Real Effective Exchange Rate Misalignment in Nigeria

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The study analyzed the relationship between relevant macroeconomic variables and the real effective exchange rate (REER) in Nigeria based on the Behavioural Equilibrium Exchange Rate (BEER) approach. An Autoregressive Distributed Lag (ARDL) model was estimated to obtain the equilibrium REER while the resultant levels of misalignment were computed for the period 1990 - 2014. Model results indicated that terms of trade and degree of trade openness are significant determinants of the REER, implying that trade policies matter for Naira REER movements. The error correction model indicated that 3.3% of disequilibrium error is corrected within a quarter. On the average, the REER was found to be overvalued by 1.40 per cent during the study period. In view of the possible adverse consequences of REER misalignment on the economy, we recommend a regular assessment of the country's trade policy with a view to ensuring that episodes of large and prolonged misalignments are avoided.

Keywords: Real Effective Exchange Rate, Exchange Rate Misalignment, Macroeconomic Variables

JEL Classification: C3, C5, C13

1.0 Introduction

Generally, the real exchange rate of any country measures the competiveness of the country with its trading partners. It is often defined as the nominal exchange rate that takes the inflation differentials among trading partner countries into account (Ahmet and Mehtap, 1997). In view of its impacts on other macroeconomic variables, a number of researchers have investigated the factors that influence the real exchange rates of various countries. To central banks, the study of real exchange rate is important because of its impact on the bank's balance sheet which also is significant in the central banks' ability to run a viable monetary policy (Arnold, 2004). In the recent past, a number of countries have suffered macroeconomic disruptions as a result of prolonged real exchange rates misalignment, a situation that has also led them to

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regularly assess the degree of misalignment of their currencies (Hinkle and Montiel, 1999).

In Nigeria, the exchange rate is among the key determinants of the level of economic strength, apart from factors such as interest rates and inflation. The role it plays in its level of trade cannot be overemphasized because of the fact that it cuts down on the purchasing power of income and affects other income factors such as interest rates, inflation and capital gains from domestic securities. As a result, it has become imperative to observe, analyse and investigate the basic fundamentals of the real effective exchange rate. A number of studies have discussed some factors that determine the real exchange rates in Nigeria as well as exchange rate trend in the country[2]. For instance, Aliyu (2011) identified the determinants of real exchange rate as including terms of trade, index of crude oil volatility, index of monetary policy performance and government fiscal stance while Omojimite (2011) identified the price of oil and openness of the economy as significant determinants. Also, government expenditure, money supply, real interest rate, productivity index and openness of the economy influenced the real exchange rates volatility in Nigeria (Ajao and Igbekoyi, 2013). These studies used the Johansen approach in their investigations of the relationship between the bilateral RER and its determinants. However, none of them investigated the determinants of the real effective exchange rate.

The objectives of this study are to examine the determinants of the real effective exchange rate during the period 1990 – 2014 and compute the corresponding degree of real effective exchange rate (REER[3]) misalignment. This study differs from the previous works by using real effective exchange rate as a broader measure of the country's competitiveness as against bilateral nominal exchange rate.

The real exchange rate measures the cost of foreign goods relative to domestic goods. It gives a measure of competitiveness, and it is a useful variable for explaining trade behavior and national income. It is thus calculated as a nominal exchange rate adjusted for the different rates of inflation between two currencies. On the other hand, REER reflects on a particular currency's

[2] See Omotosho and Wambai (2012) for stylized fact on exchange rate management in Nigeria. [3] See section 3.3 for notes on REER.

relative value compared to a basket of other currencies that are weighted according to the volume of trade occurring between the countries.

The study also adopted the autoregressive distributed lag model approach other than the usual Engle-Granger or Johansen approach to co-integration.

The paper is divided into five sections. Following the introduction is section two, which presents the review of related theoretical and empirical literatures on real exchange rate determination. Section three focuses on the methodology of the paper and preliminary estimation procedure while section four analyses the empirical results. Section five concludes the paper.

2.0 Theoretical and Empirical Literature

This section reviews some theoretical models and conceptual issues relating to the determination of the real exchange rate as well as relevant empirical studies.

2.1 Theoretical Literature

2.1.1 One Tradable/Good Model

The framework for this model adopts the law of one price in which an arbitrage is likely or expected to align price in all the markets and it comprises a single tradable product that is assumed to be internationally traded. This type of model are mostly more appropriate for the study of purely monetary phenomenon and other approaches to the clarification of the fundamentals of balance of payments information.

2.1.2 Mundell-Fleming Models

The framework for this model is based on the assumption that the domestic economy and the rest of the world specialize in manufacturing a single product and this product when traded internationally, is not considered as a perfect substitute for one another. In other words, this framework can only be applicable to countries with high concentration of manufactured products than raw materials and primary goods. The role of the real exchange rate in the Mundell-Fleming model is to determine the composition of absorption between goods produced at home and those produced abroad, this framework results in the real exchange rate coinciding with the country's terms of trade,

although the two concepts are different from each other (Takeandasa, 2006). This model gives more emphasis on a complete specialization in production. However this framework is evidently not applicable to most developing markets whose exports are largely primary goods and raw materials, the framework incorporates the real exchange rate in such a way that, it gives a clear outlook to the aggregate demand for the goods produced at home and also plays a key role in determining a nation's trade balance.

2.1.3 Salter-Swan (Dependent-economy) Models

The Salter-Swan model, also called the traded/non-traded goods model is based on a production structure that comprises two goods. One is the non-traded good which is produced and consumed only internally, while the second one is the traded or foreign good which is produced and consumed both domestically and abroad. The internal real exchange rate expressed in equation (1) describes the real exchange rate as the number of units of the non-traded good required to purchase a unit of the traded good.

$$rer = ner * \frac{P_T}{P_{NT}} \tag{1}$$

where *rer* is the real exchange rate, P_T is the foreign price, P_{NT} is the domestic price and *ner* is the nominal exchange rate. In the case of equation (1), a decrease in *rer* means an appreciation, while increase means depreciation.

Since this framework comprises of only one type of external good, it becomes difficult to compute the relative price between exports and imports for the terms of trade, unless the economy is so small, that the impact on its terms of trade is insignificant. This model is therefore applicable for analysing issues for which the role of exogenous changes in the terms of trade are not important (Hinkle and Montiel, 1999; Takaendasa, 2006).

2.1.4 Three-Good Model

Unlike Salter-Swan Model, the terms of trade do matter in the three-good model. This model is made up of exported, imported and the non-tradable goods. The exportable and importable goods may be produced and consumed domestically, while the former are produced for exports, the latter are imported goods. This framework proposes two definitions for the real exchange rates, as well as a separate definition of the terms of trade, since

there are two foreign goods. The first definition to the real exchange rate is the ratio of the domestic currency price of the exportable good to the price of non-tradable good. The second definition sees the real exchange rate, as the "ratio of the domestic currency price of the importable good to the price of the non-tradable good, while the terms of trade are defined as the ratio of the domestic currency price of the exportable good to the domestic currency price of the importable good. Montiel (2003) and Takaendasa (2006) showed that this model is useful for analysing the macroeconomic impacts terms of trade shocks.

2.1.5 Edward's Theoretical Model

The revised literature of Edwards (1994) in Takaendasa (2006) examines both in the short and the long run, the relative significance of monetary and real variables in the process of real exchange rate determination. Edwards (1989) Model was used to capture the basic macroeconomic features of emerging economies, such as a market-driven parallel exchange rate for monetary transactions, trade obstacles, and government regulatory control policies. It also permits both real and nominal fundamentals to play a vital role in the short run, while in the long run only real fundamentals affect the equilibrium real exchange rate.

2.2 Empirical Literature

The findings regarding the determinants of real exchange rate has been mixed. For instance, Chowdhury (1999) noted that in Papua Guinea, nominal devaluation, net capital inflow, foreign aid, trade restrictions and macroeconomic policies impacted positively on real exchange rate while Patel and Srivastava (1997) revealed that investment-GDP ratio, overall fiscal deficit and nominal exchange rate were the most important determinants of real exchange rate in India.

Odedokun (1997) examined the impact of macroeconomic policies, devaluation and fundamentals on real exchange rate movement in a group of 38 African countries. The author concluded that the factors that led to real exchange rate appreciation included public sector fiscal deficits, growth of domestic credit, domestic absorption-GDP ratio, the government consumption-GDP ratio, the private consumption-GDP ratio, improvement in terms of trade, income per capita and black market exchange rate premium. In

another panel analysis, Imed and Christophe (2003) analyzed the main determinants of the real exchange rate in the Middle East and North Africa (MENA) countries, their findings proved that government consumption, real interest rate variances, output per capita, as well as the degree of openness of the economy stimulate the real exchange rate.

Mkenda (2001) used a co-integration analysis in estimating the long-run determinants of the real exchange rates for imports and exports, and of the internal real exchange rate in Zambia. Their analysis showed that real exchange rate for imports is characterised by terms of trade, government consumption, and investment share while terms of trade, central bank reserves and trade taxes impact real exchange rates for exports in the long-run. The internal real exchange rate is affected by terms of trade, investment share and rate of growth of real GDP in the long-run.

In South Africa, MacDonald and Ricci (2003) found that real interest rate differential, GDP per capita, terms of trade, overall fiscal balance, degree of openness and net foreign assets impact on the real exchange rate. Gelgard and Nagayasu (2004) also investigated the determinants of Angola's real exchange rate and concluded that oil prices and foreign interest rate are the most significant factors. They further argued that a flexible exchange rate is more expedient than a fixed exchange rate regime.

Dufrenot and Yehoue (2005) analysed the correlation between real exchange rates and economic fundamentals in 64 developing countries; their analysis shows that exchange rate dynamics is not likely to be determined by fundamentals such as productivity, terms of trade, and trade openness for middle-income countries than for low income countries. Obadan (1994) also found that the improvement in terms of trade and the increase in net capital inflows led to appreciation in the nominal and the real exchange rates, respectively, while the increase in monetary aggregates resulted to real exchange rate depreciation.

In Angola, Takaendesa (2006) established that terms of trade, the real interest rate differential, domestic credit, the degree of openness of the economy and technological progress have long-run impact on the real exchange rate. Terms of trade, domestic credit and degree of openness of the economy have significant influence on the real exchange rate in the short-run. In a similar study for Venezuela, Yu-Hsing (2006) concluded that broad money supply, world interest rate, county risk, and the estimated rate of inflation have

adverse effect on exchange rate while government deficit appreciates the exchange rate.

Quite a number of studies have also been conducted to investigate the determinants of real exchange rate in Nigeria and the extent of real exchange rate misalignment. Mapenda (2010) also used the Johansen approach and the Vector Error Correction Model (VECM) to evaluate the long-run determinants of the exchange rate in Ghana and Nigeria, using the terms of trade, trade restrictions, domestic interest rates, foreign aid inflow, income, money supply, world inflation, government consumption expenditure, world interest rates, capital controls and technological progress. His empirical results for Ghana revealed that any increase in government consumption expenditure, the terms of trade, net foreign aid inflow and openness significantly led to currency depreciation, while an increase in world cocoa prices appreciated the Ghanaian currency. On the other hand, an increase in world oil prices and government consumption expenditure appreciated the Nigerian currency, whereas a rise in net foreign assets devalued the Naira. His work finally showed that the Naira exchange rate was overvalued within the period 1980 to 1983 and undervalued within the period 1984 to 1991.

Rano (2008) estimated the long-run behavioural equilibrium exchange rate in Nigeria. The regression results obtained in his work showed that most of the long-run behaviour of the real exchange rate could be accounted for by real net foreign assets, terms of trade, the index of crude oil volatility, the index of monetary policy performance and government fiscal stance. Within his sample period, four episodes of overvaluation and undervaluation were identified. He explained that the undervaluation episodes were associated with large inflows of oil revenues into the country and a steady macroeconomic performance between 2001Q1 and 2006Q4 in the country.

Victor and Dickson (2012) investigated the determinants of the real exchange rate in Nigeria, where their main objective was to present a dynamic model of real exchange rate determination using data from 1970 to 2010. They considered government spending, GDP, terms of trade, capital flow, price level, technological progress and nominal effective exchange rate. The Johansen co-integration test they applied suggested that a long relationship existed among the variables.

Udousung and Umoh (2012) analyzed exchange rate determinants in Nigeria from 1971 to 2000. Six variables were included in the exchange rate model, including openness of the economy, import tax, balance of payment, the fiscal deficit, exports tax and trends. Their result revealed that import tax, openness of economy and export tax had positive coefficients, implying a direct positive relationship between these variables and the real exchange rate.

Ajao and Igbekoyi (2013) investigated the determinants of real exchange rate volatility in Nigeria from 1981 to 2008. Using Generalized Auto-regression Condition Heteroskedasticity (GARCH) techniques and the Error Correction Model (ECM) to examine the various determinants of exchange rate volatility in Nigeria. However, the result of their analysis suggest that the openness of the economy, government expenditures, interest rate movements and the lagged exchange rate among others, were the significant variables that influenced real exchange rate volatility during the period reviewed.

In terms of real exchange rate misalignment, Edwards (1988, 1989) studied about twelve developing countries and found that those with less real exchange rate misalignment performed better (in terms of growth of output) than those with more real exchange rate misalignment. He also observed that the nature of exchange rate misalignment in developing countries has more of overvaluation, which negatively affects the tradable sector by reducing producers' real prices. Baffes, *et al* (1990) studied misalignment for Côte d'Ivoire and Burkina Faso using single equation approach. Their findings showed that the actual real exchange rate was misaligned by 34 percent within their sample period of 1987 - 1993, as opposed to the analysis by Devajaran (1997), who found that Burkina Faso's currency was undervalued by 14 per cent during 1987 - 1993. In Nigeria, Aliyu (2011) employed the Johansen's cointegration approach and vector error correction model to investigate RER misalignment in Nigeria. He identified terms of trade, crude oil volatility, monetary policy performance and government fiscal stance as major determinants of the RER and his study showed that the Naira was overvalued by about 5.9 per cent during 2005Q4, just before the introduction of WDAS in 2006Q1. Also, Omotosho and Wambai (2012) found that the Naira was misaligned by 0.29 per cent during the period 2000-2011.

3.0 Methodology

3.1 Model Specification

As enunciated in Edwards (1988), the Behavioural Equilibrium Exchange Rate (BEER) approach to exchange rate determination models the real exchange rate as a function of selected fundamentals in the economy. We adopt this approach by expressing the real effective exchange rate as a function of terms of trade, degree of openness, nominal effective exchange rate and the real gross domestic product. In its functional form, the model is given as:

$$lreer = f(ltot, lopen, lneer, lrgdp) \tag{2}$$

where lreer is the log of real effective exchange rate, ltot is the log of terms of trade, lopen is the log of trade openness, lneer is the log of nominal effective exchange rate and lrgdp is log of real GDP.

3.2 Estimation Procedures

This study adopted the Autoregressive Distributed Lag (ARDL) approach (i.e. the bounds testing approach to cointegration) by Pesaran *et al* (2001) to examine the determinants of real effective exchange rates during the study period. The approach was adopted as it does not require pre-testing of the variables to determine their order of integration since the model can be estimated regardless of whether the series are purely I(1), purely I(0), or mutually integrated. The ARDL(p,q,r,s,m) model used for the bounds test takes the following form

$$\begin{aligned}\Delta lreer_t = \propto &+ \sum_{i=1}^{p} \beta_i \Delta lreer_{t-i} + \sum_{j}^{q} \varphi_j \Delta lneer_{t-j} + \sum_{k}^{r} \eta_k \, \Delta ltot_{t-k} \\ &+ \sum_{l}^{s} \sigma_l \, \Delta lopen_{t-l} + \sum_{m}^{t} \theta_m \, \Delta lrgdp_{t-m} + \delta_1 lreer_{t-1} \\ &+ \delta_2 lneer_{t-1} + \delta_3 ltot_{t-1} + \delta_4 lopen_{t-1} + \delta_5 lrgdp_{t-1} \\ &+ \varepsilon_t \end{aligned} \tag{3}$$

where Δ is a difference operator, l is logarithm, t is time, α_0 is an intercept term, $\beta, \eta, \sigma, \phi, \theta$ and δ_1 to δ_5 are the coefficients of their respective variables and p, q, r, s and m are the respective lag lengths for the independent variables.

To examine the existence of long-run relationship, the study first test, based on Wald test (F-statistics), for the joint significance of the coefficients of the lagged levels of the variables, i.e.

$$H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$$
$$H_1: \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq 0$$

The asymptotic critical values for the bounds test provides a test for cointegration with lower values assuming the included variables are I(0), and an upper value assuming I(1) variables. If the calculated F-statistics exceeds the upper critical value, the null hypothesis is rejected, implying that there is cointegration. However, if it is below the lower critical value, the null hypothesis cannot be rejected, indicating lack of cointegration. If the calculated F-statistics falls between the lower and upper critical values, the result is inconclusive. Once cointegration is established, the conditional ARDL long-run model can be specified as:

$$lreer_t = \alpha_0 + \beta lreer_t + \varphi \ln eer_t + \eta ltot_t + \sigma lopen_t + \theta lrgdp_t + \mu_t \quad (4)$$

In the next step, we obtain the short-run dynamic parameters by estimating an error correction model associated with the long-run estimates. This is specified as follows:

$$\Delta lreer_t = \alpha_0 + \sum_{i=1}^{p} \beta_i \Delta lreer_{t-i} + \sum_{j=0}^{q} \varphi_j \Delta \ln eer_{t-j} + \sum_{l=0}^{r} \eta_l \Delta ltot_{t-l} + \sum_{k=0}^{s} \sigma_k \Delta lopen_{t-k} + \sum_{n=0}^{m} \theta_n \Delta lrgdp_{t-n} + \vartheta ecm_{t-1} + \xi_t \quad (5)$$

where ecm is the error correction term derived from equation (4) and ϑ is the speed of adjustment.

3.3 Data

Quarterly data covering the period 1990:Q1 to 2014:Q4 were used for the study. The dataset included Real Gross Domestic Product – RGDP (1990 constant basic prices), which was obtained from the statistics database and statistical bulletin of the Central Bank of Nigeria. The SITC classification of the exports and imports observations were sourced from the National Bureau of Statistics (NBS) and were used to compute the degree of openness – *open* and the terms of trade - *tot*. The real effective exchange rates- *REER* and the nominal effective exchange rates – *NEER* were compiled from the International Financial Statistics database of the International Monetary Fund (IMF).

REER is the NEER adjusted for relative price differentials between the home country and other countries, that is, the trading partners (Obadan, 1994) while NEER is a weighted average of exchange rate relatives or simply a weighted average of a basket of currencies over time, deriving from nominal exchange rate movements. For the purpose of this work, REER and NEER are defined here as geometric averages ($NEER_t$ and $REER_t$ respectively) as follows:

$$NEER_t = \prod_{i=1}^{n} \left[\frac{E_{it}}{E_{i0}}\right]^{\alpha_i} \quad (6)$$

$$REER_t = \prod_{i=1}^{n} \left[\frac{E_{it}}{E_{i0}} . \frac{P_{it}^f}{P_t^d}\right]^{\alpha_i} . 100 \quad (7)$$

$REER_t$ can also be expressed as follows:

$$REER_t = \prod_{i=1}^{n} \left[NEER_t . \frac{P_{it}^f}{P_t^d}\right] . 100 \quad (8)$$

Where:

α_i is the weight assigned to ***i***th country's currency;

E_{it} is the exchange rate of the domestic currency in terms of currency ***i*** in time ***t***;

E_{io} is the exchange rate of the domestic currency in terms of currency ***i*** in base period;

P_{it}^f is the price index of the ***i***th foreign economy at time ***t*** relative to the base period;

$P_t^d is$ the price index of the home economy at time ***t*** relative to the base period.

4.0 Empirical Results

4.1 Unit Root Tests

Although the ARDL methodological framework does not require that the variables be tested for stationarity, the test could be useful in motivating the use of the ARDL approach.

Table 1: Unit Root Test Results

	LEVEL		FIRST DIFFERENCE	
VARIABLE	**ADF**	**PP**	**ADF**	**PP**
LNEER	-3.487876**	-3.416035**	-9.30071*	-9.297747*
LOPEN	-2.954234**	-2.884392**	-10.12335*	-10.25965*
LREER	-3.156013**	-3.447985**	-8.94606*	-8.994688*
LRGDP	1.640366	0.575331	-5.537114*	-17.21356*
LTOT	-1.129447	-1.079831	-11.80752*	-11.77271*

' and ** indicate significance at 1 and 5 per cent levels*
The Mac Kinnon critical values were -3.48, -2.88 and -2.58 at 1, 5 and 10 per cent levels for both ADF and PP Tests.

The use of ADF and PP tests were adopted to infer the time series properties of the variables and the results are presented in Table 1. LNEER, LOPEN and LREER were found to be I(0) at the 5 per cent significant level. Results from both the ADF and PP tests indicated that LOPEN and LRGDP were stationary at first difference. This result was a motivating factor in the use of the ARDL model.

4.2 Bounds Tests for Cointegration

We examined cointegration amongst the variables in the model by conducting the ARDL bounds test. The critical values for the bounds test are documented in Pesaran et al. (2001) and are based on assumptions regarding whether the variables in the model are I(0) or I(1). The results of the ARDL bounds test are presented in Table 2. The results indicated that the variables have long run relationship. The F-statistic was 13.37, which was higher than the upper bound of the critical values at the 1 per cent level (4.68) and implies the presence of a long run relationship amongst the variables. A maximum lag of 3 was chosen in the ARDL cointegration test since the study utilized quarterly series. The optimal lag length was chosen in line with Akaike Information Criteria (AIC) and the selected ARDL representation for the model was ARDL (1, 2, 0, 0, 0).

Table 2: ARDL Bounds Test Results

Variables	F-Statistic	Bound Critical Values			
		(unrestricted Intercept and No Trend)			
LREER		1% level		5% level	
LOPEN					
LTOT	13.37				
LNEER		I (0)	I (1)	I (0)	I (1)
LRGDP		3.41	4.68	2.62	3.79

4.3 Long and Short Run Model Estimates

The long run results, which were presented in Table 3 are in conformity with the a priori expectations. Three variables were found to be statistically significant, while LRGDP was not significant. This implies that in the long-run, LREER was largely determined by NEER, TOT and OPEN in Nigeria. The results indicated that an increase in the nominal effective exchange rate causes real appreciation of the real effective exchange rate due to its impact on domestic prices.

Table 3: Estimated Long Run Model

Dependent Variable is LREER

Variables	Coefficient	T-Ratio	Prob
LNEER	-0.71838	-2.10670	0.03800
LTOT	0.32434	-2.45390	0.01600
LOPEN	-0.99546	-2.89500	0.00500
LRGDP	0.22211	0.54661	0.58600
INPT	8.0018	2.12220	0.03700

Table 4: Error Correction Representation for the Selected ARDL Model
Dependent Variable is LREER

Variables	Coefficient	T-Ratio	Prob
DLREER(-1)	0.46227	6.11680	0.0000
DLNEER(-2)	0.07771	3.94570	0.0000
DLNEER	0.95836	54.71340	0.0000
DLNEER(-1)	-0.41953	-5.25890	0.0000
DLTOT	0.01061	-2.50870	0.0140
DLOPEN	-0.32569	-2.95760	0.0040
DLRGDP	0.00727	0.52626	0.6000
DINPT	0.26180	2.25580	0.0260
ecm(-1)	-0.03272	-4.48080	0.0000
R-squared		0.97588	
R-Bar-Squared		0.97347	
Dw-statistic		2.10480	
F-stat	F(8,91)	455.2187 (.000)	
Schwarz Bayasian Criterion		213.0306	
Akaike Info Criterion		226.0564	

ARDL (1,2,0,0,0) selected based on Akaike Information Criterion

Table 4 presents the result of the short-run model. The model shows that past values of the dependent variable, NEER, TOT and OPEN were statistically significant in determining the REER. An increase in terms of trade depreciates the real effective exchange rate while increased degree of openness leads to an appreciation in the short run. As recorded in the long run, the error correction model results showed that an increase in real gross domestic product impacts positively on the real effective exchange rate. The adjusted R-squared of the error correction Model is 0.97 which is relatively high. The error correction term was negative and statistically significant at the 1per cent level, further providing evidence of the existence of cointegrating relationships among the variables. The error correction model sheds more light on the speed of adjustment from the short run equilibrium to long run equilibrium. At -0.033,

the size of the error correction term reveals that about 3.3 per cent of disequilibrium error is corrected in each quarter.

4.3 Model Stability Test

The CUSUM test was used to examine the stability of our estimated ARDL model. A model is stable if its recursive residuals lie within the two critical bounds. The CUSUM test indicated that the model was stable (Fig. 1).

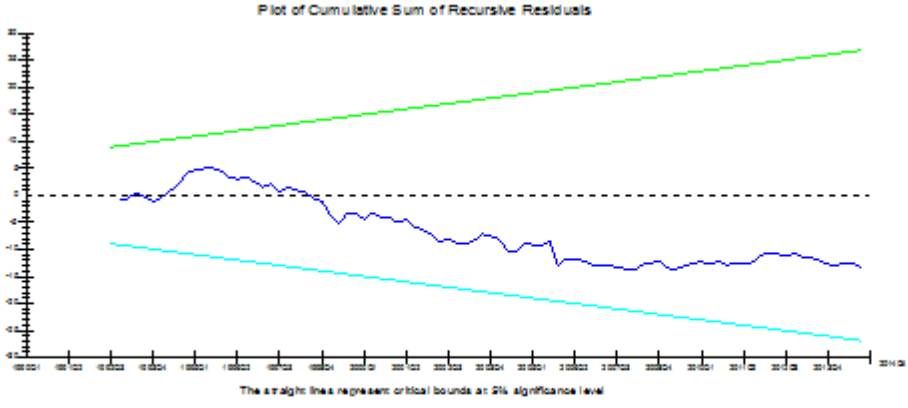

Fig. 1: Plot of Cumulative Sum of Recursive Residuals

4.4 Estimates of REER Misalignment

In an effort to achieve the second objective of this study, we applied the estimated ARDL based error correction model to obtain the equilibrium REER and thereafter computed the extent of misalignment associated with the real effective exchange rate. The equilibrium real effective exchange rate was obtained by substituting the sustainable values of the fundamentals in the error correction model. The difference between the estimated equilibrium real effective exchange rate and the actual real effective exchange rate was computed as follows to arrive at the degree of (short-run) misalignment:

$$Misalignment = \frac{\widehat{lreer} - lreer}{lreer} * 100 \qquad (9)$$

where $\widehat{lreer}$ is the estimated lreer [from equation (5)] equilibrium real effective exchange rate.

The estimates of the computed reer misalignment are summarised in Table 5. On the average, the observed reer was overvalued by an average of 1.40 per cent during the study period, with 35 cases of undervaluation and 64 cases of overvaluation. It was also observed that periods of significant misalignments (i.e. overvaluation or undervaluation) were associated with identifiable government policy shifts and macroeconomic shocks. For instance, the largest degree of overvaluation during the period of estimation was recorded in 1994:Q1, a period that coincided with the introduction of a pegged exchange rate system. This finding is in line with Edwards (1989) who found that the currencies of developing countries are usually overvalued due to their sub-optimal exchange rate policies.

Table 5: Average Real Effective Exchange Rate Misalignment, 1990 - 2014

Period	Maximum	Average	Minimum	Std.Dev.
1990Q1-1995Q4	32.1064	3.4393	-18.6053	10.7932
1996Q1-2000Q4	8.6794	-0.1674	-43.2379	10.6844
2001Q1-2005Q4	8.2277	1.1057	-9.0101	4.1583
2006Q1-2010Q4	10.8835	0.7228	-12.1966	4.5673
2011Q1-2014Q4	4.2026	1.6295	-2.8277	1.8852
1990Q1-2014Q5	32.1064	1.398	-43.2379	7.6041

The depreciation of the Naira around the period the interbank foreign exchange market (IFEM) was introduced in October 25, 1999 was also associated with a large undervaluation of the Naira REER, as the actual REER was substantially above the equilibrium REER during 1999:Q1. The introduction of the IFEM was aimed at deepening the foreign exchange market and enabling the naira to achieve a realistic exchange rate. The introduction of the rDAS in Q3 2002 led to a correction to equilibrium as the extent of misalignment narrowed to about 0.79 per cent in 2003:Q4 (Fig. 2).

During the period 2006 – 2010, the real effective exchange rate was largely in line with the levels implied by the fundamentals as the REER was slightly overvalued by 0.72 per cent. However, there were distortions in 2008 and 2009 arising from the 2008/09 global financial crisis. In 2006, the REER revolved closely around its equilibrium path indicating that the introduction of WDAS as a foreign exchange management strategy was quite successful in evolving a realistic exchange rate for the naira. The year was also associated with a period of moderation in demand pressure in the foreign exchange

market owing to non-accommodating monetary policy stance of the CBN, stringent fiscal policy measures, increased surveillance over the activities of the authorized dealers by the CBN as well as increased depth of the foreign exchange market. Thus, the divergence of the actual REER from the EREER narrowed substantially during the year (Fig. 2). However, as the impact of the global financial crisis persisted in 2009, the depreciation in the exchange rate manifested in the undervaluation of the REER as it was misaligned by about -12.0 per cent.

The period 2011Q1 – 2014Q4 recorded a higher degree of misalignment as the REER was overvalued by about 1.63 per cent, higher than an overvaluation of 0.72 per cent in the period 2006Q1 - 2010Q4 (Fig. 2).

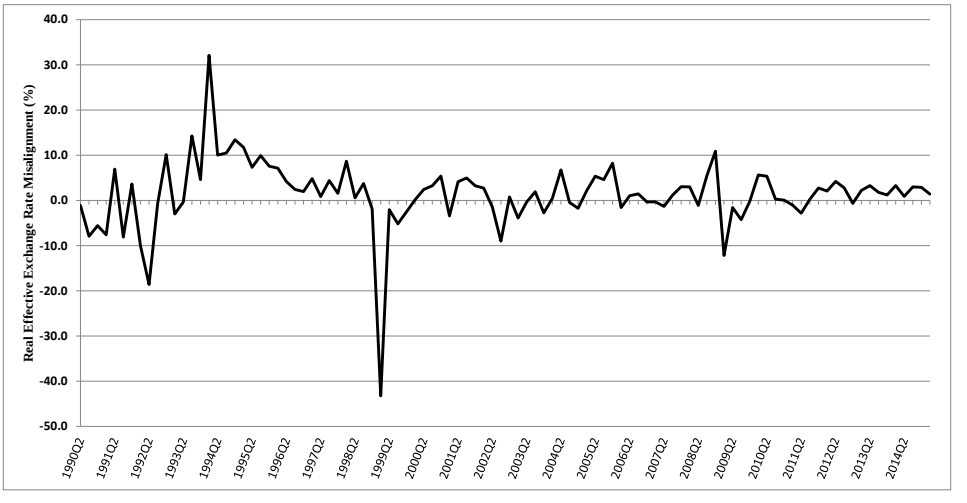

Fig. 2: Real Effective Exchange Rate Misalignment, 1990Q2 - 2014Q4

5.0 Summary and Conclusion

This paper investigated the determinants of the real effective exchange rates (REER) in Nigeria using the ARDL model approach. The model was estimated using quarterly data for the period 1990 to 2014. In addition we computed the deviations of the REER from its equilibrium levels with a view to gaining insight into the extent of REER misalignment during the sample period. Findings showed that REER, OPEN and NEER are stationary at levels while the RGDP and TOT were found to be stationary at first difference (I (1)), hence, the use of ARDL approach to cointegration and error correction modelling. The F-statistic obtained from the bounds test was higher than the

upper bound of the critical values which implies the presence of a long run relationship amongst the variables.

The long-run model showed that *open, tot* and *neer* were statistically significant determinants of the *reer*. Increased *tot* depreciates the *reer* while the increased degree of openness and *neer* will impact negatively on the *reer*. The *rgdp* was found to be non-significant both in the long run and in the short run. In the short-run, increased trade openness appreciates the *reer* while the *tot* has a positive impact on the *reer*. At -0.03, the error correction coefficient indicated that about 3 per cent of disequilibrium error is corrected within a quarter after a given shock.

Although there was a minimal (short-run) misalignment in Nigeria's real effective Exchange rate in recent periods, some traces of large misalignment were recorded around 1994, 1999 and 2008/09. On the average, the Naira was overvalued by about 1.40 per cent during the period 1990Q1 – 2014Q4. At an average of 3.4 per cent, the extent of REER misalignment was highest during 1990Q1 – 1995Q4. Also, the volatility of the misalignment was at the highest during 1990Q1-1995Q4, compared with the situation in the other periods. However, the REER revolved closely around its sustainable equilibrium path during the period 2006Q1 – 2010Q4 as the misalignment level was 0.72 per cent. In view of the possible adverse consequences of REER misalignment on the economy as well as the role of trade policy in determining the REER, we recommend a regular assessment of the country's REER vis-a-vis its equilibrium level. When large deviations are noticed, we suggest that trade policy be altered to ensure that the extent of misalignment is reduced.

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