14

Effect of Selected Macro-Economic Variables on Nigeria's Foreign Reserve: 1986-2016

Nanwul Diyemang Felix
Department of Economics
University of Jos
nandalut@yahoo.com

Bolaji Eunice Kehinde
Department of Economics
Federal College of Education Zaria
christluvinme@gmail.com

Abstract

*N*igeria has over the past three decades implemented numerous policy initiatives and measures in the management of its external reserves. Although very little was achieved because the structure in place could not support sustainable external reserves management. The study thus examines the effect of selected macro-economic variables on Nigeria's foreign reserve between 1986 and 2016. The study adopted ARDL method of analysis in carrying out the empirical analysis. Unit root test was carried out on each of the variables to avoid spurious regression results; while the bound test showed that long-run equilibrium relationship exists between macro-economic variables and Nigeria's foreign reserve. Findings from the study revealed that deprecation of exchange rates had a negative effect on Nigeria's foreign reserve. It showed that one percent depreciation of the exchange rates (holding other factors constant) has on the overage reduced foreign exchange reserve by 0.73 percent between 1986 and 2016. However, it was found that GDP had a positive and significant relationship with foreign reserve. It showed that a percentage change in GDP has on the average (holding other variables constant) increased the foreign reserve by 0.63 percent between 1986 and 2016. Lastly, it was discovered that inflation rate has had a positive effect on the Nigeria's foreign reserve within the period under review. The study thus recommends that in achieving the optimal level of external reserves, the monetary authority should balance the macroeconomic adjustment costs incurred if reserves are exhausted with the opportunity cost of holding the external reserves. Managers of Nigeria's foreign reserves should encourage the monitoring of the use of scarce foreign exchange resources to ensure that foreign exchange disbursements and utilization are in line with economic priorities and within the annual foreign exchange budget. This will help to ensure availability of a regular and comfortable balance of payments position as well as the stability of the Naira and hence, go a long way in equilibrating foreign reserves.

Keywords: Foreign Reserve, Exchange rates, Inflation rates and GDP

INTRODUCTION

Foreign reserves are used by countries to support monetary and foreign exchange policies, among other uses, in order to meet the macroeconomic objectives of safeguarding currency stability and to smoothen the normal functioning of domestic and external payment system. It also serves as a veritable source of funds for the payment of government expenditures overseas, especially those with known import bills for the authorities to meet (Nugee, 1999). The fear of financial crisis has also necessitated countries, both developed and developing to maintain certain level of foreign reserves in order to intervene in the foreign exchange markets and reduce foreign exchange volatility while also safeguarding the international value of their currencies.

Nigeria has over the past three decades implemented numerous policy initiatives and measures in the management of its external reserves. Although very little was achieved because the structure in place could not support sustainable external reserves management, hence fundamental lessons could be extracted from the nation's past experience. The World Bank (2014) stated that "mono product economies, especially those dependent on oil would remain vulnerable due to volatility of oil prices". Since the 1970s, Nigerian economy has persistently depended on oil as the main source of foreign exchange earnings with the attendant cycles of economic booms and bursts. Nigeria's dependence on oil for over 90 per cent of its foreign exchange earnings makes its capital account vulnerable to the fluctuations in crude oil prices. This, in addition to its high import bills contributed to the fluctuations in the level of external reserves over the years, and consequently, the way the external reserves are being managed.

Nigeria expressed concern over the drop in fiscal buffers stating that the development had exposed the economy to weaknesses arising from both domestic and external shocks. This had drawn the attention of monetary authorities to the regime of persistently high interest rates as well as elevated demand for foreign exchange.

The efforts by the CBN to stabilize the naira at the interbank market depleted the Nigeria's external reserves by $4.9bn in the first quarter of 2015 as reserves fell by 14.3 per cent, down from $34.24 billion at the end of December 2014 to $29.36billion at the end of March 2015. The CBN spent the sum of N136.96 billion to support the exchange rate and ensure the stability of the financial system in 2014. This development led to an increase of about 220.2 per cent in forex supply in 2014 as compared to 2013.The reserves for March 2015 dropped by $8bn when compared to the level at end- March 2014. The CBN attributed the decline in the external reserves to its intervention at the interbank market, funding of the retail Dutch auction system and the bank's drive to stabilize the naira (Nwachukwu, Ali, Abdulahi, Shettima, Zirra, Falade & Alenyi, 2016).

It is pertinent to note here that the decline in reserves increased the risk to the economy from any renewed drop in oil prices. Therefore, it can be argued that the outlook is very bleak if our foreign reserves continue to deplete at this rate; there will be a time when nothing will be left to cover our imports. Given the background above, it is observable that the management of foreign reserve has been one of the most serious problems faced by the governments of developing countries including Nigeria. Thus, the main objective of the paper is to examine the effect of selected macro-economic variables on Nigeria's foreign reserve.

CONCEPTUAL AND THEORETICAL FRAMEWORK:

External reserves according to IMF (2001)"consist of official public sector foreign assets that are readily available to and controlled by the monetary authorities for direct financing of payment imbalances and directly regulating the magnitude of such imbalances, through intervention in the exchange markets to affect the currency exchange rate and/or for other purposes. In this

context, a reserve management entity is normally made responsible for the management of reserves and associated risks. Foreign reserve accumulation in a country is moved by the quest for macroeconomic stabilization such as exchange rate stability. Vojtisek (2002) maintains that a country's external debts and reserves are important indicators of external vulnerability which include current account indicators such as debt indicators, liquidity indicators and other indicators such as the ratio of foreign reserves to money supply, nominal and real exchange rate. Accumulating of foreign reserves by government has shown some profound features with reference to size, pace, and ownership categorizations. Furthermore, adequate foreign exchange reserves are expected to have a positive impact on total external debt outstanding and export and that it has a negative effect on the average maturing consumption.

Macroeconomic variables are key indicators that provide an insight into the economic performance of a country; such statistics are usually made available periodically by government agencies. The most prominent of these variables are gross domestic product, inflation, interest rate and unemployment amongst others. For this study, the selected macroeconomic variables are gross domestic product, exchange rate and inflation.

Keynesian International Reserves Theory: This theory holds that nations would resort to currency devaluation as a lever to improve their balance of trade, seldom improving in the process either their own terms of trade or the opportunities inherent in a flourishing and expanding trade network. As balance of payments accounting had become more common, many western nations had come to believe that unilateral currency devaluation would, in the absence of reciprocal action, improve the terms of trade. It would make a nation's own exports cheaper in terms of foreign currency and would, make imports equally more expensive. It was not uncommon to find, however, the price of imports rising under such an initiative to the point where the aggregate value of imported goods continued to outpace the value of the higher, newly attained level of exports.

Keynes's theoretical insight which is adopted for this study recognizes that in modern industrial economies, monetary policy would simply have little effect in restoring balance through price deflation. It would regulate external balance instead, by causing unemployment, lower incomes, and decreased imports. He then seized upon the notion that exchange rate mechanism mattered far less than international liquidity. Though gold, the pound sterling, and the U.S. dollar had all proved somewhat useful in attempts at securing substantial international reserves with which to conduct increasing levels of trade, even the highly regarded British and American currencies remained vulnerable to the deflationist tendencies Keynes so abhorred.

Robert and Vijay (2010) however, argue that the fact that the reserves were held mainly in dollars allowed the US to avoid deflation, and instead run a "Keynesian" domestic policy which set the stage for an unsustainable asset and consumption boom. In short, there was a nexus connecting reserve accumulation by China and expansionary monetary and fiscal policy in the US.

EMPIRICAL REVIEW

Various studies have been carried out on the effect of macro-economic variables on foreign reserve with mixed results and findings. For example, Bentum-Ennin (2008) adopted a modified version of the monetary approach to balance of payments in analyzing the link between Ghana's international reserves and macroeconomic performance and a buffer stock model to analyse the opportunity cost of holding reserves. He used the Johansen's cointegration procedure to examine long run relationships that existed among the variables and found that an improvement in macroeconomic performance brings about an improvement in the reserve position of a country,

high domestic credit was discovered to have a negative effect on international reserves but, trade and financial openness, and increased tourism receipts have positive impacts on international reserves.

Khan (2013) studied the relationship between exchange rate and foreign exchange reserves in Pakistan. His study concludes that there is a long run relationship existing between foreign exchange reserves and exchange rates. He also examined the causality relation between them and concluded that causality direction goes from Nominal and Real Exchange rate to foreign reveres.

Chowdhury, Uddin and Islam (2014) undertook an econometric analysis of the determinants of foreign exchange reserves in Bangladesh, using the Augmented Dicky Fuller (ADF) unit root test to examine stationarity, Engle Granger residual based co-integration approach to show the co-integrating relationship among the variables. The empirical results of their study confirmed the existence of strong relationship among foreign exchange reserves, GDP exchange rate, remittance, home interest rate, broad money and per capita GDP. The study suggested that exchange rate, strong remittance related policies, quality items of exports and sustainable GDP can keep a substantial and feasible role to make up a healthy amount of foreign exchange reserves for the host country

Oputa and Ogunleye (2010) adopted Shcherbakov (2002) model to estimate the optimal level of international reserves for Nigeria along the line of the drivers of external reserves. They explained that the accumulation of reserves in recent period were in line with global trend, especially in emerging economies and concluded that the country's external reserves during their study period could not be adjudged to be sufficient or in excess of expectations.

Ajibola (2015) also studied the long-run relationship between exchange rate and external reserves in Nigeria during 1990Q1 – 2012Q4 using the two-regime Threshold Vector Error Correction Model (TVECM) via maximum likelihood procedure. They confirmed the existence of threshold co-integration between the variables in Nigeria, as against linear co-integration. Consequently, the results indicated that co-integration between the variables occurs only when the equilibrium error exceeds an estimated threshold parameter of 0.52. Based on the obtained threshold, the result showed that the error correction coefficients of the exchange rate in the two regimes were not significant, implying that exchange rates do not respond to equilibrium error during the estimation period. Conversely, external reserves adjust to correct past divergence, albeit only when the equilibrium error exceeds the threshold parameter. Their result also revealed that external reserves adjust to maintain long run equilibrium; while exchange rates do not. They concluded that their findings aligned to the monetary authority's action of deploying external reserves to maintain exchange rate stability in Nigeria.

Different reasons have been advanced on the need for countries, both developed and developing to accumulate reasonable level of foreign reserves. For example, Aizenman and Lee (2005) argued that reserve accumulation serves not only as a means for effective exchange rate management, but also as a tool for maintaining low exchange rate in order to promote trade and international competitiveness. According to them, adequate accumulations of foreign reserves help boost investors' confidence and enhance investment and growth. Allen and Hong (2011) posit that South Korea's foreign reserve accumulation is necessitated by the 1997 Asian financial crisis. Hence, foreign reserve is held as a self-insurance in order to deal with future crisis. They argue that reserves accumulation helps countries whose currencies are less liquid and capital market access is less than assured to reduce both risk and impact of current account shocks or capital account crisis.

However, Jeanne and Ranciere (2006) posited that there is no theoretical justification for the large quantity of foreign resources being amassed. They submitted that irrespective of whether the rule of thumb or econometric models are used to measure the optimal level of reserve, the result shows that there is always an excess international or foreign reserve. These excess reserves according to them it being wasted, and could be employed for alternative purposes such as growth of the economy.

Foreign reserve build ups in Nigeria is due to the unavailability of sound industrial base. Migap (2010) puts forward that those countries with sound industrial base - which export a substantial portion of her industrial output is not likely to suffer from seasonal fluctuating in exports which is not applicable to developing countries whose major exports are primary product. He argues that foreign exchange reserves help developing countries to overcome the crop failure or cyclical variations of the prices in the world market that could lead to disruptions in the flow of imports into the country affected unless it has sufficient reserves to absorb the unexpected shock.

It has also been argued that many developing countries pursue the conscious policy of low exchange rate as part of their general export orientation strategy (Polterovich and Popov, 2002). They explain that by creating a downward pressure on their currencies through building up foreign reserves, these countries are able to limit consumption and imports and to stimulate growth, export and investment. Popov (2005) in another study opined that foreign reserves accumulation causes real exchange rate undervaluation that is expansionary in the short run and may have long term effects, if such devaluation is carried out periodically and unexpectedly. He argues the accumulation of reserves attracts Foreign Direct Investment (FDI) because it increases the credibility of the government of a recipient country and lowers the dollar price of real assets.

Sound reserve management practices are important because they can increase a country or regions overall resilience to shocks. Through their interaction with financial markets, reserve managers gain access to valuable information that keeps policy makers informed of market developments and views on potential threats. The importance of sound practices has also been highlighted by experiences where weak or risky reserve management practices have restricted the ability of the authorities to respond effectively to financial crises, which may have accentuated the severity of these crises. Moreover, weak or risky reserve management practices can also have significant financial and reputational costs. Several countries, for example, have incurred large losses that have had direct or indirect fiscal consequences. Accordingly, appropriate portfolio management policies concerning the currency composition, choice of investment instruments, and acceptable duration of the reserves portfolio which reflect a country's specific policy settings and circumstances, serve to ensure that assets are safeguarded, readily available and support market confidence. Sound reserve management policies and practices can support, but not substitute for, sound macroeconomic management. Moreover, inappropriate economic policies (fiscal, monetary and exchange rate) can pose serious risks to the ability to manage reserves. Therefore, reserve management should seek to ensure that adequate foreign exchange reserves are available for meeting a defined range of objectives. Examples are, liquidity, market, and credit risks are controlled in a prudent manner; and subject to liquidity and other risk constraints, reasonable earnings are generated over the medium to long term on the funds invested. Reserve management forms a part of official economic policies, and specific circumstances will impact on choices concerning both reserve adequacy and reserve management objectives. In order to ensure the availability of reserves, and as part of setting appropriate investment priorities, the reserve manager needs to have an assessment of what constitutes an adequate level of reserves. Such an assessment may be made by the reserve management entity, or it may involve consultation between the reserve management entity and other agencies. There

are no universally applicable measures for assessing the adequacy of reserves and the determination of reserve adequacy.

Relevant factors have traditionally included a country's monetary and exchange rate arrangements, and the size, nature, and variability of its balance of payments and external position. More recently, financial risks associated with a country's external debt position and the volatility of its capital flows has received particular attention, especially for economies with significant but not fully certain access to international markets. In the process, ensuring the availability of reserves will be influenced by the exchange rate system practiced by the country, and the particular objectives for which they are held. To ensure that reserves are available at the times when they are needed most, liquidity-which is the ability to convert quickly reserve assets into foreign exchange, usually receives the highest priority, albeit with a cost that usually involves accepting lower yielding investment instruments. Closely following is the need for the management and control of risks to ensure that asset values are protected. Market and credit risks, for instance, can lead to sudden losses and impair liquidity. Finally, earnings are an important outcome of the management of reserve assets. For some countries, they play a role in offsetting the costs associated with other central bank policies and domestic monetary operations, which among other things fund the acquisition of reserves. In other cases, such as where reserves are borrowed in foreign markets, earnings play an important role in minimizing the carrying costs of reserve assets. Accordingly, achieving an acceptable level of earnings should be a priority within clearly defined liquidity and risk constraints. In summary, the reserve management entity should seek to maximize the value of reserves, within the prudent risk limits that form the framework for reserve management, so that reserves are always available when they are needed. As a consequence, reserve asset portfolios tend to be highly risk-averse, with a consequent priority for liquidity and security before profit, or carrying cost considerations. This necessarily involves making a trade-off between risk and return in the context of setting reserve management priorities. International Relations Committee Task Force (IRC, 2006) identified other uses of foreign reserves that necessitate its accumulation and management by the central banks as: payment for the importation of goods and services, servicing of the nation's external debt and financing domestic fiscal expenditure.

METHODOLOGY
The ex-post facto research design is used for this study. Onwumere (2005) states that ex-post facto design is the type of research involving events that have already taken place. This design is used because the study intends to use what already exist and look backwards to explain why. This kind of study is based on analytical examination of dependent and independent variables. More so, independent variables are studied in retrospect for seeking possible and plausible relations and the likely effects, the changes in independent variables produce on a dependent variable.

To examine the long run as well as short run relationship between the selected macro-economic variables and foreign reserve, autoregressive distributed lag (ARDL) modelling approach was employed. The justification for using ARDL model is due the fact that the long run and short run parameters of the model are estimated simultaneously; and it can be applied irrespective of whether the variables in the model are endogenous. In addition, the econometric methodology is relieved of the burden of establishing the order of integration among the variables and of pre-testing of unit roots. Furthermore, applying ARDL is helpful in data generating process through taking sufficient number of lags general-to-specific modeling framework.
ARDL model specified by Pesaran, Shin and Smith (2001)is given as:

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 X_{t-1} + \sum_{i-1}^{i} \beta_{1i} \Delta Y_{t-i} + \sum_{i-0}^{j} \beta_{2i} \Delta X_{t-i} + \varepsilon_t \qquad (1)$$

Where;

$Y_t =$ un-estimated dependent variable at time t

$X =$ explanatory variables

$\alpha_1 =$ coefficient of parameter estimates of lagged dependent variable

As a tradition, the test for null hypothesis of no Co-integration against alternative of the existence of a long run relationship is tested by using F-test such as;

$$H_0 = \alpha_i = 0$$

$$H_1 = \alpha_i \neq 0$$

If the computed F-statistic falls above the upper bound critical value of F-tabulated developed by Pesaran, the null of no Co-integration is rejected which implies that long run relationship exists among the variables of interest. On contrary, if it falls below the lower bound, then the null of no Co-integration cannot be rejected.

Following the position of Nwachukwu et al.(2016), the relationship between macroeconomic variables and foreign exchange reserve we have an implicit function as:

$$FR = f(GDP, EXR, INF) - - - - - - -(2)$$

Incorporating our selected macroeconomic variables and foreign exchange reserve into the unrestricted ARDL model framework of equation (1) so as to obtain the conditional (restricted) ARDL steady-state model(which was accomplished by applying OLS methods to estimate the general ARDL model), of the form:

$$\Delta \ln RE = \beta_0 + \sum_{i-1}^{k} \beta_1 \Delta \ln RE_{t-i} + \sum_{i-1}^{k} \beta_2 \Delta \ln GDP_{t-i} + \sum_{i-1}^{k} \beta_3 \Delta EXR + \sum_{i-1}^{k} \beta_4 \Delta INF + \lambda_1 RE_{t-1} +$$

$$\lambda_2 \ln GDP_{t-1} + \lambda_3 EXR_{t-1} + \lambda_4 INF_{t-1} + \varepsilon_t -(3)$$

In the above equations, the terms with the summation signs represent the error correction dynamics while the second part [terms with λ in equation] correspond to the long run relationship between the variables.

Where;

β_0 = Drift operator or the intercept term or constant variable in the models.

$\beta_1 - \beta_4 =$ Error correction or short run dynamics. They are the partial slope coefficients or parameters of the explanatory variables respectively and also represent the rate of change in the dependent variables for each unit change in independent variables respectively

λs = Long run multipliers

Δ = First difference operator

k = Respective specific optimum lags orders of the variables entering ARDL-ECM

ε_t = Disturbance or white noise error term.

t   = a deterministic trend

Once a cointegration relationship is established between the variables, the study would proceed to examine the long-run effect and the short-run dynamics using unrestricted error correction term (ECT) estimator specified as follows:

$$\Delta FR_t = \alpha_0 + \sum_{i=1}^{m} \alpha_1^i \Delta FR_{t-i} + \sum_{j=0}^{n} \alpha_2^i \Delta \ln GDP_{t-i} + \sum_{k=0}^{o} \alpha_3^i \Delta EXR_{t-i} + \sum_{l=0}^{p} \alpha_4^i \Delta INF_{t-i} + \delta ECT_{t-1} + \varepsilon_t --------(4)$$

A priori expectations for the coefficients of the parameter are: $\alpha_1^i > 0$, $\alpha_2^i > 0$, $\alpha_3^i > 0$ and $\alpha_4^i > 0$

This means that we expect a positive functional relationship between dependent variables and the independent variables respectively.

ECT_{t-1} is the lagged Error correction term. It is the residual obtained from the long run estimation.

RESULTS AND DISCUSSION

Descriptive Statistics

The summary of the descriptive statistics is captured in table 1. It can be observed that foreign reserve averaged about 9.3%; while EXR was found to have an average value of 88.82, GDP averaged by 8.7%; while inflation rate averaged 20.69%.

Skewness which measures the shape of the distribution shows that FR, EXR and INF have their values to be positive, which suggests the distribution tails to the right of the mean. However, the skewness GDP have its value to be negative which suggests that the distribution tails to the left of the mean.

The kurtosis statistics reveals that INF is leptokurtic implying that the distribution is peaked relative to the normal distribution, while the other variables (FR, GDP and EXR) are platykurtic, suggesting that their distributions are flat relative to normal distribution.

Jarque-Bera is a statistical test that determines whether the series is normally distributed. The null hypothesis here is that the series is normally distributed (i.e skewness = 0) so as to be consistent with skewness test. The Jarque-Bera statistics here accepts the null hypothesis for FR, EXR and GDP since their probability values are greater than 0.05, however, INF was found not to be normally distributed.

Table 1: Summary of Descriptive Statistics Results

	LOG(FR)	EXR	LOG(GDP)	INF
Mean	9.300008	88.82697	8.711361	20.69917
Median	8.980183	111.9433	8.838581	12.16854
Maximum	10.97632	253.4923	11.52878	76.75887
Minimum	7.363177	2.020575	4.902332	0.223606
Std. Dev.	1.084436	70.29011	2.000187	19.44263
Skewness	0.042037	0.209984	-0.285127	1.574500
Kurtosis	1.662318	1.996446	2.000601	4.248097
Jarque-Bera	2.320430	1.528680	1.710152	14.82052
Probability	0.313419	0.465641	0.425251	0.000605
Sum	288.3002	2753.636	270.0522	641.6742
Sum Sq. Dev.	35.28002	148221.0	120.0224	11340.48
Observations	31	31	31	31

Source: Authors Computation, 2017 (Eviews-10)

Unit Root Test

In empirical research on time series data, there always exist problem of non-stationarity which renders the traditional tools of econometrics (like OLS and 2SLS) inappropriate. To overcome this problem of Unit-Root, the first strategy here will be to test for the stationarity of the series since time-series data will be used. Thus, this paper adopted Augmented Dickey-Fuller (ADF) techniques to test and verify the unit root property of the series and stationarity of the model.

Table 2: Summary of Unit Root Test Results

Variables	ADF Test Statistic(at first difference)	Order of Integration
FR	-3.562253(-3.221728)***	I(1)
GDP	-5.327628(-4.309824)*	I(1)
EXR	-3.645959(-3.574244)**	I(1)
INF	-6.254744(-4.440739)*	I(1)

*Notes: ***, ** and * significant at 10%, 5% and 1%, respectively*
Source: Authors Computation, 2017 (E-views-10)

From table 2, it could be discovered that all the variables were found stationary at first difference. The FR ADF test statistics of-3.562253 was found greater than the critical value of -3.221728 at 10 percent statistical level. However, GDP and INF which were also found to be stationary at first difference but at 1 percent statistical level. Lastly, EXR has its ADF statistics of -3.645959 greater than the critical value of -3.574244 at 5 percent level. They all satisfied the ARDL-bound testing approach which necessitates every variable in the equation to be static either at level, mixed or at first difference.

Result of Co-integration test

Table 3 presents the result of the ARDL bound test approach to Co-integration. The result revealed that there is an existence of co-integration among the variables. The f-statistics value of 7.31 is greater than the lower and upper bound values at 5% level of significance. Hence, there is a sufficient proof of the existence of a long-run equilibrium relationship between foreign reserve and selected macro-economic variables in Nigeria between 1986 and 2016. The result thus shows that macro-economic variables have long run effect on foreign reserve within the period under study.

Table 3: ARDL-Cointegration Test Results

F-Bounds Test				Null Hypothesis: No levels relationship
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	7.310434	10%	2.37	3.20
K	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

*Notes: ***, ** and * significant at 10%, 5% and 1%, respectively.*
Source: Authors Computation, 2017 (E-views-10)

The ARDL-ECM result shows how the system adjusts to the long-run equilibrium. The dimensions of the parameter space were reduced to a parsimonious ARDL-ECM specification by using omitted and redundant variable test to exclude the statistically insignificant lags. The results of the reduced short-run dynamic foreign reserve model are presented in table 4.

Table 4: **Parsimonious ARDL-ECM Regression Result**

ARDL Error Correction Regression
Dependent Variable: DLOG(FR)
Selected Model: ARDL(1, 5, 4, 4)
Case 2: Restricted Constant and No Trend
Date: 08/09/17   Time: 19:51
Sample: 1986 2016
Included observations: 26

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(EXR)	-0.450649	0.125092	-3.602537	0.0070
DLOG(EXR(-1))	-0.659099	0.198643	-3.318002	0.0106
DLOG(EXR(-2))	-0.517649	0.165991	-3.118536	0.0143
DLOG(EXR(-3))	-0.948957	0.136219	-6.966390	0.0001
DLOG(EXR(-4))	-0.735322	0.169286	-4.343670	0.0025
DLOG(GDP)	-0.198643	0.194739	-1.020048	0.3376
DLOG(GDP(-1))	0.450605	0.182099	2.474513	0.0384
DLOG(GDP(-2))	0.926568	0.176717	5.243239	0.0008
DLOG(GDP(-3))	0.633836	0.201739	3.141863	0.0138
D(INF)	0.008428	0.003464	2.433089	0.0410
D(INF(-1))	0.015828	0.004571	3.462404	0.0085
D(INF(-2))	0.021238	0.003776	5.624443	0.0005
D(INF(-3))	0.004820	0.003376	1.427443	0.1913
CointEq(-1)*	-0.614866	0.083038	-7.404611	0.0001

R-squared	0.936776	Mean dependent var		0.078774
Adjusted R-squared	0.868283	S.D. dependent var		0.430140
S.E. of regression	0.156110	Akaike info criterion		-0.572776
Sum squared resid	0.292445	Schwarz criterion		0.104660
Log likelihood	21.44609	Hannan-Quinn criter.		-0.377699
Durbin-Watson stat	2.267257			

* p-value incompatible with t-Bounds distribution.
Source: Authors Computation, 2017(E-views-10)

Post-Estimation Diagnostics Result

The study conducted various diagnostic tests to ascertain the appropriateness and stability of the models as well as the robustness of the results as shown in Table 5.
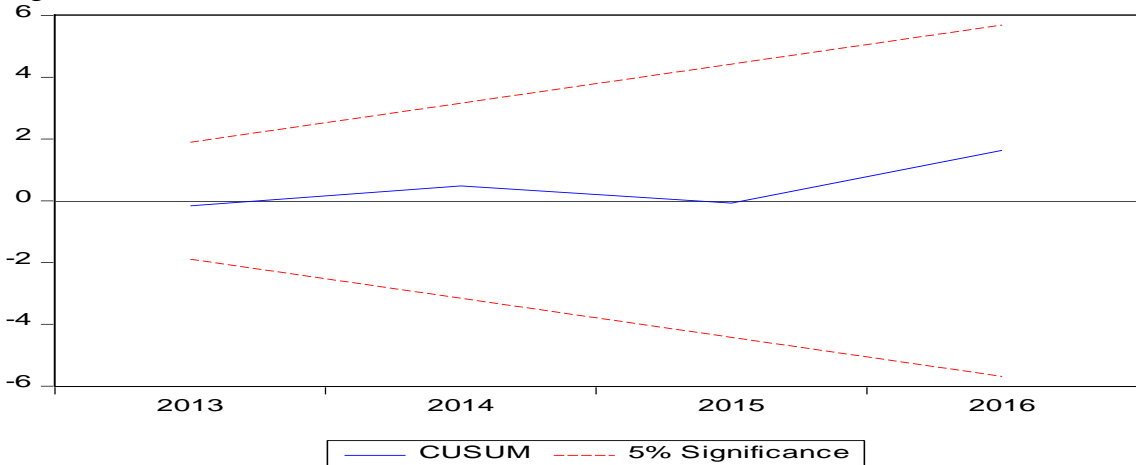
Table 5: Residual Test Results

Tests		Values	
		Coefficient	Probability
Heteroscedasticity- ARCH Test	F-stat.	0.372290	0.9405
	Obs*R-squared	17.19993	0.6989
Serial Correlation Test	F-stat.	16.8309	0.0561
	Obs*R-squared	24.5418	0.0000
Normality Test	Jarque-Bera	13.409	0.0012
CUSUM Test	Harvey-Collier	stable	0.6762
Ramsey Reset	F-stat.	0.7855	0.1841

Source: Authors Computation, 2017 (E-views-10)

The result as presented in Table 5 revealed that there were no evidences of serial correlation and heteroskedasticity in the Parsimonious model. More, the estimates were found robust as the normality and presence of specification bias were all rejected at the 5 percent levels.

The stability tests in Figure 5 revealed that the model is stable andthe regression equation is correctly specified as the plots of the charts lie within the critical bounds at 5% significant level.

Figure 1: CUSUM Test

Source: Authors Computation, 2017(E-views-10)

DISCUSSION OF FINDINGS

The lagged error correction term was found to be negative, less than one and statistically significant at 5 percent as expected. The coefficient revealed that once there is disequilibrium in the system, it takes an average (annual) speed of 61.48percent to restore the long-run relationship between the foreign reserve and macro-economic variables. This proves the existence of long-run relationship between foreign reserve and the selected macro-economic variables; and its ability to adjust from dis-equilibrium state towards equilibrium level.

The coefficients of exchange rates, inflation rates and GDP were discussed in-line with the ARDL (1, 5, 4, 4) result. Findings from the result showed that exchange rate had a significant effect on Nigeria's foreign exchange reserve. However, this effect was found to be negative. It showed that one percent depreciation of the exchange rates (holding other factors constant) has on the overage reduced foreign exchange reserve by 0.73 percent between 1986 and 2016. This is in-line with the findings of Ajibola et al (2015) whose result showed that the error correction coefficients of the exchange rate in the two regimes examined were not significant, implying that exchange rates do not respond to equilibrium error during the estimation period. In addition, Bentum-Ennin (2008) earlier found that higher interest rate differential and exchange rate volatility have negative impacts on international reserves.

The result however showed that GDP has a positive and significant relationship with foreign reserve. It showed that a percentage change in GDP has on the average (holding other variables constant) increased foreign reserve by 0.63 percent between 1986 and 2016. This in agreement with Chowdhury et al (2014) whose empirical results confirmed the existence of strong relationship among foreign exchange reserves, GDP, broad money, UPI of export and import, and per capita GDP

Lastly, inflation rate was found to have positive effect on the Nigeria's foreign reserve. This was effect was however found to be insignificant as shown in table 4. This agrees with Kyaland and Prescott (1977) who arrived at the conclusion that when the inflation rate increases, foreign exchange reserves will rise. In addition, Usman and Waheed (2010) found that changes in reserves show no significant relationship between accumulation of reserves and inflation. They added that external reserves holding in Nigeria has no impact on inflation but the domestic money supply which should be a control measure for domestic inflation.

CONCLUSION AND RECOMMENDATIONS

The uses of external reserves cannot be over emphasized. Essentially, external obligations have to be settled in foreign exchange. Thus, stocks of reserves become important as a source of financing external imbalances. Therefore, the existence of a variety of debatable discourse regarding the level of Nigeria's foreign reserves motivated this seminar. The seminar employed ARDL econometric method to analyze the time series data sourced from CBN Statistical Bulletin (1986–2016). The results from the econometric analyses showed that there is a long-run relationship between foreign reserves and selected macroeconomic variables using bound test approach. The study confirms that in Nigeria, the macro-economic factors that influence the level of foreign reserves are GDP and exchange rates.

The study thus recommends that in achieving the optimal level of external reserves, the monetary authority should balance the macroeconomic adjustment costs incurred if reserves are exhausted with the opportunity cost of holding the external reserves. This means that they can decide to accumulate reserves to get rid of all or some of its consumption unpredictability. Thus, the level of foreign reserves would move in the same direction with Nigeria's risk aversion and macro-economic volatility.

In addition, there is the need for monetary authorities to control the inflationary trend in the country through restrictive monetary policies and adequate exchange rate managements to prevent depleting the foreign reserve and maintain foreign investment attractions.

Managers of Nigeria's foreign reserves should encourage the monitoring of the use of scarce foreign exchange resources to ensure that foreign exchange disbursements and utilization are in line with economic priorities and within the annual foreign exchange budget. This will help to ensure availability of a regular and comfortable balance of payments position as well as the stability of the Naira and hence, go a long way in equilibrating foreign reserves.

REFERENCES

Aizenman, J and Lee, J. (2005), "International Reserves: Precautionary vs. Mercantilist Views, Theory and Evidence". *IMF Working Paper* /05/198

Ajibola, I.O (2015) Nonlinear Adjustments between Exchange Rates and External Reserves in Nigeria: A Threshold Co-integration Analysis. *CBN Journal of Applied Statistics* 6(1)

Archer, D. and Halliday J. (1998), "Rationale for Holding Foreign Currency Reserves". *Reserves Bank of New Zealand Bulletin*, Vol. 61, No.4 pp.347-51.

Bentum-Ennin (2008) An Econometric Analysis of the Determinants of International Reserves in Ghana. *A paper submitted to the African Economic Research Consortium*, Nairobi, Kenya

CBN (2010), Reserves Consumptions and Future Savings: What Option? Available at www.cenbank.org/inteps/reservest.

Central Bank of Nigeria (CBN, 2016). *Annual Statistical Bulletin*, Various Issues, 25(24)

Chowdhury N.M, Uddin M.J, and Islam M.S. (2014). An Econometric Analysis of the Determinants of Foreign Exchange Reserves in Bangladesh. *Journal of World Economic Research.* 3(6), 72-82.

Fukuda and Kon (2008). "Macroeconomic Impact of Foreign Exchange Reserve Accumulation: Theory and International Evidence", *ADBI Working Paper Series*, No. 197

Gosselin M and Parent N (2005). An empirical analysis of foreignexchange reserves in emerging Asia.*Bank of Canada Working Paper* 2005-38. Ottawa, Canada.

Heller, H.R (1996). Optimal International reserves. *Economic. Journal.*, 76: 296-311.

Hur,M and Kondo,G (2011). A Theory of Sudden Stops, Foreign Reserves, and Rollover Risk in Emerging Economies, *Federal Reserve Bank of Minneapolis.*

IMF (2001). Balance of payment manual. International Monetary Fund, Sixth edition

International Monetary Fund, IMF (2003). Are foreign exchange reserves in Asia too high? *World Economic Outlook*. 63-77.

IRC Task Force (2006). The accumulation of foreign reserves, *European Central Bank Occasional Paper,* 43, February.

Jeanne, M., Oliver, K., & Roman. R. (2006). The Optional Level of International Reserves for Emerging Market Countries: Formulas, and Applications"; Working Paper Wp/06/229, International Monetary Fund, Washington.

Khan, M. (2013). The Demand for International Reserves: A Case Study of Pakistan, *The Pakistan Development Review*, 44 (4), 939-957

Magnus, O.A. (2007). "Foreign Exchange Reserves Accumulation: Implications for the Nigerian Economy", *Central Bank of Nigeria Working Paper*, pp.31-43.

Mendoza, R.U (2004). International reserve-holding in the developing world: Self Insurance in a crisis-prone era?.*Emerging. Market. Review.*, 5:61-82.

Nugee, J. (2000). Foreign Exchange Reserves Management, Bank of England Centre for Central Banking Studies, *Handbooks in Central Banking*, No. 19, November

Nwachukwu, N.E., Ali, A. I., Abdulahi, I.S, Shettima, M.A., Zirra, S.S., Falade, B.S., andAlenyi, M.J., (2016). Exchange Rate and External Reserves in Nigeria: A Threshold Cointegration Analysis. *CBN Journal of Applied Statistics*, 7(1) 1-22.

Onwumere, J. U. (2005). Business and Economic Research Methods, Lagos: Don-Vinton Limited.

Oputa, N.C. and T.S. Ogunleye (2010). External Reserves Accumulation and the Estimation of the Adequacy Level for Nigeria. *Economic and Financial Review*, 48 (3)

Osabuohien, E.S.C. and Egwakhe, A.J. (2008). External Reserve and the Nigerian Economy. The dual Folded Debate,*AJBER*, 3(23).

Polteronich, V. and Popov, V. (2002). Accumulation of Foreign Exchange Reserves and the Framework on the New Economic School Research Programme, Russia. 161-195.

Robert, M and Vijay, K. (2010). Keynes, Global Imbalances, and International Monetary Reform, Rebalancing the Global Economy: A Primer for Policymaking by StijnClaessens, Simon Evenett and Bernard Hoekman (eds), Wednesday, June 23.

Shcherbakov, S. G. (2002). *Fifteenth Meeting of the IMF Committee on Balance.* Australia.

Tariq, M., HaqZ.,Jan S., Jehangir M., andAamir M. (2014). Real Exchange Rate and Foreign Exchange reserves: A Mercantilist View. *Life Science Journal*, 11(3s).

Usman, A. and Waheed .I. (2010). External Reserve Holdings in Nigeria: Implications for Investment,Inflation and Exchange Rate. *Journal of Economics and International Finance*, 2 (9), 183-189.

Voltisek, P. (2002). The Measurement of External Debt and External Reserves: The Case of the Czech Republic, Statistics Department, Czech National Bank.