



## Exchange Rate Instability and Nigerian Foreign Exchange Reserves (1993 – 2016): Short Run and Long Run Analyses

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### Abstract

This study examined exchange rate instability and the Nigerian foreign exchange reserves. The effort to regularise the instability in the exchange rate market has resulted in adverse pressure on the Nigerian foreign exchange reserves. The study ascertains the short run and long run analyses of exchange rate instability on the Nigerian foreign exchange reserves. Data were obtained from the Central Bank of Nigeria Statistical Bulletin and World Bank data base for a period of 24 years: 1993 to 2016. The ex post facto research design was applied using the simple time series econometric technique to perform the diagnostic tests and inferential analyses of the data. The model was estimated using the descriptive statistics, Augmented Dickey-Fuller (ADF) unit root test, Johansen co-integration test, Error Correction Mechanism (ECM) and the Ordinary Least-Squares (OLS). The study establishes that exchange rate instability has inconsequential influence on the Nigerian foreign exchange reserves at the short-run and long-run which has not been the main depleting factor of the foreign reserves. Thus, the significant depletion in the Nigerian foreign exchange reserves was induced by other factors. This study recommends among others that the Nigeria government should enact Policy that would control the standard and limit of foreign travels for government officials, including the presidency.

**Key words:** Exchange Rate, Instability, Nigerian Foreign Exchange

**JEL Classification:** F31, N17, O16

**Paper Classification:** Research Paper

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### Introduction

Developed, developing and emerging economies were more conscious about the stability of their exchange rates following the collapse of the Bretton Woods system of fixed exchange rates. The introduction of flexible exchange rates in the 1970s, motivated most countries to accrue sufficient level of external reserves in order to protect their economies against currency crisis. Some developing and emerging economies with floating exchange rates may possibly be resistant to currency crisis. This is due to the possibilities of market adjustments as determined by the interactions of supply and demand for currency compared to fixed exchange rate regimes with higher exposure to currency crisis. The Fixed exchange rate is usually set by the government as the official exchange rate which does not automatically adjust to changes in supply and demand.

Thus, some researchers have attempted to investigate the relationship between exchange rate and external reserves (Ahmad & Pentecost, 2009; Ghosh, Ostry, & Tsangarides, 2010; Reuven & Hutchison, 2011; Calvo & Reinhart, 2002; Inyama & Ikechukwu, 2015; Akinwunmi & Adekoya, 2016). In attempt to regulate the Naira at the foreign exchange market, a drop in the Nigeria foreign reserves was observed which was in nexus to the severe and continuous exchange rate instability (Stober, 2016; Uguru, 2015; Okonjo-Iweala, 2009) considering, the instability in exchange rate as well as the depletion in the Nigerian foreign reserves between 1993 and 2016. Thus, this study attempted to empirically establish if there is any relationship between exchange rate instability and the Nigeria foreign reserves depletion. The study hypothesized that exchange rate instability has no short run and long run relationship with the Nigerian foreign reserves.

## Literature Review

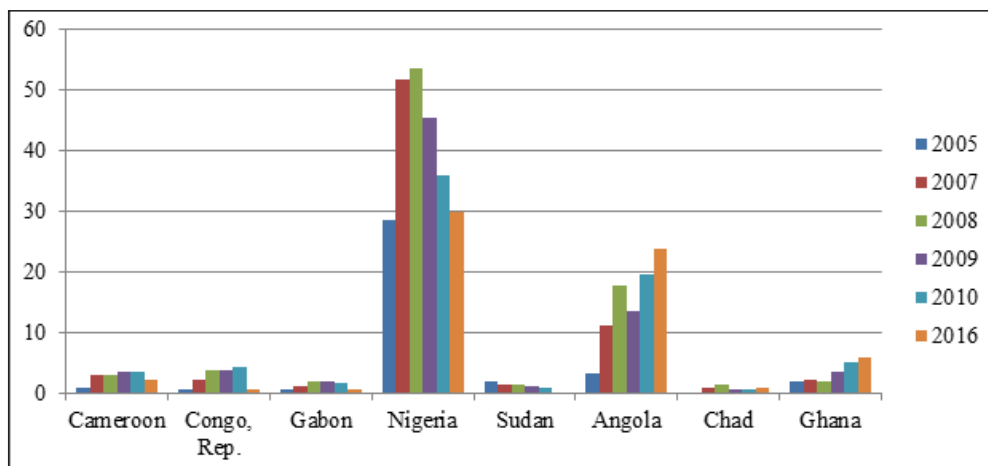
### Conceptual Review

#### Exchange Rate

Exchange rate refers to the price of one country's currency expressed in terms of some other currencies which is influenced by interest rate, inflation, or political condition of a country. It involves the relative prices of domestic and foreign goods, as well as the strength of external sector contribution in the international trade. In most monetary policy regimes, exchange rate is used as policy instrument to achieve low inflation rate and to stabilize the economy. The fixed exchange rate is usually set by the government (Central Banks) as the official exchange rate which does not automatically adjust to changes in supply and demand, while the floating exchange rate is determined by the interactions of supply and demand for currency (Obansa, Okoroafor, Aluko & Millicent, 2013; Inyama & Ikechukwu, 2015). In support, Ogundipe and Ogundipe (2013) referred to the exchange rate as the price of a country currency expressed in terms of one unit of another country's currency. Exchange rates are quoted in values against the United States dollar. Besides, exchange rates can be quoted against another nations currency, which are known as Cross Currency, or Cross Rate. Uguru (2015) categorised exchange rates as Nominal and Real Exchange rates. The Nominal Exchange rate measures the relative price of two currencies while the real exchange rate which may appreciate or depreciate measures the relative price of two commodities. Exchange rates serve sustainable competitiveness in international market, and a nominal pivot for domestic prices. Global economies became more conscious about the stability of their exchange rates following the collapse of the Bretton Woods system of fixed exchange rates in the early 1970s. Ahmad and Pentecost (2009) attributed the introduction of flexible exchange rates in the 1970s as a motivation for most countries to accumulate the adequate level of external reserves in order to protect their economies from currency crises. Countries with floating exchange rates could be more resistant to currency crises because there are tendencies for continuous market adjustment, when compared to Fixed Exchange Rate regimes with greater vulnerability to financial crisis (debt crises, sudden stops in capital inflows, and banking crisis) for developing and emerging market economies with more open capital accounts (Ghosh, Ostry, & Tsangarides, 2010; Reuven & Hutchison, 2011). Contrarily, Calvo and Reinhart (2002) opined that most countries purportedly with floating exchange rates experienced currency crises. This may be attributable to the fact that countries are reluctant to allow their currencies to float due to the fear of floating behaviour. Calvo and Reinhart (2002) stated that developing countries believed to always focus on maintaining exchange rate instability at the detriment of external reserves fluctuations, such that countries relatively intervene to maintain stability in the foreign exchange market using their stock of external reserves.

## Foreign Exchange Reserves

Foreign reserves otherwise known as International Reserves, External Reserves, Foreign Exchange reserves or Foreign Deposits are classified as Public External Assets. It is referred to as official public assets in foreign accounts, usually kept in foreign banknotes - US Dollar, British Pound Sterling, Euro and Japanese Yen. Foreign reserves can also be kept in treasury bills (foreign), short and long-term foreign government securities, gold reserves and special drawing rights. Foreign reserves are controlled by monetary authorities and are always made available for direct financing of international payment obligations, exchange rate management and as a buffer against external shocks (Imarhiagbe, 2015; Osuji, 2015; Akinwunmi & Adekoya, 2016). External reserves have necessitated external sector developments such as international trade transactions, exchange rate, external debt and other related external obligations. It forms the means for holding Sovereign Wealth Fund. Reserve holdings are means to measure a country’s credit ratings and credit worthiness as a form of shock absorber in periods of financial shocks (Umeora, 2013; Osuji & Ebiringa, 2012). For instance, the Nigerian Central Bank holds external reserves for the purpose of exchange rate stability, exchange rate targeting, creditworthy consciousness, provision of emergency fund, and as a buffer to meet unexpected capital outflows (Archer & Halliday, 1998). Nzotta (2004) opined that foreign reserves come about when foreign exchange receipts exceed foreign exchange disbursement. It represents the balance of foreign exchange surpluses of a nation’s accumulated reserves over a period of time. The foreign reserves for some selected Sub-Sahara African Countries between 2005 and 2016 are shown in Figure 1. It is observed that Nigeria and Angola maintained the highest and higher reserves respectively during this period (IMF, 2017).



Source: IMF (2017), foreign reserves for selected sub-Sahara African countries.

Figure 1: Foreign Exchange Reserves – Selected Sub-Sahara African Countries

## Theoretical Review

This study anchored on the financial instability hypothesis. This theory was developed by Hyman Minsky in the 1960s after the Second World War. Minsky hypothesis is an explicit model which considered an economy with stable financing regimes and unstable financing regimes. Minsky’s apparently stipulates that an economy could move from stability to instability when there is a rising exchange rate instability which tends to have a deteriorating effect on the foreign reserves. In the hypothesis, the depreciation of exchange rate could have a dampening effect on

productivity and investment. The overall impact reduces output. A reduction in output means low productive capacity of the economy. Low productive capacity of the economy implies lower foreign exchange earnings.

## Empirical Review

Umeora (2013) examined the relationship between Exchange Rate and Foreign Exchange Reserves in Nigeria: 1986 - 2011. The results of the ADF test, Johansen test and ECM showed positive and significant relationship between Exchange Rate and Foreign Exchange Reserves. Ahmad and Pentecost (2009) examined the long-run relationship between Exchange Rate and International Reserves of African countries: 1980Q1 - 2004Q4, using the threshold co-integration technique. The result showed long-run relationship between exchange rate and international reserves. Nwachukwu, Ali, Abdullahi, Shettima, Zirra, Falade, and Alenyi (2016) modelled the long-run connection between the Bureau de Change Exchange Rate and external reserves in Nigeria, using the threshold VECM on daily data from January 1st, 2014 to July 31st, 2015. The results indicate a non-linear long-run relationship between Bureau de Change Exchange rate and external reserves. Ajibola, Udoette, Omotosho and Muhammad (2015) examined the long-run correlation between exchange rate and external reserves: 1990Q1 - 2012Q4 in Nigeria using the 2-regime threshold VECM. Their results affirmed co-integration between the two variables. Abdullateef and Waheed (2010) found that Exchange Rates had no effect on Foreign Exchange reserves in Nigeria: 1986 - 2006 using OLS and VECM. Osigwe, Okechukwu and Onoja (2015) modelled the determinants of foreign reserves in Nigeria adopting the Johansen co-integration approach. Exchange rate was found to be significant but with negative determinant on Foreign Exchange Reserves. Ibrahim (2011) used OLS and VECM; and observed that the fluctuations in external reserve were not significantly influenced by Exchange Rate instability between 1986 and 2006 in Nigeria. Audu and Okumoko (2013) econometric results showed that real Exchange Rate had positive significant effect on Real Foreign Reserve in Nigeria: 1970 - 2012. Osuji and Ebiringa (2012) investigated the long run relationship between exchange rate and external reserve management in Nigeria: 1981 to 2010. Their results from econometric analysis showed significance between Exchange Rate and External Reserves. Elhiraika and Ndikumana (2007) used panel data for 21 African countries: 1979 - 2005. They examined the sources, motivation and economic implications of reserve accumulation considering its relationship with Exchange Rate. Nominal Exchange Rate strongly responded to changes in International Reserves both in the short-run and the long-run. Aizenman and Marion (2004) results of the effective Exchange Rate volatility for a panel data analysis of 64 countries: 1980-1996 showed that Exchange Rate volatility was significant and accounted for about 70% of the variation in the observed reserve holdings.

## Research Methodology

The ex post facto research design was adopted using the simple time series econometric techniques. The model was estimated employing the descriptive statistics, Augmented Dickey-Fuller (ADF) unit root test, Johansen co-integration test, Error Correction Mechanism (ECM) and Ordinary Least-Squares (OLS). The Descriptive statistics is a test for normality of the data, Augmented Dickey-Fuller (ADF) unit root test for stationarity of the variables. The Johansen co-integration test for long-run equilibrium relationship while the error correction mechanism examines the short run relationship. The data were annual records for 24 years: 1993 - 2016 sourced from the Central Bank of Nigeria Statistical Bulletin and World Bank data base. The test hypotheses were at 5% level of significance using p-value statistic which denotes to reject the null hypothesis and accept the alternative if  $p < 0.05$ , otherwise accept the null hypothesis if  $p > 0.05$ .

### Model Specification

The model of Umeora (2013) was followed by this study to determine the relationship between the variables in the time series data. Umeora (2013) used the simple regression model and was specified as;  $FER = \alpha_0 + \alpha_1 EXR + e_i$ ; and  $FER = \beta_0 + \beta_1 INF + m_i$ . The model for this study is specified as:

$$FORESt = F\{EXRATE_t\} \dots\dots\dots (1)$$

Equation 1 was transformed into log linear forms to avoid heterosedacticity and to eliminate abnormality in the data as shown in equation 2:

$$LFORESt = \beta_0 + \beta_1 LEXRATE_t + e_i \dots\dots\dots (2)$$

Where:

$LFORESt$  = log of Nigerian foreign reserves

$LEXRATE_t$  = log of exchange rate instability as proxy for official exchange rate of the naira to the United States dollar

$\beta_0$  = constant coefficient and

$\beta_1$  = Coefficient of the independent variable.

The a-priori expectation:  $\beta_1 < 0$ .

### Interpretation of Results

**Table 1: Descriptive Statistics**

FORES	EXRATE	
Mean	23.75996	112.5177
Median	22.94450	127.2424
Maximum	53.59900	253.4923
Minimum	1.640000	21.88610
Std. Dev.	18.44690	62.00117
Skewness	0.212938	-0.123552
Kurtosis	1.468104	2.646022
Jarque-Bera	2.528076	0.186361
Probability	0.282511	0.911029
Sum	570.2390	2700.424
Sum Sq. Dev.	7826.628	88415.34
Observations	24	24

Source: Researcher’s Computation (2018) using E-view 7.0

The value of Skewness for EXRATE (-0.123552) is skewed to the left in log levels though not greater than zero. This depicts that the distribution is platykurtic relative to normal. The Kurtosis of 2.646022 is approximately equal to 3, shows symmetric situation in the distribution. Thus, the p-value of 0.911029 ( $p > 0.05$ ) and the Jarque-Bera statistic of 0.186361 for EXRATE established that the data is normally distributed from Table 1.

**Table 2: Stationarity Test Result Using Augmented Dickey Fuller Unit Root Test**

Variables	At Level	Prob.*	At First Difference	Prob.*	Order of Integration	Remark
LFORES	-1.90416	0.323	-3.283837	0.0283	I(1)	stationary
LEXRATE	-1.213487	0.6504	-4.528124	0.0018	I(1)	stationary

Source: Researcher's Computation (2018) using E-views7.0

Table 2 indicates that the variables are stationary at first difference with p-values less than 0.05. This signifies order of integration at first difference, I(1). Thus, the variables do not have unit root problem at 5%. Therefore, the Johansen co-integration test can be carried out to determine the long run relationship between LEXRATE and LFORES.

**Table 3: Johansen Co-integration Test Result: LEXRATE and LFORES**

Hypothesized No. of CE(s)	Eigenvalue	Trace /Max-Eigen Statistics	0.05 Critical Value	Prob.**
None *	0.184218	4.479390	3.841466	0.0343

Trace test and Max-eigenvalue test indicate no cointegration at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

Source: Researcher's Computation (2018) using E-views7.0

The results in Table 3 showed co-integration between LEXRATE and LFORES. Thus, there is long-run equilibrium relationship between these variables such that the Trace and Max-Eigen statistic test have co-integrating equations and their probability values are less than the test of significance at 5%.

**Table 4: Result of the Error Correction Model after Lag Adjustment**

Dependent Variable: DLFORES				
Variables	Coefficient	Std-Error	t- statistic	Prob.*
C	0.287639	0.118865	2.419873	0.0257
DLEXRATE	-0.036600	0.273390	-0.133875	0.8949
ECM(-2)	-0.490108	0.171270	-2.861613	0.0100
R-squared	0.352467			
Adjusted R-squared	0.284306			
Durbin Watson	1.011890			

Source: Researcher's Computation (2018) using E-views 7.0

Table 4 showed a negative sign of -0.490108 which is less than 1 with a significant value of 0.0100 in conformity to short run equilibrium after lag adjustments. This indicates the validity of short run equilibrium relationship between LEXRATE and LFORES. The coefficient of 0.490 indicates that about 49% of the deviation from equilibrium is corrected annually, showing the speed of adjustment from short run disequilibrium to long run equilibrium.

**Table 5: Ordinary Least Square (OLS) Result with Autocorrelation**

Dependent Variable: LFORES				
Variables	Coefficient	Std-Error	t- statistic	Prob.*
C	-2.366936	0.772247	-3.064997	0.0057
LEXRATE	1.130331	0.169821	6.655999	0.0000
R-squared	0.668187			
Adjusted R-squared	0.653104			
Durbin Watson	0.677665			

Source: Researcher's Computation (2018) using E-views 7.0

The OLS result in Table 5 shows evidence of autocorrelation given Durbin Watson statistic of 0.677665 which is less than 2. This indicates that the OLS result is spurious and is not adequate for inference. Thus, correction for autocorrelation was carried out using the Cochrane-Orcutt Iterative procedure.

**Table 6: OLS Result after Cochrane-Orcutt Iterative Estimation**

Dependent Variable: LFORES				
Variables	Coefficient	Std-Error	t- statistic	Prob.*
C	6.055862	1.792647	3.378168	0.0030
LEXRATE	-0.378731	0.236746	-1.599733	0.1253
AR(-1)	0.903261	0.047981	18.82521	0.0000
R-squared	0.920047			
Adjusted R-squared	0.912052			
Durbin Watson	1.477842			

Inverted AR Roots .90

Source: Researcher's Computation (2018) using E-views 7.0

The Durbin Watson statistic (1.477842) of the Cochrane-ortcutt iterative estimation in Table 6 falls in grey region – the region of indecision (Neither presence nor absence of autocorrelation). However, the result is valid for analyses. The R-squared and adjusted R-squared of 92% and 91% respectively showed confirmative high variations between the variables. The result showed negative coefficient of -0.378731 and negative t- statistic of -1.599733 with a p-value of 0.1253 > 0.05. This conforms to our a-priori expectation and in line with the economic hypothesis. Thus, the negative coefficient indicates exchange rate instability and the insignificant p-value shows no depleting effect on LFORES.

## Test of Hypothesis

The hypothesis of the study is that exchange rate instability has no short run and long run relationship with the Nigerian Foreign Reserves. Table 7 showed the test of hypothesis using the coefficient, t-statistic and p-value at 5 % level of significance.

**Table 7: Summary result of the hypothesis**

Variable	Coefficient	Std-Error	t- statistic	Prob.*	Remarks
LEXRATE	-0.378731	0.236746	-1.599733	0.1253	Accept $H_0$

Source: Extracted from Table 3

Thus, exchange rate instability has insignificant relationship with Nigeria's foreign reserves.

## Discussion of Findings

The study employed the simple regression model to empirically examine the short run and long run relationship between exchange rate instability and the Nigerian Foreign Reserves. The findings of this study revealed short run and long-run equilibrium relationship between Exchange Rate instability and Nigerian Foreign Reserves from the ECM and Johansen test results respectively. However, the OLS result showed that the relationship between exchange rate instability and Nigerian Foreign Reserves was negative but insignificant. The findings is in line with the Minsky's financial instability hypothesis which stipulates that an economy could move from stability to instability when there is a rising exchange rate instability which tends to have a deteriorating effect on the foreign reserves. It is inferred though that exchange rate instability conforms to our a-priori expectation but has no significant impact on the Nigerian Foreign Reserves. The result is consistent with the findings of Irefin and Yaaba (2012); Akinwunmi and Adekoya (2016); Onoja (2015) whose findings were negative with insignificant relationship between exchange rate and the Nigerian Foreign Reserves. Thus, contradicts the results of Usman and Adejare (2012); Umeora (2013) which showed positive and significant results in their findings. However, Osigwe, Okechukwu and Onoja (2015) findings was significant with a negative coefficient.

## Conclusion

The study revealed that the instability in Exchange Rate has inconsequential influence on the Nigerian Foreign Exchange reserves. Thus, exchange rate instability has not been the main depleting factor to the Nigerian Foreign Exchange reserves. Basically, the significant depletion in the Nigerian Foreign Exchange Reserves was induced by other factors.

## Recommendations

Based on the empirical results, consequently the conclusion drawn from the results, efforts to block leakages from the foreign reserves should be the aspirations of all policy makers in the Nigeria project. Thus, the study recommends that:

- The government should genuinely and adequately address the alleged funding of oil subsidy to prevent excess capital leakages.
- The fight against corruption by the anti-corruption agencies in Nigeria should be holistic in their approach on corruption.
- The Nigeria government should enact policy that would control the standard and limit of foreign travels such as medical vacations for government officials including the presidency.

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### Appendix: Johansen Co-integration Test Result

Date: 06/03/18 Time: 02:51  
 Sample (adjusted): 1995 2016  
 Included observations: 22 after adjustments  
 Trend assumption: Linear deterministic trend  
 Series: LFORES  
 Exogenous series: LEXRATE  
 Warning: Critical values assume no exogenous series  
 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 *	0.184218	4.479390	3.841466	0.0343

Trace test indicates 1 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 *	0.184218	4.479390	3.841466	0.0343

T Max-eigenvalue test indicates 1 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):

LFORES  
1.605715

Unrestricted Adjustment Coefficients (alpha):

D(LFORES) -0.139728

***Authors' Profile***

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