EXCHANGE RATE AND FOREIGN RESERVES INTERFACE: EMPIRICAL EVIDENCE FROM NIGERIA

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ABSTRACT

This work was set out to measure the responsiveness of foreign reserves to exchange rate variables with a focus on the Nigerian economy. Foreign reserve was used as a dependent variable and all the exchange rate related variables used as independent variables. Time series data spanning 1996 to 2016 was used. A combined use of the Auto Regressive Distributed Lag Model (ARDL) and correlation matrix were employed. It was found that a positively significant relationship exists between real exchange rate and reserves with nominal exchange rate sharing a positive but non-significant relationship with foreign reserves. This makes a case for proper policy direction in the management of exchange rate in a manner that produces the best economic results for the Nigerian economy. The results are considered useful for economies in the shape of Nigeria for generalization and policy direction in the management of foreign reserve and its interface with exchange rate and its related factors.
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Contribution/Originality: This study contributes to the existing literature by uncoupling exchange rate into nominal and real in measuring the nexus with foreign reserves. This study uses new estimation methodology which is the ARDL approach unlike prior studies that used OLS predominantly. The paper contributes the first logical analysis by carrying out pre-test, estimation proper and diagnostic analyses. The paper's primary contribution is that it exposes the fact that a nexus exists between foreign reserves and changes in exchange rate.

1. INTRODUCTION

The focus of this study is to check the interface of exchange rate with foreign reserves in the Nigerian economy. Exchange rate is defined as how much or rate at which, foreign currency per unit can exchange to local or domestic currency, Osigwe and Uzonwanne (2015).

Foreign exchange systems that are not well planned or left unplanned has the tendency to cause an expansion or contraction in domestic currency volume with a transmission effect on monetary policy and other monetary aggregates. Even those central banks that strictly limit foreign exchange interventions, however, often recognize the volatility of the currency markets and may adopt interventionists' policies to counter likely disruptive short-term movements.

Talking about interventionist policies, by 1977 the International Monetary Fund made some advocacies in such areas as:

• Countries not using the exchange rate as an instrument to garner competitive advantages or balance of payment distortions management

• Interventions should be driven by the desire to smoothening out excessive volatility

• other countries interest should be considered as countries drive their exchange rate regimes and policies

Judging from the above, it is obvious that exchange rate should be well planned, thought-out and properly implemented to achieve desired monetary policy directions, improve reserves and contain inflation (Onwuka and Igwezea, 2014).

In Nigeria, prior to the exchange control Act of 1962, foreign exchange was private sector driven that is left to the forces of demand and supply; with mainly foreigners doing business in Nigeria with their funds held in their banks outside the. Agricultural exports were mostly the buck of foreign exchange receipts given that Agriculture was the mainstay of the Nigerian economy. The Nigerian currency then, that is the Nigerian pound was denominated against the British pound which made it a highly ease of convertible currency. This approach delayed the development of an active foreign exchange market in Nigeria until 1958 with the setting up of the Central Bank of Nigeria, (CBN) with the attendant centralization of foreign exchange authorities. It is in the light of the role of the CBN as the central monetary authority that the need to develop an indigenous foreign exchange market became prominent.

Growth in Foreign exchange and reserves in Nigeria came in the wake of discovery of oil in commercial volume as well as increase in price of crude oil mostly in the 1970s. following the introduction of the Structural Adjustment Programme (SAP) in 1986, the Second-Tier Foreign Exchange Market (SFEM) was introduced with dual exchange rates. Government businesses were done at N22 per/ US $ while others were left in the hands of the market forces. Then came the Autonomous Foreign Exchange Market (AFEM) in 1995 for the purposes of selling exchange rate end users by the CBN using authorized dealers such as commercial banks at market driven exchange rates. In 1999, Inter-Bank Foreign Exchange Market (IFEM) came in and in 2006 Dutch Auction System (DAS). Notably, there has been the blend of market forces and official control in the management of the exchange rate system in Nigeria.

Obviously, the subject of exchange rate fluctuations has become a topical one in Nigeria. This is because it is the goal of every economy to maintain a stable rate of exchange but in Nigeria, this goal has not been easily realized in spite of the fact that the country has tried devaluation to promote export and stabilize the rate of exchange. Onwuka and Igwezea (2014) stated that the issue of exchange rate market, that is facing Nigeria just like any other developing economies has a lot to do with the gap that exists between supply of foreign exchange and its demand.

One of the most official definition of Foreign Reserves is by International Monetary Funds (2006) that sees international reserves as "consisting 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." This view is corroborated by Nzotta (2004) that foreign reserves are produced by the disparity between foreign exchange disbursements and foreign exchange receipts. Though various views about reserves holding abound, scholars are undecided as to the relevance or otherwise of such especially in its interface with foreign exchange rates and its relative elements.

In Nigeria like most other countries, the management of reserves and exchange rate systems are the vested responsibility of the apex monetary authority which in Nigeria's case is The Central Bank of Nigeria (CBN). This authority is embodied in the CBN Act 1991. This is remarkable within the context of this study as the two variables of interest are within the purview of the Central Bank which makes it interesting to see how they are juggled in the interest of any economy.

It is noteworthy that at some point in history, gold and silver where key denominators for international reserves. The Bretton Woods System that came in the wake of World War II made the US Dollar the reserve currency hence official international reserves assets. This is largely as a result of its convertibility and widespread use in international dealings and exchanges. Even though currently, the US Dollar and other vehicle currencies are no longer convertible into gold, they still function as official international reserves.

Over the years, there has been a fluctuation in the crude oil price in the international market which has led to instability in Nigeria external reserves with its resultant effect on the exchange value of naira especially to the dollar. The exchange rate instability became quite prominent around the 1980's especially in 1986, following the Structural Adjustment Programme and the consequent deregulation of the foreign exchange market leading to the introduction of the second-tier foreign exchange market (SFEM); the parallel exchange system.

In the year 2015, the naira exchange rate to a dollar was =N=199 but suddenly the naira went on a free fall until it found its self presently playing around =N=360 (2018) to a dollar. Curiously, the Nigeria foreign reserves had the lowest drop over the recent times. Volatilities have been quite evident in crude oil prices, exchange rate and foreign reserves over these periods prompting a question on whether this is a coincidence or is there any causal relationship among them using data series covering the period 1996-2016. Could there be any link between the changes in exchange rate and those of changes in the Country's foreign reserves.

The value addition of this study is varied but firstly it is believed that Nigeria being the most populous black nation and a leading economy in Africa can provide empirical evidence for the purposes of generalization in the matter of foreign reserves and exchange rate relationship. It should also be pointed out that Nigeria as an economy has a high-level international trade exposure given that it is an import-dependent economy in terms of subsistence and an export-dependent economy in terms of the public revenue architecture. These exposures to foreign transactions and the concomitant shocks on not just Nigeria but also on economies in the ilk of Nigeria calls for a study of this relationship so that policies can be better directed.

Another obvious value addition is the novelty of our estimation procedure. The study firstly presents sections on pre-estimation tests which focus on data description and the exposition of the basic statistical properties of the series under study. This is important because the choice of an appropriate estimation method should be preconditioned on the properties of the parameters. Second, we apply the estimation method which in this case is the Autoregressive Distributed Lag (ARDL) form of regression. The choice of this method is predicated on the fact that it circumvents some diagnostic problems that are common with the regular Ordinary Least Squares given that the ARDL is a dynamic model that simultaneously shows lagged and contemporaneous relationship amongst the variables under study. Before inference, we carry out diagnostic tests to ensure validity and validity of our estimates making them consistent with assumptions underlying the choice estimation framework.

In addition to the introduction, this paper has four other sections with section two having reviews of literature; three deals with the methodology and model specification, section four contains analyses and presentation of findings while section five gives the summary and conclusion.

2. REVIEW OF RELATED LITERATURE

There is unanimity in literature regarding the definitional make-up of foreign reserves (Nzotta, 2004) holds that foreign reserves represent the excess of foreign exchange receipts and disbursement accumulated over a period of time. More so, Ndikumana and Elhiraika (2007) submits that reserves are kept to manage exchange rate, its volatility or excess fluctuations

There is consensus in literature that exchange rate is the conversion value of a country's currency relative to other countries' currency of the world denominated by major or convertible/vehicle currencies. Literature also evidently shows that price adjusted exchange rate is called real exchange rate while non-price adjusted rates are considered nominal. Reserves are seen to be held to manage international exposure shocks especially exchange rate

and for other economic purposes. Aizenman and Marion (2003) argued that apart from exchange-rate management, countries may hold precautionary reserves to smoothen consumption and other temporary distortions. Though this may be politically motivated or corruption tendencies, it still to a large extent explain the recent accumulation of reserves in Asian countries following the Asian financial crises. This views are corroborated by Aizenman and Marion (2003); Polterovich and Popov (2002) including Bastourre et al. (2004).

Romero (2011) carried out a study of causative factors of foreign reserves in China and India and found that these countries have increased demand for reserves over time. This is consequent upon the fact that exchange rate varies inversely with reserves. Abdullateef and Waheed (2010) extended the study by evaluating the determinant of foreign reserves with emphasis on change in external reserve (EXTR) positions of Nigeria relative to domestic investment, inflation rate, and EXR. With a battery of tests, it was discovered that change in external reserves influences Foreign Direct Investment and Exchange Rates. There was however no influence on domestic investment and inflation rates.

Amarcy (2009) studied Mozambique and Nigeria with a view to finding out the implications of excessive accumulation of reserves and found that the studied parameters (exchange rates and its relative factors) assisted in evaluating the adequacy of reserve levels.

This position is corroborated by Lin and Wang (2005) tailored after Kydland and Prescott (1977) who studied some Far East Asian Countries and arrived at the conclusion that increase in foreign reserves causes inflation to rise with a stronger effect on exchange rate. These shades of opinion are consistent with Abdullateef and Waheed (2010); Khan (1979).

In a slight departure from others, Olayungbo and Akinbobola (2011) disaggregated real and nominal exchange rate and studied reserves and exchange rates in Nigeria and found that foreign reserves significantly influence nominal and real exchange rates in the short run. The Granger causality test suggests unidirectional causality emanating from nominal exchange rate to reserves.

Chinaemerem and Ebiringa (2012) as well as extended the discourse by including other macroeconomic indicators in exposing the effect of foreign reserves. While the former found that exchange rates share contemporaneous and lagged relationship, the current values of GDP, CPG, NCPG and EXCHR are found to be influencing factors that determine exchange rate; the latter a unidirectional causality from EXR to foreign reserves.

This study therefore is set to make an addition into the reserves and exchange rate nexus by using real and nominal exchange rate in agreement with prior authors but adopting an estimation method that would address diagnostic challenges hitherto expressed by prior authors.

3. THEORETICAL CONSIDERATION AND METHODOLOGY

The major theoretical underpinning for this study is the financial fragility hypothesis as formulated by Guha (2009). This captures the exposures of the developing economies to the changes and volatility of the foreign exchange market. This specifically shows how the economies of these developing nations are susceptible to changes in exchange rate which overly affects their foreign reserves. Following Henry Paulson's discussion quoted in Guha (2009) foreign reserve is modelled after exchange rate thus:

$$FR = f(NEXR, REXR)$$

The model for this work is thus structured following an ARDL Framework. The advantages include robustness in the face of small samples, ability to accommodate different orders of integration even being able to overcome diagnostic problems such as autocorrelation.

Specifically, the model is specified thus:

$$\Delta FR_t = \beta_0 + \sum_{i=1}^{m} \beta_1 \Delta NEXR_{t-1} + \sum_{i=1}^{n} \beta_2 \Delta REXR_{t-1} + \gamma_1 NEXR_{t-1} + \gamma_2 REXR_{t-1} + \mu_t$$

Where:

FR = Foreign Reserves

NEXR= Nominal Exchange Rate

REXR = Real Exchange Rate

μ_t = *Error term*

The dataset for the study is drawn from the Central Bank of Nigeria (CBN) sources for the period 1996 to 2016. The datasets are annualized time series that are secondary in nature. The estimation processes will follow an array of pre-estimation test, the ARDL estimation and a couple of diagnostic tests. The study is a research survey design. The endogenous/caused variable is foreign reserves while the exogenous/causal variables are nominal exchange rate and real exchange rate.

4. DATA PRESENTATION AND DISCUSSION OF FINDINGS

The basic statistical properties of the variables under study are contained in table 4.1 below:

Table-4.1. Descriptive statistics

	FR	NEXR	REXR
Mean	25027.38	87.07191	83.37636
Median	26990.60	95.64209	79.57667
Maximum	58472.90	131.2967	155.7536
Minimum	2158.000	28.32107	19.07426
Std. Dev.	17149.06	27.29767	38.94991
Skewness	0.190155	-1.159910	0.118246
Kurtosis	1.716192	3.639129	2.600048
Jarque–Bera	1.568698	5.066295	0.188904
Probability	0.456417	0.079409	0.909872
Observations	21	21	21

Table 4.1 above, presents the basic descriptive statistics showing the mean, median and mode for all the observations at first difference. This includes the standard deviation which is a measure of dispersion. The kurtosis, skewness and the Jacque Bera Statistics which are tests for normality for the distributions. We found the variables largely playtykurtic since their kurtosis are all less than two and the p-values of the JB Statistics in all the instances are greater than 5% except in the case of nominal exchange rate that is leptokurtic.

Table 4.2 below shows the result of the test of the degree of linear association of the variables.

Table-4.2. Correlation Analyses

	FR	NEER	REER
FR	NA	0.502044	0.481660
NEER	0.502044	NA	0.771279
REER	0.481660	0.771279	NA

From the correlation matrix shown in Table 4.2, foreign reserves, nominal and real exchange rate are positively correlated with varied percentages. Foreign reserve share 50% and 48% positive correlation with nominal

and real exchange rates respectively. On the other hand, nominal exchange rate shares a 77% positive correlation with real exchange rate.

Table 4.3. ARDL Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
FR(-1)	0.845262	0.142492	5.931978	0.0002
FR(-2)	-0.328082	0.208258	-1.575358	0.1496
FR(-3)	-0.159342	0.219629	-0.725504	0.4866
FR(-4)	0.314977	0.132664	2.374241	0.0416
NEER	57.37953	113.8750	0.503882	0.6264
REER	-205.1349	80.17844	-2.558479	0.0308
REER(-1)	358.8179	61.81597	5.804615	0.0003
C	-8489.569	8126.160	-1.044721	0.3234
R²	97%			
Adjusted R²	94%			
F-statistic	44.3(p<0.05)			
Durbin-Watson stat	2.44			

Table 4.3 shows the ARDL estimates while the equation below shows the substituted coefficients all following the form specified in equation 1.

Substituted Coefficients:

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$FR = 0.85*FR(-1) - 0.33*FR(-2) - 0.16*FR(-3) + 0.31*FR(-4) + 57.38*NEER - 205.13*REER + 358.82*REER(-1) - 8489.57$

From table 4.3 above, the R^2 which is a show of the goodness of fit of the model is 97% which means that 97% of variation in FR was explained by the independent variables and about 13% of the relationship is explained by factors outside the model. The F-statistics of (44.36641 P-value = 0.000003) at a critical value of 0.05 shows that the overall regression is significant and can be used for meaningful analyses. The Durbin Watson statistics (DW) value of 2.45 shows that there is no evidence of a first order serial autocorrelation (AR(1)). By rule of thumb, if the DW statistics is approximately equal to 2, it is evidence against the existence of a first order serial correlation.

5. TEST OF HYPTHESES

Hypothesis 1

The null of this hypothesis is stated thus;

H_0: Nominal exchange rate does not positively and significant impact of on foreign reserves.

H_a: Nominal exchange rate does positively and significant impact of on foreign reserves.

This hypothesis is tested using auto regressive distributed lag models (ARDL) from table 4.3. The coefficient of the relationship between Nominal Exchange rate and foreign reserves is 57.37953 indicating that a unit change in nominal exchange rate leads to a 57.3% change in foreign reserve. This change is however not significant since the p-value of the t-statistics which is 0.6264 (63%) is greater than 0.05 (5%). Based on the above, we cannot reject the null hypothesis. This makes us conclude that there is no significant relationship between nominal exchange rate and foreign reserves.

Hypothesis 2

H_0: Foreign reserves do not positively and significantly correlate with real exchange rate.

H_a: Foreign reserves positively and significantly correlate with real exchange rate.

This hypothesis is tested using correlation analysis from table 4.2. Given that foreign reserves and real exchange rate share positive and significant correlation, (48%, pvalue = 0.027). We conveniently reject the null hypotheses and conclude that foreign reserves positively and significantly correlate with real exchange rate.

6. CONCLUSION, SUMMARY AND RECOMMENDATION

This work was set out to measure the responsiveness of foreign reserves to exchange rate variables with a focus on the Nigerian economy. Exchange rate was proxied by the nominal and real variants while the natural logarithm of aggregate foreign reserves was used for foreign reserves. A combined use of ARDL and correlation matrix was employed as estimation technique at the end of which a positive and significant correlation was found between real exchange rate and foreign reserves with nominal exchange rate sharing a positive but non-significant relationship with foreign reserves.

Theoretically speaking, there seem to be no relationship between the nominal value of exchange rate and foreign reserve in the Nigeria context given that foreign reserves are dollar denominated hence may not be affected by nominal changes in the domestic exchange rate.

Conversely, the relationship with real exchange rate presents a different proposition since it is domestic price dependent. This obviously shows the reality of the found relationship between the real variant as opposed to the nominal variant. It is common knowledge even in literature that real exchange rate is a favoured choice in exchange rate related discourses as it has an adjustment for price.

By way of policy implication, this calls for a redirection in a manner that will ensure the evolution of appropriate exchange rate policies and regimes that will enable the economy build its reserves. This is made necessary by the fact that reserves provide buffer in times of economic difficulties especially for developing economies like Nigeria.

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