Still on the Equilibrium Real Exchange Rate of the Naira: A Re-Examination

Omolara O. Duke, Oladunni Adesanya and Abdulkadir R. Ahmadu*

Abstract

This study estimates the equilibrium real exchange rate for Nigeria using the purchasing power parity (PPP) approach and the behavioral equilibrium exchange rate (BEER) model as well as determined the extent of naira exchange rate misalignment over the period 1970q1 to 2013q4. We provide evidence of three major episodes of over/undervaluation of the nominal exchange rate using the PPP. The BEER model results established the existence of a long-run interaction between the real exchange rate (RER) and the fundamental variables. In particular, the behavior of the RER is determined by the degree of openness, net foreign assets, real interest rate differential and government spending. Furthermore, the result suggests that 4.9 per cent of the short-run shocks are obviated each quarter.

Keywords: Real exchange rate, purchasing power parity, exchange rate misalignment, equilibrium exchange rate, undervaluation and overvaluation

JEL Codes:F31, C01, 024

Authors' e-mail: ooduke@cbn.gov.ng; oadesanya@cbn.gov.ng; arahmadu@cbn.gov.ng

I. Introduction

The real exchange rate (RER) measures the relative price of goods and services in a domestic economy vis-à-vis a foreign country in the same currency (domestic or foreign). The real exchange rate combines the effects of nominal exchange rate change, which is the price of one currency in terms of the other, with the difference in price index of a basket of goods in the two countries. The RER is useful in the reconciliation of the demand and supply and the effective allocation of resources within an economy.

The choice of the price index used for the computation of the RER varies from consumer price indices, interest rate, prices of tradeable goods, relative unit labour cost and ratio of tradeables to non-tradeables (Driver and Westaway, 2004). In an open economy, movements in the RER have implications for various policy decisions and the business cycle. It impacts on production, output gap and the external sector competitiveness. For instance, an appreciation of the RER

**O. O. Duke (Mrs.) is an Assistant Director, O. Adesanya (Mrs.) is a Senior Economist while A. R. Ahmadu is an Assistant Economist in the Research Department.* *The usual disclaimer applies.*

promotes foreign consumption which is cheaper than the domestic consumption basket signifying loss of competitiveness. This results from increased cost of producing domestic goods, which herds domestic consumers towards the consumption of cheaper foreign goods, thus diminishing net exports. It should be noted that in relation to increased consumption of imported goods, where value effects dominate for domestic goods, there could be improvement in the trade balance and the current account, but where the quantity effects dominate the trade balance and current account would deteriorate. An appreciation of the RER reduces the cost of financing external obligations, which may also promote the build-up of external liabilities because foreign currency becomes cheaper. Foreign direct investment could also become restricted, due to the high cost of production in the domestic economy which would invariably reduce profit. Overall, an appreciated RER results in loss of competitiveness, capital account deficit and deterioration of the international position. It can be deduced therefore that the RER is not a constant; it changes according to the underlying macroeconomic variables. For policy formulation, however, the movement in RER, in relation to its equilibrium position, provides the intuition for policy formulation.

The measurement of RER misalignment is determined by its deviation from its equilibrium in the short, medium and long-run. The equilibrium real exchange rate (ERER) is thus computed to determine an approximate exchange rate in an economy during these periods. According to Driver and Westaway (2004), an equilibrium exchange rate is relative to a particular period and can deviate from an earlier state of equilibrium due to changes in macroeconomic conditions; therefore, in the short-term, the ERER is random.

A contextual overview of Nigeria shows that the country is heavily dependent on imports. It is a mono-product economy with over 85.0 per cent dependence on exports of crude oil for its foreign exchange earnings and the remainder is accounted for by non-oil primary exports. The Nigerian economy, therefore, is susceptible to the vagaries of external demand for crude oil and world commodity prices both of which are exogenous to the domestic economy. Exchange rate management therefore continues to be at the forefront of monetary policy formulation. The country has undergone two broad distinct exchange rate regimes. From 1959-1986 the fixed exchange rate regime was in place followed by the managed float, which has largely remained in practice till date. Under both regimes, exchange rate management remained central to monetary policy formulation and implementation.

Several studies have been undertaken to estimate exchange rate misalignment in Nigeria. This paper extends the literature by estimating the ERER of the naira during the period 1970-2012 using the relative PPP and the Behaviourial Equilibrium Exchange Rate (BEER) model approach as compared with other econometric models adopted in the literature. It is expected that the study would provide recommendations on exchange rate policy.

Following this introduction, section 2 provides the conceptual framework for the study. Section 3 reviews the RER theoretical frameworks and empirical literature on the ERER in both developed and developing economies, with particular reference to studies on Nigeria. The methodologies adopted in estimating the ERER are presented in section 4, while the empirical results and analysis are presented in section 5. The summary and concluding remarks are provided in section 6.

II. Review of Literature

II.1 Conceptual Framework

The nominal/bilateral exchange rate defines one currency in terms of another and it carries information only on the price of a domestic currency against the foreign currency it is paired with. It can also be expressed as an inverse of the other.

The RER is the nominal exchange rate adjusted for price differentials between two countries. The price used for the adjustment usually depends on the availability of data and it includes: consumer price index, producer prices, wholesale prices, gross domestic product (GDP) deflators, unit labour cost, etc.

The RER can be classified into the short run RER (SRER) and the long run RER (LRER). In the short run, the value of the RER is determined by the forces of demand and supply without any intervention. The sustainability of the LRER is a function of policies and for exogenous variables. In the literature it is indicated that ineffective policies promote disequilibria in the LRER. When LRER is achieved through a policy that promotes market efficiency it is referred to as desirable Equilibrium Real Exchange Rate (DRER) (Montiel, 1999). Since LRER is achieveable only on sustainable policies, it therefore equates DRER, hence LRER is a more acceptable methodology for exchange rate policy formulation.

The Equilibrium Real Exchange Rate (ERER) is the rate that clears the market without the intervention of the monetary authority. It is determined by macroeconomic fundamentals including prices that affect the nominal

exchange rate and the lags of those fundamentals at a current setting without the influence of the random effects. It is classified into short, medium and long run ERERs (Driver and Westaway, 2004).

The short-run equilibrium exchange rate describes the current state of an exchange rate in which its fundamental determinants are not influenced by random effects. The medium term equilibrium exchange rate is when internal and external balance is achieved. Internal balance is achieved when within the domestic economy, demand matches supply, output gap is zero, unemployment does not result in inflation, the current account is sustainable and domestic interest rate converges towards the world rate. In the long-run, RER equilibrium is achieved when the stock flow equilibrium is realized across the economy. The effect of LRER misalignment on an economy presents macroeconomic challenges. It is because the adjustments that could be made for exchange rate in disequilibria would be through either the nominal exchange rate, the domestic price level or both.

Exchange rate misalignment is the deviation of an exchange rate from its equilibrium position. It may be an overvaluation (undervaluation), in which the case value of the prevailing exchange rate is higher (lower) than the equilibrium exchange rate. Furthermore, exchange rate misalignment could be defined based on its computational methodologies which include; price, mode, and the solvency/sustainability approaches.

For an overvalued exchange rate, when the level remains unchanged, the adjustment is achieved automatically through relative price mechanism that would keep the domestic price level lower than the foreign price in an economic recession. The automatic adjustment mechanism occurs through reduction in expenditure pattern, leading to a reduction in aggregate demand and consequently lower prices.

When the value of the prevailing exchange is lower than the equilibrium exchange rate, the exchange rate is said to be undervalued. An undervalued currency could however be a strategy for a country to promote external competitiveness, currency war and to achieve trade balance. A misaligned currency impacts on the aggregate demand and supply of an economy and could have serious implications for the balance of payments and the domestic output. Under a fixed exchange rate regime, the government may revalue an undervalued currency or devalue an overvalued currency to promote trade surplus or reduce large deficit, respectively.

III. Review of Theoretical Framework and Empirical Literature

III.1 Theoretical Framework for the Real Exchange Rate

III.1.1 Purchasing Power Parity Approach

The purchasing power parity (PPP) is a simple theory of equilibrium exchange rate determination and it is used mainly for cross-country comparison of living standards and examining the productivity levels over time as well as determining the relative value of currencies (Vachris and Thomas, 1999). The theory is based on the proposition that exchange rates would adjust to equalize the relative purchasing power of currencies. Thus, it is expected that in perfectly competitive markets, identical products would trade at equivalent prices when valued in the same currency.

The PPP theory is based on the notion that the exchange rate is dependent on the actual buying power over a basket of goods, and so changes in the nominal exchange rate should reflect changes in the price of goods (Taylor and Taylor, 2004). Hence, the PPP theory is rooted on the concept of the 'law-of-one-price', which assumes that nominal exchange rates should change to compensate for price differentials across countries. In its simplest form, the law-of-one-price can be expressed as

$$P_t = P_t^* \times S_t \tag{3.1}$$

Where

p_t: domestic prices for a good or basket of goods,

p^*_t: foreign prices for a good or basket of goods, and

s_t: spot/market-determined exchange rate – units of domestic currency for each unit of foreign currency.

If PPP holds true then equation (3.1) can be rearranged to derive the form of absolute PPP.

$$P_t \Big/ P_t^* \times \frac{1}{S_t^{ppp}} = 1 \tag{3.2a}$$

or

$$S_t^{ppp} = P_t \Big/ P_t^* \tag{3.2b}$$

The left hand side of (3.2a) can also be referred to as the real exchange rate or the exchange rate that has been adjusted for relative price levels. It differs from the absolute PPP approach as it takes into cognizance changes in prices and exchange rates. This implies that the expected change in exchange rates would be equivalent to the change in the ratio of the two countries' price levels, given that there are no changes in fundamental relationships. Thus, the relative PPP model which establishes a relationship between the price indices of both domestic and foreign countries is given as follows:

$$\frac{S_t^2 - S_t^1}{S_t^1} = \pi_t - \pi_t^* \qquad (3.3a)$$

or

$$\%\Delta S_t = \%\Delta P_t - \%\Delta P_t^* \qquad (3.3b)$$

where
π_t : domestic inflation, and the depreciation,
π^*_t : foreign inflation
$\hat{s}_t$: Rate of depreciation of home currency

In equation (3.3a) one sees that the percent change in exchange rate over a given range of time will be equal to the differences in inflation of the domestic economy π_t and the foreign inflation π_t^*. Put in slightly different form, equation (3.3b) expresses the differences in percent changes in price levels in the domestic country and the foreign country, also known as the changes in relative inflation, as direct determinants in the relative changes in exchange rate between the two countries. It is thus, the calculation of relative PPP that many economists and theorists normally anchor their empirical tests in order to establish the validity of PPP.

The PPP theory is premised on some implausible assumptions among which are; all goods are identical and tradeable, there are no barriers to trade, there is absence of transportation costs, taxes and tariffs, there is complete market information and relative inflation rates are the sole determinants of exchange rates. Notwithstanding these limitations, the PPP approach provides very useful insights to the basic determination of the equilibrium exchange rate.

III.1.2 Monetary Approach

The basic monetary model for the determination of the exchange rate evolved with the commencement of the floating exchange rate regime in the early 1970s following the collapse of the Bretton woods exchange rate system. The monetary approach is a refinement of the traditional PPP approach and differs from the latter since it assumes that a long run equilibrium relationship exists between the nominal exchange rate and selected monetary fundamentals.

There are many variants of the monetary models of exchange rate determination; however, most of these varieties originated from the basic flexible-price monetary (FPM) model of Frenkel (1976), Dornbusch's (1976) and Bilson (1978). The FPM model assumes flexibility of prices which instantaneously adjusts to equilibrate the money market. The basic equations of the FPM model are expressed as follows:

$$e_t = p_t - p_t^* \tag{3.3}$$

$$m_t = p_t + \kappa y_t - \theta i_t \tag{3.4}$$

$$m_t^* = p_t^* + \kappa^* y_t^* - \theta^* i_t^* \tag{3.5}$$

Equation 3.3 captures the purchasing power parity assumption, where e_t represents the nominal exchange rate, p_t and p_t^* denotes the domestic and foreign price levels, respectively. Equations 3.4 and 3.5 represent the domestic (m_t) and foreign (m_t^*) money demand functions with y_t and y_t^* denoting domestic and foreign real incomes, respectively. Variables (i_t) and (i_t^*) symbolizes the domestic and foreign interest rates. Furthermore, κ, κ^*, θ and θ^* are elasticities and semi-elasticities. Since the model assumes perfect capital mobility, the domestic interest rate is exogenously preset in the international market. Writing equations (3.4) and (3.5) in equivalent form yields equation (3.6) expressed as:

$$e_t = (m_t - m_t^*) - \kappa(y_t - y_t^*) + \theta(i_t - i_t^*) \tag{3.6}$$

Equation 3.6 indicates that increases in the domestic money supply in excess of the increases in foreign money supply would result in domestic currency depreciation and the nominal exchange rate would increase in relation to the money stock. Similarly, an increase in domestic real income would stimulate increased domestic money demand and eventually climax in domestic currency appreciation, thus for equilibrium to be restored, the domestic price level must decline. According to Siregar (2011), the FPM model simply shows that changes in

the nominal exchange rate are predominantly determined by excess domestic money supply, real income and interest rate relative to their foreign levels. A notable shortcoming of the FPM model is its inability to accommodate the effect of fiscal variable and regime changes on the demand for money (Wilson, 2009).

III.1.3 Montiel Theory

The Montiel model of exchange rate determination is an extended version of the Dornbusch (1983) sticky-price monetary model which allows for short-run adjustments to output around the equilibrium level. Montiel (1999) explained that the dynamic path of exchange rate can be easily determined in conjunction with other relevant set of fundamental exogenous macroeconomic variables in response to an extensive range of macroeconomic shocks. An essential feature of the model is that the economy tends to revert to its steady-state after a shock. The long-run equilibrium exchange rate is attained whenever both long-run internal and external balances are reached. For internal balance, equilibrium must be simultaneously attained in both the non-traded (N) goods and labour markets; hence the long-run internal balance condition is represented as:

$$y_N(e,\phi) = (1-\theta)\,{}^{c}/_{e} + g_N \qquad (3.7)$$

The supply of non-traded goods (y_N) must be equivalent to private $[(1-\theta)\,{}^{c}/_{e}]$ and government demands (g_N). The long-run external balance condition is given as:

$$\pi^* f^* = \phi y_X(e,\phi) + y_Z(e,\phi) + (r^* + \pi^*)f^* - [\tau(\varepsilon + \pi^*) + \theta]c - g_Z \qquad (3.8)$$

The condition in equation 3.8 states that in a long-run equilibrium, the current account balance ($\pi^* f^*$) which comprises the trade balance and net interest receipts from the rest of the world must correspond to the left-hand side which captures the inflow of sustainable capital. Since a country's net international creditors balance f^* is largely dependent on the exogenously predetermined interest rate (r^*), then adjustments in f^* would only occur when r^* changes. Overall, the underlying idea is that the ensuing long-run ERER must be aligned with the stable saddle-path of the country's international net creditor's position and fundamental policy variables (Montiel, 1999).

III.1.4 Edwards Theory

The main feature of the model by Edwards (1988) is that in the short-run, both real and nominal macroeconomic fundamentals play a vital role in the determination of the RER; however, in the long-run, only real dynamics are utilized. The model assumes that the exchange of both tradeables and non-tradeables are necessary in the identification of fundamental variables required for the

determination of the ERER. The theory assumes, the existence of a public sector and dual exchange rate system.

Edward's dynamic model is more useful in fixed exchange rate regimes, but can be modified for countries with flexible regimes. The model assumes a three good, small, open economy with restrictions on capital mobility and that economic agents must instantaneously adjust their consumption and investment decisions in response to unsustainable current account. Furthermore, it is presumed that both the private and public sectors have budget constraints. Thus, the ERER in its reduced form is as expressed in equation (3.9);

$$\text{ERER} = \text{HH}\left(p^*, \tilde{p}^*, \gamma, \tilde{\gamma}, \delta, \delta^*, \text{V}, \text{T}, \tilde{\text{T}}, \text{G}_\text{X}, \tilde{\text{G}}_\text{X}, \ldots\right) \quad (3.9)$$

Where, p^* is the price of imports relative to exports, γ is the import tariff rate, δ is the world discount factor, V captures productivity level, T represents lump-sum transfers from the private sector, G_X is government expenditure on exportables. Lagged variables are specified with the tilde (~) while (*) indicates world prices.

III.2 Empirical Literature

III.2.1. Equilibrium Real Exchange Rate in Developed Economies

A review of studies conducted on developed countries includes Feyzioglu (1997) who assessed the RER in Finland during the period 1975-95. He adopted the Johansen cointegration techniques and the results showed that positive terms of trade shocks, world real interest rate as well as productivity differential between Finland and its main trading partners contributed to the appreciation of the RER. In addition, RER disequilibrium persisted for long periods and it would take about one and a half years to correct 50.0 per cent of such disequilibrium.

A vast number of empirical literatures have examined the ERER on the euro-dollar relationship. Clostermann and Schnatz (2000) empirically assessed the main factors driving changes in the RER in the European region during 1975-1998. They constructed a synthetic real euro-dollar exchange rate and used cointegration techniques and the error correction model for their analysis. Their findings suggested that the international real interest rate differential, relative prices in the goods sectors, real oil prices and government spending accounted for significant changes in the RER. Also, they estimated the medium-term equilibrium exchange rate of the euro to be US$1.13/€. A Similar study carried out by Lorenzen and Thygenssen (2000) on the euro-dollar link indicated that net foreign assets, demographics, research and development spending and the relative prices of

the goods sector accounted for changes in the euro. They observed that the estimated euro-dollar exchange rate ranged from US$1.17/€ to US$1.24/€.

In a related study, Chinn (2000) investigated the behaviour of the dollar/euro exchange rate using the monetary approach to the exchange rate. Variables analyzed included money stocks, industrial production, interest and inflation rates, relative price of non-tradeables and synthetic euro. Conducting a cointegrating VAR analysis he found that the real value of the euro lied between US$1.15/€ - US$1.17/€ and that the euro was undervalued by about 13.0 to 15.0 per cent in January 2000, implying that it was below its equilibrium value. Similarly, Wren-Lewis (2000) estimated the euro's equilibrium exchange rate from 1980q2 to1995q3 using the fundamental equilibrium exchange rate (FEER) methodology and found that it was US$1.26/€ while it was undervalued by 36.0 per cent during the period covered by the study.

Alberola et al. (1999) applied the BEER framework and conducted panel cointegration analysis of twelve currencies from 1980q1 to 1998q4 in order to evaluate their ERERs. They estimated RER using the ratio of wholesale to consumer prices index to capture the Balassa-Samuelson effects and current account to GDP ratio and unemployment, to serve as a measure of net foreign assets. Their findings revealed that the euro was undervalued against the dollar by 7.5 per cent and the equilibrium dollar-euro RERs was US$1.26/€ by end-1998 while the equilibrium euro-sterling rate was about €1.25/£ in 1998.

III.2.2 Equilibrium Real Exchange Rate in Developing Economies

Studies surveyed on developing economies revealed varied outcomes. For instance, Mathisen (2003) estimated the ERER for Malawi using Edwards approach. The fundamental variables utilized in the estimation included; government spending as a share of GDP, terms of trade, real per capita growth, investment, government salaries and wages as a share of GDP, technological progress, capital flows, ratio of domestic credit to nominal GDP and nominal government balance as a share of high-powered money. The Johansen cointegration technique was used in establishing the link between the RER and the fundamentals. He found that government spending, real per capita GDP, investment and terms of trade exerted positive effects on the RER, while expansionary monetary policy was linked to a depreciating RER. Furthermore, his analysis revealed that the exchange rate quickly reverted back to its steady state value following a shock. If there were no shocks, the deviation between the actual RER and its equilibrium values would be reduced by 50.0 per cent in approximately 11 months.

The empirical work on Jamaica by Robinson (2010) examined the determination of equilibrium exchange rate over the short, medium and long-run. He used three different methodologies namely; capital enhanced, behavioural and permanent equilibrium exchange rates to assess the mean reverting process of the RER. The fundamental variables employed were; terms of trade, net foreign assets, productivity, net government debt and interest rate differentials. He utilized cointegration-based techniques and discovered that an appreciated domestic currency was associated with higher interest rate and productivity growth while increase in government domestic debt gave rise to a depreciated currency which confirmed the Balassa-Samuelson effect. On the average, the RER would move towards its equilibrium value between 6 to 13 months in the short and medium term.

Imam and Minoiu (2011) evaluated the ERER of the Mauritian rupee over the medium-term using two theoretical approaches- macroeconomic balance and fundamental equilibrium. Variables considered in the macroeconomic balance model were; overall budget balance/GDP, net foreign assets/GDP, relative income, per capita GDP growth and population growth. Those used in the fundamental model included terms of trade, trade openness and government consumption. They employed the cointegration and autoregressive distributed lag (ARDL) techniques for the fundamental model and three estimators – pooled OLS, random effects, and fixed effects in modeling the macroeconomic balance framework. Overall, their findings showed that the variables confirmed theoretical expectation and that the Mauritian currency remained close to its equilibrium value during the period of study.

In investigating the equilibrium exchange rate in the new European Union member countries from 1993 to 2004, Alberola and Navia (2007) estimated RERs using two explanatory variables - productivity and net foreign assets with a view to determining the extent of over/undervaluation their analysis revealed that the Polish zloty was undervalued by 7.5 per cent, while, the Hungarian forint was overvalued by 3.5 per cent in 2004. However, the Czech koruna was very close to its long-term equilibrium value during the same period.

Babetskii and Égert (2005) investigated the equilibrium exchange rate in Czech Republic covering the period 1993m1 to 2004m9 and using the BEER framework. They performed cointegration analysis and estimated the Czech RER vis-a-vis the euro on dual productivity differential and net foreign asset using the dynamic ordinary least squares (DOLS) and ARDL approaches. A period of overvaluation was identified in 1997 and 1999, overvaluation persisted until 2002; an

undervaluation occurred in 2003, and a correction towards equilibrium in the second half of 2004.

III.2.3 Past Studies on Equilibrium Real Exchange Rate in Nigeria

Several studies investigating the determination of the ERER for Nigeria have produced varied outcomes. In the work of Daboh (2010) on the RER misalignment in the West African Monetary Zone, Nigeria was one of the four countries on which he modeled the determinants of the RER to obtain model-based ERER and the extent of RER misalignment in the West Africa Monetary Zone (WAMZ). He adopted the Edwards model (1989) of RER determination and used annual time series from 1970-2006. Hodrick-Prescott filter was used to derive the ERER and the RER misalignment. The variables used for modeling were terms of trade, degree of openness, government expenditure, investment as a share of GDP, GDP growth rate, capital flows, domestic credits, nominal and RER (lags). The result for Nigeria showed that there was RER misalignment in which the currency was mostly overvalued. In general, the explanatory variables used showed that TOT significantly depreciated the RER in Nigeria only in the short run while the degree of openness carried the a priori negative sign and appreciated RER in the long run. Furthermore, government expenditure as a ratio of GDP appreciated the RER in the short and long run. Investment as a ratio of GDP which served as a proxy for capital accumulation appreciated the RER in the short run, but caused depreciation in the long run. The Balassa-Samuelson effect was captured by the growth in technology for which growth in GDP was used as a proxy. It appreciated the RER in the short run. Capital flows had a significant effect on RER in Nigeria as it depreciated RER by 0.06 per cent in the short run. Domestic credit had no significant effect. Nominal exchange rate (current and lagged) depreciated the exchange rate by 1.21 per cent in the short run. The error correction model showed 24.8 per cent deviation from the ERER and the speed of adjustment was 4.1 years.

Obaseki (2001) examined the naira equilibrium exchange rate covering the period 1970 to 1996 to test the validity of the PPP in the long-run. He adopted the cointegration and OLS estimation techniques to establish the likelihood of a long-run relationship between the exchange rate and relative prices – (Nigeria and United States consumer price indices). The results showed that developments in the exchange rate were significantly affected by adjustments in the foreign prices. In addition, he found that the naira exchange rate was responsive to its previous levels and contemporaneous foreign prices. Overall, the author confirmed the validity of a long-run equilibrium relationship between exchange rates and relative prices.

In the work of Aliyu (2009), the long run ERER of the naira was estimated using the BEER approach and applied the vector error correction technique on a set of variables from 1986q1 - 2006q4. The variables used were net foreign assets, terms of trade, government fiscal stance, index of crude oil volatility and index of monetary policy performance. In his result, the long run exchange rate was affected by terms of trade, index of crude oil volatility, index of monetary policy performance and government fiscal stance. In addition, exchange rate misalignment was eliminated by the end of the second year. He further indicated that huge crude oil export proceeds resulted in the undervaluation of the RER during 2003-2004 and overvaluation during 2005-2006 and that deviations of the RER from its equilibrium path were eliminated within 1-2 years. A notable limitation of the study was that the chosen period, i.e.,1986-2006 covered only the period of exchange rate liberalization and managed float exchange rate regime and did not cover the period of fixed exchange rate regime, 1970-1986.

III.3 Background on the Foreign Exchange Market and Exchange Rate in Nigeria

Nigeria has undergone various changes in exchange rate regimes from 1959 to date. The fixed exchange rate regime had many variations, which included, the Nigerian pound pegged at parity with the pound sterling, pegging against a basket of currencies and the import-weighted basket approach. The flexible regime began in 1986 and the US dollar was the currency of intervention. The variants of the flexible exchange rate regime were; the dual exchange rate regime, the era of guided deregulation and full deregulation.

III.3.1. Fixed Exchange Rate Regime (1959-1985)

Prior to 1960, there was a global fixed exchange rate arrangement in which currencies were linked to gold. This allowed for unrestricted capital mobility and global stability in currencies and trade. The parity with the British pound sterling was fixed at £1=2.488 grams of gold in 1962 when Nigeria became a member of the International Monetary Fund (IMF). Subsequent economic challenges that confronted Britain in 1967 led to the devaluation of the British pound sterling by 14.0 per cent and the Nigerian pound was re-valued to 1.17 British pound sterling. In 1971, the breakdown of the Bretton Wood system and the difficulty of exchange rate formulation led the Nigerian government to jettison the British pound sterling and the adoption of the US dollar as a reference currency for the purpose of determining the exchange rate of the Nigerian pound. The US government de-valued the dollar against gold by December of the same year, the Nigerian government refused to de-value its currency on the ground that such policy option would increase the cost of domestic production and escalate

inflation; these were supported by the sustained increase in external reserves during the period.

Furthemore, in January 1973, the Nigeria pound was replaced with the naira as the domestic currency and its par value with the US dollar was US$1.52/₦. In the same month, the US dollar was devalued by 10.0 per cent, and Nigeria also devalued its currency to the tune of 10.0 per cent to maintain external sector competitiveness. The Central Bank of Nigeria adopted a strategy to use the country's export performance to determine the exchange rate of naira against the dollar in 1974. The increase in oil prices was the antecedent for the conscious and consistent appreciation of the exchange rate of the naira. The policy was not sustained for a long period, as the first oil glut between 1976 and 1978 led to fixing of the rate to a currency basket. There was also a reduction in external reserves occasioned by the huge outflows due to increased import bills.

The domestic currency was tied to a single currency (the US dollar) as the currency of intervention in 1985. The fixed exchange rate regime induced an overvaluation of the naira and significant distortions in the economy which gave rise to massive importation of finished goods with its adverse consequences on domestic production, balance of payments position and the nation's external reserves. Moreover, sharp practices were perpetrated by dealers and end-users in the foreign exchange market. These problems informed the adoption of the flexible exchange rate regime within the context of the Structural Adjustment Programme (SAP), adopted in 1986 (Sanusi, 2004).

III.3.2. Flexible Exchange Rate Regime (1986-2013)

The Central Bank of Nigeria (CBN) adopted a Second-tier Foreign Exchange Market (SFEM) in 1986 to establish a realistic exchange rate for the naira and all official transactions were conducted at a fixed pre-SFEM rate, while private sector transactions were based on the market rate. However in 1987 the system merged into a single regime to mitigate the structural distortions in the economy. The exchange rate, therefore depreciated sharply from ₦2.02/US$ in 1986 to ₦17.30/US$ by 1992 and further to ₦21.89/US$ by 1994.

The merger was insufficient to curb the excessive demand pressure, which consequently led to massive devaluation of the naira. The autonomous foreign exchange market emerged in 1988, and in 1989, the inter-bank foreign exchange market commenced.

The CBN introduced the Dutch Auction System to curb excessive demand in 1990. Bureau de Change (BDCs) was also licensed to service small scale foreign

exchange to end-users. In a quick session, the Bank moved from deregulated exchange rate system in 1992 to a fixed system in 1994 when the naira was pegged at ₦21.99/US$. A foreign exchange committee was set-up to allocate scarce foreign exchange resources. The prevailing macroeconomic conditions led to further devaluation of the naira and thus, the dual exchange rate system was re-introduced in 1995 under a "Guided Deregulation" to address the substantial depreciation of the naira and to manage the country's external resources.

In 1995, the Exchange Monitoring and Miscellaneous Provisions Act, 1995 was enacted, which gave legal backing to the creation of the Autonomous Foreign Exchange Market (AFEM) for trading privately-sourced foreign exchange. The exchange rate was fixed at ₦22/US$ at the official window and for bona fide government transactions. The rate at the AFEM was market-determined while the CBN intervened periodically to stabilize the market. This improved the market situation and eased the pressure on both the official and autonomous sources.

In 1999, the foreign exchange market was fully deregulated to reduce the rent-seeking behaviours and establish some level of macroeconomic stability. The Inter-Bank Foreign Exchange Market (IFEM) was then established in October 1999 and was conducted daily with banks as major participants and the CBN as a moderator. In 2002, the Retail Dutch Auction (rDAS) was introduced to narrow the premium that existed between the official and the parallel market and to stem the rising demand for foreign exchange. Under the rDAS, the naira exchange rate moved from ₦92.69/US$ in 1999 to ₦133.50/US$ in 2004 but appreciated to ₦118.92/US$ by 2008.

Following the success of the rDAS and the sudden rise in the level of external reserves, the successful consolidation of commercial banks and enhanced fiscal discipline, the Wholesale Dutch Auction (wDAS) was adopted in 2006 to further liberalize the foreign exchange market. The naira exchanged for an average of ₦128.65/US$ in 2006, appreciated to ₦125.83 in 2007 and to ₦118.92 in 2008 and was stable all through to June 2009 before it sharply depreciated to ₦148.90/US$ on the back of the global financial crisis and the attendant economic downturn. rDAS was re-introduced for a brief period in 2009 but by end-2009 the wDAS was reinstated to determine and manage the exchange rate.

IV. Methodology

Two approaches were adopted by the study for the estimation of the equilibrium RER and exchange rate misalignment. The relative PPP approach and the econometric or behavioural equilibrium exchange rate (BEER) approach were

used to determine the equilibrium exchange rate and derive the exchange rate misalignment.

IV.1 Purchasing Power Parity Approach

The methodology adopted for this approach is the relative PPP. The relative PPP model which establishes a relationship between the price indices of both domestic and foreign countries is given as follows:

$$\frac{P_{it}}{P_{it-1}} = \left(\frac{E_t}{E_{t-1}}\right)\left(\frac{P_{it}^*}{P_{it-1}^*}\right) \tag{4.1}$$

$$\frac{\sum P_{it}}{\sum P_{it-1}} = \left(\frac{\sum E_t}{\sum E_{t-1}}\right)\left(\frac{\sum P_{it}^*}{\sum P_{it-1}^*}\right) \tag{4.2}$$

where

P_{it}: Domestic prices for a good in terms of domestic currency at time t

P_{it}^*: Foreign prices for a good in terms of foreign currency at time t

E_t: Nominal exchange rate expressed as domestic price of foreign currency at time t

IV.2 Econometric Approach-BEER

IV.2.1 Sources of Data

Quarterly time series from 1970q1 - 2013q4 were employed. All the data series were obtained from various issues of the CBN Annual Report and Statements of Account, CBN Statistical Bulletin and the IMF, International Financial Statistics.

IV.2.2 Model Specification

We estimate the ERER by defining exchange rate misalignment as the deviation of the actual from its equilibrium value. The econometric approach views the ERER as being determined by changes in economic fundamentals; as such the BEER model is used in determining the ERER following Robinson (2010). The choice of the model is informed by data availability. The BEER is wholly determined by economic fundamentals hence, it can be used for both short and medium- run analysis.

Accordingly, the BEER model to be estimated is expressed in equation (4.3);

$$RER_t = [\alpha_1 DOP_t + \alpha_2 NFA_t + \alpha_3 RIRD_t + \alpha_4 GSP_t] + \beta T_t + \varepsilon_t \quad (4.3)$$

Where, the RER_t is a function of government spending as a share of GDP (GSP), net foreign assets to GDP (NFA), real interest rate differential (RIRD), degree of openness (DOP) and the error term (ε_t). α_1, α_2, α_3 and α_4 are the parameter estimates. In estimating the BEER model, cointegration procedures would be employed so as to establish if there is a long-run relationship between the RER and the set of economic fundamentals. The path of RER generated would correspond to the short and medium term ERER while a deviation from the actual RER would generate the extent of misalignment.

IV.2.3 Methodology

The existence of a long-run relation between the variables is captured with the application of Johansen (1988, 1991 and 1994) cointegration technique. This technique is well-suited for this purpose because it produces more robust estimates and a number of cointegrating vectors as well as indicates if the time series move together in the long-run. A Vector Autoregressive (VAR) model in level is estimated to obtain the optimal lag length which is selected using the information criteria. The number of cointegrating vectors is then determined using the trace and the Max-eigenvalue tests. Given a vector X_t comprising endogenous variables with n × 1 dimension, each variable follows a process that is influenced by its own lagged variables and the lagged variables of the other endogenous values.

$$X_t = \Pi_{t-1}X_t + \ldots + \Pi_k X_{t-k} + \epsilon_t \quad \text{with } t = 1, \ldots, T \quad (4.7)$$

The error-correction form in first differences is expressed as;

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + \ldots + \Gamma_{k-1}\Delta X_{t-k-1} + \Pi X_{t-k} + \mu + \varepsilon_t \quad (4.8)$$

$$\varepsilon_t \sim N(0,\Lambda) t = 1, \ldots, T$$

where $\Gamma_i = -I + \Pi_1 + \Pi_i$ for $i = 1, \ldots, 1-k$ and $\Pi = -(I - \Pi_1 - \ldots - \Pi_k)$ are n x n matrices, μ is a n x 1 vector of constants, ε_t is a n x 1 error vector and Λ is the n x n covariance matrix. Cointegration involves investigating the rank of Π so as to determine the number of cointegrating vector (r). If rank (Π) = r < n, then $\Pi = \alpha\beta'$, where α is the speed of adjustment while β is the matrix of cointegrating vectors. Consequently, the vector X_t would become stationary by the linear combinations of $\beta' X_t$.

The trace statistic tests the null hypothesis of rank (Π) = r against the alternative of rank (Π) > r while the maximum eigenvalue test examines the exact number of r cointegrating vectors. The formulae for the trace and maximum eigenvalue tests are given in 4.9 and 4.10, respectively.

$$\lambda_{trace} = -T \sum_{i=r+1}^{p} In\left(1 - \hat{\lambda}_i\right) \quad (4.9)$$

$$\lambda_{max} = -T\ In\left(1 - \hat{\lambda}_i\right) \quad (4.10)$$

Once the number of cointegrating vectors has been established a dynamic equation in the form of an error correction model (ECM) would then be estimated using the OLS so as to determine the short-run and long-run dynamics of the models. The ECM is given as follows:

$$\Delta Y_t = \alpha_1(Y_{t-1} - \beta_1{}'X_{t-1} - \beta_0 - \beta_2 t) + \sum_{i=1}^{p} \gamma_i' \Delta Z_{t-1} + \alpha_0 + \varepsilon_t \quad (4.11)$$

Where α_1 is the speed of adjustment coefficient, α_0 is a constant, ΔY is the first difference of RER, X_{t-1} is an n-dimensional vector of I(1) variables cointegrated with RER. ΔZ_t explains the short-run dynamic effects on RER, β_i and γ_i are parameters, p is the number of lags and ε_t is the white noise error term. The relationship expressed in equation 4.11 is the dynamic specification of the relationship between the RER and the fundamental variables.

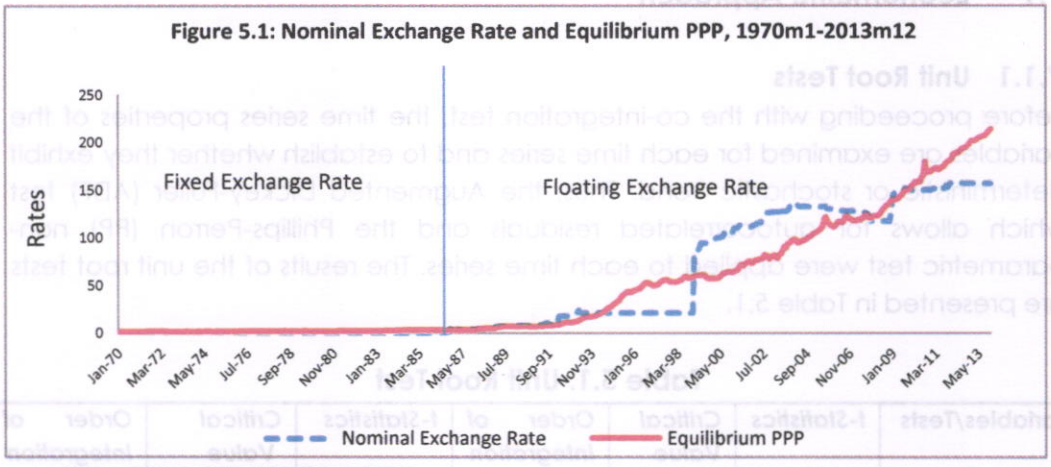
V. Empirical Analysis and Results

V.1 PPP Approach

There were three major episodes of overvaluation and undervaluation identified during the review period (figure 5.1 and 5.2). The first overvaluation occurred during 1970m1 – 1986m8, the period of fixed exchange rate regime when the nominal exchange rate was overvalued to the tune of 49.5 per cent. This could have accounted for the large depletion in the external reserves which was mainly used to fund importation of finished products into the country. The other two major episodes of overvaluation occurred during 1994m7-1998m12 and 2009m10 – 2013m12. During these periods the nominal exchange rate were overvalued by 50.6 and 12.6 per cent, respectively. This result implies that nominal exchange rates during 2013m10 – 2013m12 should be N161.4464/US$1, N161.2996/US$1 and N161.3004/US$1, respectively. Overvaluation is usually associated with a decrease in reserves, the stagnation in reserves around US$32.00 billion during 2009m10 –

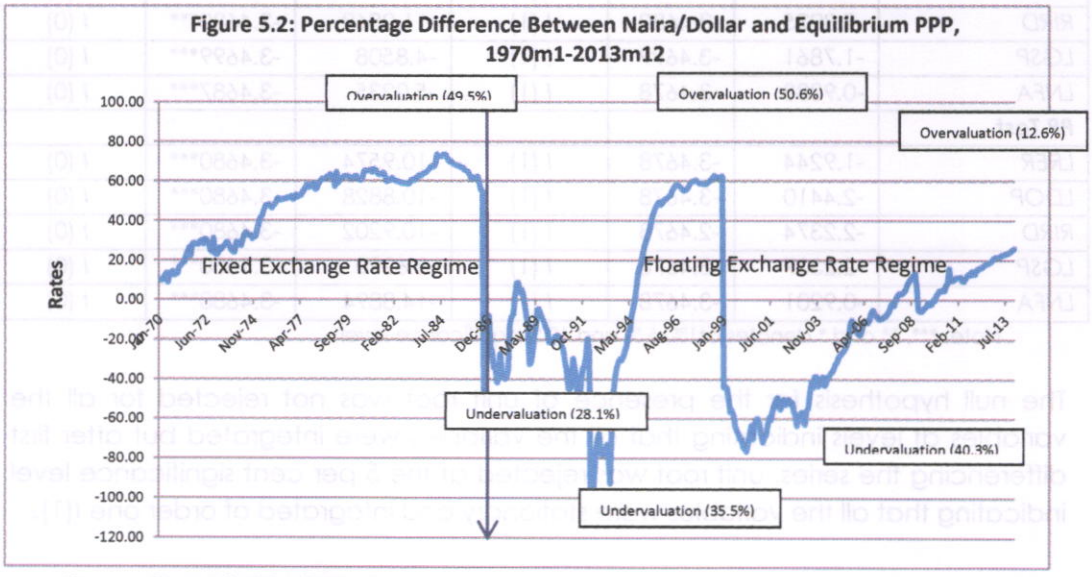
2012m12, reflected the overvaluation during that period. The degree of overvaluation ranged between 2.4 and 73.7 per cent with the highest occurring in 1984m5 and the lowest recorded in 1988m4.

Figure 5.1: Nominal Exchange Rate and Equilibrium PPP, 1970m1-2013m12



Source: Computed by the authors

Figure 5.2: Percentage Difference Between Naira/Dollar and Equilibrium PPP, 1970m1-2013m12



Source: Computed by the authors

There are three major episodes of undervaluation discovered under the review period, namely 1986m9-1999m3, 1988m10-1994m6 and 1999m1-2007m10, averaging 28.1, 35.5 and 40.3 per cent, respectively. The highest undervaluations

of nominal exchange rate occurred in 1993m3 at 92.3 per cent while the lowest was 1.9 per cent in 2009m9.

V.1 Econometric Approach

V.1.1 Unit Root Tests

Before proceeding with the co-integration test, the time series properties of the variables are examined for each time series and to establish whether they exhibit deterministic or stochastic trend. Thus, the Augmented Dickey-Fuller (ADF) test which allows for autocorrelated residuals and the Phillips-Perron (PP) non-parametric test were applied to each time series. The results of the unit root tests are presented in Table 5.1.

Table 5.1: Unit Root Test

Variables/Tests	t-Statistics	Critical Value	Order of Integration	t-Statistics	Critical Value	Order of Integration
	Levels			First difference		
ADF Test						
LRER	-1.8644	-3.4689	I (1)	-10.6132	-3.4689***	I (0)
LDOP	-2.2524	-3.4689	I (1)	-5.8918	-3.4689***	I (0)
RIRD	-2.3925	-3.4680	I (1)	-11.0869	-3.4680***	I (0)
LGSP	-1.7861	-3.4699	I (1)	-4.8508	-3.4699***	I (0)
LNFA	-0.9388	-3.4678	I (1)	-5.0235	-3.4687***	I (0)
PP Test						
LRER	-1.9244	-3.4678	I (1)	-10.9574	-3.4680***	I (0)
LDOP	-2.4410	-3.4678	I (1)	-10.8828	-3.4680***	I (0)
RIRD	-2.2374	-2.4678	I (1)	-10.9202	-3.4680***	I (0)
LGSP	-2.2337	-3.4678	I (1)	-8.6290	-3.4680***	I (0)
LNFA	-0.9201	-3.4678	I (1)	-14.8894	-3.4680***	I (0)

Note: ***, ** and * denotes at1%, 5 % and 10 % significance level

The null hypothesis for the presence of unit root was not rejected for all the variables at levels indicating that all the variables were integrated but after first differencing the series, unit root was rejected at the 5 per cent significance level indicating that all the variables were stationary and integrated of order one *I*(1).

V.1.1 Cointegration Tests and Error Correction Model

To determine the optimal lag length, we specified a VAR (8) model and applied the conventional selection criteria. The summary of results for the choice of lag length is presented in Table 5.2. The Schwarz information criterion (SC) recommended a lag length of two (2) while both the modified Likelihood Ratio (LR), Akaike information criterion (AIC) and Hannan-Quinn criterion (HQ)

suggested an optimal lag length of six (6). We settled for lag length of one (2) as the ideal lag order as determined by the SC because it ensures the attainment of a parsimonious model.

Table 5.2: VAR Lag Order Selection Determination

Lag	LogL	LR	AIC	SC	HQ
0	-470.0359	NA	5.655189	5.748164	5.692923
1	589.6204	2043.623	-6.662148	-6.104297	-6.435745
2	656.4871	124.9770	-7.160561	**-6.137835***	-6.745489
3	682.4294	46.94321	-7.171779	-5.684177	-6.568038
4	691.8209	16.43462	-6.985960	-5.033483	-6.193550
5	780.1579	149.3321	-7.7359975	-5.322622	-6.758896
6	824.5388	**7238309***	**-7.970700***	-5.088471	**-6.800951***
7	841.1656	26.12782	-7.871019	-4.523915	-6.512601
8	861.1003	30.13932	-7.810717	-3.998738	-6.263630

Note: * indicates lag order selected by the criterion

To establish the existence of a long-run equilibrium relationship among the difference non-stationary variables, the Johansen and Juselius (1990) cointegration test using the trace and max-eigenvalue tests was carried out and the results are presented in Table 5.3.

Table 5.3: Unrestricted Johansen's Cointegration Rank Test (Trace and Max-eigenvalue)

Null Hypothesis (H_0)	Alternative Hypothesis (H_1)	Eigenvalue	Trace Statistic (λ_{trace})	5 per cent Critical Value	P -ratio
r = 0	r ≥ 1	0.209133	76.22231	69.81889	0.0141
r ≤ 1	r ≥ 2	0.101395	35.63202	47.85613	0.4151
r ≤ 2	r ≥ 3	0.057468	17.13639	29.79707	0.6300
r ≤ 3	r ≥ 4	0.037655	6.897276	15.49471	0.5896
r ≤ 4	r = 5	0.001485	0.257147	3.841466	0.6121
Note: * denotes rejection of the hypothesis at 5 per cent significance level Trace test indicates 1 cointegrating equation at 5 per cent significance level					
Null Hypothesis (H_0)	**Alternative Hypothesis (H_1)**	**Eigenvalue**	**Max-eigenvalue Statistics (λ_{max})**	**5 per cent Critical Value**	**P –ratio**
r = 0	r = 1	0.209133	40.59029	33.87687	0.0068
r ≤ 1	r = 2	0.101395	18.49564	27.58434	0.4545
r ≤ 2	r = 3	0.057468	10.23911	21.13162	0.7219

r ≤ 3	r = 4	0.037655	6.640128	14.26460	0.5325
r ≤ 4	r = 5	0.001485	0.257147	3.841466	0.6121
Note: * denotes rejection of the hypothesis at 5 per cent significance level Max-eigenvalue test indicates 1 cointegrating equation at 5 per cent significance level					

From the trace and max-Eigenvalue test results, the null hypothesis of no cointegrating vector (r = 0) is strongly rejected as the trace and max-eigenvalue statistic were greater than their corresponding critical values at 5.0 per cent significance level, thus we concluded that there exists a unique long-run equilibrium relationship between the RER and the economic fundamentals.

Since a single cointegrating vector was established, we proceeded to estimate the long-run behavioural equilibrium relationship using the vector error correction model (VECM). In the first stage, we estimated the cointegration equation for the ERER by imposing 1 normalizing restriction while in the next stage, we estimated the error correction terms arising from the cointegration relation. The result of the estimated cointegrated vectors normalized on LRER is presented in equation 5.1.

$$LRER = \underset{(0.439)}{-1.288^{*}LDOP} + \underset{(0.007)}{0.038^{*}RIRD} + \underset{(0.183)}{0.661^{*}LGSP} + \underset{(0.030)}{0.103^{*}LNFA} \qquad (5.1)$$

The result of the error correction model is presented in Table 5.4. The long-run relationship between the ERER and the fundamental variables revealed that LDOP, RIRD, LGSP and LNFA are all highly statistically significant. In the estimated long-run ERER equation, the degree of openness exerted the strongest impact on the RER in Nigeria, thus it is expected that a 1.0 per cent increase in trade openness would be associated with a depreciation of the LRER of about 1.3 per cent while a 1.0 per cent increase in government spending (share of GDP) would be related to 0.7 per cent RER appreciation. Likewise, a 1.0 per cent growth in the net foreign asset would result in an appreciation of 0.1 per cent in the long-run. Consequently, the real interest rate differential that captures arbitrage opportunities between Nigeria and the US had the least influence on the RER such that a 1.0 per cent increase would cause the LRER to appreciate by only 0.04 per cent, this implies that increases in the domestic interest rates are not matched by corresponding increases in the foreign interest rates.

Table 5.4 : Short Run Result (Error Correction Model)

CointEq1	*D(LNFA)*	*D(LGSP)*	*D(LDOP)*	*D(IRD)*
-0.049062*	**0.031326**	**0.021875**	**-0.026702***	**2.047023***
-0.02143	-0.0534	-0.01487	-0.01189	-0.66295
[-2.28945]	[0.58666]	[1.47125]	[-2.24643]	[3.08777]

Standard errors are in ( ) and t-statistics in [ ]

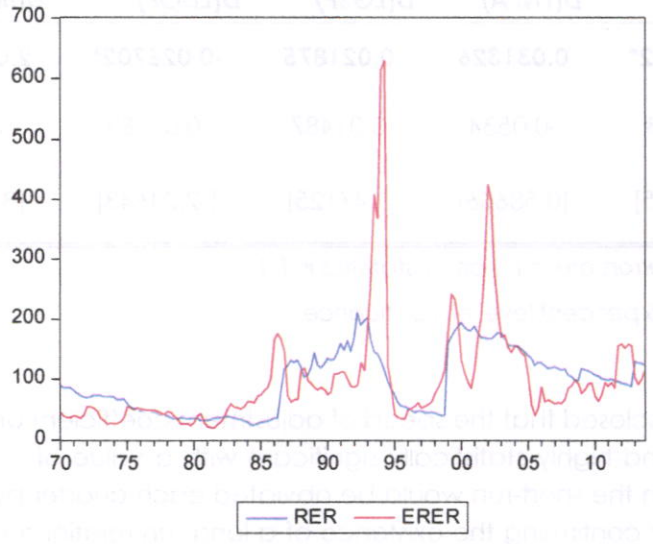
** denotes 5 per cent level of significance*

The estimates disclosed that the speed of adjustment coefficient of the RER had a negative sign and highly statistically significant with a value of -0.049 indicating that any shock in the short-run would be obviated each quarter by about 4.9 per cent and further confirming the existence of a long-run relationship between the variables. The adjustment process is relatively slow, indicating that any short-run RER disequilibrium would be corrected to settle towards its long-run or new equilibrium value.

Additionally, the dynamic RER error correction specification showed that the parameter estimate of the RER and NFA are statistically different from zero at 5.0 per cent significance level, while the remaining fundamental variables are statistically insignificant.

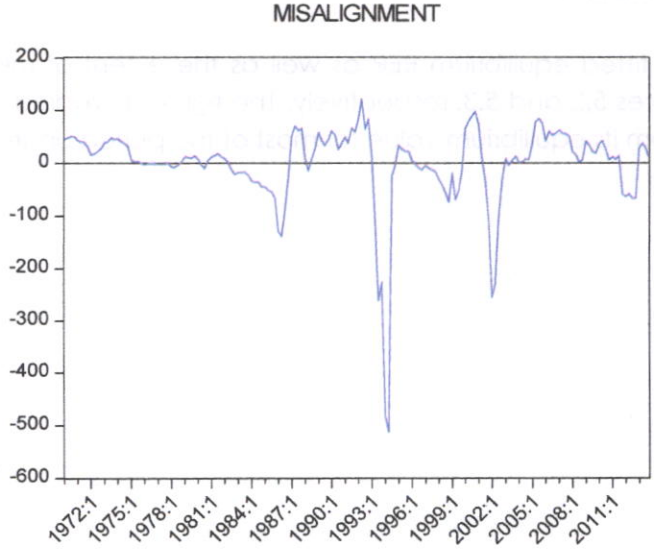
The actual and fitted equilibrium RER as well as the extent of misalignment are depicted in Figures 5.2 and 5.3, respectively. The figures revealed that the actual RER deviated from its equilibrium value for most of the period under study.

Figure 5.2: Actual and Equilibrium Real Exchange Rate, 1970q1 -2013q4



The episodes of overvaluation or undervaluation indicate that the RER is time-varying. As well, it is observed that the magnitude of misalignment was significantly narrow at the commencement of the floating exchange rate regime in1986 until 1995.

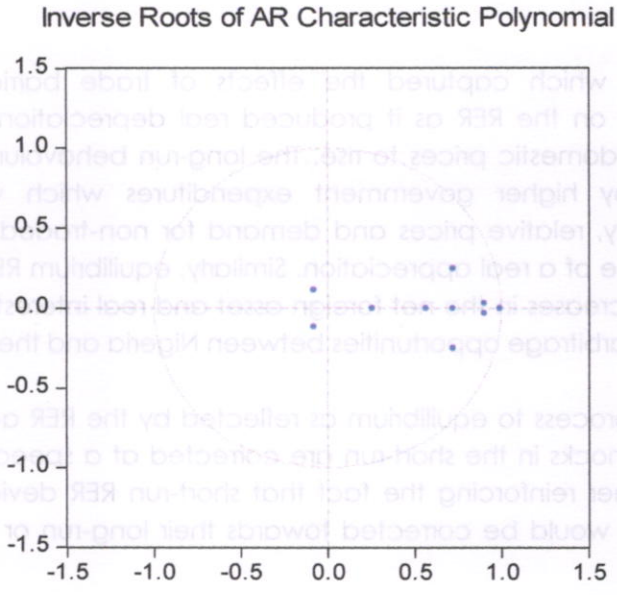
Figure 5.3: Real Exchange Rate Misalignment, 1970q1 -2013q4



V.1.1 Stability Test

A diagnostic test for parameter stability was conducted and the result is presented in Table 5.6 and Figure 5.1. All the parameters of the BEER model satisfied the stability condition which further verifies the stationarity of the model. The stability test result is presented in Figure 5.1.

Figure 5.1: Inverse Roots of AR Characteristic Polynomial



Since the autoregressive (AR) process was found to be stable, i.e., all the five roots of the characteristic AR polynomial have absolute value less than one and lie inside the unit circle, it implies that the impact of shocks in the variables would diminish over time and the parameter estimates would produce stable dynamics for the ERER.

VI. Conclusion and Policy Implications

This paper evaluated the equilibrium real exchange rate for Nigeria using the PPP and econometric approaches from 1970q1 to 2013q4. The PPP approach computed as the domestic RER was inadequate in determining the equilibrium RER, so we complemented it using an alternative approach to enable us to determine the real macroeconomic variables affecting the RER as well as the extent of misalignment.

In the PPP approach, we observed that there were three major episodes of overvaluation which occurred during 1970m1 – 1986m8, 1994m7-1998m12 and

2009m10–2013m12. This result implies that nominal exchange rates during 2013m10–2013m12 should be N161.4464/US$1, N161.2996/US$1 and N161.3004/US$1, respectively. In addition, three episodes of undervaluation were observed between 1986m9-1999m3, 1988m10-1994m6 and 1999m1-2007m10, averaging 28.1, 35.5 and 40.3 per cent, respectively. In the econometric approach, first, we established the existence of one cointegrating long-run equilibrium relationship between the RER and the fundamental variables. Second, using the BEER framework, the dynamic changes in the RER were estimated and analyzed.

Trade openness which captured the effects of trade barriers exerted the strongest impact on the RER as it produced real depreciation in the long-run thereby causing domestic prices to rise. The long-run behavoiur of the RER was also affected by higher government expenditures which would stimulate economic activity, relative prices and demand for non-traded goods with the eventual outcome of a real appreciation. Similarly, equilibrium RER appreciations were linked to increases in the net foreign asset and real interest rate differential which captured arbitrage opportunities between Nigeria and the US.

The adjustment process to equilibrium as reflected by the RER adjustment factor suggested that shocks in the short-run are corrected at a speed of 4.9 per cent per quarter, further reinforcing the fact that short-run RER deviations from their equilibrium levels would be corrected towards their long-run or new equilibrium value.

In view of these findings, the study recommends exchange rate policy that reflects the prevailing equilibrium conditions. However, because the pass-through effect of exchange rate to inflation is high (External Sector Division, 2012) and the economy is import dependent. Hence an immediate adjustment of exchange rate could result in high-pass through to inflation.

The retention of an overvalued rate is a precursor, to loss of external and internal balance.

From the aforementioned, an exchange rate policy that would gradually push the rate toward its equilibrium position must be encouraged. The objective would be to adopt an exchange rate that would enable the automatic adjusters in the economy correct misalignments when it occurs. For the above reasons this paper recommends gradual depreciation of exchange rate.

References

Aguirre, Á. and C. Calderón (2005) "Real Exchange Rate Misalignments and Economic Performance" *Central Bank of Chile, Working Papers* No 315.

Alberola, E., Cervero, S., Lopez, H. and Ubide, A. (1999) "Global Equilibrium Exchange Rates: Euro, Dollar, "Ins," "Outs," and Other Major Currencies in a Panel Cointegration Framework". *IMF Working Paper* WP/99/175.

Alberola, E. and D. Navia (2007) "Equilibrium Exchange Rates in the New EU Members: External Imbalances Vs. Real Convergence", *Bank of Spain document* no.0708

Aliyu S. U. R. (2009) "Impact of Oil Price Shock and Exchange Rate Volatility on Economic Growth in Nigeria: An Empirical Investigation" Munich Personal RePEc Archive MPRA Paper No. 16319 Available at: http://mpra.ub.uni-muenchen.de/16319/1/MPRA_paper_16319.pdf

Babetskii, I. and B. Égert (2005) "Equilibrium Exchange Rate in the Czech Republic: How Good is the Czech BEER?" *Center for Economic Research and Graduate Education- Economics Institute, Working Paper* Series 267

Bussière, M. and M. Fratzscher (2006) "Towards a New Early Warning System of Financial Crises", *Journal of International Money and Finance*, Vol. 25(6), pp. 953-973.

Chinn, M. D. (2000) "The Empirical Determinants of the Euro: Short and Long Run Perspectives", paper presented at the *Deutsche Bundesbank conference on Equilibrium Exchange Rates of the euro*, March 27-28, 2000.

Clostermann, J. and B. Schnatz (2000) "The Determinants of the Euro-Dollar Exchange Rate - Synthetic Fundamentals and a Non-Existing Currency" Discussion Paper 2/00, *Economic Research Group of the Deutsche Bundesbank*.

Costa, S. (1998), "Determination of the Equilibrium Real Exchange Rate for the Portuguese Economy using the FEER". *Economic Bulletin of the Banco de Portugal*.

Daboh L (2010) "Real Exchange Rate Misalignment in the West African Monetary Zone" *Journal of Monetary and Economic Integration* Vol. 10, No. 2 JEL

Classification: F31, C22 Available at: http://www.wami-imao.org/ecomac/english/newreports/v11_no1/pdfdocs/v10n2_unit1.pdf

Di Bella, G. M. Lewis, and Martin A., (2007) "Assessing Competitiveness and Real Exchange Rate Misalignment in Low-Income Countries" *International Monetary Fund Working Paper* 07/201.

Dornbusch R. (1976) "Expectations and Exchange Dynamics", Massachusetts Institute of Technology, *Journal of Political Economy* Vol. 84 No. 6, pp 1161-1176.

Dornbusch R. (1983) "Equilibrium and Disequilibrium Exchange Rate", *National Bureau of Economic Research (NBER) Working Paper* No. 983, pp.1 -43.

Driver R. C. and P. F. Westaway (2004) "Concepts of Equilibrium Exchange Rates" Working Paper no. 248 Bank of England Pp. 1-64 Available at: http://www.bankofengland.co.uk/publications/Documents/workingpapers/wp248.pdf

Edwards S. (1988) "Real and Monetary Determinants of Real Exchange Rate Behavior: Theory and Evidence from Developing Countries" *National Bureau of Economic Research Working Paper* Series No. 2721 pp. 1-41

External Sector Division (2012) "Exchange Rate Pass-Through to Inflation in Nigeria" Central Bank of Nigeria, *Economic and Financial Review*, Vol 50, No. 2 pp. 19-36

Feyzioglu, T. (1997) "Estimating the equilibrium real exchange rate: an application to Finland", IMF Working Paper, No. 109, pp. 1-24.

Frenkel J. A. (1976) "A Monetary Approach to the Exchange Rate: Doctrinal Aspects and Empirical Evidence", *The Scandinavian Journal of Economics* Vol. 78 No. 2, pp. 200-224.

Hakkio C. S. (1992) "Is Purchasing Power Parity a Useful Guide to the Dollar" Federal Reserve Bank of Kansas City *Economic Review*. Third Quarter Available at: http://www.kc.frb.org/PUBLICAT/ECONREV/EconRevArchive/1992/3Q92HAKK.pdf

Imam, P. and Minoiu, C. (2011) "The Equilibrium Exchange Rate of Mauritius: Evidence from two Structural Models". *Emerging Markets Finance and Trade* 47(6), pp. 134–147.

Johansen, S. (1988) "Statistical Analysis of Cointegration Vectors". *Journal of Economic Dynamics and Control*, Vol. 12, pp. 231–254.

Johansen, S. (1991) "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models". *Econometrica*, Vol. 59, pp. 1551–1580.

Johansen S. and Juselius K. (1990) "Some Structural Hypotheses in a Multivariate Cointegration Analysis of the Purchasing Power Parity and the Uncovered Interest Parity for UK" Discussion Papers 90-05, Department of Economics, University of Copenhagen.

Johansen, S. (1994) "The Role of the Constant and Linear Terms in Cointegration Analysis of Nonstationary Variables". Econometric Reviews, Vol. 13, pp. 205–229.

Kaminsky, G., Lizondo, J and Reinhart, C., (1998) "Leading Indicators of Currency Crises", *International Monetary Fund Staff Papers*, Vol. 45 (1), pp. 1-48.

Kiptoo C. K. (2009) "Empirical Analysis of the Real Exchange Rate (RER) Misalignments: The Case of Selected COMESA Countries A Paper Scheduled for Presentation during the Center for the Study of African Economies Conference Pp. 1-44 Available at: http://www.csae.ox.ac.uk/conferences/2009-EDiA/papers/060-Kiptoo.pdf

Lorenzen H. P and Thygesen N (2000) "The Relation between the Euro and the Dollar" Paper for EPRU Conference Perspectives on Danish and European Economic Policy

Mathisen, J. (2003) "Estimation of the Equilibrium Real Exchange Rate for Malawi," IMF Working Paper No. 03/104. Washington: International Monetary Fund.

Montiel, P. J. (1999) 'Determinants of the Long-Run Equilibrium Real Exchange Rate: An Analytical Model' in Hinkle, L and Montel, P, J (eds) Exchange Rate Misalignment, Concepts and Measurements for Developing Countries, *A World Bank Research Publication*, Oxford University Press.

Nwafor F. C. (2006) "The Naira-Dollar Exchange Rate Determination: A Monetary Perspective" International Research *Journal of Finance and Economics Issue 5*

Obaseki, P. J. (2001) "The Purchasing Power Parity Measure of Naira's Equilibrium Exchange Rate," *CBN Economic and Financial Review*, 36, pp.1-21.

Oriavwote V. E. and D. O. Oyovwi (2012) "The Determinants of Real Exchange Rate in Nigeria". *International Journal of Economics and Finance*, Vol. 4 No. 8, pp. 150 -160.

Rano A. S. U. (2008) "Real Exchange Rate Misalignment: An Application of Behavioral Equilibrium Exchange Rate (BEER) to Nigeria", *MPRA Paper* No. 10343, pp. 1-35

Robinson, J. S. J. (2010) "Determining the Equilibrium Exchange Rate for Jamaica: A Fundamentalist Approach for deferring Time Horizon". *Research and Economic Programming Division*, Bank of Jamaica.

Rogoff K. (1996) "The Purchasing Power Parity Puzzle" *Journal of Economic Literature* Vol. XXXIV Pp. 647-668 Available at: http://www.as.ysu.edu/~ohu/Econ5812/ppp_Rogoff.pdf

Sanusi J.O. (2004). "Exchange Rate Mechanism: the Current Nigerian Experience. Available at: http://www.cenbank.org/OUT/SPEECHES/2004/Govadd-24Feb.pdf

Siregar R. Y. (2011) "The Concepts of Equilibrium Exchange Rate: A Survey of Literature" The South East Asian Central Banks Staff Paper No. 81, pp. 1-36

Taylor, A. M. and M. P. Taylor (2004) "The Purchasing Power Parity Debate" Journal of Economic Perspectives, Vol. 18, Number 4 pp. 135–158.

Vachris, M. A. and J. Thomas (1999) "International Price Comparisons Based on Purchasing Power Parity" Monthly Labor Review.

Wilson I. (2009) "The Monetary Approach to Exchange Rates: A Brief Review and Empirical Investigation of Debt, Deficit, and Debt Management: Evidence from the United States" *The Journal of Business Inquiry*, 8, 1, pp. 83-99

Wren-Lewis, S. (2000) "How much is the Euro Undervalued?" Paper presented at the Workshop on Euro-Dollar relations on January 25, at the Centre for European Policy Studies, Brussels, Belgium.

Wren-Lewis, S. (2004) "A model of Equilibrium Exchange Rates for the New Zealand and Australian dollars", Reserve Bank of New Zealand Discussion Paper Series 07, pp. 1-33.