THE MACROECONOMIC FACTORS THAT INFLUENCE FOREIGN EXCHANGE RATES VOLATILITY IN NIGERIA

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Ernest Odior

1. Introduction

In international trade, foreign exchange rate plays an important role, as it gives value for currency in order for one country to make conversion to another country. It means that through foreign exchange rate, value of currency is converted to another. Foreign exchange rate will affect the real return of an investor's global investment portfolio. Investor may prefer to invest in a country where its exchange rate is stable because in an economy where the exchange rate volatility is high, it gives higher risk to investors, a risk- adverse investor will never invest in this type of economy. In order to better forecast future foreign exchange rate, understanding the determinants that force a move on foreign exchange rate is crucial. From time to time, researchers carryout researche to improve forecasting performance. A country must manage its exchange rate in order to boost up its economy (Chowdhury & Hossain, 2014; Bouraoui & Archavin, 2015).

Foreign exchange rates also play a very important role in international trade. For example, companies and banks need a stable foreign exchange rate in order to evaluate the performance of their investment, by doing financing and hedging so as to help them reduce the risk they take during operation. Also, firms and companies which are involved in exportation and importation will be heavily impacted with high cost of importing capital and raw materials they may incur when there is depreciation in exchange rate which may result in increase in unemployment rate and increase price of domestic goods (Abbasi and Safdar, 2014).

Most economies (developed and developing) of the world have experienced high foreign exchange rate volatility, which translates into high degree of uncertainty in the attainment of major macroeconomic and monetary policy objectives in the area of price stability and economic growth. Volatile foreign exchange rates are associated with unpredictable movements in the relative prices in the economy. Hence, foreign

exchange rate stability is one of the main factors influencing foreign (direct and portfolio) investments, price stability, and stable economic growth.

The foreign exchange rate and its volatility are key factors that influence economic activities in Nigeria. That is why foreign exchange (FX) market fluctuations have always attracted considerable attention in both the economics and statistics literature. Foreign exchange rate traditionally played a crucial role in Nigeria's monetary policy because of its crucial impact on the country's trade relation with other countries, first, as a mono-product (oil) export dependent economy and second, as an import dependent (developing) nation; besides the country's competitiveness and overall economic growth. This study sought to determine the factors that influence volatility in the foreign exchange rate in Nigeria.

The foreign exchange rates in Nigeria over the last two decades have been characterised by volatility that creates uncertainty in the economy; meaning, potential international businesses are naturally exposed to exchange risks if they are to invest in Nigeria. Therefore, understanding the impact of economic factors affecting the Nigerian foreign exchange policy is very crucial for multinational corporations, investors, and practitioners.

In relation to foreign exchange, Nigeria is now a hot topic due to the sharp depreciation and devaluation in domestic currency. Naira started to depreciate in late 2015 to 2017, it breached at ₦362/USDollar. These not only affect the consumer daily spending in that country, but also influence the economy in Nigeria as well. Besides, Nigeria is a developing country; foreign exchange rate is important to the large amounts of the importer and exporter. In order to help maintain stability of Naira, it is necessarily to understand the determinants that affect it. Thus, Nigeria was chosen to be the research target in this study, to help in avoiding similar cases happening again.

Nowadays, foreign exchange trading becomes a very popular profit earning method in Nigeria. Foreign exchange rate is a very important topic to study because it influences not only government but also all companies, traders, as well as all individuals in an economic. Barbara (2015) stated that about 62 per cent 8 million foreign exchange trading accounts were opened by people who are under age 35. People nowadays like to work with jobs which have flexible working time, and many students trying to find a simple way to earn some pocket money, foreign exchange trading always is one of their choices of alternative income as it is easy to be exercised. As more and more people enter into foreign exchange market, the fluctuations in foreign exchange rate will have a bigger impact towards the society.

Residents should realise that they are responsible for foreign exchange rate stability of their nations, and thus, it is important for them to study more about foreign exchange rate in order to avoid personal losses and also social losses, knowing that determinants of foreign exchange rate are crucial.

From time to time, researchers used variety of variables on their researches to examine the determinations of foreign exchange rate, such as debt, export, import money supply, tax and so on (Ahmed *et al*., 2012; Hassan and Gharleghi, 2015; Udousung *et al*., 2012). It cannot be denied that the macroeconomic variables tend to have notable effects on foreign exchange rate; however, it's arguable in order to know which macroeconomic variables are significant to determine the rate.

This study is aimed at investigating the dynamic influence of some of the macroeconomic factors on the volatility of the foreign exchange rate in Nigeria. The research was guided by the following research questions: Is there a relationship between foreign exchange rate and lending interest rate, inflation, terms of trade and external debt?

This study is organised into 7 sections. Sections one is the introduction, giving a general idea of the research. Section 2 is the review of the literature. Section 3 is the quantitative framework and model specification. Section 4 is the estimation techniques, while 5 is the analysis of empirical result of the study. Section 6 and 7, give the implication of findings, conclusion, and policy recommendation respectively.

2. Literature Review

Foreign exchange rate shows the value of a nation's currency against another nation's currency, it can be quotedeither in a direct or an indirect way. Direct quotation refers to a foreign currency being expressed in terms of domestic currency; while indirect way means that a domestic currency is expressed in terms of foreign currency. In modern era, countries are able to determine the foreign exchange rate solely based on the market forces with established standard. Most currencies fixed their values in terms of gold before World War I but after World War II, most of the currencies are fixed based on the USD (Bashir *et al*., 2014).

Foreign exchange rates are determined by factors, such as inflation rates, interest rates, trade flows, external debt, foreign reserve, confidence, the current account on balance of payments, economic growth etc. For example: If Nigeria businesses become relatively more competitive, there would be greater demand for Nigerian goods; this increase in demand for Nigerian goods would cause an appreciation

(increase in value) of the Naira. However, if markets were worried about the future of the Nigerian economy, they would tend to sell Naira, leading to a fall in the value of the Naira.

Inflation is one of the major factors that affect the Foreign exchange rate. Theoretically a low inflation rate scenario will exhibit a rising currency rate, as the purchasing power of the currency will increase as compared to other currencies. The influence of foreign exchange rate towards inflation itself depends on the choice of exchange rate regime in the country. Exchange rate system has an important role in reducing or minimising the risk of fluctuations in exchange rates, which will have an impact on the economy. Any changes in exchange rates will have a great impact on the economy (Eichengreen, 2004).

According to Ngumo (2012), lending interest rate is a price which a borrower pays in order to consume resources. In other words, it is an amount charged by a lender to borrower for uses of assets (Vikram and Vikram, 2015). The theoretical as well as empirical relationship between the interest rate and exchange rate has been a debatable issue among the economists. According to Mundell-Fleming model, an increase in interest rate is necessary to stabilise the exchange rate depreciation and to curb the inflationary pressure, which thereby helps to avoid many adverse economic consequences. The high interest rate policy is considered important for several reasons. Firstly, it provides the information to the market about the authorities, resolves not to allow the sharp exchange rate movement that the market expects, given the state of the economy and thereby reduce the inflationary expectations and prevent the vicious cycle of inflation and exchange rate depreciation (Calvo and Reinhart 20001).

There are many researchers that have analysed the relationship between lending interest rate and foreign exchange rate. From the research of Mirchandani (2013), lending interest rate and foreign exchange rate are highly correlated. The researcher indicated that there is a negative correlation between lending interest rate and foreign exchange rate, where increase in lending interest rate will cause depreciation of home currency. According to Ramasamy and Abar (2015), lending interest rate should positively affect the home currency in foreign exchange rate as per theory but at the end it came out with opposite results. The researchers have analysed some of the reasons. Firstly, the value of currency is extremely stronger. The strength probably comes from the confidence of the public and investors and not from the influence of economic variable prevailing in the countries.

On the other hand, Sinha and Kohli (2013) found that lending interest rate and foreign exchange rate has a positive relation. They further stated that higher interest rates may attract foreign capital as the investors would like to invest with higher interest rate to generate more profits. The demand for the domestic currency will then increase, hence, the value of domestic currency will also increase. Moreover, highlighted from Chowdhury and Hossain (2014), increase in lending interest rate will cause appreciation of home currency against another currency. Bashar and Kabir (2013) also found a positive and significant relationship between lending interest rate and foreign exchange rate in the long run.

Besides, Abdoh *et al* (2016) stated that there is an insignificant relationship between foreign exchange rate and lending interest rates while other variables such as exports significantly affect the foreign exchange rate. Their findings are identical with the findings of Nwude (2012), who stated that lending interest rate has no statistical significant relationship towards exchange rates.

Theoretical analyses of the relationship between higher exchange rate volatility and international trade transactions have been conducted by different scholars. Higher exchange rate volatility leads to higher cost for risk averse traders and to less foreign trade. This is because the exchange rate is agreed on at the time of the trade contract but payment is not made until the future delivery actually takes place. If changes in exchange rates become unpredictable, this creates uncertainty about the profits to be made reducing the benefits of international trade (Hooper and Kohlhagen, 1978).

As mentioned earlier, commonly, export values have a positive relationship with foreign exchange rate while import values have negative relationship with foreign exchange rate. Thus, in order to have a foreign exchange rate appreciation, researchers said it should have a high export value and low import value, where the value of ratio will be larger than 1 or 100%. It is hypothesised that the relationship between export/import ratio and foreign exchange rate is positive (Meng, 2015). Increase in export and/or decrease in import will cause the ratio to increase; and when the ratio becomes higher, the domestic currency value will be appreciated and thus foreign exchange rate will increase. It might be due to when export is larger than import that demand for local currency will be higher, and thus, the value of local currency will be appreciated.

Besides, Meng (2015) stated that increase in export rebate rate, will restore a country's export competitiveness and thus foreign exchange rate devaluation. Continued fiscal expansions will also cause rising in home price level and foreign exchange rate. For example, as the Chinese exports become cheaper, other nations

will be in a disadvantaged position if they are competitors of China in export markets, which can explain the competition in exportation market with the price effect.

Studies have found that exchange rates play a role, together with more standard arguments such as economic activity and inflation, in interest rate rules for EMEs. Bashir and Luqman (2014) stated that too much trade restrictions and import barriers imposed by country, and the decreased import values will lead to appreciation of exchange rate. Parveen *et al*. (2012) also suggest that increases in import would lead to depreciation of foreign exchange rate. Further, Gelbard and Nagayasu (2004) said that import value is assumed to be negatively related to the exchange rate. These results are consistent with research results from Nucu (2011) who found that increase in imports would cause current balance account to become poor, and thus lead to currency depreciation. Besides, Abbas and Raza (2013) found that there is no significant relationship between the trade values and foreign exchange rate. The reaction of the trade balance to exchange rate volatility is a fundamental issue in macroeconomics.

Muhammad and Fayyaz (2015) primarily focused on finding the impact of external debts and world oil prices on foreign exchange rate; to compare the findings with Nigeria and to urge the requisite course of actions by the concerned authorities of the government of Pakistan. Least Square Regression model with lag variables and Granger Causality Test were used to analyse the data of 1965 to 2009. The results portrayed that external debts have significant influence over exchange rate, while no such evidence was found for the world oil prices. Management of funds borrowed from foreign countries can negatively influence foreign exchange of a nation. For the last forty years the United States USD and the Indian Rupee PKR has escalated to 98 from 4.60. In the case of Pakistani economy, external debts have led to very ugly incidents; negative impact on capital productivity and labour, which lowers the growth of the economy. Pakistan uses the debt for consumption purposes and to partially finance the investment programmes (Baxter & Stockman, 2011).

Ajayi and Oke (2012) established that both Pakistan and Nigeria are developing nations and suffer from foreign exchange crisis. Nigeria‘s economy is not diversely affected by the foreign exchange crisis like the Pakistan situation. It has been established that heavy borrowing from the foreign markets dry up the capital and foreign exchange since the country‘s reserves are used to repay foreign debts principles and interest. Consequently, the country loses in terms of foreign exchange to other stable nations. In states like Kenya where the borrowed funds are used for

consumption purposes, there is no economic growth, which in turn negatively affects the foreign exchange (Rogoff *et al*., 2009).

3. Theoretical Framework and Model Specification

3.1 Theoretical Framework

Relative Purchasing Power Parity
A more reliable version of purchasing power parity (PPP) is relative PPP, which allows deviation in price levels across nations, while requiring nominal depreciation to equal inflation differential so that the real exchange rate does not change. However, relative PPP sometimes is not empirically supported and it needs further investigations (Goyal, 2014).

Relative Purchasing Power can be modelled as:

$$\frac{S_1}{S_0} = \frac{(1+I_y)}{(1+I_x)} \qquad (1)$$

S_0 = spot exchange rate at the beginning of time period (Currency Y per each unit of currency X); S_1 = spot exchange rate at the end of the time period; I_y = expected annualised inflation rate for country Y; I_x = expected annualised inflation rate for country X.

International Fisher Effect (IFE)
IFE is the extension of Fisher Effect hypothesised by an American economist, Irving Fisher. IFE theory suggested that foreign exchange spot rate between two nations should change by an amount equal to but in opposite direction of the nominal interest rates differential. If the nominal rate in nation A is lower than nation B, the currency of nation A should appreciate against that of nation B by the same amount.

The formula for IFE is as follows:

$$e = \frac{(i_1 + i_2)}{(1+i_2)} \qquad (2)$$

where, e = rate of change in the foreign exchange rate, i_1 = interest rate of nation 1, and i_2 = interest rate of nation 2. However, a lot of researchers argue that IFE theory

does not constantly holds, and that the relationship between nominal interest rate and foreign exchange rate is not stable and predictable.

Interest Rate Parity

Interest Rate Parity (IRP) is one of the theories employed in forecasting foreign exchange rate. It states that there is no-arbitrage profit due to interest rates differentials that will set off the differential in foreign exchange rate, assuming that international market is capital mobilise and perfect substitutable. However, interest rate parity (IRP) does not always hold, and when IRP does not hold, arbitrage profit exists. There are generally two categories of interest rate parity theory: covered and uncovered. Covered interest rate parity (CIRP) are linked to forward exchange rates, while uncovered interest rate parity (UIRP) make expectations on future spot rates (McBrady *et al*., 2010).

Covered Interest Rate Parity (CIRP)

Investor may hedge against foreign exchange risk by forward contracts on foreign exchange market (Eeddin, 1988). Covered interest rate parity (CIRP) is a theory establishing the relationship between forward contract and interest differential in different nations. It states that covered interest rate differential between two risk-free ccountries with different currencies should be null (Fong *et al*., 2010).

The return on one country's deposit, $1+r_d$, will be equal to the return from another country's deposits, $f/s(1+r_f)$. CIRP connects money market interest rates to spot and forward exchange rates.

The following equation represents the covered interest rate parity:

$$\frac{F}{S}=\frac{(1+r_d)}{(1+r_f)} \tag{3}$$

where, r_d and r_f = domestic and foreign interest rates on similar assets, S = spot exchange rate, and F = forward rate of same maturity as the interest rates. The spot and forward markets are not always at equilibrium level as described by IRP, when interest differential and forward discount/premium are not equal, riskless arbitrage profit will exists.

Uncovered Interest Rate Parity (UIRP)

Uncovered interest rate parity (UIRP) is a status where no-arbitrage condition is reached without the use of forward contract. UIRP states that the difference between two nations' interest rates should be equal to the expected foreign exchange rate, thus, the regression of foreign exchange rate returns on interest differential will have intercept of zero and unit slope coefficient, which eliminate potential arbitrage profits. UIRP helps economists in explaining the determinants of foreign exchange rate, although this theory is often being rejected in research data (Chaboud & Wright, 2005). Besides, UIRP predicts while all other factors remain unchanged, an increase in real interest rate will appreciate the currency value, vice versa.

The equation below represents the uncovered interest rate parity:

$$(1+i_{RN}) = \frac{E_t(S_t+k)}{S_t}(1+i_{\$}) \tag{4}$$

Where, $E_t(S_t+k)$ = expected future spot exchange rate at time $t+k$, k = number of periods into the future from time t; S_t = current spot exchange rate at time t; i_{RN} = interest rate in one country (e.g. Nigeria), and $i_{\$}$ = interest rate in another country with different currency (e.g: U.S.)

Traditional Flow Approach

Traditional flow approach to foreign exchange rate determination stated that foreign exchange rate represents the relative price of different national export and import outputs. In flow approach, exports raise supply of foreign exchange; imports raise demand for foreign exchange. The exchange rate is in equilibrium when any current account imbalance is matched with net capital flow in the opposite direction of same amount. Thus, if exchange rates were allowed to float, the problems caused by current account imbalances will be ceased. Exports and imports were flow variables. The model posits that foreign and domestic assets are imperfect substitutes in a portfolio. When balance of trade surpluses are associated with increases in domestic holdings of foreign money, thus holdings of foreign money will increase relative to domestic money and the value of foreign currency will depreciate; vice versa for situation when trade deficits are financed by depleting domestic stocks of foreign currency (Husted and Melvin, 2010).

Lastly, it makes sense that balance of trade flows in a model where foreign exchange rate is determined by desired and actual financial-asset flows, thus the role of exports

and imports in foreign exchange rate determination may be consistent with the modern asset approach to the exchange rate. In short, exports and imports are crucial fundamental determinants of foreign exchange rate

3.2 Model Specification

With inferences from the reviewed versions from the quantitative framework, an empirical model to dilate the relationship between foreign exchange rate and its determinants in Nigeria would be specified to include the variables as shown in equations 1 to 4 and traditional flow approach. After a minor modification of the above stated equations, the empirical model adopted in this study is thus expressed as;

$$LOGFER_t = \beta_0 + \beta_1 INF_t + \beta_2 LIR_t + \beta_3 TOT_t + \beta_4 LOGEXD_t + \mu_t \quad (5)$$

Equation (5) is the level of equation between the foreign exchange rate and the macroeconomic fundamentals that determines it. FER_t is the foreign exchange rate; the units of domestic currency in order to buy one unit of foreign currency, without taking inflation into account. $INF_t(+)$, is the inflation rate that is used to represent the annual percentage change in price level of commodities in the economy. Hence, inflation rate is measured by annual percentage change in consumer prices. $LIR_t(+)$ is the lending interest rate, it is also the bank rate that usually meets the short- and medium-term financing needs of the private sector. Lending interest rate in Nigeria (Percentage per annum) or the amount charged (expressed as a percentage of principal) by a lender to a borrower at the end of period *t*, $TOT_t(-)$, is the terms of trade, calculated as the value of its exports as per cent of the value of its imports. That is, the ratio of export volumes to import volumes at the end of period *t*. $EXD_t(+)$ is the External debt; Government debt in foreign exchange at the end of period *t*

The sign between each variable shows the expected direction of FER in response to the corresponding explanatory variable. Therefore, we expect as the apriori expectation the parameters b_0, b_1 and b_4 to be greater than zero, while b_3 is expected to be less than zero. An increase (decrease) in FER indicates real depreciation (appreciation). The independent variables, with the signs expected for the regression coefficients are given in parentheses. We outline our apriori expectation of the sign and magnitude of each included parameter, based on the provisions of the theory and the findings of previous studies by scholars with similar interest(Bashir and Luqman, 2014).The data set for this paper consists of annual time series from 1980 – 2016,

a period of 37years. The study is mainly based on the information obtained from the Central Bank of Nigeria Statistical Bulletin and Monetary Policy Review (CBN, 2016) and the International Monetary Fund (IMF, 2016).

4. Estimation Method

The goal of this study is achieved in these following steps:

Testing for Stationarity: This study takes into consideration the problem of non-stationarity. A time series is said to be stationary if its mean, variance and covariance remain constant with respect to time.

Testing for Co-integration: The co-integration test examines the long run equilibrium relationship between exchange rate and inflation. To determine the number of significant co-integration relationships, we use the Engle-Granger co-integration test that yields the log likelihood estimates for the unconstrained co-integration vectors for a single-equation test. If variables are non-stationary at level, but co-integrated, their dynamic relationships will be specified correctly by an error correction model. However, if the two different series are non-stationary individually, but are co-integrated among the variables, we can apply an error correction model (ECM).

Autoregressive Distributed Lag (ARDL) Model. This looks into the short run dynamics and long run relationship between the variables. In this method of data analysis, three representations are estimated to achieve the objective and exploits the direct links between dependent and independent variables. The three representations are:

i. **Intertemporal Dynamics Regression:** The typical starting point for most ARDL applications is the estimation of intertemporal dynamics. In this form, one is interested in estimating the relationship between y_t on both its own lags as well as the contemporaneous and lagged values of the k regressors $X_{j,t}$

ii. **Post-Regression Derivation of LongRun Dynamics:** This second representation is in essence an attempt to derive the long-run relationship between y_t and the k regressors

iii. **Conditional Error Correction Form and the Bounds Test:** The final representation is arguably the most interesting and one that typically receives the most attention in applied work. The objective here is to test for co-integration by reducing a typical vector autoregression framework to its corresponding conditional error correction (CEC) form.

Assuming that all variables are I(1) and co-integrated, v_{it} is supposed to be I(0) for all *i* and is independently distributed across *t*. More specifically, with a maximum of one lag for all variables, the equilibrium error correction representation of the ARDL(1) model is given by the following relation:

$$D\log FER_t = \phi_i[\log FER_{t-1} - \phi_0 - \phi_1 INF_t - \phi_2 LIR_t - \phi_3 TOT_t - \phi_4 \log EXD_t] - \delta_1 D\log INF_t - \delta_2 DLIR_t - \delta_3 DTOT_t - \delta_4 D\log EXD_t + u_t \quad (6)$$

The coefficients of interest are both ϕ and δ, for the long run and for the ECM, the first and second part of the analysis. This is to assess the differential impact of each type of explanatory variables on the FER; we will add into equation 6, the error correction equilibrium representation.

Note: ARDL does not require pretesting of the data, so, it is not necessary to determine the order of integration of all the data before running the ARDL.

5. Empirical Result Analysis

Unit Root Test

Table 1 shows the ADF test statistics, comparing the variables *p* values levels with the first difference ADF unit root test statistic and various probabilities. The result shows that all the included variables were integrated at order one, that is I(1) or they were stationary at first difference. From the results in Tables 1, there is an existence of unit root. This implies that all the series are non-stationary at levels. Therefore, the null hypothesis ($\rho = 1$) is accepted at levels and the null hypothesis ($\rho = 1$) that the series are non-stationary after the first difference is rejected for all the series. This implies that a long rum equilibrium exist between the dependent variable (LOGFER) and the included independent variables.

Table 1: Summary of Results of Unit Root Tests

Series LOGFER, INF, LIR, TOT, LOGEXD					
Method			Statistic		Prob.**
ADF - Fisher Chi-square			73.7550		0.0000
ADF - Choi Z-stat			-9.75105		0.0000
Intermediate ADF test results					
Series	t-Stat	Prob.	Order of Integration	Max Lag	Obs
D(LOGFER)	-5.3312	0.0006	I(1)	1	35
D(INF)	-6.0498	0.0001	I(1)	1	34
D(LIR)	-6.7203	0.0000	I(1)	1	35
D(TOT)	-6.3837	0.0000	I(1)	1	34
D(LOGEXD)	-4.5041	0.0052	I(1)	1	35
Test critical values:		1% level		-3.03800	
		5% level		-2.77800	
		10% level		-2.63400	

Source: *Author's Computation*

Single-Equation Co-integration Test

The result of using Engle-Granger co-integration test for a single-equation test for the variables is shown in Table 2. The result shows that there exists three co-integrating equation at 1% level of significance. The Engle-Granger tau-statistic (t-statistic) and normalised autocorrelation coefficient (which we term the z-statistic) did not reject the null hypothesis of no co-integration at the 10% significance level. This implies that both did not rejected the null hypothesis of no co-integration among the variables at the 1% level of significance.

Table 2: Engle-Granger Co-integration Test Results

Series: LOGFER INF LIR TOT LOGEXD					
Co-integrating equation deterministics: C					
Dependent	tau-statistic	Prob.*	z-statistic	Prob.*	Long run residual variance
LOGFER	-2.923093	0.7960	-13.78209	0.8186	0.054233
INF	-5.071270	0.0662	-54.33575	0.0000	482.8034
LIR	-4.465127	0.1747	-26.15536	0.1630	5.921941
TOT	-4.017091	0.3220	-44.67115	0.0002	2287.821
LOGEXD	-4.416711	0.1897	-36.20448	0.0089	0.301848

Source: *Authors' Computation*

Long run residual variance is the estimate of the long run variance of the residual based on the estimated parametric model. These residual variance and long run variances are used to obtain the denominator of the z-statistic. On balance, given the

small sample size of the probabilities and critical values and using the z-statistic of the Engle-Granger test, evidence clearly suggests that there are three co-integration equation between the variables at 1% significance level, and the null hypothesis of no co-integration rejected. This implies that there exists a long run relationship or co-integration between inflation, terms of trade and external debts.

Estimated ARDL Coefficients Results

The long-term movements of the foreign exchange rate and its determinants are expected to be stable, but the short-term movements are expected not to be stable within the period under study. The summary of the ARDL estimated regression model and the ECM tests analysis are presented and interpreted below (Tables 3, 4 and 5).

Table3: Intertemporal Dynamics Regression

Dependent Variable: LOGFER				
Method: ARDL				
Dynamic regressors (1 lag, fixed): INF LIR TOT LOGEXD				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
C	-1.165312	0.485431	-2.400572	0.0238
LOGFER(-1)	0.854293	0.034758	24.57819	0.0000
INF	0.004692	0.001974	0.237394	0.8142
INF(-1)	0.044891	0.001596	2.813116	0.0092
LIR	0.019015	0.009763	1.947717	0.0623
LIR(-1)	-0.012087	0.009863	-1.225428	0.2314
TOT	0.098257	0.099161	0.990887	0.3309
TOT(-1)	0.012350	0.087838	0.140595	0.8893
LOGEXD	0.335853	0.208990	1.607028	0.1201
LOGEXD(-1)	-0.218695	0.190778	-1.146332	0.2621
R-squared	0.990914	F-statistic		315.0465
Adjusted R-squared	0.987768	Prob(F-statistic)		0.000000
		Durbin-Watson stat		2.223022
*Note: p-values and any subsequent tests do not account for model				

Source: *Authors' Computation*

A positive coefficients on the level variable means that the current change in the explanatory variables affects current level of explained variable positively, and a negative sign of the level variable means the current change in explanatory variables affects current level of the explained variable negatively. The coefficients of a lag one of the explanatory variables means the effect of changes in past years. Values of explanatory variables results in a change in current values of explained variable or the current changes in explanatory variables affects values of explained variable in next time periods. This can also be positive or negative.

To test our hypothesis, we used the t-statistic given that the coefficient is equal to zero. In the estimated regression line above, the value of β_0 (the constant term) is -1.165 which means that holding the value of all the explanatory variables used, constant or with no contribution of these variables to foreign exchange rate (FER), the value of FER will decline by 1.165% in Nigeria annually.The result of the analysis however, shows that the past value of foreign exchange rate (FER(-1)) is positively and significantly impactful on current foreign exchange rate (FER) for the period under review. (Table 3).

In the estimated regression line in Table 3, it gives the coefficients of the current and past INF as 0.00479 and 0.0449, these imply that 0.48 and 4.5% of the increase in FER within the period under study was accounted for by the 100% increase in current and past INF. The calculated t-statistics for current and past INF are 0.2374 and 2.8131with probability value of 0.8142 and 0.0092; this implies that the relationship between FER and INF is positive. The result shows that the past value of inflation is statistically significant in explaining the current fluctuation in FER while the current value of is not.

The estimated regression line in Table 3 shows that the coefficients of the current and past LIR are 0.0190 and -0.0121, which implies that 0.19 and -0.12% of the increase and decrease in FER within the period under study was accounted for by the 100% increase in current and past LIR. The calculated t-statistics for current and past LIR are 1.9477 and -1.2254. This means that the relationship between FER and LIR is positive and significant at current level but negative and not significant at past level. And that the past value of LIR is not statistically significant in explaining the current fluctuation in FER.

Also, in Table 3, are the coefficients of current and past of terms of trade (TOT). The estimate regression lines are given as 0.09826 for the current value and 0.012135 for the past value of TOT. Which implies that 0.98 and 0.12% of the increase in FER within the period under study was accounted for by the 100% increase in current and past TOT. The calculated t-statistics for the current and past TOT are estimated as 0.9909 and 0.14059, this implies that the relationship between FER and TOT is positive but less statistically significant in explaining FER.

Finally in Table 3, are the coefficients of current and past log of external debt (logEXD). The estimate regression lines are given as 0.3358 for the current value and -0.2187 for the past value of EXD. Which implies that 0.34 and -0.22% of the increase and decrease in FER within the period under study was accounted for

by the 100% increase in current and past LOGEXD. The calculated t-statistics for current and past LOGEXD are estimated as 1.6070 and -1.146354, which means that the relationship between FER and LOGEXD is positive but less significant with current and past level of EXD.

Table 3 indicates a statistical goodness of fit, given that R2 is 0.99 and Adjusted R2, which is a better measure of goodness of fit, is 0.98. This indicates that over 98% variation in our dependent variable is explained by the explanatory variables, while the F-Statistic is 315.0465. Estimated variables were greater than 3.257 (critical) at that level of significance. The result tends to suggest that the regression equation and the overall fitness are good.

Using the order test for autocorrelation, the Durbin-Watson (DW) test statistic (d*) shows the presence of serial correlation between the error terms. From the result d* is less than 2, that is 2.223 > 2 (the rule of thumb benchmark for absence of autocorrelation). This indicates the presence of a negative serial correlation. We therefore accept the null hypothesis (H_0).

Analysis of Long Run Steady-State Results

The ARDL long run form has two tables result outputs. The conditional error correction (CEC) regression or co-integrating form and the levels equation or long run coefficients. The long run coefficients part displays the estimates of long run variables, their standard errors computed their t-statistics, as well as the appropriate p-values. Moreover, just below this table is a line starting with EC. This expression lists the name of the dependent variable minus an expression enclosed in brackets. This is the long run, otherwise known as the error correction equation. Table 4 presents the long run coefficients with their standard errors and *t*-values extracted from the estimated ECM

Table 4: ARDL Long Run Form

Dependent Variable: D(FER)				
Selected Model: ARDL(1, 1, 1, 1, 1)				
Conditional Error Correction Regression/ Co-integrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.165312	0.517278	-2.252775	0.0329
LOGFER(-1)*	-0.145707	0.051831	-2.811172	0.0093
INF(-1)	-0.004958	0.003115	-1.591603	0.1236
LIR(-1)	0.006928	0.013849	0.500252	0.6211
TOT(-1)	0.110607	0.120126	0.920759	0.3656
LOGEXD(-1)	0.117158	0.060575	1.934094	0.0641
D(INF)	-0.000469	0.002667	-0.175659	0.8619
D(LIR)	0.019015	0.010697	1.777613	0.0872
D(TOT)	0.098257	0.116843	0.840932	0.4081
D(LOGEXD)	0.335853	0.113579	2.956991	0.0065
* P-value incompatible with t-Bounds distribution.				
Levels Equation/Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF	-0.034024	0.011614	-2.929605	0.0070
LIR	0.047547	0.075569	0.629184	0.5347
TOT	0.759103	0.618219	1.227888	0.2305
LOGEXD	0.804064	0.255438	3.147792	0.0041
C	-7.997634	2.503293	-3.194846	0.0036
EC = LOGFER - (-0.0340*INF + 0.0475*LIR + 0.7591*TOT + 0.8041*LOGEXD – 7.9976				

Source: *Author's Computation*

Table 4 shows the steady-state long run relationship between LOGFER and INF; and LIR, TOT and LOGEXD are solved from or implicit in the estimated error correction equation. The levels equation result shows that inflation rates are negatively associated with the foreign exchange rate. The one period lag value of INF has a negative impact on the foreign exchange rate. The estimated coefficient of INF(-0.034) which has no expected sign in the long run. This indicates that a once-and-for-all unit increase in the ratio of annually net inflation will cause a long run appreciation of the naira of about 3.4 per cent when measured by the nominal foreign exchange rate. In other words, a 1% percentage point increase in inflation implies a 3.4 per cent depreciation of the foreign exchange rate. This implies that an increase in inflation to Nigeria in a particular year depreciates the foreign exchange rate in the following year in the long run.

The results also show that estimated coefficient of lending interest rate (LIR)(0.0475) and external debt (LOGEXD)(0.8041) have the expected signs, while terms of trade(TOT)(0.7591) did not conform to a prior expectation. The result shows that an

increase in LIR cause the appreciation of the foreign exchange rate (depreciation of the naira in the long run). Also, the result shows that increased in EXD caused appreciation of the foreign exchange rate (depreciation of the naira in the long run). In addition, the result also shows that terms of trade (TOT) (0.7591) has a positive impact in explaining the foreign exchange rate in the long run. This implies that, increased in TOT will lead to the appreciation of the Naira or it is associated with the long run depreciation of the foreign exchange rate.

Equilibrium-Correction Single-Equation Model

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

Table 5 presents the ARDL Error Correction Regression with their standard errors and *t*-values extracted from the estimated ECM. In this view, an ECM which estimates the speed of adjustment to equilibrium in a co-integrating relationship. Here, the error correction term (ECT) derived as the Levels Equation earlier, is included among the regressors and is denoted as CointEq. The coefficient associated with this regressor is typically the speed of adjustment to equilibrium in every period.

Here, as well we find the F-Bounds Test and the t-Bounds Test tables below the regression output. While the F-Bounds Test will not have changed from the Long Run Form and Bounds Test view, the t-Bounds Test here reflects the t-statistic associated with the CointEq regressor. Again, since the distribution of this test is non-standard, the P-value provided in the regression output is not compatible with this distribution and any inference must be conducted using the t-Bounds test critical values provided.

Table 5: ARDL Error Correction Regression

Dependent Variable: D(FER)				
ECM Regression				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(INF)	-0.000469	0.002094	-0.223807	0.8247
D(LIR)	0.019015	0.007633	2.491153	0.0194
D(TOT)	0.098257	0.079116	1.241937	0.2253
D(LOGEXD)	0.335853	0.066048	5.085010	0.0000
CointEq(-1)*	-0.145707	0.032492	-4.484340	0.0001
R-squared	0.608617	Mean dependent var		0.170366
Adjusted R-squared	0.558116	S.D. dependent var		0.296906
Durbin-Watson stat	2.223022			
* p-value incompatible with t-Bounds distribution.				
F-Bounds Test		**Null Hypothesis: No levels relationship**		
Test Statistic	Value	Significant	I(0)	I(1)
F-statistic	2.810979	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: *Author's Computation*

The ECM estimation implies that the first difference of FER is regressed on explanatory variables. The error correction term can be used to determine the speed of adjustment of the deviation of the foreign exchange rate from its equilibrium. The adjustment term is always negative and significant, indicating that there is no omitted variable bias.

The coefficient of the lagged error term or equilibrium error correction model (ECM) (-0.14571), is negative and significant, confirming that a long run (co-integrating) relationship exists between the foreign exchange rate and the set of explanatory variables (Table 5). The size of this coefficient implies that adjustment to disequilibria towards the long run equilibrium via the equilibrium correction term is relatively weak, as 14.57% of disequilibrium in a given annual is corrected in the following annual.

Also, as in Table 5, the results reported the regression estimate of the model in the context of equilibrium error-correction representation of the autoregressive-distributed-lag model. Short run properties can be derived from the estimated ECM result.The implication of this is that it takes about a year to eliminate 14.57% of deviation between the actual and equilibrium foreign exchange rate as determined

by the fundamentals. It is also shown that the foreign exchange rate is slow to adjust back to equilibrium, implying policy ineffectiveness or inflexibility.

The result of the error correction model shows that most of the variables are significant at 5%. For example, the result of ECM in Table 5 shows that the one period lag value of lending interest rate (LIR) has a positive impact on the foreign exchange rate as against the long run value, and statistically significant at 1% in determining the foreign exchange rate. This implies that an increase in LIR to Nigeria in a particular year increase the foreign exchange rate and depreciate the value of naira in the following year in the short run. Also, the result of the error correction model shows that an increase in external debt leads to the appreciation of the foreign exchange rate of Nigeria in the short run.

The result indicates that the long run overall model is well fitted, as the independent variables explained over 55.81 % Adjusted squared $(\bar{R}^2)$ movement in the dependent variable, which strongly suggests less than perfect multicollinearity, while the high Durbin-Watson (DW) statistic of 2.22 strongly suggests the presence of no positive first-order serial correlation therefore, the efficiency of the model will not be affected.

6. Implication of Findings and Conclusion

The study is about the post-regression derivation of long run dynamics of the response to foreign exchange rate and its fundamental determinants. The study develops an integrated model of foreign exchange rate behaviour that synthesises many recent and older contributions to the theory of exchange rate determination. The determinants included are: inflation rate, lending interest rate, terms of trade and external debt.

This long-run analysis procedure begins with an autoregressive distributed lag (ARDL) specification of an appropriate lag. The consideration of the available degrees of freedom and type of data determine the decision on lag length. With annual data, one lag would be long enough. Under this ECM procedure, the long run relationship is embedded within the dynamic specification. The result find support for some hypotheses, and overall, the empirical results displayed the partial conformation to the previous researches and the conclusion of some existing literature.

The findings from the intertemporal dynamics regression shows that the relationship between foreign exchange rate, external debt, and terms of trade are

positive. The findings also shows that the past value of inflation is statistically significant in explaining the current fluctuation in foreign exchange rate.

The long run findings shows that inflation will cause a long run appreciation of the naira, of about 3.4 per cent when measured by the nominal foreign exchange rate. This implies that an increase in inflation in Nigeria in a particular year depreciates the foreign exchange rate in the following year in the long run.

The results also show that estimated coefficient of lending interest rate and external debt have the expected signs, while terms of trade did not conform to a prior expectation in the long run. The implications of these results are that increased in LIR caused appreciation of the foreign exchange rate (depreciation of the naira in the long run) and increased in external debt caused appreciation of the foreign exchange rate (depreciation of the naira in the long run). While the increased in terms of trade will lead to appreciation of the Naira or it is associated with long run depreciation of the foreign exchange rate. The size of this coefficient implies that adjustment to disequilibria towards long run equilibrium via the equilibrium correction term is relatively weak.

7. Policy Recommendations

As appreciation or depreciation in foreign currency would affect a country's economic, understanding the factors that influence foreign exchange rate movement would give government and policymakers a clear view in formulating effective exchange rate policies to safeguard stability of a country's economy and achieve economic growth. It is crucial to emphasise that the macroeconomic policies have to be implemented in order to stabilise and reduce the exchange rates volatilities.

The study recommends that, the government should increase the level of lending and reduce the level of borrowing. It should also review the credibility of the debtor before making a decision and ensure that funds that are borrowed are used in efficient and productive investments to prevent the depreciation of exchange rate.

The government should expand its exports and this will help balance the current account and provide revenue without incurring further debt. It should focus on reducing its imports and enhance more production and consumption of local goods and services.

In addition, the government should expand the money supply to lower the inflation rates through tight fiscal and monetary policies. This would increase output and lower interest rates, with net exports increasing to reach a new balance of payments.

The external debt was found to have the most significant influence on external debt. Therefore, the government needs to pursue policies that encourage reductions in borrowing and increases in lending. This will lead to an increase levels of foreign exchange rate in Nigeria over the long-term.

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