Journal of
Economics and Policy
Analysis

Volume 2 March '07 Number 1

Articles



A Publication of the Department of Economics, University of Lagos, Akoka, Lagos Nigeria

# JOURNAL OF ECONOMICS AND POLICY ANALYSIS (JEPA)

Volume 2, Number 1

March 2017

**Journal of Economics and Policy Analysis**

**Volume 2, Number 1, March 2017**

**ISSN: 2536-6874**

*A Publication of:*
**Department of Economics, University of Lagos, Akoka, Lagos**

**Printed by: LATMUS NIG. ENT.**
**08033505887**

**ISSN**: 2536-6874

**Publishers**
Department of Economics,
*University of Lagos, Akoka, Lagos*

## EDITORIAL BOARD



## EDITORIAL ADVISORY COMMITTEE

# Nigerian International Reserves and Nominal Official Exchange Rate Volatility

**Ernest S.O. Odior and Isaac C. Nwaogwugwu**
*Department of Economics, University of Lagos, Nigeria*

**Abstract**

*This study examined the long and short-run impact relationship between international reserves and nominal official exchange rate for the economy of Nigeria using annual time series data from 1980 to 2014. The study used the unit root test, cointegration test and an autoregressive distributed lag (ARDL) model to dilate econometrics long-run equilibrium of international reserves. The empirical evidence showed that one lagged value of official exchange rate was negatively associated with the Nigerian international reserves on the long run. Oil export was the major contributor to the Nigerian international reserves, while imports and external debts were the factors that inversely affected the reserves both in the long and short run. The study recommended that, to increase international reserve holding, it is essential to pursue and implement monetary policies that can considerably relax the binding constraint on the availability of foreign exchange, particularly for exporting firms; and that government should effectively control the volume of imports in order to minimize its import bill while also diversifying its exports in a bid to boost export earnings to enhance its foreign reserves.*

**Keywords**: Nigerian international reserves, exchange rates
**JEL Classification:** F31, F33, C22

## 1. Introduction

The last 20 years have witnessed a large increase in international reserve holdings by central banks in developing economies. Countries usually hold international reserves to have a favourable level of exchange rate, especially with a view to stabilizing it and removing possible volatility. It is essentially held in terms of marketable securities, among others. According to Archer and Halliday (1998), the reasons for holding international reserves include: exchange rate stability, exchange rate targeting, exchange market stability, creditworthy consciousness, provision of emergency fund, and having transactions safeguard. In the view of Akdogan (2010), most countries increased their quantum level of foreign exchange reserves after the financial crisis of the 1990s, because many of them gained considerable experience from the crisis that accumulation of large amounts of foreign exchange reserves is a good decision for

protecting a national economy.

Most of theories suggest that a country which has fixed or managed floating exchange rate system should have more reserves accumulation than a country with a freely flexible exchange rate system, because in fixed or manage floating exchange rate system, state banks interfere in international market for necessary arrangement to stabilize the exchange rate (Choi et al., 2004). Beaufort and Kapteyn (2001) have pointed out that the type of exchange rate system influences reserve demand. Frenkel (1981) found evidence that after the collapse of the Bretton Woods agreement, the move to floating exchange rates decreased the level of reserves. This follows the macroeconomic theory that in a fixed exchange rate scenario, market forces will act to change the real exchange rate. Therefore, the government will have to intervene to keep the nominal peg.

Many countries, especially in Asian and Latin America, have been holding large foreign exchange reserves. In making the case for a robust level of foreign reserves in Nigeria, the Central Bank of Nigeria (CBN) argued that China has over one trillion dollars in her foreign reserves, even though her population is very large (Soludo, 2006). Indeed, the People's Bank of China's Monetary Policy Report stated that foreign exchange reserve of China grew from US$172 billion in 2000 to US$ 3,388 billion in 2012, while the value for Nigeria, a developing country, was about US$11 billion in 2000 and US$47 billion in 2013 (IMF, 2013). Dooley et al. (2004) argued that the accumulation of foreign reserves can be seen as collateral, which is being used for attracting foreign investment. Such holding is also seen as a costly self-insurance strategy for smoothening the vulnerability impacts of domestic and foreign shocks and to intervene in the foreign exchange market.

In this regard, there has been a debate whether there is a need to beef up the level of a nations' foreign reserves or trim them back, and this debate is becoming more interesting, especially in developing countries like Nigeria. Some individuals, scholars and non-scholars alike, are of the opinion that keeping scarce resources in reserves when there is a series of issues to be attended to domestically, such as education and health, may not be a very wise decision (Osabuohien and Egwakhe, 2008). Nonetheless, some others have argued that the foreign reserve position determines the country's rating in the global market. In other words, these proponents hold the view that a robust level of foreign reserves will make the country appear financially responsible and creditworthy in the eyes of other countries, creditors and donors (Ford and Huang, 1994).

Having a floating exchange rate allows Nigeria to let its currency depreciate without using reserves immediately. Since there will be no intervention from the central bank to counteract currency depreciation, Nigeria will continue accumulating reserves due to other factors, such as the current account balance or its import activities, without regard to its currency depreciation. This hypothesis works under the assumption that Nigeria does not have a managed float, which would mean that it would only allow depreciations and appreciations of its currency up until a threshold level, determined by CBN officials. Thus, the current research was an attempt to answer the questions: is there a long and short-run relationship between international reserves and official exchange rate? What are the influences of other major control variables (eg, imports, oil export, etc) on international reserves? The aim of this study is to investigate the appropriateness or otherwise of using reserve volatility as an indicator of interventions, especially for Nigeria. The study was an attempt to understand whether such unprecedented levels of international reserves have a bearing on the exchange rates between 1980 and 2013 in Nigeria.

This report is organised in seven sections. Following this introductory section is that which gives the basic gamut of existing literature on the issue, both the theoretical and empirical. Section three is an overview of the Nigerian international reserves, while section four shows the theoretical framework and model specification. Section five is the model analytical framework and estimation techniques, while six presents the analysis of empirical results. Section seven provides the conclusion and policy implications of the study.

## 2. Literature Review

Muhammad (2013) modelled the relationship and causality link between foreign exchange reserves and exchange rate (nominal and real exchange rates) for Pakistan using annual data series from 1983 to 2009. He used cointegration analysis to point out that there was a long-run relationship between foreign exchange reserves and exchange rate. The study also examined causality relationship and found that the causality direction went from nominal effective exchange rate and real effective exchange rate towards foreign exchange reserves; meaning that in Pakistan, both nominal effective exchange rate and real effective exchange rate affected the foreign exchange reserves.

David and Yaaba (2012) used autoregressive distributed lag (ARDL) approach to run a slightly modified econometrics 'buffer stock model' of Frenkel and Jovanovic (1981) to estimate the determinants of foreign reserves in Nigeria with a focus on

income, monetary policy rate, imports and exchange rate. The results debunked the existence of buffer stock model for reserves accumulation and provided strong evidence in support of income as the major determinant of reserves holdings in Nigeria.

Kasman and Ayhan (2008) explored the association among foreign exchange reserves and exchange rate of Turkey and found that the variables have long-run relationship. On the causality link between foreign exchange reserves and exchange rate, they suggested that in the case of real effective exchange rate, the causality link was from foreign exchange reserves to real effective exchange rate in both long and short run; while in the case of nominal exchange rate, the long-run nominal exchange rate effected foreign exchange reserves. Edwards (1984) and Calvo and Reinhart (2002) observed that demand for foreign exchange reserves accumulation is higher in developing countries because of exchange rate fluctuation This means that in a country with experience of higher exchange rate fluctuation, the monetary authority intervenes in international market and uses the reserves stock to reduce the exchange rate fluctuation. This, therefore, suggests that there is a long-run inverse relationship between the two variables.

Prabheesh (2007) explored the demand for foreign exchange reserves using cointegration analysis. He found that foreign reserves demand is a function of exchange rate flexibility in the long run and suggested, therefore, that accumulation of international reserves is more highly responsive to capital accounts than opportunity cost. Narayan and Smyth (2006) studied the short and long-run correlation among real exchange rate, international reserves and interest rate differentials and exchange rate. They found that these variables have single correlation: real exchange rate effects positively on international reserves; interest rate differential also has positive effect but was statistically insignificant; and the short-run relationship between the variables was non-monotonic.

Ahmed and Pentecost (2006) studied the association between exchange rate and international reserves, and found that the variables have extensive association. Aizenman and Marion (2003) and Flood and Marion (2002) both studied the demand for foreign exchange reserves. They found that the instability of nominal effective exchange rate significantly reduces the level of international reserves, and suggested that greater exchange rate flexibility lowers reserves holding. In the same vein, Fukuda and Kon (2007) examined the macroeconomic impacts of accumulated foreign exchange reserves on developing countries and found that when governments increase their foreign reserves, their liquid and total debts increase also, while debt maturity

becomes shorter and foreign debt leads a permanent decline in consumption. Flood and Perraudin's (1998) study of reserves and exchange rate cycle suggested that there is an inverse correlation between reserves and exchange rate series.

Many other studies (Mayuresh et al., 2013; Prasad and Raju, 2010; Flood and Marion, 2002; Aizenman and Marion, 2003, among others) argued for an inverse relationship between nominal effective exchange rate and foreign reserves, and that the greater the exchange rate fluctuation, the lower the foreign reserves. This means that when the nominal effective exchange rate fluctuations increase, they significantly reduce the foreign reserves level because of intervention of central bank in international market for the necessary arrangement of exchange rate.

## 3. Overview of the Nigerian International Reserves

International reserves are variously called external reserves, foreign reserves or foreign exchange reserves. Over the past three decades, Nigeria has taken numerous policy initiatives and measures in the management of its external reserves. Although very little was achieved because the structure in place then could not support efficient reserves management, enduring lessons could be distilled from the nation's experience. Thus, since the 1970s, Nigeria has persistently depended on oil as the main source of foreign exchange earnings, with the attendant cycles of economic booms and bursts. From 1999, world oil prices began to rise again, resulting in another but better managed boom and unprecedented accumulation in the level of reserves from US$4.98 billion in May 1999 to US$59.37 billion in March 2007. One of the major reasons put forward by the CBN for foreign reserves accumulation is the need to make Nigeria more creditworthy; this is believed to be essential for attracting foreign capital (Hassan *et al.*, 2009). Nigeria has accumulated unprecedented foreign exchange reserves, compared to other SSA countries, and synchronously has been experiencing large depreciation in its naira, vis-à-vis the US dollar.

With the oil price increase in the global market as a source of huge foreign exchange earnings, Nigeria's foreign exchange reserves increased. The reserves grew robustly from US$27.3 billion in 2004 to US$51.5 billion in 2006 (CBN, 2006). As at March 2013, the reserves stood at 47 billion dollars; but this was inconsistent with the African trend of accumulating excessive foreign exchange reserves. Nigeria's external reserves have enjoyed a robust growth in recent times, peaking at $53.60 billion in 2008, when the international oil price peaked at $164 per barrel (World Bank, 2013). The country's external reserves continued to inch up by the day, even as threat of price

volatility of its main source, crude oil, was becoming palpable.

In March 2013, Nigeria's foreign reserves rose by 2.5% to $48.6 billion from the previous 2012 amount of $47.55 billion (NSSIEN, 2013 and WDI, 2012), making the country the twenty-fourth largest reserves holder in the world. This pace of reserves accumulation occurred without regard to its diminishing marginal benefits and rising marginal costs. According to Okonjo-Iweala (2014), when Nigeria's foreign reserves hit $50 billion, the country was declared as Africa's best investment destination. With a foreign reserve of nearly 50 billion dollars, a stable exchange rate, strong banking sector, massive human and natural resources, Nigeria indeed became one of the most attractive investment destinations in the world. Accordingly, CBN attempted to control the money supply, as well as achieve a balance between demand for and supply of foreign exchange through intervention (that is, offering to buy or sell foreign currency to banks) in the foreign exchange markets. When CBN sells foreign exchange to commercial banks, its level of reserves declines by the amount of the sale, while the domestic money supply (in naira) also declines by the naira equivalent of the sale. Conversely, when CBN purchases foreign exchange from the banks, its level of reserves increases, while it credits the accounts of the banks with the naira equivalent, thus increasing the domestic money supply.

Exchange rate policy in Nigeria over the years has been the shift from fixed exchange rate to the deregulation of structural adjustment programme (SAP) of 1986. Prior to this, the growth rates of macroeconomic variables were low. This was compounded following the collapse of oil price in the world market in 1978, which led to the deterioration of the domestic currency and the depletion of its reserves to finance accumulated deficit and attract nominal official exchange rate. The crises led not only to rapid reserve depletion but also to large amount of unexpected devaluation and a switch to more liberalized exchange rate regimes. The exchange rate started from a very low base of N0.5464 to $1 in 1980 and depreciated persistently to about N155 to $1 in 2012 (CBN, 2012, 2014).

## 4. Theoretical Framework and Model Specification

Various models have been developed to measure the determinants of foreign reserves. Heller (1966) theorized that reserve demand is essentially an inventory control problem. In other words, he predicted that reserves are buffer stock, which is accumulated in times of abundance and depleted in times of scarcity. His main hypothesis is that a country's holding of international reserves is negatively related to its marginal

propensity to import (MPI). He also included measures for the current account balance and exchange rate regimes in his study. Frenkel (1978), on the other hand, argued that MPI only measures an economy's openness to external shocks and, therefore, would be positively related to foreign currency reserves if the reserves were held as a precautionary measure. His model is that 'optimal reserve holdings would increase as the volatility of reserves increased.' His study demonstrated that volatility of reserves is indeed a robust predictor of foreign reserve holdings.

Building on this buffer-stock theory, a precautionary theory of international reserve demand has developed. The theory proposes that reserves are held as self-insurance against financial crisis. Mendoza (2004) viewed this precautionary theory as a 'natural extension of all previous theories.' Distayat (2001), while building on the theory, developed a reserve demand model 'compatible with the second generation financial crisis'. This theory proposes that reserves are held as self-insurance against financial crisis. However, the most widely used models in the literature is the 'buffer stock model,' which implies that the authorities demand reserves as a buffer to curb fluctuations in external payment imbalances. This is to avoid macroeconomic adjustment cost arising from imbalances in the external payments. The advantage of the model over others is its adaptability to both fixed and floating exchange regimes. The model is as relevant in a modern floating exchange regime as it was during the Bretton Woods regime.

In their study, Flood and Marion (2002) confirmed the applicability of the buffer stock model in the modern regime of floating exchange rate as it was during the Bretton era. They submitted that with greater exchange rate flexibility and financial openness, the model will perform better if these variables are well represented. Distayat and Mathieson (2001) adopted Frenkel and Jovanovic model for fifteen countries in Asia and Latin America and submitted that the volatility of exchange rate is an important determinant of reserves accumulation and that the financial crisis of the late 1990s produced no structural breaks. IMF (2003) standardized the buffer stock model and applied it on the emerging markets economies of Asia. The study concluded that reserves accumulations were driven by increases in current account and capital flow. Aizenman and Marion (2003) used the buffer stock model on sixty-four countries over the period 1980-1996 and found that the standard variables in the model explained about 70% of the movement in the observed reserves holding without country-fixed effects and 86% with country-fixed effects.

Ramachandran (2005) applied the buffer stock model for India, covering the period

April 1993– December 2003, which was characterized by flexible exchange rate, and high level of capital flows. He found that the standard measure of volatility defined as the fifteen years rolling standard deviation of change in trend adjusted reserves used by Frenkel and Jovanovic (1981) produced biased estimates; but when he adopted the GARCH approach, he found that the estimated coefficients were closer to the theoretical predictions. The buffer stock model of Frenkel and Jovanovic (1981) is given as:

$$dR(t) = \mu\, dt + \sigma\, dW(t) \qquad (1)$$

Where:
$Rt$ = reserves held in time t
$Wt$ = standard Weiner process with zero mean and variance t
$\mu$ = deterministic part of the instantaneous change in reserves
$\sigma$ = standard deviation of the Weiner increment in reserves

At each point in time, the distribution of reserves holdings $R(t)$ is characterized by:

$$(R(t) = R^{*} - \mu t + \sigma\, dw(t) \qquad (2)$$

*Where*: $R^{*}$ is the optimal stock of reserves, which is obtained by minimizing two types of costs viz: i) the cost of adjustment, which is incurred once reserves reach an undesirable lower bound; and ii) foregone earnings on reserves holdings.

The optimal stock of reserves is obtained by minimizing these two costs and it yields an expression:

$$R^{*} = \sqrt{\left[\frac{2c\sigma^{2}}{(2r\sigma^{2})0.5}\right]} \qquad (3)$$

*Where*:
$c$ = fixed cost of adjustment
$r$ = opportunity cost of holding reserves
$\sigma$ = standard deviation of change in reserves.

$$\log R_t = \beta_0 + \beta_1 \log \sigma_t + \beta_1 \log r_t + u_t \qquad (4)$$

*Where* $\mu_t$ is white noise

Equation 4 is considered the benchmark for reserves' determinant equation in most empirical studies. The theoretical prediction suggests $\beta 1 = 0.5$ and $\beta 2 = -$

0.25. Past studies, however, arrived at different results for the elasticities (Flood and Marion, 2002; Ramachandran, 2004). The differences in the results were attributed largely to the sensitivity of the model to different proxies for the opportunity cost of holding reserves, estimation methods and modification of the original model by adding new variables.

**Model specification**

With inferences to the buffer stock model of Frenkel and Jovanovic (1981) in our theoretical framework and following their empirical work, the long-run empirical model to dilate the relationship between international reserves and official exchange rate in Nigeria in this study, after modification of equations 2, 3 and 4, is expressed as:

$$INRV_t = \beta_0 + \beta_1 OEXR_t + \beta_2 IMT_t + \beta_3 OEXT_t + \beta_4 EXD_t + \beta_5 MPR_t + \beta_6 GDP_t + \mu_t \quad (5)$$

Where: INRV is the Total Foreign Exchange Reserves (Includes Gold). This is the total assets of the central bank held in different reserves currencies abroad. The reserves currencies include US dollar, pound sterling, euro, and Japanese yen. OEXR is the Official Exchange Rate; IMT is Imports; OEXT is Oil Export; Value is equal to the price per unit of quantity of oil exports multiplied by the number of quantity units (US dollars). EXD is the External Debt; MPR is the Monetary Policy Rate, which is the rate at which CBN lends to the deposit money banks (DMBs). The opportunity cost of holding reserves is proxy by monetary policy rate (MPR) in this case, since CBN, which manages reserves, has the duty of the lender of last resort. GDP is the Gross Domestic Product.

In order to reduce errors and improve the linearity of the model, log is introduced. The study got the natural logarithms of sequence INRV, IMT, OEXT, EXD and GDP, respectively LOGINRV, LOGIMT, LOGOEXT, LOGEXD and LOGGDP. Some of the independent variables included in the study were frequently considered as determinants of growth in cross-country studies.

$$LOGINRV_t = \beta_0 + \beta_1 OEXR_t + \beta_2 LOGIMT_t + \beta_3 LOGOEXT_t + \beta_4 LOGEXD_t + \beta_5 MPR_t + \beta_6 LOGGDP_t + \mu_t \quad (6)$$

The a-priori assumptions for the above model, based on equation 6 are: $\beta_1$ is ambiguous, $\beta_2 < 0$, $\beta_3 > 0$, $\beta_4 < 0$, $\beta_5 > 0$, $\beta_6 > 0$. Equations 6 was designed to measure the relationship between the dependent variable (foreign reserves) and independent variables. $\beta_s > 0$ implies a positive relationship between the dependent variable. This

implies that an increase in these independent variables will lead to an increase in the foreign reserves. $\beta,s>0$ means that there is a negative relationship between the dependent variable and independent variables. This means that an increase in the independent variables will lead to a decrease in the foreign reserves and vice-versa.

## 5. Analytical Framework and Estimation Techniques

The long-term behaviour of the variables proposes an intermediate estimator that allows the short-term parameters to differ in the short run while imposing equality of the long-term coefficients. The long-term movements of real effective exchange rate and other macroeconomic fundamentals are expected to be stable, but short-term movements are not expected to be stable within the period under review. The dynamic heterogeneous time series model is an unrestricted error correction autoregressive distributed lag (ARDL) $(p,q)$ representation (see Combes et al., 2011).

$$\Delta y_t = \phi_i y_{t-1} + \beta_i' x_{t-1} + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{t-j} + \sum_{j=0}^{q-1} \delta_{ij}' \Delta x_{t-j} + \varepsilon_t \qquad (7)$$

The time series are denoted by $t=1, 2, \ldots, T$ represents time period; $Y_t$ is the dependent variable; $x_t$ is the matrix of repressors$\phi_i$ is the coefficient on the lagged dependent variable; $\beta_i$ is the vector of coefficients on the explanatory variables; $\lambda_{ij}$ the coefficients on the lagged first-differences of the dependent variable; and $\delta_{ij}$ the coefficient on the first-differences of the explanatory variables and their lagged values. The disturbances, $\varepsilon_t$, are supposed to be normally distributed across $t$ with zero mean and variances $\sigma^2 > 0$.

With $\phi_i <0$, there is a long-term relationship between $y_t$ and $x_t$ and in the form:

$$y_t = \theta_i' x_t + \eta_t \qquad (8)$$

*Where:*

$\theta_i' = \frac{\beta_i'}{\phi_i}$ represents the long-term coefficient, and the error terms of the long-term relationship $(\eta_t)$ are stationary.

Considering the long-term relationship, equation 8 can be rewritten as;

$$\Delta y_t = \phi_i \eta_{t-1} + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{t-j} + \sum_{j=0}^{q-1} \delta_{ij} \Delta x_{t-j} + \varepsilon_t \qquad (9)$$

The error correction term, $\eta_{-1}$, is derived from the long-term equation 6, and the associated coefficient, $\phi_i$ measures the speed of adjustment to long-run. By allowing short-term coefficients, intercepts, and error variances in the time series and by constraining long-term coefficients to be identical $(\theta' = \theta)$, the mean estimator of the parameters with the maximum likelihood technique, the likelihood estimators is defined

as; $\hat{\phi}$, $\hat{\beta}_i$, $\hat{\lambda}_{ij}$, $\hat{\delta}_{ij}$ and $\hat{\theta}$.

In line with the above analytical framework, the estimation technique in this study was a four-step procedure. The first step was the unit root test, which involved the determination of the order of integration, using the ADF - Fisher chi-square test. The second aspect was to test for cointegration using the Engle-Granger single-equation cointegration test. The third was the estimation of long and short-run dynamic relationship impact between the dependent and independent variables over the sample period, using the vector error correction model (VECM). This error correction model produces best linear unbiased estimates. The parameter estimates obtained through this estimation technique are best because they are efficient (possess the smallest variance among all estimation techniques); they are unbiased because their expected values are equal to population parameters; and they are easy to compute. Assuming that all variables are *I(1)* and cointegrated, $v_{it}$ is *I(0)* for all *i* and is independently distributed across *t*. More specifically, with a maximum of one lag for all variables, the equilibrium error correction representation of the ARDL (1,1) model (after a modification of the above equations), used to justified the long-run and short run empirical analyses in this study, is given by the following relation:

$$\begin{aligned} D\log INRV_t = {} & \omega_i[\log INRV_{t-1} - \omega_0 - \omega_1 OEXR_t - \omega_2 \log IMT_t - \omega_3 \log OEXT_t - \omega_4 \log EXD_t \\ & - \omega_5 \log MPR_t - \omega_6 \log GDP_t] - \psi_1 DOEXR_t - \psi_2 D\log IMT_t - \psi_3 D\log OEXT_t \\ & - \psi_4 D\log EXD_t - \psi_5 DMPR_t - \psi_6 D\log GDP_t + u_t \end{aligned} \tag{10}$$

The coefficients of interest are both $\omega$ and $\psi$ for the long run and short-run error correction equilibrium model (ECEM), the first and second part of the analysis. The differential impact of each type of nominal official exchange rate on the INRV is also assessed. The data for this study were generated in line with the period covered by the study (1980-2014), a period of 35 years. This choice is predicated on the research method adopted and following the purpose and objectives of the study. The data used (such as international currency reserves and other variables) were obtained from the publications of the World Bank and the Central Bank of Nigeria on major economic indicators.

## 6. Analysis of Empirical Results

### Stationarity test

Table 1 presents the summary of the unit root tests on the REER and other fundamental variables; that is, the results of the intermediate Augmented Dickey-Fuller (ADF) tests

for the order of integration of the variables under investigation using the ADF - Fisher chi-square method. Although ARDL does not require pretesting of the data, the order of integration of all the data was determine before running the ARDL.

**Table 1: Stationarity test result**

| *Method* | | *Statistic* | *Prob.*** |
|---|---|---|---|
| ADF - Fisher Chi-square | | 71.018 | 0.0000 |
| ADF - Choi Z-stat | | -7.2124 | 0.0000 |
| T-bar critical values ***: | 1% level | -2.89800 | |
| | 5% level | -2.67900 | |
| | 10% level | -2.56900 | |

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results

| *Variable* | *1st Difference t-Stat* | *Probability* | *Order of integration* | *Maximum Lag* |
|---|---|---|---|---|
| D(LOGINRV) | -5.9581 | 0.0001 | I(1) | 1 |
| D(LOGOEXR) | -5.1279 | 0.0008 | I(1) | 1 |
| D(LOGIMT) | -7.3945 | 0.0000 | I(1) | 1 |
| D(LOGOEXT) | -7.0624 | 0.0000 | I(1) | 1 |
| D(LOGEXD) | -5.1346 | 0.0008 | I(1) | 1 |
| D(LOGMPR) | -7.0525 | 0.0000 | I(1) | 1 |
| D(LOGGDP) | -9.2616 | 0.0000 | I(1) | 1 |

*Source*: Author's computation

From data in table 1 confirmed that all variables were non-stationary and could be considered as integrated of order one, I(1), or that they were stationary at first difference by comparing their first difference t-static values with the various probabilities and the T-bar critical values. All the variables were statistically significant at 1%, 5% and 10% critical values in their first difference. This implies that all the series were non-stationary at levels. Therefore the null hypothesis ( $\rho = 1$) was accepted at levels; the null hypothesis ( $\rho = 1$) that the series are non-stationary after the first difference was rejected for all the series.

Maximum lags were set at 1 and lag length was determined by AIC. The correct lag length in the underlying ARDL was determined to be 1 lag. Since the variables were found to be integrated of the same order, the study proceeded to establish a cointegrating relationship among the variables.

**Engle-Granger single-equation cointegration test**

In the second step, the Engle-Granger **single-equation cointegration test was used to**

**confirm** the existence of a cointegrating vector and the results are reported in table 2. Looking at the test description, it was first confirmed that the test statistic was computed using constant and trend as deterministic repressors, and noted that the choice to include a single lagged difference in the ADF regression was determined using automatic lag selection with a Schwarz criterion and a maximum lag of 1.

**Table 2: Engle-Granger cointegration test results**

| *Dependent* | *tau-statistic* | *Prob.** | *z-statistic* | *Prob.** |
|---|---|---|---|---|
| LOGINRV | -5.594014 | 0.0603 | -33.24348 | 0.0723 |
| OEXR | -3.737518 | 0.5702 | -23.16570 | 0.4449 |
| LOGIMT | -4.295244 | 0.3364 | -33.20972 | 0.0728 |
| LOGOEXT | -5.903321 | 0.0542 | -36.68673 | 0.0280 |
| LOGEXD | -4.761965 | 0.1851 | -30.68611 | 0.1280 |
| MPR | -5.183911 | 0.0814 | -59.68006 | 0.0000 |
| LOGGDP | -6.215316 | 0.0162 | -39.49085 | 0.0127 |

*MacKinnon (1996) p-values.

*Intermediate Results*

| | LOGINRV | OEXR | LOGIMT | LOGOEXT | LOGEXD | MPR | LOGGDP |
|---|---|---|---|---|---|---|---|
| Rho - 1 | -0.736183 | -0.626534 | -0.803926 | -1.081621 | -0.791074 | -1.325025 | -1.091285 |
| Rho S.E. | 0.169775 | 0.167634 | 0.187167 | 0.220589 | 0.166123 | 0.255603 | 0.175580 |
| Residual variance | 0.169580 | 260.8678 | 0.046227 | 0.037524 | 0.469077 | 5.831464 | 0.162746 |
| Long-run residual variance | 0.169580 | 260.8678 | 0.091178 | 0.082036 | 0.469077 | 11.45180 | 0.162746 |
| No of lags | 0 | 0 | 1 | 1 | 0 | 1 | 0 |
| No. of observations | 33 | 33 | 32 | 32 | 33 | 32 | 33 |
| No of stochastic trends** | 7 | 7 | 7 | 7 | 7 | 7 | 7 |

**Number of stochastic trends in asymptotic distribution

*Source*: Author's computation

As to the tests themselves, the Engle-Granger t-statistic and normalized auto-correlation coefficient (termed z-statistic) both rejected the null hypothesis of no cointegration (unit root in the residuals) at the 5% significance level. The probability values were derived from the MacKinnon response surface simulation results. Given the small sample size of the probabilities and critical values, there was evidence of four cointegrating equations at the 5% level of significance, using t-statistic; and evidence of six cointegrating equations at the 5% level of significance, using the z-statistic. This implies that they

both rejected the null hypothesis of no cointegration among the variables at the 10% level of significance. On balance, using the t-statistic, the evidence suggests that LOGINRV, LOGOEXT, MPR and LOGGDP were cointegrated, while LOGINRV, LOGIMT, LOGOEXT, MPR and LOGGDP were cointegrated using the z-statistic. Thus, there existed long-run relationship or cointegration between international reserves and some of its determinants.

The middle section of the output of table 2 displays intermediate results used in constructing the test statistic that may be of interest. First, the 'Rho SE' and 'Residual variance' are the (possibly) degree of freedom of corrected coefficient standard error and the squared standard error of the regression. Next, the 'Long-run residual variance' is the estimate of the long-run variance of the residual, based on the estimated parametric model. The estimator was obtained by taking the residual variance and dividing it by the square of 1 minus the sum of the lag difference coefficients. The residual variance and long-run variances were used to obtain the denominator of the z-statistic. Lastly, the 'number of stochastic trends' entry reports the value used to obtain the p-values.

**Long-run steady-state analysis**

The next step after establishing the cointegration is the estimation of long-run coefficients by estimating the ARDL model in equation 8. This procedure began with an autoregressive distributed lag (ARDL) specification of an appropriate lag. The consideration of available degrees of freedom and type of data determined the decision on lag length. With annual data, one lag would be long enough. Under this ECM procedure, the long-run relationship was embedded within the dynamic specification. The long-run properties or steady-state long-run relationship between INRV and OEXR, IMT, OEXT, EXD, MPR and GDP could be derived or solved from the estimations in table 3.

The coefficient of the equilibrium correction term (ECT) was significant, confirming that a long-run (cointegrating) relationship existed between the logarithm of real exchange rate and the set of explanatory variables. The size of this coefficient implies that adjustment to disequilibria via the equilibrium correction term (ECT) (-0.50) was relatively quick, as 50% of a disequilibrium in a given year was corrected in the following year. The ECM appeared reasonably well specified, judging from the behaviour of the fitted and actual values of the corresponding residuals between the logarithm of the international reserves and official exchange rate (shown in figures 1a

and 1b, respectively).

**Table 3: Long-run coefficient estimates and ECM of ARDL model**

| *Dependent Variable: LOGINRV* | | | |
|---|---|---|---|
| *Variable* | *Coefficient* | *Std. Error* | *t-Statistic* |
| ECM(-1)1/ | -0.502415 | 0.222056 | -2.262565 |
| constant | 11.24736 | | |
| OEXR(-1) | -0.808515 | 0.43563 | -1.85596 |
| LOGIMT(-1) | - 0.344807 | 0.17073 | -2.01956 |
| LOGOEXT(-1) | 0.870952 | 0.37282 | 2.33611 |
| LOGEXD(-1) | -0.523718 | 0.17718 | -2.95585 |
| MPR(-1) | 0.168654 | 0.14710 | 1.14624 |
| LOGGDP(-1) | 0.238405 | 0.09437 | 2.52627 |
| D(LOGINRV(-1)) | 0.371324 | 0.473083 | 0.784901 |
| D(LOGINRV(-2)) | 0.072421 | 0.572471 | 0.126505 |
| D(OEXR(-1)) | 0.002486 | 0.012093 | 0.205554 |
| D(OEXR(-2)) | -0.004900 | 0.011416 | -0.429248 |
| D(LOGIMT(-1)) | -1.286748 | 0.435572 | -2.954160 |
| D(LOGIMT(-2)) | -0.992107 | 0.410521 | -2.416702 |
| D(LOGOEXT(-1)) | 1.358189 | 0.456052 | 2.978146 |
| D(LOGOEXT(-2)) | 0.974263 | 0.398550 | 2.444518 |
| D(LOGEXD(-1)) | -0.270100 | 0.205956 | -1.311445 |
| D(LOGEXD(-2)) | -0.211967 | 0.388358 | -0.545803 |
| D(MPR(-1)) | 0.067883 | 0.034176 | 1.986292 |
| D(MPR(-2)) | 0.012630 | 0.035149 | 0.359315 |
| D(LOGGDP(-1)) | 0.117259 | 0.191262 | 0.613080 |
| D(LOGGDP(-2)) | -0.035881 | 0.167207 | -0.214592 |
| constant | 0.381401 | 0.125546 | 3.037936 |
| Adjusted R-squared | 0.731300 | | |
| Durbin-Watson stat | 1.996985 | | |

*Source*: Author's Computation

Table 3 presents data on the long-run coefficients, with their standard errors and *t*-values extracted from the estimated ECM. With cointegration analysis, the potential endogeneity between international reserves and official exchange rate and other fundamentals did not affect the long-run coefficients. This regression result indicates conformity with certain theories, such as the buffer stock model of Frenkel and Jovanovic (1981). First, the estimations present the long-run impact of aggregated official exchange rate on international reserves. The results show that official exchange rate was negatively associated with the international reserves. The one period lag value of official exchange rate had a negative impact on international reserves. The estimated

coefficient of OEXR (-0.809) which has the expected sign, indicated that a once-and-for-all unit increase in the rate of annually official exchange rate to annually international reserves will cause a long-run reduction of the international reserves of about 0.81% when measured by the true value. In other words, a one percentage point increase in the ratio of official exchange rate implies a 0.81% decrease of the international reserves, which was statistically higher at -1.856. This implies that a depreciation (a rise in official exchange rate) in naira (against the dollar) in a particular period would reduce the international reserves in another period. A rise in the official exchange (fluctuation) rate is associated with a dollar appreciation and reduction in Nigeria's international reserves.

With respect to other fundamental variables that determine the behaviour of the Nigeria international reserves, the results show that regression coefficient of LOGIMT was -0.3448, which implies that 34.48% of the decrease in international reserves (INRV) in the long run was accounted for by a 100% increase in imports. This result corroborates the fact that imports is vital to Nigeria's external reserves and its availability, to some extent, determines the availability of other factors. One other important variable estimated in this model was oil export. The estimated regression shows that oil export (OEXT) had high positive relationship with Nigeria's international reserves. The regression coefficient of OEXT was 0.870952, which implies that 87.10% of the increase in the long run is accounted for by a 100% increase in oil export. This also means that the relationship between international reserves and oil export was positive and statistically significant; hence, oil export was the major contributor to Nigeria's international reserves.

The data in table 3 also show that excess external debt growth was associated with the reduction in the international reserves in the long run, with an elasticity of 0.52. Thus, there was an inverse relationship between external debt and Nigeria's international reserves, while the increases in the monetary policy rate and GDP, with an elasticity of 0.17 and 0.24 respectively, were associated with increases in the country's international reserves in the long-run. Although MPR was positively related to reserves, it was not significant. This is consistent with most empirical studies on the determinants of reserves. The non-significant relationship provides evidence in support of opportunity cost of reserves holding in Nigeria. A decline in MPR in any proceeding period will induce deposit money banks to borrow more from the CBN, hence restraining CBN from building more reserves. MPR elasticity, which is the measure of opportunity cost, was found to be 0.168654 in the long run. This result supports those of

other scholars, such as Ben-Bassat and Gottlieb (1992), that MPR can take positive sign. The result also showed a positive relationship between nominal GDP and Nigerian international reserves; hence, establishing a direct relationship between GDP and the country's international reserves.

The variables in equation 8 explained fairly well the stochastic behaviour trend of international reserves and official exchange rate. Figures 1a and 1b, which plot the corresponding residuals for the period 1980 -2014, showed the stochastic response of international reserves to changes in official exchange rate and other fundamentals. Figure 1b witnessed real stochastic trend in the official exchange rate from 1980 to 2014. Figure 1a revealed the inconsistence that characterized the Nigerian international reserves residual trend as a result of the changes in the fundamentals. Nigeria's foreign external reserve, in its naira equivalent, was N5813.14m, N1690.86, N46356.83, N37405.83, N1031206.26, N3783639.74, N7488845.21, N6685764.01, and N5752572.5 in 1985, 1985, 1990, 1995, 2000, 2005, 2012, 2013 and 2014 respectively. Figure 1a shows the stochastic trend of Nigeria's foreign reserves from 1980 to 2014. The trend shows that its foreign external reserves was on the increase from 1994 to 2012, but had a sharp drop in 2010.

Figure 1b shows the residual trend of official exchange rates derived from the fluctuation of this variable, from 1980 to 2014. From 0.5464 in 1980, it rose to 8.0378 in 1990, and further to 102.9702 in 2000. It rose further to 128.65 in 2006, 150.30 in 2010 and to 168.00 in 2014. This has implication for the rate of growth of inflation, for the fact that the variables witnessed a shape increase between 1999 and 2009.

Fig 1a: Stochastic Trend of LOGINRV

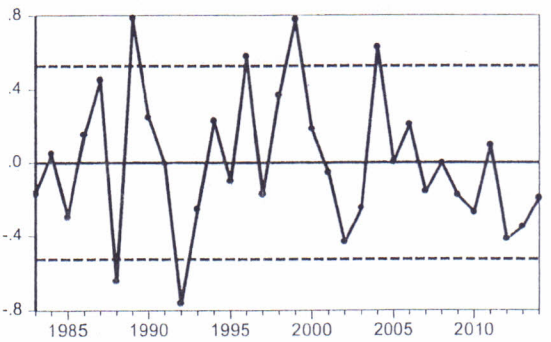
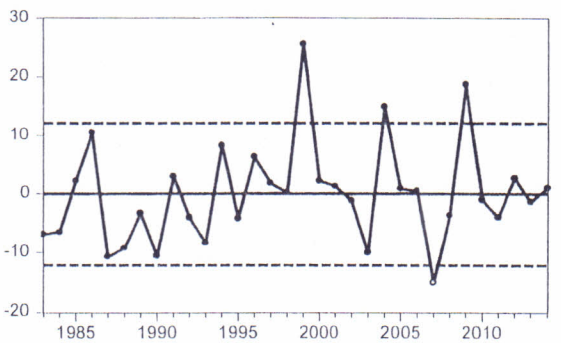



Fig 1b: Stochastic Trend of OEXR




**Equilibrium-correction single-equation model**

The short-run properties of this model can be derived from the estimated ECM result in table 3. The data in table 3 are from **the** regression estimate of equation 8 in the context of equilibrium error-correction representation of the autoregre-ssive distributed lag

model. Given the cointegration, movement in the international reserve is estimated using an error correction model, because the estimation of international reserves model largely takes place during a period in which there are large real fluctuations in the official exchange rate, introduction of structural reforms, and a change in the exchange rate regime. Therefore, there must also be an error correction model (ECM) that describes the short-run dynamics or adjustment of the cointegrated variables towards their equilibrium values. Although the model estimated here is often called an error correction model, it is an equilibrium correction model, technically speaking.

The ECM estimation implies that the first and second difference of INRV is regressed on explanatory variables. The error correction term can be used to determine the speed of adjustment of the deviation of international reserves from its equilibrium. As already mentioned, the coefficient of the lagged error term or equilibrium error correction model (ECM) was negative (-0.50) and highly significant, confirming that a long-run cointegrating relationship existed between the logarithm of international reserves and the set of explanatory variables. The implication of this is that it took about a year to eliminate 50% of deviation between the actual and equilibrium international reserves as determined by the fundamentals. It is also shown that the international reserves were quick to adjust back to equilibrium, implying policy effectiveness or flexibility.

The result of the error correction model shows that most of the variables were not significant in the short term, except for imports and oil export. The result of ECM shows that the first period lag value of official exchange rate had a positive impact on the Nigerian international reserves, as against the long-run value, while the second period lag value of official exchange rate had negative impact on the reserves in line with the long-run value. This implies that an average change in Nigeria's official exchange rate to a dollar in a particular year increase/decrease the international reserves the following year in the short run. Also, the result of the error correction model shows that an increase in imports and external debt would lead to a reduction in the nation's international reserves in the short run, both in the first and second period lag values, while only in the second lag value of GDP. Oil export and monetary policy rate, as well as first lag value of GDP were associated with real short-run increases of international reserves; although, some are not statistically significant. The result indicates that the long-run overall model was well fitted, as the independent variables explained over 73% adjusted squared

**Table 4: ARDL residual diagnostic test results**

| *Residual normality tests* *Orthogonalization: Residual covariance* *Test* | *t-stat* | *p-valve* |
|---|---|---|
| VEC residual serial correlation LM Tests | 36.66908 | 0.4377 |
| Normality (Jarque-Bera*statistic)* Joint | 3.195805 | 0.8584 |
| Skewness test ($\chi^2$) Joint | 0.768371 | 0.5826 |
| Kurtosis ($\chi^2$) Joint | 2.812179 | 0.8283 |
| VEC Residual White heteroscedasticity test | 19.50749 | 0.7316 |

*Source:* Author's Computation

## 7. Conclusion and Policy Implications

This study examined the relationship between international reserves and official exchange rate for the economy of Nigeria. It employed econometric tools to analyse time series data sourced mainly from CBN Statistical Bulletin and World Bank website (1980–2014). This study employed the techniques of unit root test, cointegration and equilibrium error correction model representation of ARDL in estimating the effect of official exchange rate and its macroeconomic fundamentals on the Nigerian international reserves. The results showed that, on the long run, the one lag value of official exchange rate were negatively associated with the reserves on the long run. This implies that an average change in official exchange rate in Nigeria in a particular year reduced the international reserves in the following year. With respect to the macroeconomic fundamentals, the results showed that, on the long run, the estimated coefficient of imports and external debt had the expected signs and that they both had decreasing influence on the Nigerian international reserves.

Levels of oil export, monetary policy rate and GDP were found to exhibit positive impact on the Nigerian international reserves. Oil export, especially, exhibited very high positive influence on the international reserves, supporting the self-insurance theoretical base of foreign reserves in oil-producing countries. But imports and external debt had very strong negative relationship with foreign reserves, which tends to contradict the accumulation of reserves agenda of CBN. The results revealed that export receipts and export earnings had a positive and statistically significant relationship with reserves in the short run. While the one period lagged value of international reserve accounted for positive changes in actual reserve holding, positive oil price shocks had positive effect on reserves holding, and import had negative and statistically significant effect. This may be attributed to Nigeria's high import bill financing, which has led to persistent reserve depletion. The result provided strong evidence for the long-run

relationship among the determinants of international reserves in Nigeria. It debunked the existence of buffer stock model for reserves accumulation and provided strong evidence in support of oil export as a major determinant of reserves management in Nigeria.

As said earlier, international reserves provide a fall back for the rainy day when economies of nations sometimes experience a drop in revenue and would need cushioning through savings as lifeline. A good international reserves position would readily provide this cushion and facilitate the recovery of such economies. The view has predictions for the behaviour of official exchange rate fluctuation that are consistent with the data. Oil export turns out to be the most important factor determining Nigeria's foreign exchange reserves. The empirical estimates showed that long-run oil export is elastic with respect to official exchange rate and inelastic for oil export and foreign reserves. This implies that volume of oil export would grow faster than official exchange rate in significantly influencing Nigeria's international reserves, both in the short and long run. But the economic impact of such influence is relatively larger in particular to the size of estimated official exchange rate coefficients. Also, imports and external debt constitute an important determinant of international reserves accumulation. Reserves accumulation, in this study, was associated with currency depreciation. Also, during crisis, the central bank uses reserves to fight depreciation. The study observed the two in its use of data.

Going by different theories, one would have expected that reserve holdings would be low in a freely floating exchange rate regime. But the increasing frequent financial crisis and exchange rate uncertainty has made emerging countries to build their reserves. The implication of the findings of this study is that increase in reserve holdings would serve as a complementary tool for domestic monetary authorities to stabilize the exchange rate, especially in a dollarized economy like Nigeria. Based on the findings and conclusion, therefore, it is recommended that:

i. To increase its reserves holding, Nigeria should pursue and implement monetary policies that can considerably relax the binding constraint on the availability of foreign exchange, particularly for exporting firms.
ii. Government should effectively control the volume of imports in order to minimise its import bill while also diversifying its economy to boost export earnings.
iii. The CBN should continue to manage the exchange rate regime, as the study has revealed that estimates of opportunity cost variable via the interest rate mechanism is sensitive to reserves, as well as the fact that exchange rate fluctuations affect

external reserves.

iv. Keeping high level of external demand for domestically produced good would definitely lead to inflationary pressures. Thus, CBN should keep depreciating the nation's nominal exchange rate, which requires further reserve accumulation in an unending process.

v. To prevent high inflation rates, CBN should sterilize its foreign exchange market interventions, which could be very costly. This would help export-led strategy to go beyond exchange rate undervaluation.

References

Ahmed, A. and Pentecost, N. (2006). Exchange rate and international reserves: A threshold cointegration analysis. *Economics Letters*: 1-81.

Aizenman, O. and Marion N.P. (2003). The high demand for international reserves in the Far East: What is going on? *Journal of the Japanese and International Economies*, 17: 370-400.

Akdogan S. (2010). Foreign exchange reserves demand: An information value approach. *Central Bank Review*, 10: 33-44.

Archer, D. and Halliday, J. (1998). Rationale for holding foreign currency reserves. *Reserve Bank of New Zealand Bulletin*, 61(4): 346–54.

Beaufort O. and Kapteyn P. (2001). Reserve adequacy in emerging market economies. Working Paper, International Monetary Fund.

Ben-Bassat, A. and Gottlieb D. (1992). Optimal international reserves and sovereign risk. Journal of International Economics

Calvo, G.A. and Reinhart C.M. (2002). Fear of floating. *Quarterly Journal of Economics*, 117(2).

Central Bank of Nigeria (2011). Statistical Bulletin, Vol. 21, Abuja.

Central Bank of Nigeria (2012). Statistical Bulletin, Vol. 22, Abuja.

Central Bank of Nigeria (2013). Reserves management. Assessed from www.cenbank.org on 19/3/2013.

Central Bank of Nigeria (2014). Statistical Bulletin, Vol. 24, Abuja.

Choi F. and Gwan B. (2004). Exchange rate regimes and international reserves. *International Research Journal of Finance and Economics*, 1-28.

David, I. and Baba N.Y (2001). Determinants of foreign reserves in Nigeria: An autoregressive distributed lag approach. *CBN Journal of Applied Statistics* 2(2).

Disyatat, P. and Mathieson D. (2001). Currency crises and the demand for foreign reserves. *Mimeo.*

Edwards, D. (1984). The demand for international reserves and monetary disequilibrium: Some evidence from developing countries. *Review of Economics and Statistics*, 66: 496-500.

Engle W. and Granger C. (1987). Cointegration and error correction: Representation estimation and testing. *Econometrica,* pp.251-276.

Flood R.P. and Marion N.P. (2002). Holding international reserves in an era of high capital mobility. IMF working paper, 2(62).

Flood R.P. and Perraudin J. (1998). Reserves and exchange rate cycle. *Journal of International Economics*. 46: 31-59.

Flood, R.P. and Marion, N.P. (2002). International reserves in an era of high capital mobility. IMF Working Paper No. WP/02/62. Washington DC.

Ford, J.L. and Huang, G. (1994). The demand for international reserves in China: An ECM model with domestic monetary disequilibrium. *Economica*, 67: 379-97.

Frankel, J.A. (1978). The demand for international reserves under pegged and flexible exchange regimes and aspects of the economics of managed float. *NBER Working Paper No. 287.*

Frenkel, J.A. (1978). International reserves under pegged exchange rates and managed float: corrections and extensions. *Journal of Monetary Economics,* 6(2): 295-302.

Frenkel, J.A. and Jovanovic B. (1981). Optimal international reserves. *Economic Journal* 91(362): 507-14.

Fukuda G. and Kon A. (2007). Macroeconomic Impact of Foreign exchange reserves accumulation: A theory and some international evidence. *Journal of Economic Modeling*, 2: 75-90.

Hassan, I., Wachtel P. and Zhou M. (2009). Institutional development, financial deepening and economic growth: Evidence from China. *Journal of Banking and Finance*, 33: 157–70.

Heller, R. (1966). Optimal international reserves. *Economic Journal,* 76(302).

IMF (2000). Debt and reserves-related indicators of external vulnerability. Presented by the Policy Development and Review Department, March. IMF.

IMF (2001). Guidelines for Foreign Exchange Reserves Management, International Monetary Fund, September.

IMF (2013). Annual Report. Available at www.imf.org/external/2013.

Kasman K. and Ayhan B. (2008). Foreign exchange reserves and exchange rate in Turkey: Structural breaks, unit roots and cointegration. *Journal of Economic Modelling*, 25: 83-92.

Mayuresh S.G. and Ramana R.J.V. (2013). Causality between exchange rate and foreign exchange reserves in the Indian. *Global Journal of Management and Business Research Finance* 13(7).

Mendoza, S. (2004). International reserves holding in the developing world: Self-insurance in a

crisis-prone era? *Emerging Market Review*, 5: 61-82.

Muhammad, T.K. (2013). Exchange rate as a determinant of fluctuation in foreign exchange reserves: Evidence from economy of Pakistan. *Social Sciences and Humanities*.

Narayan D. and Smyth K. (2006). the dynamic relationship between real exchange rate, real interest rate and foreign exchange reserves: Empirical evidence from China. *Applied Financial Economics*, 16: 639-651.

Okonjo-Iweala N. (2014). External reserves now $50b in Nigeria. *The Vanguard,* Wednesday February 26th.

Osabuohien, E.S.C. and Egwakhe A.J. (2008). External reserves and the Nigerian economy: The dual folded debate. *African Journal of Business and Economic Research*, 3(2): 28–41.

Prabheesh H. (2007). Demand for foreign exchange reserves in India: A cointegration approach. *South Asian Journal of Management*, 14: 36-46.

Prasad W. and Raju G. (2010). Foreign exchange reserves management in India: Accumulation and utilization. *Global Journal of Finance and Management*, 2:295-306.

Ramachandran, M. (2005). High capital mobility and precautionary demand for international reserves. *Journal of Quantitative Economics*, July.

Soludo, C.C. (2006). Can Nigeria be the China of Africa? Lecture delivered at the Founders' Day of the University of Benin, Nigeria, 23 November.