parsimonious results presented in table 6 and the fitted single line regression results showed that the outcome of the coefficient of error correction term was satisfactory. The coefficient has the expected sign and is statistically significant at 1% level, complying with the theoretical expectation on the sign, magnitude and statistically significant of the variable. Theoretically, the estimated coefficient of the error correction term (ECT) should be negative and should lie within zero and one, to allow for adjustment back to equilibrium convergence and the larger the magnitude, the faster the speed of adjustment towards the long run equilibrium.

The value of coefficient of the error correction term for this study is -0.652936 with the corresponding probability value at 0.0011. This implies that previous exogenous shock (disequilibrium) in the model was corrected in the current period at the speed of 65% to restore long run equilibrium. The speed is pretty high and has further reaffirmed the result of unit root and existence of about 4 cointegrating vector of the Johansen multivariate cointegration obtained prior to estimation of the 2SLS long run regression. The result of the error correction term signified that the long run relationship was dynamic and any disequilibrium created in the short run will be corrected over time. The high speed of convergence of this finding is as a result of the rapid response of transmission mechanism involved in the economy to restore equilibrium as a result of disequilibrium in the short run. This dynamic process of convergence was central to economic analysis, because economists are generally interested in the achievement of equilibrium of any economic processes.

The coefficient of error correction model (ECM) is often called the speed of adjustment factor (SAF). It shows the speed to which the system adjusts to restore equilibrium, and also captures the reconciliation of variables over time from the position of disequilibrium. If the coefficient of the error correction term has a positive sign, it

means that the system in the model is moving away from equilibrium (Engel and Granger, 1987; Ogundipe, Ojeaga & Adeyemi, 2014).

The interpretations of the other exogenous variables in the error correction results are explained as short run impact variables on the dependent variable. The value of the coefficient of short run economic size proxied by GDP, and debt servicing (DBTSERV) have short run negative lagged contemporaneous (current) effects on the level of foreign exchange reserve with their values as 0.378780 and -0.141259 respectively. This implies that economic size (GDP) has delayed but negative effect because of the longer channel it will take for growth to translate to foreign exchange reserve, if growth was tailored towards export or the terms of trade was unfavourable even with growth in size of the economy. Nigeria has for long recorded deficit balance of trade due to its high import propensity; while debt servicing also has a negative and insignificant effect on the level of foreign exchange reserve in the short run. This result is expected, because if debt repayment is one of the main policies, foreign exchange reserve will witness downward trend. This finding was in line with Shuaibu and Mohammed (2012).

The variables with the short run contemporaneous (current) positive effect on level of foreign exchange reserves are exchange rate vulnerability (EXRV), trade openness (TOPEN), net export (NEXPT) oil revenue (OILREV) with their coefficient values as 0.279906, 0.952244 and 0.000130, 0.442901 and 0.413090, respectively. The result implies that the increased exchange rate vulnerability, net export, high revenue from crude sales calls for more foreign exchange reserve to shield the domestic currency. This is line with the self insurance motive and to promote export. For net export, the country's disposition in the export of oil sometimes creates favourable terms of trade and hence positive level of foreign exchange reserve. The short run coefficient of oil revenue continued to show expected result both in the current and lagged period. The short run result is consistent with all the findings in the other techniques; this is a true reflection of

the real situation concerning the variable on the Nigerian foreign exchange reserve level. Most importantly, both coefficient (the current and lagged) variables are highly statistically significant at 1% level. Thus foreign exchange reserve is highly dependent on oil revenue both in the short run and the long run.

The short run coefficient of multiple determinations in terms of adjusted R^2 is 0.529221, approximately 52%. This means that 52% variation in the level of foreign exchange reserve was accounted for by the changes in the explanatory variables included in the model in the short run. This is a good indication of goodness of fit also. The value of F-ratio was 5.075001 with its probability value of 0.001314 less than 0.05%, hence a significant level at 1%. This implies that, all the included explanatory variables can jointly explain changes in foreign exchange reserve in the short run. The coefficient of Durbin Watson statistic was 1.640388. This is within the region of free serial correlation or first order based on the rule of thumb.

4.5 DISCUSSION OF FINDINGS

The study commences its analysis with descriptive statistic using trend graphs analytical instrument. The finding from the graphical presentation in figure 1 revealed that the growth rate trend in foreign exchange reserve was not definitive; rather it rises and falls within the period of the study. Further inquiry revealed that the ratio of dwindling pattern in crude oil sales was found to be responsible for the type of trend in foreign exchange reserves for the period of the study as displayed by the plotted graph in table two. Also, literature review evidences have reported that oil revenue is not only responsible for the rise and fall in the level of foreign exchange reserves\, but also a major determinant of the changing level of foreign exchange reserves in Nigeria. Also informative from the graph showing reserve adequacy ratio and the ratio of foreign reserves to GDP shown in figure 2, is that for the period of the study, the finding from this presentation showed that the reserves were adequate and also above the 10%

threshold prescribed to support the economy in period of crises. Foreign reserves adequacy, though related and an important determinant of foreign reserve variation as reported by Sharma (2013) in the case of India, but was not the reason for the fluctuating trend in case of Nigeria. The value of foreign currencies and macroeconomic variables performance are influenced by the quantum of foreign exchange reserve, In the perspective of the ratio of the reserve to GDP, it was evident also that the reserves were adequate to meet up with growth requirement to particularly execute major capital projects like power, railroads, water projects etc without necessarily scuttling other purposes for which reserve are intended. This is in line with findings of Aghion (2006) who provided strong empirical evidence to state that the ratio of foreign exchange reserve increases the ability of countries to smooth adjustment to shock which is optimal in an open economy in the framework of the permanent income hypothesis. Based on this finding, the study's specific objective one has been addressed.

The finding on the behaviour of the variables employed in the model under the unit root and cointegration analyses revealed that all the variables have inherent tendency of reverting to their natural means and variances after differencing. Also, their combination in an equation produced long run equilibrium convergence. This implies that a dynamic long run relationship is eminent in the model, even when disequilibrium occurred in the short run. The study found on the basis of granger causality analysis results that there was an evidence of feedback relationship (interrelationship) that was established between the level of foreign exchange reserve and performance of the selected macroeconomic variables in Nigeria. This is because the result produced bidirectional causality relationship between economic size proxied by GDP and the level of foreign exchange reserve. It was also established that bidirectional causality existed between the level of foreign exchange reserve and oil revenue. Unidirectional causality

was found between exchange rate vulnerability, net export and the level of foreign exchange reserves. All the results were expected.

These finding implied that economic size proxied by GDP can predict the changing trend in the foreign exchange reserves and vice versa. The bigger, the size of the economy, the more the accumulation of foreign exchange reserve. Because of the simple reason that the economy experienced large amount of international capital flows and trade. This finding agrees with what Williams (2005) statement that the structure of production must be geared towards export earnings in order for economic growth and foreign exchange reserves accumulation to be equal. Osabuohien and Egwakhe (2008) also agreed that foreign reserves were held to make the economy more attractive to foreign investment which in turn would improve the economic performance of the nation; hence reserves should have positive relationship in line with economic productivity captured by GDP.

The unidirectional (one way) causality that runs from changes in foreign exchange reserve to exchange rate volatility means that the exchange rate volatility causes changes (positively or negatively) in foreign exchange reserve. With rapid volatility, foreign exchange reserve will be reduced. On the other hand, gradual or stabilize foreign exchange rate movement means a stable growth also in the level of foreign exchange reserve. This finding is consistent with the self insurance or precautionary motives of holding reserve, in which central bank may accumulate foreign exchange reserves for foreign exchange market intervention aimed at stabilising the exchange rate. This finding corroborates the result findings of Rehman (2007).

Similarly, net export (NEXPT) granger caused changes in foreign exchange reserve. This means that net export can predict changes in the level of foreign exchange reserves. The country is a net exporter of primary goods notably crude oil, and, at the same time, a net importer of refined petroleum and manufactured goods. With excess

export over import, growth rate of foreign exchange reserve will be positive, but lower export over import results in negative growth rate in the level of foreign exchange reserve. Nigeria's term of trade has always been in deficit because of its dual net export and import. In whichever way, this will imply a negative or positive influence on the level of foreign exchange reserve. This finding supports Oputa and Ogunleye (2010) view that foreign exchange reserve are accumulated for different reasons, which include financing of imports, provision of funds for intervention in the foreign exchange market and guide against unexpected drop in prices of crude oil. They further observed that Nigeria's economy was highly susceptible to variations in export prices due to frequent changes in crude oil price at the international market. Also the funding of foreign exchange market remains the major source of outflow or a drainer of foreign exchange reserves in Nigeria. It was estimated that the funding of imports through the Central Bank of Nigeria (CBN) constituted 87.2% of foreign exchange reserve outflow in 2000-2009. This finding lend credence to mercantilist motive or the export -led-growth postulations where it pertains the mercantilist idea of promoting exports to promote growth which in turn would generate huge foreign exchange reserve.

The study found bidirectional (feedback) causality between oil revenue and the level of foreign exchange reserve for the period of the study. This means that for the period of this study, oil revenue predicted changes in the level of foreign exchange reserve and vice versa. The level of Nigeria's foreign exchange reserve has a direct bearing on its oil revenue, because oil revenue constitutes 70% source of foreign exchange reserve. In period of favourable oil revenue, positive growth rate of reserves will be recorded. If, on the other hand, foreign exchange reserve were used to improve the energy sector out of the component devoted for it, oil revenue will be affected (positively or negatively). This finding is consistent with the results of Wilson, Uwuota, Inyiama, and Eneje (2014) where oil price volatility was found to be responsible for

Nigeria's downward reserves. The finding supports the statement by Soludo (2007) that the main sources of rising foreign exchange reserves in Nigeria includes inflow of oil revenues complemented by Diaspora remittances, growing foreign direct investment and portfolio investment, capital inflows, banks on lending activities to financial institutions, growing guarantees and grants.

It is also in tandem with the Nigeria's present situation that oil revenue is a major determinant of foreign exchange reserves movement. As an economy that solely depends on one major source of foreign earnings, the crude oil export makes the economy susceptible to the variation in the crude oil price and ultimately changes in the level of foreign exchange reserve. The finding is also consistent with the assertion by Abiola and Adebayo (2013) that Nigeria's foreign exchange reserve was derived mainly from the proceeds of crude-oil production and sales. Accordingly, Nigeria produces above 2 million barrels per day of crude-oil in joint venture with some international oil companies, such as Shell, Mobil, and Chevron, and sells a predetermined portion directly. Consequent upon the establishment of causality between foreign exchange reserve and some selected macroeconomic variable, the study's objective two has been achieved.

In the study, the empirical evidences shown thus far, could only establish evidence of relationship without precision on the sign and the magnitude of the relationship involve. For this reason, the study's next empirical analysis from the 2SLS overcomes these limitations. On the basis of Two-Stage least Square (2SLS) analysis, the coefficients values for the selected macroeconomic variables that have accounted for the positive influence on the level of foreign exchange reserve were exchange rate vulnerability (EXRV), net export (NEXPT), and oil revenue (OILREV). The implication of this finding with respect to the exchange rate vulnerability variable is anchored on the need to mitigate the volatile nature of the exchanges rate market, thereby making frequent intervention to stabilise the rate. This is important for exporters of natural resources and that was what informed the positive increase in foreign exchange reserves. This was done to possibly keep the value of the

domestic currency low and make the home goods cheaper and thus improve export. This finding agrees with the school of thought that foreign exchange reserve were needed as a way to protect the country's volatile exchange rate market so as to boost the credit worthiness and provide a means for a rainy day. This is consistent with the empirical findings of Shammas and Barton (2013); Flood and Marion (2002); and Aizenman and Marion (2002; 2004) where they established using panel data that volatility of nominal effective exchange rate is related to the given level of foreign exchange reserve. They also suggested that high exchange rate flexibility increases foreign exchange reserve holdings.

Amarcy (2009) also observed that for wanting to keep the foreign exchange rate stable and possibly low to boost export in line with the export-led growth paradigm, the government keeps depleting the reserve stock to intervene in the volatile foreign exchange market. Studies like Kyereboah- Coleman (2009), Bordo, Eichengreen, Klingebiel and Martinez, (2001); have linked positive relationship exchange rate volatility with foreign exchange reserves variability.

The result was also very much in tune, particularly with the precautionary or self insurance motives of holding foreign reserve, and the relevant theories like the buffer stock, the export led growth models and Mundel Fleming models (1963) where foreign exchange reserve were generally viewed as stored assets that were used to stabilise foreign exchange; and also provide the needed income and exchange rate to resolve the dual gap constrains often experienced in open economies of developing countries.

Index of trade openness turn-out a positive relationship with the level of foreign exchange reserve, as a small open economy is susceptible to external disequilibrium and thus witnessed an inflow of foreign capital. This finding corroborates the finding of Udah (2011) in which economic performance that produced impressive growth in reserves was established.

Net export positively influenced the level of foreign exchange reserve for the period of the study. This means that Nigeria is a net exporter of oil with some little improvement in the non-oil sector, thereby having the combine effect on foreign exchange reserve. Although Nigeria's term of trade has continued to be in deficit, more of the positive effect of crude oil export earnings has overshadowed any negative effect of import and that was what informed the positive sign of the coefficient of net export on foreign exchange reserve. This is a reflection of the export-led- growth theory as earlier mentioned.

Closely linked to the above finding, is the establishment of positive effect of the coefficient oil revenue on the level of foreign exchange reserve. Most importantly, this variable has been consistently found to have a strong relationship with the level of foreign reserves in the different analyses (descriptive, causality and in two stage least square) in this study, and has the highest magnitude of influence in the two stage estimation on the dependent variable. As an oil exporting country, it is likely that the level of its foreign exchange reserve was highly dependent on oil revenue. Studies by Gounder and Bartleet (2007); Odulami (2008) have also established the existence of crude oil on the economic performance in Nigeria.

The positive effect of debt servicing on the level of foreign reserve negates the theoretical expectation of this variable. The reason why it turned out to be positive is because of the debt relief granted Nigeria in 2005 that almost split the period of the study into two equal halve, so the reduction in its principal and interest has a combined positive effect on the reserve. As far as this study is concerned, the variables that were responsible for dwindling trend in foreign reserve were exchange rate volatility, net export and oil revenue. Therefore, these findings have achieved the third broad objective of this study.

CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 SUMMARY OF FINDINGS

The study examined the trend and adequacy of Nigeria's foreign exchange reserve and linked it to selected (key) macroeconomic variables with the primary objective to identify the forms of relationship involve. The following major findings have emerged from the study:

1. The study discovered that the trend pattern of foreign exchange reserve in Nigeria for the period of this study presented by descriptive analysis exhibited gradual and thereafter assumed a downward fluctuating trend. This is indicative of some factors responsible for the observed trend. The fluctuating foreign exchange reserve was further found to be associated majorly with the movement in oil revenue inflows
2. The foreign exchange reserve for the large part of the study was found to be adequate to play its statutory functions and also to stimulate growth. This was evident from the two yardsticks employed to measure adequacy- the ratio of foreign reserve to GDP and the ratio of foreign reserve to months of import. Thus, foreign exchange reserve for the period of the study could perform the expected roles and at the same time shield the economy to any form of external disturbances.
3. The study found that the variables employed in the study have simultaneous relationships among themselves. This therefore means that both the dependent (foreign exchange reserves) and the independent variables (selected macroeconomic variables) possessed information that can explain changes in one another.
4. The study also found that the observed fluctuating trend in foreign exchange reserve was caused largely by factors originating from the external macroeconomic environment. This is a clear manifestation of the extent to how the external macroeconomic environment has influenced the Nigerian economy with weak mechanism in place to protect the domestic environment.

5. The model used for the study contains both the long run and short run information to permit the achievement of equilibrium condition even when distortion occurs in the system. The speed of this adjustment was estimated to be 65% for the restoration of equilibrium in the system.

5.2 CONCLUSION

Foreign exchange reserves are inventory of foreign currencies realised from international trade transactions and they are an important performance indicator of an economy. The direction in their movement can as well be associated with the pattern of performance in the relevant internal and external macroeconomic variables, notably exchange rate, export and external payment system. The Nigerian foreign exchange reserve has witnessed intermitted upward and downward trend over the years without proportionate effect on this relevant macroeconomic variables. Despite the fluctuating trend, volatility in exchange rate market, continuous deficit in the terms of trade owing to growing imports, frequent changes in crude-oil prices resulting in a drop in capital inflow, debt servicing repayment due soaring debt profile were some of the problems noticed even in periods of a rise or fall in the level of foreign exchange reserve. This observed mismatch in the dwindling foreign exchange reserve trend and the performance of key macroeconomic variables has necessitated this study to investigate the specific forms of relationship between the two.

The study found most importantly that external variables included in the model of the study contain vital information that explained the observed fluctuation in the level of foreign exchange reserve in Nigeria for the period of the study. Because the study's causality and Two Stage Least Square results indicated that these variables can predict changes, and are positively related to the dwindling trend in Nigeria's foreign exchange reserve. The implication therein was that for the period of this study Nigeria's dependence on her trading partners had increased to the extent of her domestic economy

becoming susceptible to external shock. Based on the above therefore, it can be concluded that the rise or fall in the level of foreign exchange reserve was linked to the movement in the selected macroeconomic variables, with external variables explaining more of the influenced than those emanating from within the economy. Thus, a strong long run relationship existed between the fluctuation in level of foreign exchange reserve and the selected key macroeconomic variables performance in Nigeria. Notably, the size of the economy (GDP), exchange rate volatility, oil revenue and net export have more of the influenced than others. Consequently, with an appropriate policy mix and implementation, long run stability and simultaneous performance of the variables will always be achieved even when there is a short run distortion between foreign exchange reserve and macroeconomic variables in Nigeria.

5.3 RECOMMENDATIONS

The overriding purpose of any research exercise lies in its ability to come up with realistic policy suggestions that would be used by government and other relevant organisations to ameliorate the challenges faced. From the foregoing findings of the study, the following recommendations are provided:

1. This study recommends the policy of export-led growth brought about by inclusive growth strategy. This recommendation stems from the results and discussion of descriptive and granger causality analyses, where growth variable predicted changes in foreign exchange reserve. This strategy will involve exploiting other export potential sectors like agriculture, solid minerals, manufacturing and tourism to bring about broad based sources of exchange rate earnings to achieve a sustainable reserve growth rate. Doing this will relief the over reliance and reduces the danger of exposing the economy to the vagaries of external disequilibrium.
2. The study also recommends that effective and efficient allocation of exchange rate policy be adopted. This will be achieved through the rationalisation of exchange rate to

productive sector like manufacturing, mining sectors, improving our economic and social institutional framework to attract foreign investors. This will in the long run generate additional exchange rate to eliminate supply and demand gap.

3. The study recommends for non-oil export policies and optimal management of oil revenues. In periods of surplus export and earnings, excess crude revenue should be saved into stabilisation and future funds to mitigate any cyclical fluctuations in the crude oil revenue flows, just like in the case of Libya, Algeria, and Saudi Arabia who are also oil export countries.

5.4 LIMITATIONS OF THE STUDY

There are quite a number of research issues in this area that requires intellectual investigations. It was difficult however to capture all of that in one single research of this nature. Therefore, this study was limited in the following ways.

1. The analysis of this study only dwelt on issues within the periods of the study; however the concerns raised transcend beyond the selected scope of the study.
2. The number of macroeconomic variables were restricted only to related (key) variables; meanwhile there are other variables to relate foreign exchange reserve with the economy particularly endogenous growth and development variables.
3. The movement in foreign exchange reserve was limited only from the perspective of using it to mitigate the present situations and ignoring the future consequences.

5.5 SUGGESTIONS FOR FURTHER STUDY

In view of the above limitations, further studies should address the following areas.

1. To expand the periods of study beyond the scope of this study to cover current periods
2. Further study should consider increasing the number of explanatory variables to Capture developmental issues
3. Subsequent studies to dwell on the movement in foreign exchange reserve taken into mind the distinction between using foreign exchange reserve for stabilization and also the building of funds for future generations (the sovereign wealth fund debate).

5.6 CONTRIBUTION TO KNOWLEDGE

The study has provided evidences into the issues of foreign exchange reserve that is different from previous study. Therefore, the frontier of knowledge has been extended by this study in the following ways:

1. The size of the economy proxied by GDP did not influence the observed trend of foreign exchange reserve by this study as previously reported by past studies. Therefore the constituent of growth for the period of this study had no significant effect on foreign exchange reserve. Although the size of the economy can predict changes in foreign exchange reserve as proven in the study.
2. This study has established the link from the perspective of flow and not stock in foreign exchange reserve with selected macroeconomic variables. Previous studies have dwelt only on the demand determinants and the rationale of accumulation from the angle of stock in foreign exchange reserve, ignoring the aspect of its dynamics.
3. The contribution of this study to theory is in the aspect of modelling the Nigerian economic system and the finding was in line with the motives of holding foreign exchange reserve management.

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APPENDICES
APPENDIX A1
UNIT ROOT RESULTS

Null Hypothesis: FER has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.186937	0.9306
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	31892583
HAC corrected variance (Bartlett kernel)	35972388

Phillips-Perron Test Equation
Dependent Variable: D(FER)
Method: Least Squares
Date: 09/09/15 Time: 19:36
Sample (adjusted): 1981 2013
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FER(-1)	-0.004602	0.058758	-0.078328	0.9381
C	1349.991	1332.870	1.012845	0.3190

R-squared	0.000198	Mean dependent var	1282.259
Adjusted R-squared	-0.032054	S.D. dependent var	5735.480
S.E. of regression	5826.677	Akaike info criterion	20.23697
Sum squared resid	1.05E+09	Schwarz criterion	20.32767
Log likelihood	-331.9101	Hannan-Quinn criter.	20.26749
F-statistic	0.006135	Durbin-Watson stat	1.724549
Prob(F-statistic)	0.938071		

Null Hypothesis: D(FER) has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.879500	0.0004
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	31762590
HAC corrected variance (Bartlett kernel)	31762590

Phillips-Perron Test Equation
Dependent Variable: D(FER,2)
Method: Least Squares
Date: 09/09/15 Time: 19:37
Sample (adjusted): 1982 2013
Included observations: 32 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FER(-1))	-0.875867	0.179499	-4.879500	0.0000
C	1256.829	1055.688	1.190531	0.2432

R-squared	0.442478	Mean dependent var	104.9681
Adjusted R-squared	0.423894	S.D. dependent var	7668.688
S.E. of regression	5820.661	Akaike info criterion	20.23668
Sum squared resid	1.02E+09	Schwarz criterion	20.32829
Log likelihood	-321.7868	Hannan-Quinn criter.	20.26704
F-statistic	23.80952	Durbin-Watson stat	1.985366
Prob(F-statistic)	0.000033		

Null Hypothesis: D(GDP) has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.008497	0.0000
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	5.71E+13
HAC corrected variance (Bartlett kernel)	3.86E+13

Phillips-Perron Test Equation
Dependent Variable: D(GDP,2)
Method: Least Squares
Date: 06/18/15 Time: 14:36
Sample (adjusted): 1982 2012
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-1.207411	0.181693	-6.645344	0.0000
C	1549028.	1420762.	1.090280	0.2846

R-squared	0.603612	Mean dependent var	90496.12
Adjusted R-squared	0.589943	S.D. dependent var	12204924
S.E. of regression	7815506.	Akaike info criterion	34.64346
Sum squared resid	1.77E+15	Schwarz criterion	34.73597
Log likelihood	-534.9736	Hannan-Quinn criter.	34.67362
F-statistic	44.16060	Durbin-Watson stat	2.126274
Prob(F-statistic)	0.000000		

Unit Root Result for Exchange Rate Vulnerability (Exrv)

Null Hypothesis: D(EXRV) has a unit root
Exogenous: Constant
Bandwidth: 30 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.33264	0.0000
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	4048.320
HAC corrected variance (Bartlett kernel)	260.1718

Phillips-Perron Test Equation
Dependent Variable: D(EXRV,2)
Method: Least Squares
Date: 06/18/15 Time: 14:38
Sample (adjusted): 1982 2012
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXRV(-1))	-0.969492	0.185612	-5.223216	0.0000
C	1.027350	11.81688	0.086939	0.9313

R-squared	0.484737	Mean dependent var	-0.035442
Adjusted R-squared	0.466970	S.D. dependent var	90.10385
S.E. of regression	65.78385	Akaike info criterion	11.27297
Sum squared resid	125497.9	Schwarz criterion	11.36548
Log likelihood	-172.7310	Hannan-Quinn criter.	11.30312
F-statistic	27.28198	Durbin-Watson stat	1.966881
Prob(F-statistic)	0.000014		

Unit Root for Trade Openness

Null Hypothesis: D(TOPEN) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.656775	0.0000
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	86.24171
HAC corrected variance (Bartlett kernel)	95.83027

Phillips-Perron Test Equation
Dependent Variable: D(TOPEN,2)
Method: Least Squares
Date: 06/18/15 Time: 14:39
Sample (adjusted): 1982 2012
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(TOPEN(-1))	-1.217484	0.181312	-6.714870	0.0000
C	0.827145	1.728390	0.478564	0.6358

R-squared	0.608581	Mean dependent var	0.047484
Adjusted R-squared	0.595084	S.D. dependent var	15.08892
S.E. of regression	9.601532	Akaike info criterion	7.424063
Sum squared resid	2673.493	Schwarz criterion	7.516579
Log likelihood	-113.0730	Hannan-Quinn criter.	7.454221
F-statistic	45.08948	Durbin-Watson stat	1.968472
Prob(F-statistic)	0.000000		

Unit Root for Net Export
Null Hypothesis: D(NEXPT) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.13804	0.0000
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	1.90E+12
HAC corrected variance (Bartlett kernel)	1.18E+12

Phillips-Perron Test Equation
Dependent Variable: D(NEXPT,2)
Method: Least Squares
Date: 06/18/15 Time: 14:40
Sample (adjusted): 1982 2012
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(NEXPT(-1))	-1.534937	0.171345	-8.958159	0.0000

C	100875.0	256912.2	0.392644	0.6975

R-squared	0.734550	Mean dependent var	-96948.77
Adjusted R-squared	0.725397	S.D. dependent var	2719585.
S.E. of regression	1425132.	Akaike info criterion	31.23977
Sum squared resid	5.89E+13	Schwarz criterion	31.33228
Log likelihood	-482.2164	Hannan-Quinn criter.	31.26993
F-statistic	80.24861	Durbin-Watson stat	2.107479
Prob(F-statistic)	0.000000		

Phillips-Perron Test Equation
Dependent Variable: D(OILREV,2)
Method: Least Squares
Date: 06/18/15 Time: 14:43
Sample (adjusted): 1982 2012
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(OILREV(-1))	-1.261124	0.214272	-5.885629	0.0000
C	330568.2	199215.9	1.659346	0.1078

R-squared	0.544316	Mean dependent var	111395.9
Adjusted R-squared	0.528603	S.D. dependent var	1587042.
S.E. of regression	1089637.	Akaike info criterion	30.70293
Sum squared resid	3.44E+13	Schwarz criterion	30.79544
Log likelihood	-473.8954	Hannan-Quinn criter.	30.73309
F-statistic	34.64063	Durbin-Watson stat	1.724264
Prob(F-statistic)	0.000002		

Unit root for debt servicing (DEBTSERV)

Null Hypothesis: D(DBTSERV) has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.832695	0.0000
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	3.27E+09
HAC corrected variance (Bartlett kernel)	2.53E+09

Phillips-Perron Test Equation
Dependent Variable: D(DBTSERV,2)
Method: Least Squares
Date: 06/18/15 Time: 14:44
Sample (adjusted): 1982 2012
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DBTSERV(-1))	-1.067232	0.185309	-5.759210	0.0000
C	1387.346	10616.55	0.130678	0.8969

R-squared	0.533526	Mean dependent var	233.3516
Adjusted R-squared	0.517441	S.D. dependent var	85076.83
S.E. of regression	59099.90	Akaike info criterion	24.87419
Sum squared resid	1.01E+11	Schwarz criterion	24.96670
Log likelihood	-383.5499	Hannan-Quinn criter.	24.90434
F-statistic	33.16850	Durbin-Watson stat	2.042466
Prob(F-statistic)	0.000003		

APPENDIX A2
MULTIVARIATE JOHANSEN COINTEGRATION RESULTS

Date: 09/08/15 Time: 21:58
Sample (adjusted): 1982 2011
Included observations: 30 after adjustments
Trend assumption: Linear deterministic trend
Series: FER GDP EXRV TOPEN NEXPT OILREV DBTSERV
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	**0.962738**	**293.8445**	**125.6154**	**0.0000**
At most 1 *	**0.934752**	**195.1509**	**95.75366**	**0.0000**
At most 2 *	**0.813384**	**113.2641**	**69.81889**	**0.0000**
At most 3 *	**0.705405**	**62.90305**	**47.85613**	**0.0011**
At most 4	0.470491	26.23839	29.79707	0.1217
At most 5	0.133569	7.164258	15.49471	0.5586
At most 6	0.091024	2.863089	3.841466	0.0906

Trace test indicates 4 cointegrating eqn(s) 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 No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	**0.962738**	**98.69359**	**46.23142**	**0.0000**
At most 1 *	**0.934752**	**81.88683**	**40.07757**	**0.0000**
At most 2 *	**0.813384**	**50.36102**	**33.87687**	**0.0003**
At most 3 *	**0.705405**	**36.66466**	**27.58434**	**0.0026**
At most 4	0.470491	19.07413	21.13162	0.0947
At most 5	0.133569	4.301169	14.26460	0.8263
At most 6	0.091024	2.863089	3.841466	0.0906

Max-eigenvalue test indicates 4 cointegrating eqn(s) 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):

FER	GDP	EXRV	TOPEN	NEXPT	OILREV	DBTSERV
9.95E-05	-7.47E-07	0.021879	-2.348619	0.003867	-1.94E-06	1.23E-05
0.000137	3.39E-07	0.013918	-7.688728	0.003495	-4.61E-06	2.94E-05
0.000225	1.10E-07	0.072118	2.560397	-0.007002	3.14E-06	-1.48E-05
-0.000425	-2.51E-07	0.023766	3.469426	0.001422	3.78E-06	-4.66E-06
2.78E-06	-5.65E-07	0.060333	-0.770343	-0.000355	2.72E-06	-2.03E-05
-6.21E-05	-2.15E-07	0.021818	21.75092	-0.000143	1.70E-06	-1.24E-05
0.000323	-2.04E-06	0.088415	2.594187	-0.001275	7.05E-06	1.22E-06

Unrestricted Adjustment Coefficients (alpha):

D(FER)	-486.2307	-1194.362	-255.2663	3020.120	481.2089	-408.4605
D(GDP)	-644536.5	282065.1	312474.2	153269.2	159731.1	-43462.59
D(EXRV)	-19.72831	-6.625813	8.544432	14.97360	-16.04454	-1.382334
D(TOPEN)	0.000576	0.002846	0.005175	-0.009318	0.005508	-0.018793
D(NEXPT)	-75.44411	-246.1199	236.3750	227.6078	-63.41202	-19.85449
D(OILREV)	157902.3	138704.2	34456.76	-16747.24	-56753.64	51011.03
D(DBTSERV)	-24307.83	-7792.546	3965.917	-12165.85	-10646.59	2440.568

1 Cointegrating Equation(s): Log likelihood -1783.136

Normalized cointegrating coefficients (standard error in parentheses)

FER	GDP	EXRV	TOPEN	NEXPT	OILREV	DBTSERV
1.000000	-0.007506	219.7829	-23592.49	38.84663	-0.019456	0.123338
	(0.00091)	(51.9927)	(10057.3)	(3.65776)	(0.00449)	(0.01804)

Adjustment coefficients (standard error in parentheses)

D(FER)	-0.048404
	(0.09052)
D(GDP)	-64.16325
	(12.3449)
D(EXRV)	-0.001964
	(0.00088)
D(TOPEN)	5.74E-08
	(1.2E-06)
D(NEXPT)	-0.007510
	(0.01056)
D(OILREV)	15.71908
	(4.85141)
D(DBTSERV)	-2.419831
	(0.74000)

2 Cointegrating Equation(s): Log likelihood -1742.192

Normalized cointegrating coefficients (standard error in parentheses)

FER	GDP	EXRV	TOPEN	NEXPT	OILREV	DBTSERV
1.000000	0.000000	131.0794	-48145.04	28.86394	-0.030173	0.192056
		(29.5962)	(7438.18)	(2.81009)	(0.00234)	(0.01366)
0.000000	1.000000	-11817.99	-3271142.	-1329.996	-1.427815	9.155239
		(5343.59)	(1342962)	(507.361)	(0.42280)	(2.46641)

Adjustment coefficients (standard error in parentheses)

D(FER)	-0.211671	-4.10E-05
	(0.14731)	(0.00071)
D(GDP)	-25.60548	0.577085
	(18.2047)	(0.08831)
D(EXRV)	-0.002870	1.25E-05
	(0.00147)	(7.1E-06)
D(TOPEN)	4.46E-07	5.33E-10
	(2.1E-06)	(1.0E-08)
D(NEXPT)	-0.041155	-2.69E-05
	(0.01546)	(7.5E-05)
D(OILREV)	34.67968	-0.071028
	(6.45890)	(0.03133)
D(DBTSERV)	-3.485057	0.015525
	(1.22372)	(0.00594)

3 Cointegrating Equation(s): Log likelihood -1717.012

Normalized cointegrating coefficients (standard error in parentheses)

FER	GDP	EXRV	TOPEN	NEXPT	OILREV	DBTSERV
1.000000	0.000000	0.000000	-89206.72	68.72158	-0.060294	0.368182
			(14006.4)	(4.59649)	(0.00372)	(0.02356)
0.000000	1.000000	0.000000	430936.5	-4923.520	1.287873	-6.724073
			(1297742)	(425.881)	(0.34426)	(2.18259)
0.000000	0.000000	1.000000	313.2580	-0.304072	0.000230	-0.001344
			(64.2835)	(0.02110)	(1.7E-05)	(0.00011)

Adjustment coefficients (standard error in parentheses)

D(FER)	-0.269125	-6.90E-05	-45.67011

	(0.24473)	(0.00072)	(66.6222)	
D(GDP)	44.72494	0.611375	12358.53	
	(23.4524)	(0.06894)	(6384.31)	
D(EXRV)	-0.000947	1.34E-05	0.092347	
	(0.00240)	(7.0E-06)	(0.65238)	
D(TOPEN)	1.61E-06	1.10E-09	0.000425	
	(3.4E-06)	(1.0E-08)	(0.00094)	
D(NEXPT)	0.012048	-1.01E-06	11.97074	
	(0.02125)	(6.2E-05)	(5.78494)	
D(OILREV)	42.43507	-0.067247	7870.141	
	(10.5423)	(0.03099)	(2869.87)	
D(DBTSERV)	-2.592425	0.015960	-354.2783	
	(2.02260)	(0.00595)	(550.603)	

4 Cointegrating Equation(s): Log likelihood -1698.679

Normalized cointegrating coefficients (standard error in parentheses)

FER	GDP	EXRV	TOPEN	NEXPT	OILREV	DBTSERV
1.000000	0.000000	0.000000	0.000000	-9.467799	-0.002681	-0.020544
				(2.09747)	(0.00170)	(0.01017)
0.000000	1.000000	0.000000	0.000000	-4545.806	1.009562	-4.846232
				(397.953)	(0.32221)	(1.92927)
0.000000	0.000000	1.000000	0.000000	-0.029503	2.75E-05	2.14E-05
				(0.01004)	(8.1E-06)	(4.9E-05)
0.000000	0.000000	0.000000	1.000000	-0.000876	6.46E-07	-4.36E-06
				(5.9E-05)	(4.7E-08)	(2.8E-07)

Adjustment coefficients (standard error in parentheses)

D(FER)	-1.552882	-0.000826	26.10558	20149.59
	(0.28902)	(0.00049)	(45.4863)	(5171.62)
D(GDP)	-20.42492	0.572965	16001.10	676863.4
	(38.8989)	(0.06598)	(6121.85)	(696032.)
D(EXRV)	-0.007311	9.68E-06	0.448208	171.1053
	(0.00401)	(6.8E-06)	(0.63071)	(71.7092)
D(TOPEN)	5.57E-06	3.44E-09	0.000204	-0.042314
	(6.1E-06)	(1.0E-08)	(0.00097)	(0.10991)
D(NEXPT)	-0.084701	-5.80E-05	17.38003	3464.421
	(0.02898)	(4.9E-05)	(4.56085)	(518.552)
D(OILREV)	49.55379	-0.063050	7472.129	-1407191.
	(19.0010)	(0.03223)	(2990.35)	(339992.)
D(DBTSERV)	2.578889	0.019009	-643.4099	84950.42
	(3.40370)	(0.00577)	(535.669)	(60903.6)

5 Cointegrating Equation(s): Log likelihood -1689.142

Normalized cointegrating coefficients (standard error in parentheses)

FER	GDP	EXRV	TOPEN	NEXPT	OILREV	DBTSERV
1.000000	0.000000	0.000000	0.000000	0.000000	-0.013965	0.125186
					(0.00170)	(0.02654)
0.000000	1.000000	0.000000	0.000000	0.000000	-4.408045	65.12362
					(0.83961)	(13.0772)
0.000000	0.000000	1.000000	0.000000	0.000000	-7.68E-06	0.000476
					(6.4E-06)	(9.9E-05)
0.000000	0.000000	0.000000	1.000000	0.000000	-3.99E-07	9.13E-06
					(1.6E-07)	(2.5E-06)

0.000000	0.000000	0.000000	0.000000	1.000000	-0.001192	0.015392
					(0.00018)	(0.00286)

Adjustment coefficients (standard error in parentheses)

D(FER)	-1.551543	-0.001098	55.13838	19778.90	-0.145144	
	(0.28403)	(0.00058)	(55.9256)	(5100.21)	(4.93080)	
D(GDP)	-19.98051	0.482711	25638.17	553815.6	-3533.185	
	(34.6027)	(0.07011)	(6813.35)	(621353.)	(600.714)	
D(EXRV)	-0.007356	1.87E-05	-0.519808	183.4651	-0.132304	
	(0.00359)	(7.3E-06)	(0.70651)	(64.4313)	(0.06229)	
D(TOPEN)	5.59E-06	3.24E-10	0.000536	-0.046557	-3.93E-05	
	(6.1E-06)	(1.2E-08)	(0.00120)	(0.10975)	(0.00011)	
D(NEXPT)	-0.084877	-2.22E-05	13.55420	3513.270	-2.461022	
	(0.02811)	(5.7E-05)	(5.53466)	(504.741)	(0.48798)	
D(OILREV)	49.39588	-0.030982	4048.010	-1363472.	850.5188	
	(17.9215)	(0.03631)	(3528.77)	(321812.)	(311.122)	
D(DBTSERV)	2.549268	0.025024	-1285.751	93151.94	-162.5283	
	(3.19099)	(0.00647)	(628.313)	(57299.9)	(55.3966)	

6 Cointegrating Equation(s): Log likelihood -1686.992

Normalized cointegrating coefficients (standard error in parentheses)

FER	GDP	EXRV	TOPEN	NEXPT	OILREV	DBTSERV
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-0.197102
						(0.05785)
0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	-36.60704
						(14.0245)
0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000298
						(5.4E-05)
0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	-6.92E-08
						(5.1E-07)
0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	-0.012112
						(0.00435)
0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	-23.07841
						(5.80153)

Adjustment coefficients (standard error in parentheses)

D(FER)	-1.526194	-0.001010	46.22648	10894.50	-0.086650	0.017675
	(0.28244)	(0.00058)	(56.4938)	(12977.3)	(4.86791)	(0.00424)
D(GDP)	-17.28323	0.492035	24689.89	-391535.8	-3526.961	1.870453
	(34.5161)	(0.07090)	(6903.99)	(1585926)	(594.897)	(0.51806)
D(EXRV)	-0.007270	1.90E-05	-0.549968	153.3980	-0.132106	0.000106
	(0.00361)	(7.4E-06)	(0.72234)	(165.930)	(0.06224)	(5.4E-05)
D(TOPEN)	6.75E-06	4.36E-09	0.000126	-0.455323	-3.66E-05	-5.01E-08
	(5.8E-06)	(1.2E-08)	(0.00116)	(0.26584)	(0.00010)	(8.7E-08)
D(NEXPT)	-0.083645	-1.80E-05	13.12100	3081.416	-2.458178	0.002677
	(0.02823)	(5.8E-05)	(5.64634)	(1297.03)	(0.48653)	(0.00042)
D(OILREV)	46.23015	-0.041926	5160.981	-253934.6	843.2137	-0.967613
	(17.1246)	(0.03518)	(3425.29)	(786829.)	(295.148)	(0.25703)
D(DBTSERV)	2.397807	0.024501	-1232.502	146236.6	-162.8778	0.024662
	(3.20289)	(0.00658)	(640.649)	(147164.)	(55.2029)	(0.04807)

APPENDIX A3
GRANGER CAUSALITY RESULT

Pairwise Granger Causality Tests
Date: 09/08/15 Time: 21:52
Sample: 1980 2013
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
GDP does not Granger Cause FER	**31**	**4.53033**	**0.0205**
FER does not Granger Cause GDP		**3.51995**	**0.0444**
EXRV does not Granger Cause FER	**32**	**6.18018**	**0.0062**
FER does not Granger Cause EXRV		0.20717	0.8142
TOPEN does not Granger Cause FER	30	1.16343	0.3288
FER does not Granger Cause TOPEN		0.26846	0.7667
NEXPT does not Granger Cause FER	**32**	**17.0431**	**2.E-05**
FER does not Granger Cause NEXPT		1.38363	0.2679
OILREV does not Granger Cause FER	**32**	**5.86482**	**0.0077**
FER does not Granger Cause OILREV		**9.53642**	**0.0007**
DBTSERV does not Granger Cause FER	32	2.27234	0.1224
FER does not Granger Cause DBTSERV		1.95283	0.1614
EXRV does not Granger Cause GDP	**31**	**2.80036**	**0.0792**
GDP does not Granger Cause EXRV		0.66024	0.5252
TOPEN does not Granger Cause GDP	30	0.13241	0.8766
GDP does not Granger Cause TOPEN		0.15758	0.8551
NEXPT does not Granger Cause GDP	31	0.70019	0.5056
GDP does not Granger Cause NEXPT		3.93841	0.0321
OILREV does not Granger Cause GDP	31	5.13808	0.0132
GDP does not Granger Cause OILREV		25.1144	8.E-07
DBTSERV does not Granger Cause GDP	31	3.18934	0.0577
GDP does not Granger Cause DBTSERV		0.03093	0.9696
TOPEN does not Granger Cause EXRV	30	0.17775	0.8382
EXRV does not Granger Cause TOPEN		0.09086	0.9134
NEXPT does not Granger Cause EXRV	32	0.39477	0.6777
EXRV does not Granger Cause NEXPT		2.25132	0.1247
OILREV does not Granger Cause EXRV	32	0.57775	0.5679
EXRV does not Granger Cause OILREV		1.50250	0.2406
DBTSERV does not Granger Cause EXRV	32	9.39688	0.0008
EXRV does not Granger Cause DBTSERV		0.02179	0.9785
NEXPT does not Granger Cause TOPEN	30	0.17188	0.8431
TOPEN does not Granger Cause NEXPT		0.13259	0.8764

OILREV does not Granger Cause TOPEN	30	0.25716	0.7753
TOPEN does not Granger Cause OILREV		0.04717	0.9540
DBTSERV does not Granger Cause TOPEN	30	0.18036	0.8360
TOPEN does not Granger Cause DBTSERV		1.03277	0.3707
OILREV does not Granger Cause NEXPT	32	3.31256	0.0517
NEXPT does not Granger Cause OILREV		17.1788	2.E-05
DBTSERV does not Granger Cause NEXPT	32	3.07503	0.0626
NEXPT does not Granger Cause DBTSERV		3.09149	0.0618
DBTSERV does not Granger Cause OILREV	32	0.54098	0.5884
OILREV does not Granger Cause DBTSERV		8.51580	0.0014

APPENDIX A4
TWO STAGE LEAST SQUARE (2SLS)

Dependent Variable: LOG(FER)
Method: Two-Stage Least Squares
Date: 09/08/15 Time: 21:42
Sample (adjusted): 1980 2011
Included observations: 32 after adjustments
Instrument specification: log(GDP) log(EXRV) log(TOPEN) NEXPT
log(OILREV) log(DBTSERV)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(GDP)	-0.234267	0.323134	-0.724985	0.4752
LOG(EXRV)	0.022495	0.167076	0.134641	0.8940
LOG(TOPEN)	0.476642	0.545673	0.873492	0.3907
NEXPT	0.000388	0.000224	1.734365	0.0952
LOG(OILREV)	0.420141	0.235689	1.782608	0.0868
LOG(DBTSERV)	0.049157	0.148376	0.331302	0.7432
C	6.698692	2.358426	2.840323	0.0088

R-squared	0.791661	Mean dependent var	8.779588
Adjusted R-squared	0.741660	S.D. dependent var	1.333118
S.E. of regression	0.677586	Sum squared resid	11.47809
F-statistic	15.83279	Durbin-Watson stat	1.342905
Prob(F-statistic)	0.000000	Second-Stage SSR	11.47809
J-statistic	0.000000	Instrument rank	7

APPENDIX A5
LAG LENGTH SELECTION STRUCTURE

Endogenous variables: log (FER) log (Gdp) log (exrv), log (topen), Nexpt, log (oilrev) log (Dbtserv).

lag	logl	LR	FPE	AIC	SC	HQ
0	-438.3779	NA	18525.32	29.69186	30.01881	29.79645
1	-288.4642	219.8734	243.2764*	22.96428*	25.57985*	23.80102*
2	-255.4166	33.04761	128.1134	24.02777	28.93196	25.59667

* 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

APPENDIX A6
SHORT RUN OVER-PARAMETERISED AND PARSIMONIOUS ECT RESULT

Dependent Variable: DLOG(FER)
Method: Two-Stage Least Squares
Date: 09/28/15 Time: 15:37
Sample (adjusted): 1982 2011
Included observations: 30 after adjustments
Instrument specification: DLOG(GDP) DLOG(GDP(-1)) DLOG(EXRV) DLOG(EXRV(-1)) DLOG(TOPEN) DLOG(TOPEN(-1))D(NEXPT) D(NEXPT(-1)) DLOG(OILREV) DLOG(OILREV(-1)) DLOG(DBTSERV) DLOG(DBTSERV(-1)) ECT(-1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.050395	0.206420	-0.244137	0.8102
DLOG(GDP)	-0.331068	0.713160	-0.464227	0.6487
DLOG(GDP(-1))	-0.384808	0.688760	-0.558697	0.5841
DLOG(EXRV)	0.182908	0.178985	1.021916	0.3220
DLOG(EXRV(-1))	0.053477	0.170469	0.313704	0.7578
DLOG(TOPEN)	1.254083	0.528378	2.373457	0.0305
DLOG(TOPEN(-1))	0.217149	0.543023	0.399889	0.6945
D(NEXPT)	0.000328	0.000248	1.322726	0.2045
D(NEXPT(-1))	5.45E-05	0.000251	0.217394	0.8306
DLOG(OILREV)	0.460142	0.189539	2.427698	0.0274
DLOG(OILREV(-1))	0.447245	0.162726	2.748457	0.0143
DLOG(DBTSERV)	0.151796	0.119719	1.267940	0.2230
DLOG(DBTSERV(-1))	-0.097777	0.133003	-0.735150	0.4729
ECT(-1)	-0.738111	0.265870	-2.776215	0.0135

R-squared	0.693848	Mean dependent var	0.098213
Adjusted R-squared	0.445099	S.D. dependent var	0.695025
S.E. of regression	0.517736	Sum squared resid	4.288801
F-statistic	2.789355	Durbin-Watson stat	1.626271
Prob(F-statistic)	0.027384	Second-Stage SSR	4.288801
J-statistic	8.36E-44	Instrument rank	14

APPENDIX A7
PARSIMONIUS RESULTS

Dependent Variable: DLOG(FER)
Method: Two-Stage Least Squares
Date: 09/28/15 Time: 15:51
Sample (adjusted): 1982 2011
Included observations: 30 after adjustments
Instrument specification: DLOG(GDP(-1))DLOG(EXRV) DLOG(TOPEN) D(NEXPT)DLOG(OILREV) DLOG(OILREV(-1))DLOG(DBTSERV(-1)) ECT(-1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.055289	0.146598	-0.377150	0.7098
DLOG(GDP(-1))	-0.378780	0.569062	-0.665622	0.5129
DLOG(EXRV)	0.279906	0.146475	1.910948	0.0698
DLOG(TOPEN)	0.952244	0.324297	2.936330	0.0079
D(NEXPT)	0.000130	0.000167	0.782190	0.4428
DLOG(OILREV)	0.442901	0.145746	3.038858	0.0062
DLOG(OILREV(-1))	0.413909	0.139072	2.976216	0.0072
DLOG(DBTSERV(-1))	-0.141259	0.094205	-1.499489	0.1486
ECT(-1)	**-0.652936**	**0.172723**	**-3.780238**	**0.0011**

R-squared	0.659091	Mean dependent var	0.098213
Adjusted R-squared	0.529221	S.D. dependent var	0.695025
S.E. of regression	0.476880	Sum squared resid	4.775702
F-statistic	5.075001	Durbin-Watson stat	1.640388
Prob(F-statistic)	0.001314	Second-Stage SSR	4.775702
J-statistic	3.08E-45	Instrument rank	9

APPENDIX.A6: LAG LENGTH SELECTION

VAR Lag Order Selection Criteria
Endogenous variables: LOG(FER) LOG(GDP) LOG(EXRV) LOG(TOPEN) NEXPT LOG(OILREV) LOG(DBTSERV)
Exogenous variables: C
Date: 09/16/15 Time: 13:31
Sample: 1980 2013
Included observations: 30

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-438.3779	NA	18525.32	29.69186	30.01881	29.79645
1	**-288.4642**	**219.8734***	**24.32764***	**22.96428***	**25.57985***	**23.80102***
2	-255.4166	33.04761	128.1139	24.02777	28.93196	25.59667

*** indicates lag order selected by the criterion**
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error

APPENDIX.A8
STABILITY RESULTS BASED ON VAR

Roots of Characteristic Polynomial
Endogenous variables: LOG(FER) LOG(GDP) LOG(EXRV) LOG(TOPEN) NEXPT LOG(OILREV) LOG(DBTSERV)
Exogenous variables: C
Lag specification: 1 2
Date: 09/16/15 Time: 13:32

Root	Modulus
0.975187	0.975187
0.819787	0.819787
-0.775101	0.775101
0.526458 - 0.551010i	0.762083
0.526458 + 0.551010i	0.762083
-0.342683 - 0.545314i	0.644049
-0.342683 + 0.545314i	0.644049
0.354716 - 0.495179i	0.609118
0.354716 + 0.495179i	0.609118
0.590977	0.590977
0.298684 - 0.302213i	0.424906
0.298684 + 0.302213i	0.424906
-0.312111	0.312111
-0.100252	0.100252

No root lies outside the unit circle.
VAR satisfies the stability condition.

APPENDIX B1
DATA ON FOREIGN EXCHANGE RESERVES AND SELECTED MACROECONOMIC VARIABLES FOR ANALYSIS

YEAR	Foreign exchange reserves (N'M)	Nominal GDP (n'm)	Exchange rate(USD to Naira)	Inflation Rate (Infr, %)	Interest Rate (Intr, %)	Debt Servicing (Dbtserv)	Oil Revenue (Oilrev)	Foreign Direct Investment (FDI)	Total export (N'M)	Total import(N'M)	TOPEN
1980	5569.54	49632.3	0.5464	9.9	25.5	518.9	8564.4	404.8	14186.7	9095.6	0.106916216
1981	47619.66	47617.66	0.6123	20.9	7.75	634.1	7814.9	334.7	11023.3	12839.6	-0.037015012
1982	49069.28	49069.28	0.6729	7.7	10.25	674.6	7253	290	8206.4	10770.5	-0.048281425
1983	53107.38	53107.38	0.7241	23.2	10	742	8369.2	264.3	7502.5	8903.7	-0.023501183
1984	59622.53	59622.53	0.7649	39.6	12	948.5	10923.7	360.4	9088	7178.3	0.028121643
1985	67908.85	67908.55	0.8939	5.5	9.25	1341.3	8107.3	434.1	11720.8	7062.6	0.067366634
1986	69146.99	69146.99	2.0206	5.5	10.5	2583.5	19027	735.8	8920.6	3259.1	0.053804858
1987	105222.80	105222.84	4.0179	10.2	17.5	2973.2	19831.7	2452.8	30360.6	4098.1	0.188822974
1988	139085.30	139085.3	4.5367	38.3	16.5	7176.6	39130.5	1718.2	57971.2	4390.6	0.247145793
1989	216797.50	216797.54	7.3916	40.9	26.8	16027.2	71887.1	13877.4	109886.1	3834.4	0.396380878
1990	267550.00	267549.99	8.0378	7.5	25.5	28714.2	39130.5	4686	121535.4	4948.1	0.373509954
1991	312139.70	312139.74	9.9095	13	20.01	34039.1	71887.1	6910.1	205611.7	7755.8	0.371480966
1992	532613.80	532613.83	17.2985	44.5	29.8	41388.2	8266.4	14463.1	216770.1	7203.7	0.306441962
1993	683869.20	683869.79	22.0511	57.2	18.32	39085.6	164078.1	29660.3	206059.2	6655.9	0.221592899
1994	683869.80	899863.22	21.8861	57	21	40336.1	162102.4	22229.2	950661	162988.8	0.407442321
1995	1933212.00	1933211.55	21.8861	72.8	20.18	35468.6	160192.4	75940.6	1309543.4	755127.7	0.205132562
1996	2702719.00	2702719.13	21.8861	29.3	19.74	41071.5	324547.6	111295	1241662.7	562626.6	0.242342165
1997	2801973.00	2801972.58	21.8861	8.5	13.54	32754.7	408783	110452.7	751856.7	845716.6	-0.034654715
1998	2708431.00	2708430.86	21.8861	10	18.29	27850.9	416811.1	80750.4	1188989.8	837418.9	0.110071776
1999	3194015.00	3194014.97	92.6934	6.6	21.32	15928.1	324311.2	92792.5	2745479.6	862515.7	0.410936622
2000	4582127.00	4582127.27	102.1052	6.9	17.98	171805.9	724422.5	115952.2	2007127	985022.4	0.215085459
2001	4725086.00	4752086	11.9433	18.9	18.29	237326.3	1591675.8	132433.7	7239386.9	1371409.1	0.848908298
2002	6912381.00	6912381.25	120.9702	12.9	24.85	140757.1	1707562.8	225036.5	3109288.4	1512695.3	0.188121499
2003	8487032.00	8487031.57	1293565	14	20.71	233803.2	1230851.2	258388.6	5129025.6	2080235.3	0.267178374
2004	11411067.00	11411066.91	1335004	15	19.18	234259.1	2074280.6	248224.6	7264534.8	1987045.3	0.362160506

YEAR	Foreign exchange reserves (N'M)	Nominal GDP (n'm)	Exchange rate(USD to Naira)	Inflation Rate (Infr, %)	Interest Rate (Intr, %)	Debt Servicing (Dbtserv)	Oil Revenue (Oilrev)	Foreign Direct Investment (FDI)	Total export (N'M)	Total import(N'M)	TOPEN
2005	14572239.00	14572239.12	132.147	17.9	17.95	1341.3	3354800	303328.8	7324680.5	247932.3	0.381195943
2006	18564595.00	18564594.73	128.6516	8.2	17.26	2583.5	4762400	654193.1	8120147.9	2528086	0.270706004
2007	20657318.00	20657325	125.8331	5.4	16.94	2375.4	5287566.9	1779594.8	9774510.9	20657317.7	-0.447919794
2008	24296329.00	24296329.29	118.5669	11.6	15.14	7176.6	4462910	141462.3	6,625,523.13	23842170.7	-0.694380973
2009	24794239.00	24794238.66	148.9017	13-0	18.36	16027.2	6530630.1	283558.4	7,131,208.53	5921449.7	0.035597104
2010	29205783.00	33984754.13	150.298	13.30	17.59	28714.2	3191937.98	255358.1	7,320,997.55	13.237.256.0	-0.157583445
2011	38397572.00	37543654.7	135.94	12.1	16,69	34039.1	5396091.05	377453.2	8,713,060.03	15,914,548.50	-0.182654369
2012	47,653.06	39,426,861.32	138.5465	11	17.61	41388.2	8848615.76	386942.3	7,447,697.33	14,728,856.20	#VALUE!
2013	47,884.10	40 542,732.23	156.45	10.5	18.9	2816027	9856514.86	246854.5	7,668,558.43	16,832,586.20	#DIV/0!

Sources: (i). Central Bank of Nigeria Statistical Bulletin, Various issues

(ii). Central Bank of Nigeria Annual Report and Statement of Account, Various issues

(ii). Central Bank of Nigeria Economic, Financial Reviews Various issues

(V) National Bureau of Statistic (NBS)