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Impact of International Liquidity on Foreign Exchange Rate in Nigeria: A Comparative Crosscheck

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Abstract

This paper investigated the impact of international liquidity on exchange rates in Nigeria. Monthly data was sourced from the CBN statistical bulletin of 2017 series from 1981M1 to 2017M12. Exchange rate was made the regressand and then international liquidity, price level, export and import, the explanatory variables. ARDL and ECM were employed to analyse our data. Findings showed that, in both the short and long run, international reserves and export revealed a positive impact on exchange rate, while price level as well as import revealed a negative impact. However, only price level was not significant. Furthermore, the scaled result indicated that export has the most comparative impact on exchange rate. This was followed by import and then international reserves. The study suggests that, international reserves has a major impact and use of stabilizing the exchange rate and so there is need for the reserves to be either maintained or improved if the economy wants to maintain a managed floating exchange rate system. The government could reduce inflation rate in other to improve exchange rate and then increase export. Import substitute goods could be environmentally improved to reduce the quest for imported goods.

Key words

International reserves, external reserves, exchange rate, export and import

JEL Codes: E62, F31, F32

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1. Introduction

Fluctuation in Nigerian Naira has been a concern to many citizens of the country and the possibility of not making use of the so-called dollar exchange rate for any external transaction. The economy sometimes ago used the fixed exchange rate, and then floating rate and finally and presently, the managed floating exchange rate. The question remains that, what is the Nigerian government doing with our international liquidity popularly known as external reserves? Do we need to have any reserve when we are in need? In place of borrowing fund from the international financial institutions that will attract cut-throat interest rate, why not we withdraw our money from the excess reserve? Unfortunately, even some economists domiciled in Nigeria, are asking such questions.

As said by Nwachukwu *et al.* (2016) that the increased demand for foreign exchange in a period and oscillation in foreign exchange earning of Nigeria, to the negative, keep on mounting pressure on the Nigeria's foreign reserves. The more the gap between demand and supply of hard currency is widened, the more the pressure to push downward the external reserves. This view made known one of the essence of external reserves as many do inquisitively enquire. The meaning of international reserves is broadly put as, the official government foreign assets that are effortlesslyat the disposal of the monetary authorities and regulated by them, mainly used for direct financing of imbalances as well as direct regulation of the degree of such imbalances through involvement in the exchange markets to influence the currency exchange rate (IMF, 2006).

2. Literature review

Exchange rate, as put in Economic textbook, "is the price of one currency in terms of another currency. Foreign exchange rate is measured as the amount of foreign currency that can be bought with one unit of domestic currency" (Samuelson and Nordhaus, 2010). Foreign exchange rate varies from week to week and month to month according to the forces of demand and supply of currencies which are the main determinants of exchange rate. Jhingan (2010) posited that exchange rate is the scale at which one currency is substituted for another. International liquidity popularly known as foreign reserves is the total stock of internationally acceptable assets held by the central bank to resolve a deficit in a country's balance of payment. More so, it provides a gauge for a country's ability to finance its deficit in balance of payments devoid of having any recourse to adjustment measures. It is also known as international reserves. Within the short period, foreign exchanges (forex) that are precipitated by market are highly elastic in response to monetary policy, political actions and change in

expectations. Basically three theories of determination of foreign exchange rate emerged: The Mint Parity; Purchasing Power Parity; and the Balance of Payment theory. The mint parity hypothesis is connected with the functioning of international gold standard. In this theory, the money in use was made of gold or what was exchangeable into gold at a flat rate. The worth of the legal tender unit used to be distinct in terms of definite mass of gold. The apex bank of the nation used to be for all time set to purchase as well as vend gold at a specific price. The rate at which the standard money of the country was convertible into gold was called the mint price of gold. Therefore, exchange rate under this theory is determined by the forces of demand and supply between the gold points and its prevention from moving outside the gold points by shipments of gold.

Under purchasing power parity theory, forex are strong-minded by the comparative prices of goods in various countries. Hence, nations with lofty inflation rates will tend to have decreasing worth of currency. This is because the country with high inflation will have its goods expensive in other countries and hence foreigners will not demand for its goods. Implicatively, exchange rate between two nations is influenced by their comparative price levels – inflation rate. Conforming to the balance of payment hypothesis, under free exchange rates, the exchange rate of the currency of a country is a function of its balance of payment. Appreciation of the exchange rate is acheived when the country experiences a favorable balance of payment and vice versa. The theory suggests that the exchange rate is regulated by the forces of demand for and supply of foreign exchange.

Even with these theories, many countries employ basically three exchange rate policies to manage their exchange rate. These policies are: fixed exchange rates, which makes all exchange rate determined solely by the monetary authority; Flexible exchange rate, in which monetary authority does not mediate to influence exchange rate, the market forces determine the exchange rate; Managed or controlled floating system or intermediate exchange rate policy, which has been put into operation when the International Monetary Fund (IMF) came into being to eschew flows inherent in the two extreme systems. Under this policy, the authority arbitrates in the exchange market to smooth out short run variations in exchange rates. This is mostly done by supplying or mopping the country's exchange reserves. If the short run demand for foreign currency in the flexible market is more than supply, the apex bank supplies the foreign exchange reserves in the market, thereby moderating devaluation of its currency. Also, when supply of currency is over and above its demand in the market, it will absorb (buy) the excess supply, which increases its foreign or external reserves, thereby moderating increase in worth of the country's currency. The policy, according to Jhingan (2010), is also known as the policy of leaning against the wind. Summary of the theories and policies is that, both foreign reserves and price level have clear impact in deciding the rate of exchange an economy will experience.

Eliza *et al.* (2008) investigated demand for foreign liquidity in Malaysia for the period between 1970 and 2004 employing autoregressive distributed lag (ARDL) tool. He made current account balance and external debt as the explanatory variables and international reserves the dependent variable. His finding revealed that there was a significant impact of current account balance on foreign reserve in both periods. In the Turkish economy, Gürđ (2012) examined the connection between international liquidity and exchange rates using the threshold error correction model (ECM) as well as granger causality. His finding showed a high correlation figure between international liquidity and exchange rate. In the same vein, studying the long run connection between foreign reserves and exchange rates, Ahmad and Pentecost (2009) investigated 34 years periods of some African countries, making use of threshold co-integration technique. Their finding indicated an existence of long-run connection between the two variables. Abdullateef and Waheed (2010), on the Nigerian economy, examined the essence of change in external reserve positions on domestic investment, price level as well as exchange rate, employing OLS and Vector Error Correction (VEC) tools. Their findings divulged that, change in external reserves did not have any influence on domestic investment and price level.

Upon ascertaining structural breaks as international liquidity relates to exchange rate, Olayungba and Akinbola (2011) investigated the relationship on the Nigeria economy during 1970–2006 using cointegration and error correction model. Their result indicated a higher speed of adjustment of international liquidity to oscillation in nominal exchange rate than changes in the real exchange rate. This could be because inflation is one of the causes of exchange rate change. However, they did not put it as part of their independent variables. Employing the Vector Autoregression technique, Chinaemerem (2012) studied the connection between international reserves and foreign exchange between 1980 and 2009. His result showed a negative connection between international reserves and foreign exchange rates in Nigeria. However, we are all aware the VAR does not have theoretical undertone.

In a study on the determinants of foreign exchange rate, Nwude (2012) employed Ordinary Least Squares (OLS) to analyse a data set of annual data between 1960 and 2011 in Nigeria, making exchange rate movement as the dependent variable and price level, deposit and lending rates as explanatory variables. His results indicated an insignificant association between the dependent and explanatory variables.

Ramasamyamy and Abar (2015) studied how macroeconomic variables make impact on rate of exchange, make use of three countries yearly exchange rates with their macroeconomic variables such as inflation, balance of payment, corruption index and deficit/surplus, employing multi-models by linking corresponding variables to categorize the best model. Findings indicated that model B showed the best, as all macroeconomic variables influenced the rate of exchange significantly.

The recent research on exchange rate, in economics literature is the work of Harley *et al.* (2018) who considered the antecedents of foreign exchange rates in Nigeria from 1986 to 2016. The focus was to analyse the causal affiliation between foreign exchange and external reserves, used multiple regression to analyse their annual data of 31 observations. Their results revealed that, the impact of foreign reserves, interest rate and inflation rate were not significant while export and import have significant impact on exchange rate. The researchers have not used the right tools to analyse the causal relationship as they intended. More seriously was the issue with spurious analysis since their data were not tested for stationarity. Hence, the work is not reliable and calls for more studies.

And the work of Kalu *et al.* (2019), is the most recent in literature, who studied exchange rate and foreign reserves in the Nigerian economy using annual data between 1996 and 2016. They made foreign reserves as the dependent and nominal and real exchange rates as explanatory variables. They employed correlation matrix and ARDL and discovered that a positive and significant connection exist between real exchange rate and reserves while the nominal exchange rate was also positive but not significant. It would have been reliable if they had removed trends from their data set. This study is therefore different from many studies of the past as it makes use of wide range of data periods, makes exchange rate as the dependent variable and then uses only all three variables backed by theory (international reserves, price level and balance of payment proxied by export and import). It is quite unique in that, it uses beta coefficient to relatively compare the explanatory variables and pick out the most influential variable in the Nigerian economy. In essence, the study has the objectives of first examining the significant impact of the explanatory variables on exchange rate, as well as determines the comparative/relative impact of the explanatory variables. This will give answer to the enquiry of many people about the essence of international reserves.

3. Methodology of research

Many researchers have used VAR and VECM which some textbooks say VAR has issues with theory and equality of lag periods which in real world situation may not be obtainable. Others used SVAR which is mostly used for relationship; ARDL and ECM. In order to analyse the essence of international reserves (IR), Balance of payment, disaggregated to import and export, and price level (inflation rate) on exchange rate in Nigeria, the work employs ARDL and ECM models because the techniques of analysis are backed with economic theory and take care of lag differences as obtainable in real life situation. More so, a scaled or standardized coefficient is employed to relatively compare the explanatory variables.

After testing for unit root using the Phillip Peron (PP) and the Augmented-Dickey Fuller (ADF) tests, the Lag Selection Order Criteria was used to select the best model, and then the ARDL equation was estimated. We examined the possibility of long run relationship in the model using ARDL bound test. We employed the cointegrating equation and long run test thereby giving us an error correction model (ECM).

3.1. Model Specification

The study adapted the work of Harley, Adegbola and Afolabi (2018) majorly because of the similarity but different in country, data period and some other peculiarities. The model was modified to test for the impact of international reserves, price level, export and import on exchange rate. Exchange rate was modeled as a function of international reserves, price level, export and import. This is expressed as follows:

$$EXR = f(IR, P, X, M) \quad (1)$$

All the variables in the dataset are first transformed into the natural logarithm for noticeable statistical reasons of standardization, equality of the variables and removal of trend as rightly said by Adefeso and Mobolaji (2010). The model specification in equation 1 thus assumes the form:

$$lEXR = \beta + \beta_1 lIR + \beta_2 lP + \beta_3 lX + \beta_4 lM + \mu \quad (2)$$

where:

lEXR=Logarithm of exchange rate; lIR = Logarithm of international reserves; lP = Logarithm of price level (inflation rate);

lX = Logarithm of export; lM = Logarithm of import.

We expect that, when export (X) increases, international reserves (IR) increases, it will improve the exchange rate, therefore, both will have positive impact of exchange rate. When price level (P) increases, it will make cost of production to

increase, which will reduce production in the home country. It will make people to demand for imported goods, which will in turn reduce exchange rate. Hence, they both have negative impact on exchange rate.

Summarily, β_1 ,β_3> 0, β_2 , β_4 < 0.

3.2. Data Sources

Data set for this study was monthly data between 1981M1 and 2017M12, showcasing 445 observations. This gave an opportunity to open up the nature of volatility in exchange rate, international reserves and other related variables in the model. Time series data (Secondary data) was sourced from the CBN statistical bulletin 2017.

4. Results

4.1 Result of Stationary Tests

Due to the problem of time series with non-stationary issue, we tested for trend using the ADF and PP unit root tests. The results are presented on Tables 1(a) and 1(b).

Table 1(a). ADF Test

Variable	At Level	Prob.	At 1st Diff	Prob.
LEXR	-1.824464	0.3685	-20.67528	0.0000
LIR	-0.867086	0.7981	-16.69637	0.0000
LP	-3.370891	0.0125	-	-
LX	-1.149111	0.6973	-21.31353	0.0000
LM	-0.812635	0.8142	-21.35592	0.0000

Source: Author's own computations

From Tables 1a and 1b, all variables are trended at level except LP that has no trend at 5% level of significance. Also, at first difference, LIR, LEXR, LX and LM become stationary at 1% level of significance. Hence all the variables are ready for further use in our model and therefore saved from spurious analysis.

Table 1(b). PP Test

Variable	At Level	Prob.	At 1st Diff	Prob.
LEXR	-1.836002	0.3628	-20.67305	0.0000
LIR	-1.811888	0.3746	-30.93594	0.0000
LP	-3.756402	0.0037	-	-
LX	-1.157244	0.6940	-21.33069	0.0000
LM	-0.807139	0.8157	-21.38909	0.0000

Source: Author's own computations

4.2. Result of Model Selection Criteria

Table 1c presents the order of model selection criteria using the Akaike Information for the top twenty models. From the figure, it is clear that the ARDL (1, 0, 0, 0, 0) is chosen as the best model (lag), therefore we employ this model.

Table 1c. Akaike Information Criteria

AIC	Model Specification
-1.8315	ARDL(1, 0, 0, 0, 0)
-1.8300	ARDL(1, 0, 3, 0, 0)
-1.8292	ARDL(1, 0, 1, 0, 0)
-1.8278	ARDL(2, 0, 0, 0, 0)
-1.8274	ARDL(1, 0, 4, 0, 0)
-1.8271	ARDL(1, 1, 0, 0, 0)
-1.8270	ARDL(1, 0, 0, 1, 0)
-1.8269	ARDL(1, 0, 0, 0, 1)
-1.8268	ARDL(1, 0, 2, 0, 0)
-1.8264	ARDL(2, 0, 3, 0, 0)

Source: Author's own computations

4.3. Results of ARDL and Scaled Coefficient

The coefficients of LIR (0.025) and LX (0.25) show that, LIR (international reserves) and LX (export) have positive impact on LEXR. This means that, a 1% increase in LIR and LX, on the average, will lead to about 2.5% and 25% increase in LEXR. Their impacts are more so significant at 5% and 1% level. Still on the same Table, the coefficients LM (-0.165) and LP (0.00105) show that they both have negative impact on LEXR, while the impact of LM is significant at 1% level, the impact of LP is not, even at 10% level of significance. On the LM result, it implies that, a 1% increase in LM (import), on the average, leads to approximately 16.5% reduction in LEXR. This also goes in line with theory since if a country continues to import, it will reduce its exchange rate.

Table 2. ARDL and Scaled Coefficient

Variable	Coefficient	Standard Error	t-Stat.	Standardised Coefficient	Probability
DLEXR(-1)	0.021613	0.047036	0.459494	0.021613	0.6461
DLIR	0.024669	0.012701	1.942278	0.092593	0.0528
LP	-0.001049	0.005655	-0.185547	-0.008759	0.8529
DLX	0.250144	0.059143	4.229455	0.326571	0.0000
DLM	-0.165308	0.065271	-2.532662	-0.194666	0.0117
C	0.015471	0.015857	0.975655	NA	0.3298
R^2	0.048123				
R^2 Adjusted	0.037080				
F –Stat	4.357918				
Prob.(F-stat)	0.000702				
Durbin Watson(DW)	2.003449				

Source: Author's own computations from E-Views 9

The R^2 shows that about 4.8% of variation in LEXR is explained by the model. This only shows that, there are many other variables responsible for changes in LEXR outside the model. The R^2 adjusted shows that about 3.7% variation, which is in close range with the R^2, indicating that there is no redundant variable par say. Though the R^2 and R^2-adjusted, show a very low percentage, our concern is mostly on the significance of the individual coefficients which is of prime importance to us for policy inference. The F-statistics (4.357) and its probability (0.000702) indicate that the goodness of fit is significant at 1% level. The Durbin- Watson statistics (2.003) is highly encouraging as it is approximately 2.0 signifying the absence of autocorrelation in our model.

Column 5 of Table 2 showcases the standardized coefficients of the variables. It is sometimes called beta coefficients, mainly employed to compare relative effect of the regressors on the regressand. From the Table 2, it shows that LX (0.3266) has the highest comparative impact of about 33% on LEXR. This is followed by LM (0.19467),about 19.5% and then LIR (0.0926), about 9.3% respectively.

4.4. Results of ARDL Bound Test

Table 3. Bound Test Result

Test Statistics	Value	K
F-statistics	83.85414	4
Critical Value Bounds		
Significance	**I0 Bound**	**I1 Bound**
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Source: Author's own computations

In order to examine whether the model has the ability to influence exchange rate in the long run, the ARDL model was tested for existence of any long run connection by means of Bound Test. Table 3 showcases this result.

Since the F-statistics (83.85414) is more than the critical value bound at 1% (3.74 – 5.06), the null hypothesis is rejected and hence accepts that there exists long run association. This result takes us to employing the ECM in determining the short and long run as well as speed of adjustment of the model.

4.5. ARDL Cointegrating Equation

Table 4. ARDL Cointegrating Equation

Variable	Coefficient	Std. Error	t-Statistics	Prob.
D(DLIR)	0.024669	0.012701	1.942278	0.0528
D(LP)	-0.001049	0.005655	-0.185547	0.8529
D(DLX)	0.250144	0.059143	4.229455	0.0000
D(DLM)	-0.165308	0.065271	-2.532662	0.0117
ECM(-1)	-0.978387	0.047036	-20.800638	0.0000
Cointeq = DLEXR - (0.0252*DLIR -0.0011*LP + 0.2557*DLX -0.1690 *DLM + 0.0158)				

Source: Author's own computations

Table 4 presents the cointegrating equation consisting of short run impact and the ECM of the ARDL model using the selected specification ((1, 0, 0, 0, 0). The short run analysis has been explained on Table 2 whose result is not different from this. The coefficient of the ECM (-0.978) shows a negative sign and high speed of adjustment which is correctly signed meaning that about 97.8% of the disequilibrium is corrected in a month. It is also significant at 1% as the t-statistics (-20.800638) and probability (0.0000) show. This result is in contrast with the work of Nwachukwu *et al.* (2016).

4.6. Results of Long Run Connection

Table 5. Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistics	Prob.
C	0.015812	0.016195	0.976355	0.3294
DLIR	0.025214	0.013043	1.933158	0.0539
LP	-0.001072	0.005780	-0.185530	0.8529
DLX	0.255670	0.062017	4.122568	0.0000
DLM	-0.168960	0.067218	-2.513594	0.0123

Source: Author's own computations

According to the result in Table 5, LIR and LX have a long run positive impact on the LEXR, and their impacts are significant at 5% and 1%levels. In essence, a1% increase in LIR and LX, on the average, will lead to about 2.5% and 25% increase in LEXR. Their impacts are more so significant at 5% and 1% levels. Still on the same Table, the coefficients LM (-0.165) and LP (0.00105) show that they both have negative impact on LEXR, while the impact of LM is significant at 1% level, the impact of LP is not, even at 10% level of significance. On the LM result, it implies that, a 1% increase in LM (import), on the average, leads to approximately 16.5% reduction in LEXR (exchange rate). The finding is in tandem with economic theory since if a country continues to import, it will reduce its exchange rate. Our result in the long run generally does not really appear in much variance with those of the short run as the results show.

6. Conclusions and Policy Implication

The study investigated the impact of international reserves on exchange rate in the Nigerian economy. Secondary data was sourced from the CBN statistical bulletin of 2017 series with monthly data from 1981M1 to 2017M12. Rate of exchange stood as the regressand and international reserves, price level, export and import represented the regressors. ARDL and ECM were employed to analyse our data. Findings showed that, in both periods, international reserves and export indicated a positive and significant impact on exchange rate, which by implication, when the government increases its international reserves and exports of goods are services, the rate of exchange of Naira to US Dollar will be fortified and appreciated significantly. On the other side, the research found out that price level along with import revealed a negative impact. The implication is that, rise in price level and import of goods and services will significantly depreciate the Naira currency, except for price level that was not found to be significant in both periods in the Nigerian economy. Furthermore, the scaled result indicated that export has the most comparative impact on exchange rate, followed by import, meaning that net export is very paramount. They are both components of balance of payment which in all, will either improve or deplete the international reserves (external reserves) of the country. The study therefore suggests that, international reserves has a major impact and use of stabilizing the exchange rate and so there is need for the reserves to be either maintained or improved if the economy wants to maintain a managed floating exchange rate system. The government could also reduce inflation rate in other to improve exchange rate and then increase net export.

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