RESERVE DEMAND AND MANAGEMENT IN NIGERIA

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Abstract

This study stems from the depletion of Nigeria's Reserves in recent times and its implications on the desirability or otherwise of holding Reserves as embedded in her Reserve Management Strategy. A Reserve demand function was developed using a simultaneous equation model and it was found that the opportunity cost of holding Reserves negatively and significantly affects Reserve holdings. The IMF condition and Guidotti-Greenspan condition for Reserves Adequacy were significant determinants of Reserve holdings, other factors included previous values of Nominal Exchange Rate, Trade Openness and the Capital and Current Account Vulnerability. Conclusions drawn were that the decision to hold Reserves is motivated by the return on Reserves and an account of the Short Term Debt by Reserves. It was also found that there is no complementarity in the interdependency between Real GDP and Foreign Exchange Reserves. Recommendations rendered were that the Federal Government should review her Exchange Rate policy in order to reduce the bearing of exchange rate management on Reserves depletion, and that the excess on Reserves should be spent on improving the investment climate in order to balance the complementarity expected of the economy's size and Reserves accumulation.

Keywords: Reserves, Simultaneous, Guidotti, Greenspan, Vulnerability

1. Introduction

Nigeria, like many other countries hold Foreign Exchange Reserve at what is perceived a favourable level, the reason for this is not farfetched. Foreign Exchange Reserve plays a critical role in the stability of any given economy on the whole and this is a major reason why its dynamics creates worrisome riddles to policy makers. Within the context of Reserves management, consideration should be given as a priority, to settling the optimality issues of liquidity and Returns on Investment. An approach to this could be a more strategic targeting of reserve portfolio in a bid to spontaneously meet the demands of both the liquidity portfolio and the investment portfolio respectively. Accordingly, Blackman's seminal work in 1982 explains that Foreign

Exchange Reserves management is an instrument of Exchange Rate policy in developed countries while it is a major national asset of economic development in developing countries.

Figure 1 below shows the expansion in Nigeria's economy size as measured by the Real GDP. Real GDP in Nigeria has soared over the years as seen between 1981 and 2014 ranging from ₦94.33 million to ₦89.043 billion, but a look at component variables of the national income on the same graph, shows a decline as seen of both Exports and Investment. The Figure 2 reveals that Reserve holdings in Nigeria has over time also been on the increase. A strong rise could be observed of the post military era (i.e. 1999 and beyond). The rise was steady, till after Reserve holdings reached its peak in 2008, when it started dropping again with the average value of Reserve holdings between 1981 and 2014 being US$ 183.082 billion. The rise in Reserves does not reflect rise in either of investment or export as the increase observed in both variables can be described to be increment at decreasing rates. This trend could be perceived when a look is taken at Nigeria's Short Term Debt between the period under review. This has also been on the rise, thus being a counter-productive factor to Nigeria's growth.

Figure 1: Some Macroeconomic Variables in Nigeria from 1981 to 2014
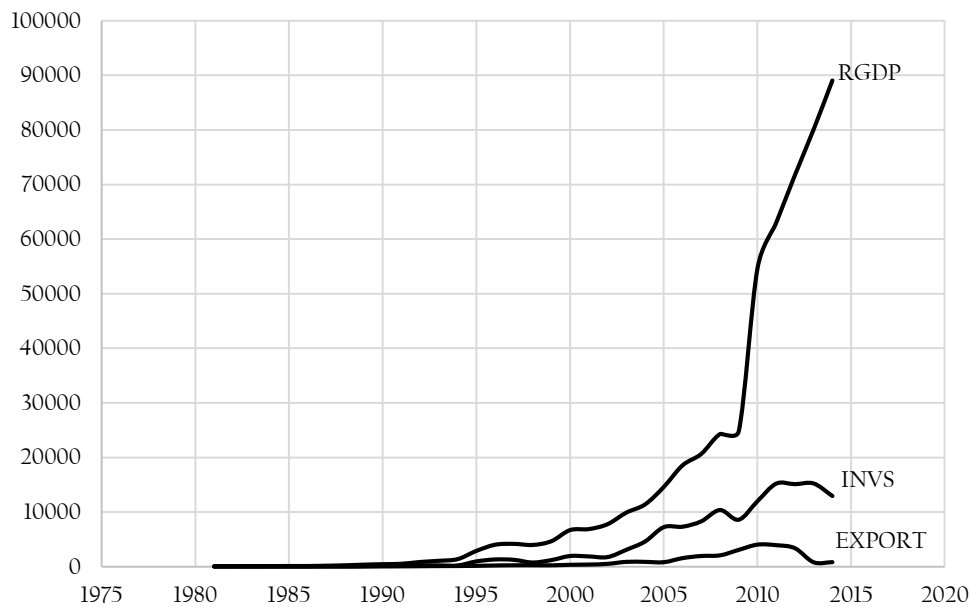
Source: Authors' Presentation for Annual Data from CBN, 2014.

Figure 2: Foreign Exchange Reserves versus Short Term Debt in Nigeria from 1981 to 2014
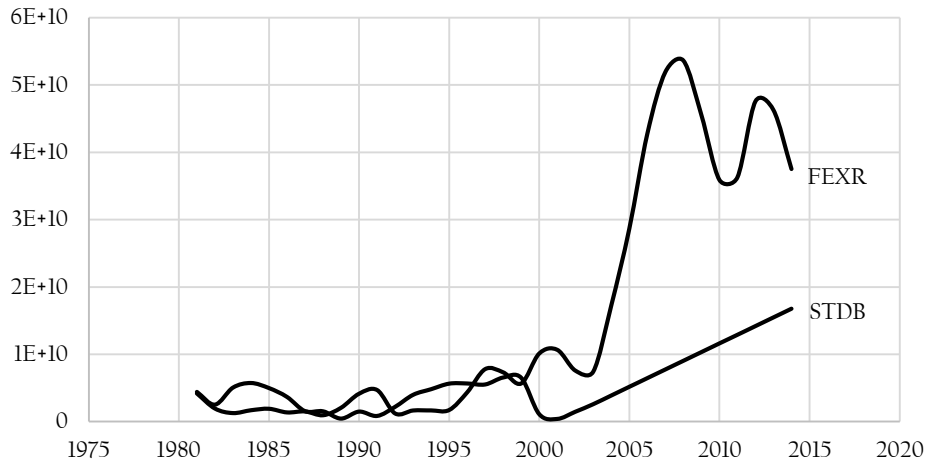
Source: Authors' Presentation for Annual Data from WDI, 2015.

The CIA WorldFact Book (2015) ranks Nigeria 48th with an estimated $37.44 billion for the year 2015, while China and Japan with a whooping accumulated Reserves holding of $3.98 trillion and $1.267 trillion, ranks 1st and 2nd respectively. In Africa, Nigeria ranks 4th in Reserves holding, while Algeria, Libya, and South Africa holds $193.6 billion, $105 billion and $50.55 billion respectively, making them the 1st three countries in Africa with regards Foreign Exchange Reserve Holdings. These huge amounts of reserves as held by Nigeria has in the last two years, through to the past few months before the May 29th, 2015 handover, been depleted due to its use to defend the Naira which had been under pressure from market speculation, pre-election spending and fall in crude oil prices giving rise to criticisms from various quarters - Pressure groups, Civil Society groups, Human Rights Proponents and of course, the then opposition party.

As arguments are being raised in favour and against the accumulation of Foreign Exchange Reserve with debate on issues of the adequacy of Reserves and its alternative uses on one hand and then building a reserve base in the face of dwindling domestic economic activities, inadequacy of infrastructure as well as high incidence of poverty respectively but to mention a few on the other hand, it becomes pertinent to weigh the decision to hold more or less Reserves in cognisance of its implications on the viability of the economy. Critical questions this study would seek to solve would include;

What is the implication of the Guidotti-Greenspan Rule in determining the demand for reserves?

Does Nigeria's Foreign Exchange Reserves account for her economy's size?

Is there a complementarity between the Foreign Exchange Reserves and Nigeria's economy size?

To this effect, this study thus seeks to analyse the various components of the demand for Reserves in Nigeria in cognisance of strategic Reserve Adequacy indices/metrics.

2. Literature Review
The Mercantilists' Trade Theory

Foreign Exchange Reserves are foreign currencies, foreign deposits and bonds held by Central Banks and monetary authorities of a nation as the choice of holding Reserves in a particular foreign currency depends largely on the stability and value parity of the exchange currency. Early Britain reportedly initiated cross-border trade in a bid to improve the earnings of the Merchants and that of the nation at large. This had been the information passed in the form of the written ideas of the Mercantilists between the periods 1500 – 1800, with a central question of how an economy could regulate its domestic and international affairs so as to promote her own interests. The Mercantilists, to this effect advocated for increased participation of the government through government regulation of trade by imposition of tariffs, trade quotas and other trade policies. This idea developed the storage of Reserves by world economies (Britain as at time of practice of the thought), as Carbaugh (2009:29) holds that "such revenues would contribute to increased spending and a rise in domestic output and employment".

The Theory of the Demand for Money

The theory of the demand for money is primarily based on the various reasons for holding money. Various schools of thought have expanded the idea on why people hold money and what influences the decisions to hold money. Chief amongst these reasons are the Transaction motive for holding money, the Speculative motive for holding money and the Precautionary motive. These various motives form the reasons for the demand for money. The study of the demand for Foreign Exchange Reserves cannot be alienated from the study of the demand for money since Foreign Exchange Reserves is analogously seen as money for an individual country. The theory of Reserves can be clearly classified into two broad issues, which are the Theory of Demand for Reserves and Reserve Management Theory. Both work in tandem to determine the levels of Foreign Exchange Reserves held by various economies, in relation to existing policies being implemented in the given period. Demand for Reserves like of Money also hinges on the Transaction, Speculative and Precautionary motives. Cross-border trade gives rise to currency inflows, handled by banks to finance trade. A sufficiently high level of Reserves is necessary to cater for uncertainties if prolonged, as Reserves can cover liquidity at risks on all accounts for a long period of time.

The Theory of Reserve Optimality/Adequacy

Most nations fear that unforeseen circumstances would be a major problem to macroeconomic stability, and in a bid to lay down fears about shocks, Reserves need be held to a certain level. The IMF (2011) was of the view that current approaches to Reserve adequacy do not appear to be followed closely by countries in their Reserves holding decisions. Suggested metrics of Foreign Exchange Reserves include the Traditional metrics and the Guidotti – Greenspan Rule. These metrics shall be discussed herein, to open a new window to the understanding of Reserve Optimality/Adequacy in contrast to political criticisms evidenced in Nigeria of late about her Reserves depletion.

The Traditional Metrics
This measure as defined by the IMF (2011) is the cover of Reserves for up to 3 months of Imports. This is regarded as an arbitrary measure of cover and applies mostly to highly importing countries just as ours. This also measures some peculiar degree of vulnerability and as such might not be the best metric for Reserve Optimality/Adequacy. The benchmark is relevant to low-income countries that are vulnerable to Current Account shocks and that are also not having significant access to capital markets. Conventionally, this metric is measured by the expression given below;

$$TRAD = \frac{FEXR}{12 \ X \ IMPT}$$

where TRAD is Traditional metric (regarded as IMFC in authors' methodology), FEXR is Foreign Exchange Reserves, and IMPT is Imports

Figure 3: Pattern of Nigeria's Ratio of Reserves to Months of Import from 1999 to 2014
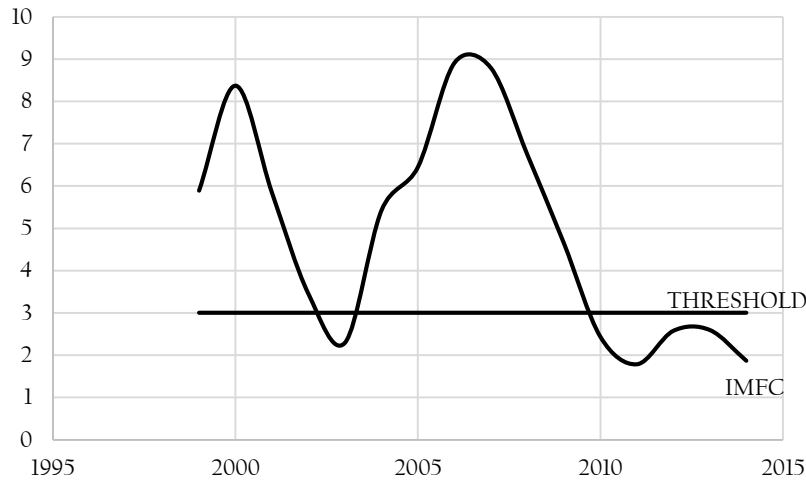
Source: Authors' presentation for data sourced from the CBN, 2014
The above graph in Figure 3 explains that between the years 1999 to 2014 inclusive, Nigeria has Reserves much more above the advocated 3 months of imports, thus an excess in the level of Foreign Exchange Reserves. It is though observable that after 2002 till 2003, Reserves was below the specified threshold advocated by the IMF and this is also same for the periods after 2009 till 2014.

The Guidotti – Greenspan Rule

This is yet another metric informed by the adequacy of Foreign Exchange Reserves in accommodating the economy's vulnerability to (Short-Term) External debts. It is most suitable for countries prone to vulnerability from a Capital Account crisis, since it explains that economies should stock Reserves enough to replace short-term debts should short-term foreign capital be massively pulled out. This metric was first introduced by Pablo Guidotti in 1999 while Greenspan Alan (1999) later popularised it in use through his speech at the World Bank in same year. Calafell

and Padilla del Bosque (2002) found out that the ratio of reserves to external debt is a relevant predictor of an external crisis. The metric is obtained as specified below;

$$GUGN = \frac{FEXR}{STDB}$$

where GUGN is Guidotti – Greenspan Rule and STDB is Short-Term Debt

Figure 4: Pattern of Nigeria's Ratio of Reserves to Short – Term Debts from 1981 to 2015
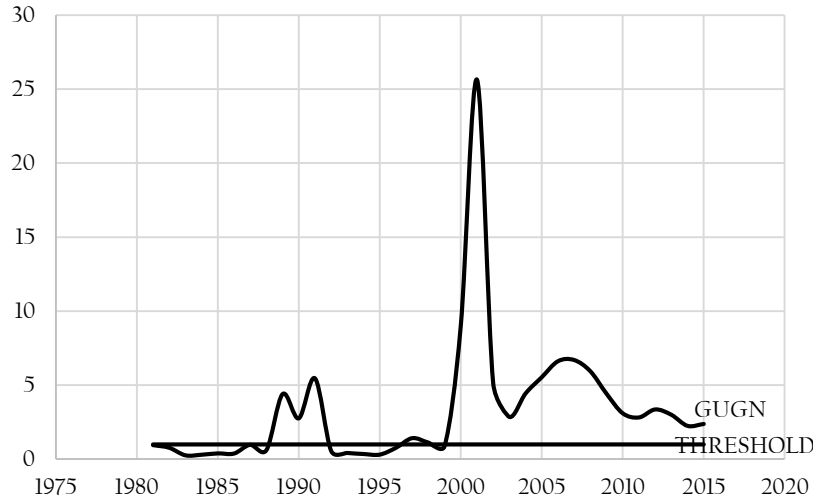
Source: Authors' presentation for data sourced from the WDI, 2015

It can be observed from Figure 4 above, that over time, especially between the periods 1981 to 1988 and then 1992 to 1999 Nigeria's Reserves was struggling to be above the threshold. The Obasanjo-led administration started off in 1999, and this was met with Reserves above the threshold, even till 2015. It could also be observed with particular reference to Figure 2, that though Reserves was at its peak in 2008, excess Reserves as measured by the Guidotti-Greenspan Rule occurred in 2001. This was as a result of Nigeria's low [Short Term] Debt profile during the period, thus allowing an excess Reserves for the cover of Short Term Debt.

Studies on Foreign Exchange Reserves over time have not been without empirics all over the world across researchers. This section of the discourse presents the findings of various authors in comparison with the theoretical expectations presented in the preceding section. Mayuresh and Ramana (2013) attempted ascertaining the Causality between Exchange Rate and Foreign Exchange Reserves in the Indian Context, their Johansen Cointegration Test and VAR analysis found no long and short term association between Exchange Rate and Foreign Exchange Reserves in India for annual data spanning from 1980 to 2010. This was so even though India had accumulated Reserves exhibiting a departure from the thumb rule ratios suggested by several researchers, implying that Reserves does not have a direct bearing on the Exchange Rate and there could be many other parameters contributing to excessive fluctuations in the currency exchange rate between the Dollar and the Rupee. This above finding though is in contrast with the findings of Osabuohien and Egwakhe (2008). They stated a problem "To explore the optimal level of External Reserves holding in Nigeria considering the benefits of exchange rate stability associated with keeping external reserve as against the cost of holding Reserves", and found that the holding

of External Reserves promotes Exchange Rate stability. Osabuohien and Egwakhe (2008) opined that a positive relationship exists between External Reserves and Exports, however, the relationship was found not to be significant.

Moving over to the determinants of Reserves, Gosselin and Parent (2005) conducted an empirical analysis of Foreign Exchange Reserves in emerging Asia using a Panel Cointegration tests as the basis for the estimation of a long run Reserve demand function in a panel of seven Asian emerging market economies and found that the coefficient on the ratio of Imports to GDP and the ratio of Broad Money Supply to GDP were positive, with the volatility of exports receipts also exhibiting a positive relationship. They explained that with the coefficient associated with the ratio of Broad Money Supply to GDP being estimated at 0.78, the potential for resident-based capital flight from the domestic currency seemed to play an increasingly pertinent role in determining Reserve holdings in emerging Asia for the post-1997 period which is consistent with increasing role for the Self-Insurance Motive of holding Reserves against internal drain. This study underlines the Self-Insurance motive of holding Reserves as more pronounced factor amongst the determinants of Reserves.

For Irefin and Yaaba (2012), they understudied the determinants of Foreign Exchange Reserves in Nigeria using the Autoregressive Distributed Lag (ARDL) Technique for quarterly data spanning from 1999 to 2011 to run a slightly modified econometrics 'Buffer Stock Model' in order to estimate the determinants of Foreign Reserves with focus on Income, Monetary Policy Rate, Imports and Exchange Rate. With a well fitted model whose goodness of fit is estimated at over 98%, the model exhibited Cointegration. Irefin and Yaaba (2012) observed that the long run coefficients revealed that income had a positive significant relationship with Reserves as well as its lagged value. Monetary Policy Rate, Exchange Rate and Imports were found to be inversely related to Reserves, for which the significant inverse relationship found between Reserves and Import debunked the existence of a buffer stock model in the management of Reserves in Nigeria. Thus the report provides strong support for income as a major determinant of Reserves holding.

Mbeng *et al* (2013) had a major poser of what Africa should do with regards holding excess Foreign Reserves in contrast to Infrastructure Finance. Unlike other studies focused on just the determinants of reserves, this study was rather an attempt at reconciling determinants of Reserve holdings in Africa with its uses. They made their research a contribution to the debate on the use of excess Foreign Exchange Reserves (from different African countries) as one of the fund sources for financing infrastructure. With data within the range of 2000 to 2011 inclusive, Mbeng *et al* (2013) opined that African countries have held more than the infrastructure financing gap identified at $ 93 billion per year and that the social cost of holding these excess Reserves amounted to up to 1.65% in GDP terms on the average. They also found that "based on the two methods of reserve adequacy applied, that African Foreign Exchanges excess can meet the infrastructure financing gap of the continent"(Mbeng et al (2013:18)). There thus is room for creating investment vehicles for holding a part of assets as less liquid, higher-yielding wealth.

The current research work as a point of deviation takes cognisance of the interdependence between Foreign Exchange Reserves and Real GDP, thus using a simultaneous equation model

in explaining the Reserve Demand Function which allows for [economic] theoretical support in explaining this interdependency. Though, studies from Osabuohien and Egwakhe (2008) analysed the potency of the IMF condition as a means to Reserve adequacy, this study would embark on verifying the significance of a more recent measure – Guidotti-Greenspan Metric of reserve adequacy – due to the type of vulnerability Nigeria is exposed to as a result of her somewhat consistent deficit budgeting over the years.

3. Methodology and Data

Theoretical Framework

This study follows Gosselin and Parent (2005)'s Reserves Demand Function. They modelled the factors determining the demand for Reserves at every point in time to include; the *economy's size, current account vulnerability, capital account vulnerability, exchange rate flexibility, and the opportunity cost of holding reserves*. For Gosselin and Parent (2005), a closer measure of the Opportunity Cost of holding Reserves is defined upon the interest rate differentials, measured as the difference between real domestic interest rate and real US Treasury bill rate. They further argued from their cross-country model that controlling for the economy's size is not sufficient to remove the upward trend in Reserves – a potential reason being increasing openness to trade which renders the economy more vulnerable to external shocks. To this effect, the Real Import Propensity ($\frac{IMPT}{RGDP}$) is used to capture Current Account Vulnerability, while the ratio of Broad Money Supply to RGDP ($\frac{BMSY}{RGDP}$) measures the Capital Account Vulnerability. Their cross-country Reserve Demand Function is presented below as

$$y_{i,t} = \alpha + \delta_i + \sum_{k=1}^{K} \beta_k x_{k,i,t} + e_{i,t} \qquad \ldots (1a)$$

with $y_{i,t}$ as dependent variable, $x_{i,t}$ a vector of independent variables, and $e_{i,t}$ a stationary disturbance term.

Mbeng et al (2013) reiterates a condition for Reserves Adequacy, such that world economies can cover up to 100% of their short-term debt. This is the Guidotti-Greenspan (1999) Rule for Reserves adequacy. This further suggests that economies are to bear this in mind in the build-up of Reserves, thus Reserves depending on this measure. This condition has over time been an improvement on the IMF (1953) condition of Reserves for Import cover suggested to reduce the risk involved in the eventuality of not meeting up with the local demands for consumables in the economy. Both metrics are thus incorporated into the demand function of Reserves and is modelled in equation (3a) as a modification to the Reserves Demand Function by Gosselin and Parent (2005).

For studies as Adam and Léonce (2011), Abdulateef and Waheed (2010) and Gosselin and Parent (2005), economy's size being a determinant of Foreign Exchange Reserves could be measured by either of Real GDP or GDP per capita. The improvements in economic size are also provided for by the level of Reserve holding, thus an interdependency between both

variables. This is supported in the works of Kruskovic and Maricic (2014), Polterovich and Popov (2003) and Ifurueze (2014) On this premise, [the implicit] equation (2) is birthed

$$RGDP = f(FEXR) \qquad \qquad \dots (2)$$

Model Specification

The model being an adjusted country-specific model of the Gosselin and Parent (2005) Reserve Demand Function, takes into cognisance, the principles of Reserve Management which are of Reserves optimality and adequacy, and so we have:

$$lnFEXR_t = \alpha_0 + \alpha_1 lnRGDP_t + \alpha_2 lnNEXC_{t-1} + \alpha_3 lnCAVT_t + \alpha_4 lnCUVT_t + \alpha_5 lnOPCT_t$$
$$+ \alpha_6 lnGUGN_t + \alpha_7 lnIMFC + \alpha_8 lnTRDP$$
$$+ \mu_t \qquad \qquad \dots (3a)$$
$$lnRGDP_t = \beta_0 + \beta_1 lnFEXR_t + \beta_3 lnBMSY_t + \beta_4 lnTGCF_{t-1}$$
$$+ \varepsilon_t \qquad \qquad \dots (3b)$$

Where $RGDP$ is Real GDP, $NEXC$ is nominal Exchange Rate, $CAVT$ is Capital Account Vulnerability, $CUVT$ is Current Account Vulnerability, $OPCT$ is Opportunity Cost of holding Reserves, $TRDP$ is Trade Openness, $BMSY$ is Broad Money Supply, $TGCF$ is Total Gross Capital Formation while $FEXR, IMFC$ and $GUGN$ has been defined under the literature review. Both equations (3a) and (3b) would be estimated simultaneously [due to the interdependency between the economy's size and Reserves which poses an endogeneity threat], thereby forming a system of equations.

4. Results and Discussions.

Structural Break Test

The Quandt-Andrews Test for structural break is conducted and the test result is presented below. The Null hypothesis tested states there is no breakpoints within 15% trimmed data

Table 1: Summary of Structural Break Test using Quandt-Andrews Test.

Variable name	Max LR F-Statistic	Break Date
lnBMSY	449.7503	1991Q1*
lnCAVT	136.3454	2000Q4*
lnCUVT	367.8261	1990Q3*
lnFEXR	488.5492	2003Q3*
lnGUGN	1122.501	2004Q2*
lnIMFC	732.0732	1991Q4*
lnNEXC	428.9231	1991Q3*
lnOPCT	8.657013	1996Q2*
lnRGDP	469.1245	1994Q3*
lnTGCF	435.5848	1995Q2*
lnTRDP	314.1044	1989Q3*

Source: Authors' Compilation, 2016

* significant at 5% level

Unit Root Test under Structural Break.
The Zivot-Andrews Test is used to verify the stationarity status and thus the order of integration of the variables since they are all found to have a structural break.

Table 2: Unit Root Test (in presence of Structural Break) Summary

Variable name	Test Statistic	Break Location	p-value (5%)	Order of Integration
lnBMSY	-3.505311	C	0.018024	I(0)
lnCAVT	-3.577705	C	0.003455	I(0)
lnCUVT	-4.336124	B	0.0033848	I(0)
lnFEXR	-4.866211	C	0.002031	I(0)
lnGUGN	-7.388170	C	0.000000000886	I(0)
lnIMFC	-4.396762	C	0.003462	I(0)
lnNEXC	-4.549599	C	0.000000000000998	I(0)
lnOPCT	-0.801161	C	0.014089	I(0)
lnRGDP	-4.605573	C	0.005599	I(0)
lnTGCF	-4.592964	C	0.029178	I(0)
lnTRDP	-3.604204	C	0.031988	I(0)

Source: Authors' Computation, 2016
Break Location: A = Intercept; B = Trend; C = Both

A look at the Table 1 reveals that with the series being in their log form, they are all stationary in levels, thus the process of conducting the test for cointegration is forgone as estimation from these could be trusted for long-run purposes.

The table 3areveals that the independent variables are significant determinants of Reservesin the demand function in Nigeria, tested at the 5% level of significance.

Table 3a: Second Stage Estimation Results (Equation 3a)

Variable	Coefficient	Standard Error	z-value	p-value*
Constant	8.990568	0.5106882	17.60	0.000
$lnRGDP$	0.947424	0.0309106	30.65	0.000
$lnNEXC_1$	1.046525	0.0622361	16.82	0.000
$lnCAVT$	-0.3033914	0.1157212	-2.62	0.009
$lnCUVT$	1.100916	0.1140696	9.65	0.000
$lnOPCT$	-0.0544306	0.0156275	-3.48	0.000
$lnGUGN$	0.0142654	0.0054064	2.64	0.000
$lnIMFC$	0.9751125	0.0391373	24.92	0.000
$lnTRDP$	-0.414518	0.1645371	17.60	0.012

Source: Authors' Computation, 2016

* denotes rejection of the hypothesis at the 0.05 significance level

Table 3b: Second Stage Estimation Results (Equation 3b)

Variable	Coefficient	Standard Error	z-value	p-value*
Constant	6.160092	0.7175908	8.58	0.000
$lnFEXR$	-0.2089208	0.0367745	-5.68	0.000
$lnBMSY$	0.7516451	0.0670388	11.21	0.000
$lnTGCF_1$	0.3744468	0.0731104	5.12	0.000

Source: Authors' Computation, 2016

* denotes rejection of the hypothesis at the 0.05 significance level

The relationship between the economy's size and foreign exchange reserves shows that growth in reserves would increase by 0.947% for every 1% rise in Real GDP. Opportunity cost of holding reserves is negative as purported by Edwards (1986), but in contrast, the relationship is significant [at 5%], thus an improvement in the methodology applied by studies like Edwards (1985), Gosselin and Parent (2005), Abdullateef and Waheed (2010), Adam and Léonce (2007) in which the opportunity cost was insignificant though negative. Reserves would grow by 0.0143% if an account of short term debts from the reserves grows by 1%, thus explaining that for every increase in short term debts, Nigeria increases her reserves holding.

Nigeria also takes into cognisance, the need to grow Reserves on the premise of the fraction of Reserves used to account for the 3months threshold of imports, thus making the IMF's condition a significant factor in reserves accumulation. Finally, there is no complementarity in the nexus between Reserves and the economy's size, in that, percentage increase in the economy's size as accounted for by the Real GDP leads to percentage increase in the Reserves (Table 3a), but percentage increase in Reserves does not lead to percentage increase in Real GDP (Table 3b).

5. Policy Recommendations.

In the presence of structural breaks and unit root test under structural break as advocated by the tests above, it is recommended that the monetary authorities should review her exchange rate regime since the nominal exchange rate under the fixed exchange rate regime, is among the dominant factors responsible for reserves depletion. The implied contradiction and non-complementarity of the interdependency between Reserves and Real GDP explains that Nigeria's Reserve holdings are not optimal, and thus a conclusion that External Reserves are held in excess. The economy's size is robust enough to yield more Reserves, but the much Reserve holdings in turn shrinks the economy as evidenced in the negative sign of the lnFEXR coefficient in Table 3b, thus Reserve holdings need be shed to its optimal level in which the economy's size would boost Reserve holdings and Reserves holdings would in turn complementarily boost the economy's size. It is thus another recommendation of the research work that more of the Reserves be spent on improving the investment climate of the economy so as to grow the economy enough to beef up the deficit required to complement Reserve accrual which would enforce a balance between the economy's size and the stock of External Reserves held.

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