Modeling the Real Naira Exchange Rate: The Beer Approach

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Abstract: *There has been argument on whether the real naira exchange rate is misaligned or not. But, exchange rate misalignment is conditional on the value of the equilibrium exchange rate, which is unobserved. Besides, international transactions choice set are predicated on the real exchange rate. Both the unobserved equilibrium real rate and the derived misalignment estimates varies across different modelling approaches. This paper is an attempt to model the real naira exchange rate using the behavioral equilibrium exchange rate (BEER). Utilizing time series from 1979 to 2015, the study employed both Johansen Cointegration technique and Vector Error Correction Mechanism in estimating the determinants of the real naira exchange rate. The findings reveal that real naira exchange is substantially contingent on the behavior of import demand, export demand, external reserves accumulation and oil price volatility. Given the prevalence of weak institutions, monetary and fiscal policies are found to be weak in keeping the exchange rate in a predetermined trajectory. The study also provide evidence that the naira exchange rate is largely misaligned. The study recommends that policy makers should, as a matter of priority, focus on institutional designs that will exchange rate volatility/misalignment is tamed.*

Keywords*: real exchange rate, BEER, misalignment, naira*

I. INTRODUCTION

Exchange rate is the price of the domestic currency as well as a variable that has a chain effect on other variables such as investment, inflation, output, domestic expenditure pattern and external trade (Abdullateef & Waheed,2010). The exchange rate of a nation's currency always attracts the attention of economic regulators and policy makers because of the crucial role it plays in defining macroeconomic performance in the present globalized world. In Nigeria, exchange rate traditionally plays a crucial role in monetary policy because of its crucial impact on her trade relations with other countries, first, as a mono-export-product economy, and second, as an import-dependent economy (Mayowa & Olushola, 2013).

Over the years, exchange rate determination and management in Nigeria and several developing economies has been based mostly on the alignment of macroeconomic objectives, such as inflation targeting. This approach is critical for economies like Nigeria whose domestic market is always flooded with foreign goods, to the extent that high exchange rates translate to high inflation rate. Various explanations have been offered on how exchange rates influence economic performance, especially in the developing economies. In recent years a significant body of research has extolled the various roles exchange rate plays in economic growth and competitiveness of nations. Specifically, Razmi, Rapetti & Skott (2011) contend that undervalued exchange rate tantamount to competitive exchange rate and are positively associated with higher economic growth. They also suggest that an undervalued exchange rate favors the re-allocation of resources towards the tradable sector which is the locus of learning-by-doing externalities and technological spillovers. In the same vein, Porcile & Lima (2009) and Razmi et al. (2011) argue that competitive exchange rate aids in relaxing the foreign exchange constraint to growth. The argument is that in developing countries with substantial open or hidden unemployment, growth can be accelerated with policies that mobilize unemployed resources. However, the acceleration of growth and capital accumulation has negative impact on the balance of payments, especially if the dependence on imported capital goods is high. In such conditions, a competitive exchange rate would help relax foreign exchange bottlenecks that otherwise could restrain the development process (Rapetti et al., 2011).

In stark contrast to the above undervaluation-growth nexus, some scholars argue that exchange rate misalignment, whether overvaluation or undervaluation, hurts growth considerably. On this part of the divide is the Washington consensus (1990) view that "exchange rate misalignment implies some sort of macroeconomic disequilibrium that is itself bad for growth". For example, fixed exchange rates in the presence of loose monetary policy may cause an appreciating exchange rate and an unsustainable current account deficit, eventually requiring a domestic contraction or import controls when foreign financing disappears" (Miao & Berg, 2010). Krueger (1983) emphasized that such misalignments would reduce the openness of the country to trade and thus growth. In this view, overvaluation is the main danger, but undervaluation does not help. It also represents a harmful misalignment that will need to be corrected; this correction may also be bad for growth.

Indeed, whether overvaluation or undervaluation, the departure of real exchange rate from its equilibrium level raises concern for all open economies. The problem is even worsened by the fact that the equilibrium real exchange rate, unlike the nominal exchange rate, is unobserved. Again, there is a fundamental

difficulty in establishing the equilibrium real exchange rates. As noted by Mayowa& Olushola (2013), since the equilibrium value of the real exchange rate is not easily observable, it can only be modeled using different models of equilibrium real exchange rate. While the exchange rate volatility refers to a situation in which a country's actual exchange rate deviates from such an unobservable equilibrium, an exchange rate is said to be "undervalued" when it depreciates more than its equilibrium, and "overvalued" when it appreciates more than its equilibrium (Aliyu, 2008). The issue, therefore, is that unless the "equilibrium" is explicitly specified, the concept of exchange rate volatility and misalignment remains subjective. No doubt, prolonged and substantial exchange rate volatility can create severe macroeconomic disequilibrium, and the correction of external balance will require both exchange rate devaluation and demand management policies (Mayowa & Olushola, 2013).It follows that managing exchange rate volatility in Nigeria must of necessity begin with an objective and a reliable stand on the determinants of exchange rate volatility in the country, as well as the equilibrium value of the naira.

Indubitably, many efforts have been made in an attempt to estimate the equilibrium real exchange rate and its macroeconomic drivers. Most of the modelling efforts in Nigeria relied heavily on the purchasing power parity (PPP) and Fundamental Equilibrium Exchange Rate (FEER) models of exchange rate determination, which, according to Ozsoz and Akinkumi (2012), are less suitable for Nigeria. According to the authors, the behavioural equilibrium exchange rate (BEER) approach is more suitable for the Nigerian case mainly because the FEER approach is based on macroeconomic identities and does not involve any theory of exchange rate determination. The BEER Approach is used, using the Vector Error Correction Model (VECM). The equilibrium concept is based on the objective of internal and external balances rather than on exchange rates (Bayoumi *et al*., 1994). Deductively, appropriate equilibrium exchange rate modeling, as well as firm knowledge of the equilibrium exchange rate is of great practical and policy relevance for the Nigerian economy. Exchange rate misalignment cannot be accurately estimated if the real exchange rate is not accurately modelled.

II. CONCEPTUAL AND THEORETICAL FRAMEWORK

(a) Exchange Rate: meaning, management and trend

Meaning of exchange rate

There is less disagreement in the definition of exchange rate. Duarte (2013) define exchange rate as the rate at which a currency may be converted into another currency. That is, it determines how much the residents of a country pay for imported goods and services, and how much they receive for exported goods and services. Kandilov (2008) sees it as the price of foreign money expressed in domestic money. Thus, exchange rate is a conversion factor, a multiplier or a ratio, depending on the direction of conversion. This has influenced scholars to argue that if exchange rates can freely move, it may turn out to be the fastest moving price in the economy. According to Black (2002), exchange rate is the price of one currency in terms of another. In other words, it is the number of units of currency required to buy another currency. In this study we adopt Black (2002) definition. This however is not synonymous with the term "Foreign exchange" which the Central Bank of Nigeria [CBN] (1996) defines as any currency other than the Nigerian currency.

The definition of exchange rate given above is referred to as the *nominal exchange* rate and it can be viewed from two angles: *domestic-currency* terms and *foreign-currency* terms. Nominal exchange rate from the domestic –currency term (E_d) is defined as units of domestic currency per unit of foreign currency. For example, in domestic-currency terms, the dollar price of naira is N X/1US$ (eg N300 / 1US$). From foreign – currency term,(E_f), it is the unit of foreign currency in per unit of domestic currency. For example, in foreign – currency term, the dollar price of naira is x US$ /1 N (eg US$ 0.0033/ N1).

On the other hand, nominal exchange rate is contrasted with *real exchange* rate which compares the relative prices of different countries' products. Specifically, Sloman, (2006) defines it as "the exchange rate index adjusted for changes in the prices of imports (measured in foreign currency) and exports(measured in domestic currency): in other words adjusted for the terms of trade". From the definition above, the real exchange rate index (RERI) can be expressed as:

$$RERI = NER\left(P_x / P_m\right).$$

The real exchange rate is not only an important relative price, but also signals the competitiveness of a country *vis-à-vis* the rest of the world. Exchange rate plays pivotal role in international transaction. Its role as itemized by Obadan (2006) includes connecting the price systems in different countries, thus enabling traders to compare commodity prices across nations. It is an important policy tool used in changing the flow of import and/or export in an economy. As a price, the exchange rate performs the role of allocating real resources, particularly between tradable and non-tradable sectors.)

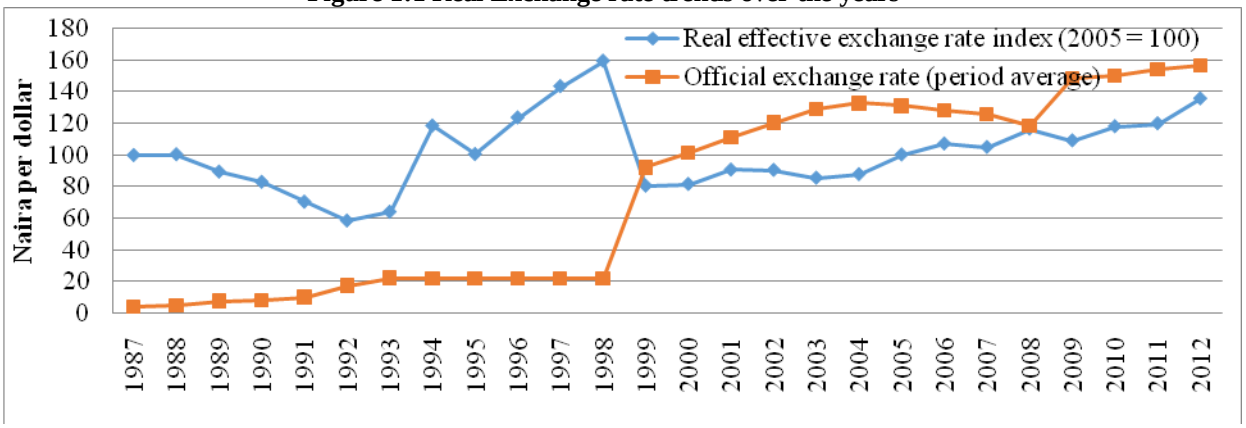
Just as nominal commodity price rises or falls in response to certain economic fundamentals or variables; exchange rate also appreciates or depreciates. Using the domestic currency per unit of foreign currency, when exchange rate increases (that is, the amount of domestic currency required to buy a foreign currency increases), the domestic currency is said to have depreciated while the foreign currency appreciates. In the same vein, a decrease in the rate of exchange of the domestic currency for foreign currency implies an appreciation of the domestic currency and a depreciation of the foreign currency (Obadan, 2006: Mordi, 2006).
As a price variable, exchange rate in a free market, is determined by the demand for and the supply of foreign currency. The equilibrium exchange rate is the rate which clears the market for foreign exchange (that is, the rate at which the demand for and supply of foreign exchange are equal) (Jhingan,1997, Dornbusch, 1987). Williamson (1997) conceptualized this as the fundamental equilibrium exchange rate (FEER) which he defined as the real effective exchange rate compatible with simultaneous achievement of internal and external balances in the medium time.

Certain economic variables called drivers (or determinants) of foreign exchange rate influence exchange rate dynamics through the demand for and supply of foreign exchange. According to Mordi (2006), such determinants include the GDP growth rate, inflation, balance of payment position, external reserves, interest rate movements, external debt position, productivity, market psychology and expectation, socio political factors, macro-economic shocks and speculative contagion (McConnell & Brue, 2005; Jhingan, 1997).

(b) Exchange Rate Management and Trend

The most important themes that emerge in the discussion of exchange rates and their management in Nigeria include the high volatility, exchange rate (RER) overvaluation, albeit in the context of continuous nominal depreciation, and the search for mechanism for market-determined rate, where government is the dominant supplier of foreign exchange (Mayowa and Olushola, 2013). Exchange rate stability is one of Nigeria's monetary policy objectives. This has led to an exchange rate policy regime strictly aimed at keeping the real exchange rate 'stable'. For the general public, the health of the economy is gauged by the real exchange rate where a depreciating rate is synonymous with a weakening economy (Mayowa & Olushola, 2013). Figure 1 below presents some selected exchange rate indices, highlighting the noticeable volatility over the years.

Figure 1:1 Real Exchange rate trends over the years



Source, World Bank's World Development Indicators Database 2013

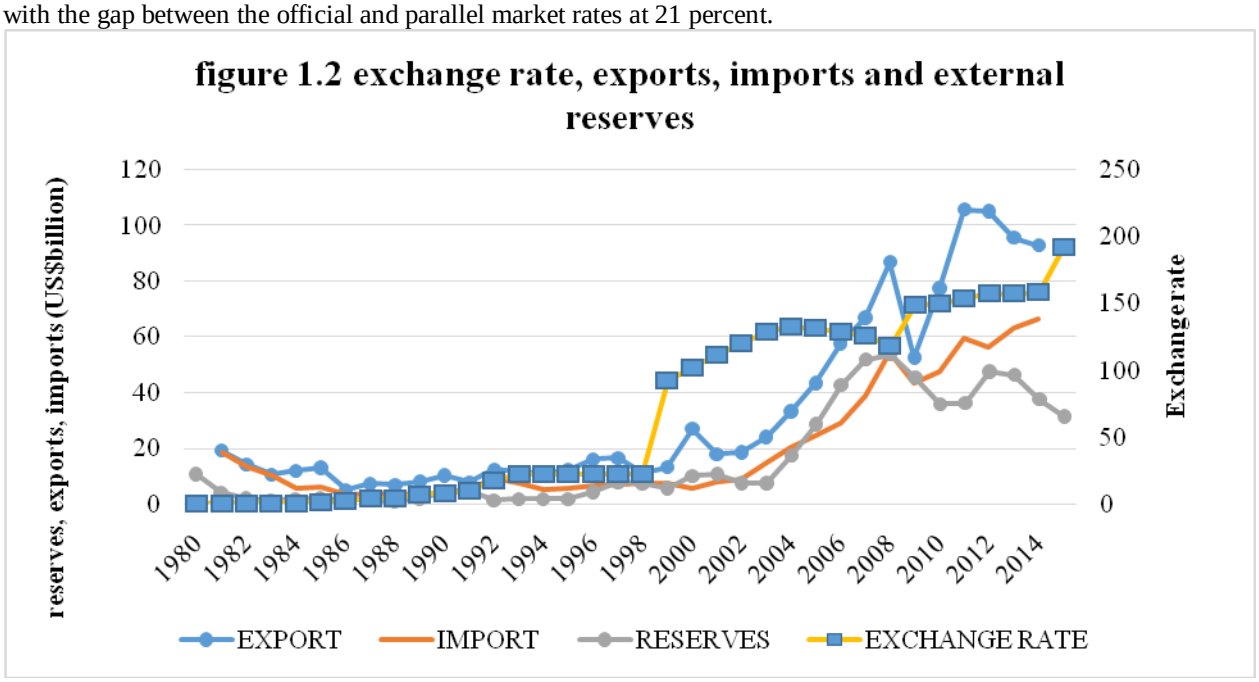
Mayowa and Olushola (2013) further note that another key feature of the present exchange rate regime is the huge premium which indicates the extent of distortions in the market. This has been due to the fixed regime until the mid 1980s, the managed float of the SAP era, the re-fixing of the official rate during the Abacha regime (1994-1998) and presently the large disparity between the official and the parallel (free) market rates. According to Soludo (2008), the parallel market grew as a result of the huge demand for foreign exchange for import and sundry reason and also the facts that forex at official rent was rightly regulated with strict documentation requirement.

Volatility is another feature of the present exchange rate regime. The standard deviation in exchange rate growth for 1961-1970 was 4 per cent. For the period 1991-2000 – a period of greater liberalization – the standard deviation was 35 per cent, with Nigeria having one of the most volatile exchange rate regimes among developing countries (Mayowa & Olushola, 2013). As can be easily noticed, exchange rate was more stable during the fixed exchange rate regime (1961-1985) and wide volatility started with the emergence of major oil earnings and fiscal imprudence, surging domestic price inflation and futile efforts to manage the real exchange rate. Exchange rate volatility is of major concern because it breads uncertainty and inhibits private sector investment (Rodrick, 2008; Aliyu, 2011; Ozsoz and Akinkunmi, 2012).

A critical issue faced by policymakers is how to avoid real exchange rate overvaluation and exchange rate premium through a market determined nominal exchange rate regime. The Central Bank tried all manner of

experiments in determining the nominal rate which is essentially a managed float. Between 1999 and 2001, the CBN reverted to the pre-reform system of selling foreign exchange in the interbank foreign exchange market(IFEM) at a predetermined rate and the interbank market split into the IFEM and the open inter-bank market where banks traded among themselves at freely negotiated exchange rates (the NIFEX). The Bureau de Change and the parallel market for foreign exchange constitute the free markets – where no documentations are required for transactions in foreign exchange. In 2000, the exchange rate depreciated in all markets. At the IFEM, the Naira depreciated on the average by 6.5 per cent to N101.65 to one US$. This was caused principally by a significant increase in import-driven demand for foreign exchange following the increased government expenditures: total demand for foreign exchange at the IFEM during the year was $6.9 billion compared with $4.9 billion in 1999. The parallel market depreciated by 30 percent between December 1999 and May 2001, and the differential with the IFEM rate widened to 20 percent (Mayowa & Olushola, 2013).

Following the excess liquidity triggered off by fiscal expansion, a foreign exchange 'crisis' emerged in April 2001 when the CBN made a small adjustment of the IFEM rate before it had effectively mopped up the excess liquidity. The government sold large amounts of foreign exchange to deal with the crisis thereby depleting foreign reserves. As a consequence of this measure and other tighter monetary policy measures, the parallel market exchange rate appreciated from N140 to an average of N133 throughout the remainder of 2001, with the gap between the official and parallel market rates at 21 percent.



Source: WDI (2016)

Clement and Eze (2017) observed that following the failure of the variants of the flexible exchange rate mechanism (the AFEM introduced in 1995 and the IFEM in 1999) to ensure exchange rate stability, the Retail Auction System was re-introduced on July 22, 2002. The RDAS was to serve the triple purposes: reducing the parallel market premium, conserve the dwindling external reserves and achieve a realistic exchange rate for the naira. On February 20, 2006 the Wholesale Dutch Auction System (WDAS) was introduced to consolidate the gains of the Retail Dutch Auction System as well as deepen the forex in order to evolve a realistic exchange rate of the naira (Auwal, 2008; CBN 2006; Obadan, 2006). By 2008, the WDAS could not be adjudged to have satisfied the aspiration that gave birth to it. As shown in figure 2.2, naira exchange rate depreciated from N4.02 for $1 in 1987 to N8.03, N101.70 and N132.89 in 1990, 2000 and 2004 respectively. However, the periods, 2005 to 2008 witnessed naira exchange rate appreciation as the naira exchange rate appreciated from N132.89 in 2004 to N118.55 IN 2008. This appreciation of the naira was viewed by many as a consequence of Paris club debt relief, reserves accretion as well as sound macroeconomic management. Unfortunately, the appreciation of the naira never reoccurred after 2008. So, the strong determination to resolve the fluctuations of foreign exchange and restore stability made the CBN to suspend the WDAS and in 2008 reintroduced the Retail Dutch Auction System (RDAS). Again, in 2015, the CBN closed the RDAS and ordered that forthwith all demand for foreign exchange should be channeled to the Interbank Foreign Exchange Market (IFEM). By this time, the exchange rate was around N197.

Following series of events in the macro economy including oil price crash, the Central Bank of Nigeria (CBN) announced a full float of the Naira after its MPC meeting on 24th May, 2016. It immediately stopped its interventionist programme to allow the market determine the true rate of the naira. Although this policy reversal was welcome by many analysts, it soon worsened the instability of the macro economy. In fact, as at 2016, a

dollar was exchanged for values oscillating between N400 and N500. Thus, the CBN quickly reserved its stand after six months of non-intervention, thereby stepping up its interventions over the past few months (that is since April 2017). With at least some of the pent-up demand for dollars now being met by banks, the rate in the parallel market has started to return closer to the official rate.

The greatest worry is that as revealed by figure 1.2, the exchange rate commoves substantially with open-economy variables such as exports, imports and reserves. Since the behavior and trend of these macroeconomic milestones have serious implication for both internal and external balance, ensuring the stability of the naira exchange rate is therefore of prime concern.

Theoretical Framework

There are various theories or models of exchange rate determination identified in the literature (Williamson, 1994; Miles-Feretti and Raziun, 1996; and Hinkle and Monteil, 1999; Naseem, *Tan and Hook (*2008); Aliyu, 2011). *First*, the Price-based criteria, such as purchasing power parity (PPP) and its variants. *Second*, the model-based criteria based on the formal models of nominal exchange rates. *Third*, the solvency and sustainability based criteria, which make reference to trends in the current account and the external debt to GDP ratio. There is also the Natural Real Exchange Rate (NATREX) model developed by Stein (1994, 1996) which permits one to generate an equilibrium benchmark using prevailing real economic fundamentals that determined the misalignment of exchange rate.

The PPP approach basically relies on the law of one price. Succinctly, the law states that when measured in a common currency, freely traded commodities should cost the same everywhere under a perfectly competitive setting, i.e., no transaction costs, no tax, homogeneous goods and complete certainty (Handa, 2009). Thus, if prices deviate from each other, then the commodity arbitragers would capitalize by buying in one market and selling in another until the profitable opportunities cease to exist. This argument subsists for two countries and for the entire global commodity market. The PPP approach is otherwise called the flow model because it traces the flow of goods and services through the current account to determine the exchange rate (Aliyu, 2011).

As a caveat, Aliyu (2011) notes that the PPP approach explains why exchange rate may diverge from its PPP equilibrium level in the short run due to possibility of restrictions on trade and capital movements, which may distort the relationship between home and foreign prices; speculative activities and official intervention by monetary authorities; the productivity bias between the tradable and non-tradable sectors, which may result in systematic divergence of internal prices (Balassa 1964;Chinn, 2000) and prices are in most cases sticky and do not move rapidly enough to offset frequent changes in nominal exchange rates. Therefore, the fact that these possibilities occur in most economies, especially in the developing ones, make the approach less attractive and undependable. However, in most empirical studies in Africa, the PPP model has rejected.

According to Jovanovik (2007), the PPP approach to calculating the equilibrium exchange rate has been criticized both on the grounds of its inherent weaknesses and its inappropriateness as a guide for the equilibrium exchange rate. As Officer (2006) points out, two groups of arguments against the PPP theory exist - arguments that the PPP theory is inaccurate, and arguments that the PPP theory is biased. Factors limiting arbitrage, on which the idea of the PPP is based, such as transaction costs, transport costs, trade barriers, product differentiation and imperfect competition, fall into the first group, as well as non-price factors affecting demand and supply of the traded goods, as income, for example, and financial flows not associated with trade which affect the exchange rate. The second group consists of factors that cause divergence from factor-price equalization, such as international differences in technology, factor endowments and tastes, which further leads to a bias in the PPP theory.

Another theoretical explanation of the determination of real exchange rate is the Fundamental Equilibrium Exchange Rate (FEER) approach which models equilibrium exchange rate as a function of real economic fundamentals. The underlying theoretical framework of this modeling is broadly consistent with the traditional macroeconomic balance approach (Aliyu, 2011). The FEER approach was first advocated by Williamson (1994). He estimated the FEERs for the G-7 countries and found that in the last quarter of 1989, the actual U.S. dollar was 14 percent overvalued, while the Japanese yen was 27 percent undervalued. According to MacDonald (1999),FEER models single out fundamental variables that affect the equilibrium current and capital account balances, such as domestic and foreign real incomes, and factors influencing national savings and investment, such as permanent fiscal consolidation. Specifically, variables such as terms of trade, index of openness, resource balance to gross domestic product, investment share, foreign price level, etc. Studies that have applied FEER approach used both time series and panel regression analysis (Elbadawi & Soto, 1997; Devarajan, 1997).

The Natural Real Exchange Rate (NATREX) model was developed by Stein (1994, 1996) to estimate the equilibrium real exchange rate. According to Naseem, Tan and Hook (2008), the model permits one to generate an equilibrium benchmark using prevailing real economic fundamentals that determined the misalignment of exchange rate.

According to Stein and Paladino (1998), the NATREX rate relies on the attempt of micro agents that make private savings, investment, exports and imports decision to optimize in presence of a significant uncertainty. The NATREX model is positive and not normative as it takes government policies as given and does not assume that the policy is welfare optimizing. As practiced, the equilibrium rate of NATREX is the real equilibrium exchange rate that associated with both internal equilibrium (production is postulated as reaching its potential) and external equilibrium (evenness of the current account balance).

Naseem *et al.* (2008) note that the NATREX model can be defined as a medium- and inter-cyclical real equilibrium exchange rate, implying the interaction between medium-term determinant factors of both capital flows and the current account balance as well as the stability of both the net external position and capitalistic intensity. Based on Stein and Lim (2002), the NATREX is a moving equilibrium exchange rate, which varies over time responding to the changes in the current real macroeconomic fundamental variables. Indeed, the NATREX approach does not require that the observed REER and the real equilibrium exchange rate be stationary (Edwards and Savastano, 1999). The NATREX model could be an appropriate measurement to acquire a good fit for the exchange rate misalignment as it takes into account real economic activities that comprised all adjustment made by the underlying real macroeconomic fundamentals of their respective economies, (Edwards, 2000). This makes it easier to consider NATREX as a real equilibrium exchange rate.

The BEER models, on the other hand, emphasize on variables that affect the relative prices of traded to non-traded goods at home and in foreign countries, such as differing trends in productivity in traded goods sectors and asymmetric terms-of-trade shocks. In addition to using fundamental variables, the BEER methodology according to Driver and Westaway (2001), categorizes as "current and cyclical equilibrium exchange rates", since their computation is based on the current levels of the fundamental factors.

Bearing in mind that the calculated level of exchange rate misalignment could vary depending on the benchmark chosen to identify misalignment, Ozsoz and Akinkumi (2012) notes that the BEER approach is more suitable for developing countries like Nigeria, as opposed to the FEER. This is mainly because the FEER approach is based on macroeconomic identities and does not involve any theory of exchange rate determination. Aliyu (2011) further highlights that the relevance of each criterion and its application in a particular study is informed by how uniquely a criterion models a given condition and on the availability of data.

According to African Development Bank Institute research paper No 70 in Dec 2005, A general way to handle a non-linear model is the linearization of a non-linear model. The linearized model forms the basis for the Behavioural Equilibrium Exchange Rate(BEER). Based on the BEER, one can estimate BEER and the misalignment of the naira exchange rate. This allows an assessment of the consequences of external shocks to exchange rates, which obviously has implications and can be a useful reference for policy makers.

Several empirical works have been carried out using the PPP approach (Taylor, 1988; Moosa & Bhatti, 1996; Baharumshah & Ariff, 1997; Mollick, 1999; Chinn, 2000; Azali, Habibullah& Baharumshah, 2001). Given the shortcomings of the PPP approach some other authors have opted for the FEER model, which relies strictly on economic fundamentals in measuring exchange rate misalignment. Empirical works in this strand include Elbadawi and Soto (1997); Baffes, Elbadawi, and O'Connell (1999); Dufrenot and Yehoue (2005). In Nigeria specifically, much of the empirical works on real exchange rate determination and naira misalignment have largely adopted the PPP and FEER models. These include Akinuli (1997); Agu (2002); Omotosho and Wambai (2005); Obaseki (2001) and CBN (2007).

As noted by Aliyu (2011), these PPP and FEER based empirical works done in the Nigerian context has serious shortcomings; they fall short of analyzing the dynamic behavior of the exchange rate movement. In addition, Ozsoz and Akinkunmi (2012) emphasize that The BEER approach is more suitable for the Nigerian case, as opposed to the FEER, mainly because the FEER approach is based on macroeconomic identities and does not involve any theory of exchange rate determination.

Finally, on the determinants of exchange rate volatility, the literature highlights several variables, and equally notes that the relevance of some variable in a given analysis depends on the currency being analyzed and the country in question. The variables identified include the level of output, inflation, economic openness, interest rates, domestic and foreign money supply, the exchange rate regime, foreign assets, government spending and central bank independence.

III. ECONOMETRIC MODELLING AND RESULTS

(a) Modeling the Real Exchange Rate

The real exchange rate is a real variable whose true value is conditional on the behavior pattern of certain macroeconomic drivers. Following Aliyu (2011) and Ozsoz and Akinkunmi (2012), we specified the econometric model as follows: -

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-1} + Bx_t + \varepsilon_t$$

where y_t is a -vector of non-stationary I(1) variables (*rer, ex,exr,iov, gfs, mpp, im*) such that $y_t = A_1 y_{t-1} + ... + A_p y_{t-p}$ and

$$\Pi = \sum_{i=1}^{p} A_i - I \ \Gamma_i = -\sum_{j=i+1}^{p} A_j$$

$x_t$is a -vector of *d*-deterministic variables, and ε_t is a vector of innovations

The real exchange rate(*rer)*is measured as $rer = NER\left(P_x / P_m\right)$ *where NER is nominal exchange rate, P_x export index and P_m import index. E*xternal reserve *(exr)* is measured as foreign exchange assets plus gold reserves. index of crude oil volatility *(Iov)*is computed as a simple average of three spot prices: Dated Brent, West Texas Intermediate, and the Dubai Fateh. Government fiscal stance (*Gfs)* is measured as the ratio of government spending to nominal GDP; following Aliyu (2011), monetary policy performance *(mpp)* is measured as domestic savings divided by lagged money supply. Dufrenot and Yahuoe (2005) notes that a high ratio of domestic credit to lagged money supply strengthens the Central Bank's balance sheet position, and is expected to lead to a real currency appreciation, thereby indicating monetary policy performance; import (im) is measured as import divided by Gross Domestic Product (im/GDP); export(ex) is also measured as export divided by gross domestic product (Ex/GDP).

Four steps comprising different analytical techniques are applied in this study. First, we utilized Augmented Dicker-Fuller (ADF) and Philip Perron tests of unit root to analyze the time series property of the data. Second, the Johansen co-integration is utilized to investigate the existence of long run relationship amongst the modeled variables. Third, a dynamic model for the behavioral equilibrium exchange rate (BEER) was estimated and we proceed to provide forecasts, using the vector error correction mechanism. Finally, we implemented a permanent-transitory decomposition on the estimated BEER using the Hodrick and Prescott (1997) filter – hereafter H-P filter – to produce the Permanent Equilibrium Exchange Rate (PEER). Misalignment is then assessed based on the filtered PEER.

(b) Presentation of Results

We first examined the time series properties of the time series using the unit root and cointegration test. The unit root test is implemented using Augmented Dicker-Fuller (ADF) test and Philip Perron unit root test. The results shown in table 3.1reveal that with the exception of export (ex) and government fiscal stance (gfs) which are significant at 10% at level, all other variables are significant at first difference. Then this means that they are integrated of order one 1(1).

The above evidence that all the variables are integrated at the same order 1(1) provides the basis for us to test for co-integration, and if co-integration relationship is found, we proceed to Error Correction Modeling.

Table 3.1: Stationarity Test Results

Philip-Perron Test				
	LEVEL		FIRST DIFFERENCE	
Variables	No Trend	With Trend	No Trend	With Trend
Lnex	-2.937101	-2.806191	-9.523229	-11.03893
Lnexr	-1.675802	-2.674798	-7.253680	-9.940636
Lngfs	-2.615776	-2.587639	-7.784956	-8.930168
Lnim	-2.011807	-1.949317	-8.575112	-8.833410
Lniov	-0.845969	-1.357832	-6.575739	-6.592060
Lnmpp	-0.257138	-0.552729	-4.937083	-5.218791
Lnrer	-0.861991	-1.280392	-5.126099	-5.131169
Critical Value				
1%	-3.610453	-4.211868	-3.615588	-4.219126
5%	-2.938987	-3.529758	-2.941145	-3.533083
10%	-2.607932	-3.196411	-2.609066	-3.198312
Augumented-Dickey Fuller Test				
Lnex	-3.024820	-2.919526	-8.828404	-6.472389
Lnexr	-1.461887	-2.884313	-6.532232	-6.527789
Lngfs	-2.660481	-2.587639	-7.570407	-7.623679
Lnim	-2.212311	-1.186363	-8.455988	-8.577109
Lniov	-0.899487	-1.397327	-6.575739	-6.590009
Lnmpp	0.533478	0.552729	-4.937083	-5.271227

Lnrer	-0.861891	-0.991673	-5.130655	-5.131169
Critical Value				
1%	-3.610453	-4.211868	-3.615588	-4.226815
5%	-2.938987	-3.529758	-2.941145	-3.536601
10%	-2.607932	-3.196411	-2.609066	-3.200320

Having, ascertain that the time series are realization of stochastic processes, we proceed to test for cointegration. The Johansen multivariate co-integration technique is utilized to test if there is a long-run relationship among the variables in our model. Before this test is conducted, we performed a lag order selection test to decide the optimal lag to be included in the Johansen Co-integration test. The result of this test is reported in Table 3.2. We follow the (sc) criteria and choose lag one(1) for the co-integration analysis.

Table 3.2: Lag Order Selection Criteria

Lag	Log L	LR	FPE	AIC	SC	HQ
1	-27.45288	NA	1.52e-07*	4.132588	6.265966*	4.884703*
2	18.09506	56.62716	2.34e-07	4.319186	8.585941	5.823417
3	85.52298	58.31604	1.91e-07	3.323082*	9.723216	5.579429

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level);
FPE: Final prediction error

The estimated co-integration result is reported in *Table 3.3.*The trace statistics and maximum eigen value detects one co-integrating vector. It shows that the null hypothesis of no co-intgerating vector is rejected at 5 percent significant level. This indicates the presence of one co integration relationship for our model, implying a long-run equilibrium relationship among real exchange rate and other modeled variables.

Table 3.3: Johansen Co-integration Test Result

Ho	Ha	Trace stat	95%	$\lambda - Max$	95%
$r \leq 0$	$r = 1$	130.1857	125.6154	47.92664	46.23142
$r \leq 1$	$r = 2$	82.25904	95.75366	29.05595	40.07757
$r \leq 2$	$r = 3$	53.20309	69.81889	20.62012	33.87687
$r \leq 3$	$r = 4$	32.58297	47.85613	19.28522	27.58434
$r \leq 4$	$r = 5$	13.29775	29.79707	7.994750	21.13162
$r \leq 5$	$r = 6$	5.302996	15.49471	5.212345	14.26460
$r \leq 6$	$r = 7$	0.090651	3.841466	0.090651	3.841466

(c) Determinants of Real Exchange Rate

The long-run coefficients are obtained from the co-integration test. The results are reported in Table 3.4 through normalizing the real exchange rate (rer), the estimated co-integrating vectors reflect the long-run elasticities. The normalized equation is obtained by multiplying the coefficients by (-1). The normalization process yield estimates of long-run *equilibrium parameters.*

Table 3.4: The Estimated Co-integrating Vector

Variables	Coefficient	Standard Error	T-value
Lnrer	-1.000000		
Lnmpp	-0.424813	0.59351	-0.7158
Lniov	0.824389	0.30195	2.7302
Lnim	2.657376	0.78817	3.3715
Lngfs	0.535868	0.45095	1.1883
Lnexr	-1.369412	0.08822	-15.5227
Lnex	-1.401110	0.37589	-3.7275

Note: Normalized cointegrating coefficients (standard error in parentheses);
critical t-value for 5% significance level is 1.96

The result shows that Index of crude oil volatility (iov), import (im), external reserve(exr) and export(ex) are all significant at 5 percent significance level, as their respective t-values are above two(2). More so, we see that while monetary policy performance (mpp), export(ex) and external reserve(exr) have negative effect on exchange rate (appreciates the exchange rate), all other variables – oil volatility(iov),government fiscal stance (gfs) andimport(im) – have positive effect on the exchange rate (that is depreciate the rate). The equation of the determinants of the real naira exchange rate is presented in equation form with the non-significant variables in brackets, as follows:

$$rer = \underset{(0.30)}{0.82}iov_t + \underset{(0.79)}{2.66}im_t - \underset{(0.88)}{1.37}exr_t - \underset{(0.38)}{1.40}ex_t + (\underset{(0.59)}{-4.23}mpp_t + \underset{(0.45)}{0.54}gfs_t)$$

(

(d) Error correction model

Table 3.5 reports the error correction model estimates. The error correction model estimated allows us to tie the short run and long run variations in our model together. The result shows that of all the dependent variables, only the coefficients of DEXR(-1), DEXR(-2),and IM(-2) are significant. More so, only DMPP(-1) and DIOV(-1) are found to have negative effects on exchange rate.

Table 3.5: Error Correction model

Dependent Variable: DOER
Included observations: 37 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DRER(-2)	0.158077	0.136335	1.159479	0.2568
DGFS(-1)	0.234439	0.130669	1.794148	0.0844
DGFS(-2)	0.173940	0.120770	1.440250	0.1617
DEXR(-1)	0.194615	0.081071	2.400561	0.0238
DEXR(-2)	0.178017	0.080393	2.214340	0.0358
DEX(-1)	0.043934	0.070355	0.624463	0.5378
DIM(-2)	0.266746	0.142159	1.876390	0.0719
DMMP(-1)	-0.298888	0.252591	-1.183289	0.2474
DIOV(-1)	-0.311191	0.204465	-1.521978	0.1401
ECM(-1)	-0.187436	0.069064	-2.713951	0.0116
C	0.198114	0.045942	4.312235	0.0002
R-squared	0.569207			
Adjusted R-squared	0.403517			
F-statistic	3.435379			
Prob(F-statistic)	0.005506			
Durbin-Watson stat	1.894599			

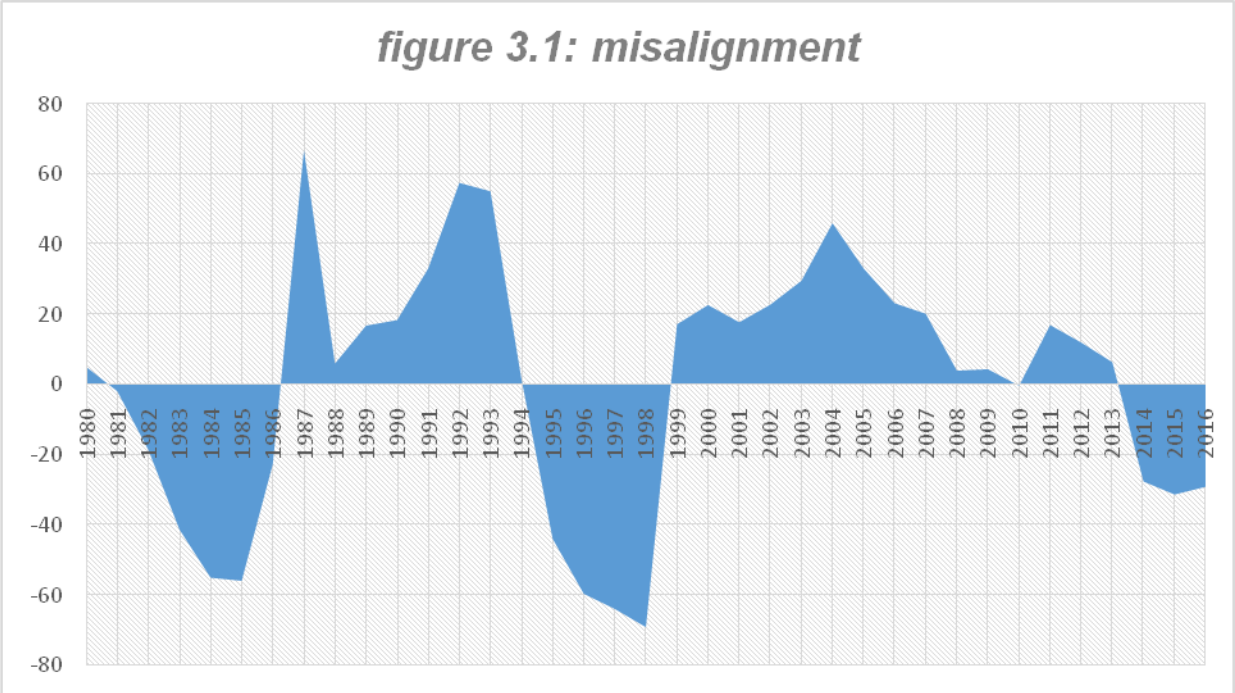
The error correction term, is correctly signed with a value of -0.1874 and is statistically significant at the 5 percent significance level. This is the speed of adjustment to equilibrium. This suggests that changes in independent variable, the exchange rate will adjust to its equilibrium rate by 18.74 %. The government fiscal stance (gfs) is significant in the short-run and also positive in the long-run. This means that government spending is very important to any economy and would help it to grow. The external reserve (exr) is positive in the short-run but negative in the long-run when it was normalized (see Table 3.4.) The import (im) is positive in the short-run but negative in the long-run.

All the variables on Table 3.5 are all in the short run movement while in the long-run, aside the variables like monetary policy performance (mpp), import (im), and external reserve (exr) which have positive effect on exchange rate, all other variables like index of oil volatility (iov), governments fiscal stance (gfs) and export (ex) are negative because they depreciate our exchange rate. In other words, our exchange rate loses value in the long-run.

(e) Evaluating Exchange Rate Misalignment

To calculate the RER misalignment the cointegrating vector (normalized in RER) obtained by Johansen (1988, 1991) and Johansen and Juselius (1992) was estimated. Then the long run coefficients of RER fundamentals were multiplied with the permanent values of these variables to obtain the fitted values of long run Behavioural Equilibrium (real) Exchange Rates (BEER). The fitted BEER was corrected using the Hodrick Prescott(HP) filter to obtain the permanent equilibrium exchange rates (PEERs). RER misalignments are computed as deviations of the actual RER from its equilibrium value. A positive value signifies an overvaluation of the actual RER relative to the PEER, and a negative value signifies an undervaluation. Thus, annual

misalignment indicators were constructed using the coefficient estimates reported in Table 3.4. The result shows that the real exchange rate was misaligned throughout the review period, in which the currency was overvalued for most of the period. However, 1981 to 1986 showed a large undervaluation of average of 32.6%, a period that marked the policy reversal and reintroduction of control and the pegging of the exchange rate by the then military regime. The largest undervaluation was recorded for the period 1995 to 1998 with average misalignment of 59.2%. This marked the period of guided deregulation, which according to Aliyu (2011) rather generated currency as well as external balance crisis. Otherwise, the currency tends to be overvalued in real terms.



As can be seen clearly from figure 3.1 the incidence of misalignment is very low (less than 2 digits in percentage points) for the periods of 1981 (1.9%), 1985 (5.95%), 1994 (1.4%), 2008 (4.0%) and 2013 (6.4%). The year 2010, however, can be said to have recorded alignment scenario since the misalignment indicator is only 0.3%. Also figure 3.1 shows that misalignment is more severe in the mid-80s and late 90s.

IV. DISCUSSION OF RESULTS AND POLICY IMPLICATION

The preceding section outlined the key findings of the study. In this section, we try to provide an extended discussion of the key implications of these findings. Mainly, it is found that external reserves have profound impact on the real exchange rate in Nigeria. This agrees with the earlier finding of Aliyu (2011), and goes to suggest that the interventionist role of the CBN is critical for stable naira. The implication is that it is in the interest of the Nigeria policy makers to build up strong foreign exchange reserve which can be deployed in active defense of the naira exchange rate when time calls for it.

Also, oil price volatility and imports demand exerts depreciating pressure on the exchange rate. In fact, in Nigeria, it is evident that the naira exchange rate is the first recipient of the effect of oil price volatility. Oil price is inherently volatile. Given that oil constitutes over 70% of Nigeria' revenue and over 80% of her foreign exchange earnings, the macro economy is hardly spared in both immediate and short run effects of oil price fall. As the exchange rate depreciates, import prices rise and inflationary pressure mounts. Rising import demand creates excess demand for foreign currency which inevitably deteriorates the naira. Moreso, both monetary policy and fiscal policy are found to be weak in driving the exchange rate in Nigeria. This may suggest the prevalence of institutional weakness.

The study also identified periods of naira-dollar exchange rate misalignment as shown in figure 3.1. The misalignment involved both undervaluation during the 1980s and overvaluation in the 1990s and between 2005 and 2010. The literature on exchange rate misalignment flag misalignment as harmful to economic growth and the economy in general. Although misalignment connotes either overvaluation or undervaluation, much of the costs are associated with overvaluation.

First, misalignment affects growth asymmetrically. Overvaluation indeed hurts economic growth while undervaluation may help it (although not at a statistically significant level). Furthermore, developed and developing countries are affected by misalignment to differing degrees. Overvaluation hurts growth and

undervaluation helps growth more in developing countries, like the case of Nigeria, than developed countries, suggesting that misalignment may not be a major focus for developed countries.

Also, persistent misalignment hurts growth. Whether a currency is overvalued or undervalued for two consecutive periods, growth is adversely affected. This invalidates the possible strategy to intentionally undervalue a currency to act as an engine of growth. Edwards (1988) in his work, "a simple model of exchange rate misalignment" suggested a significant negative relationship between economic growth and overvaluation. To begin with the most obvious and straightforward effect of exchange rate overvaluation, there is a loss in the external competitiveness of export producing (and import-competing) firms. This agrees with historical account of industrial development in Nigeria (industrial development capped and aggressively declined, and import dependence became the order of the day, from the 1970s onwards, a period in which naira overvaluation set in, as depicted in Figure 3.1 in the previous section).

As a currency becomes overvalued, it is increasingly difficult to sell products in foreign markets in an open economy (Dornbusch 1988; Collins & Razin 1997). Some of the negative connotations of this may be mitigated if the exporting firms have market power and thus price setting ability, but this is especially dangerous when an export firm is a price taker, and is constrained by world prices, as is naturally the case for firms in a small country like Nigeria which relied on the exports of primary products. The primary products are very standard, non-differentiable goods, and market power is non-existent. As a result, profit margins tend to fall and the financial health of these firms is compromised with overvaluation. Ghura and Grennes(1993) confirm that overvaluation acts as an implicit tax on export firms, and hurts growth accordingly. The rate of return on a firm's investment has a tendency to fall with overvaluation (See Kemme & Teng, 2000).

Overvaluation is detrimental through yet another channel, which is the industrial sector. The final goods sector in Nigeria often requires intermediate inputs in production. With the overvalued currency, it is cheaper to purchase the inputs from foreign firms than from domestic import-competing firms. This tends to exacerbate an often already bad trade balance, and hurts the market in which import-competing firms exist (Dornbusch, 1988).

Furthermore, Dornbusch (1988) points out that overvaluation often affect the location choice of firms. It affects the future location decisions of multinational firms, and a country with a persistently overvalued currency may lose out on foreign direct investment (FDI). In other words, in a global economy with a least some openness in trade, overvaluation may have a significant impact on existing export and import-competing firms, and future FDI.

Additionally, the agricultural sector is often harmed because of exchange rate misalignment. World Bank (1984), for instance, notes that in Africa, sustained periods of misalignment hampered the development of agriculture, and resulted in a drastically reduced food supply. Cho, Sheldon and McCorriston (2001) also find that misalignment may hurt all sectors of an economy but agricultural sectors are often hit the hardest. In the light of this, it is not mysterious as to how Nigeria, in the 1970s turned from a net exporter of Agricultural products and related consumables to a net importer. The discussion so far suggests that this development is strongly linked to the overvaluation of the naira which began in the 1970s. This overvaluation made the export of the nation's agricultural and consumer goods uncompetitive, and seemingly made import of the same goods very competitive in the domestic market. As a result, decline in earning and lack of market for the domestic farmers led to an abandonment of agricultural enterprise and export. More so, in the capital Market, an overvalued exchange rate may affect domestic and foreign investment (Collins & Razin, 1997). Investment decisions are based on price signals, and the exchange rate is certainly one of these signals. When this is not an accurate price, resources are allocated in an inefficient manner due to misleading exchange rate levels (Nabli & Varoudakis 2002).

With regards to export, fewer profits are made on production, this would withhold investment on projects, or even cut back production. Ghura and Grennes (1993) find statistical support for this contention. Bleaney and Greenaway (2001) also conclude that misalignment is negatively related to investment. This of course translates to job losses. Williamson (1985) referred to this as the `productive capacity' costs associated with overvaluation. As a number of firms perceive a state of lasting misalignment, the `productive capacity' costs create the potential for increasing unemployment of not just labor, but capital as well. Machines will set idle, not worth the cost of maintenance, and factories will set empty, depreciating without being used productively (Dornbusch 1988).

Of course, the same story can be told in the import-competing sectors of the economy, due to the existence of less expensive intermediate inputs from abroad. The capital intensive industries will decline due to the import of machinery that had been produced domestically prior to the overvaluation episode. Labor will become unemployed as firms cut production, and may become unemployed as labor intensive production is shifted overseas due to high local wages in the case of multinational production (Dornbusch 1988). At this point, all firms affected by international trade under a severely overvalued currency will be cutting jobs and production.

It goes without saying therefore that addressing the problem of unemployment and industrialization in the Nigerian economy has lots to do with aligning exchange rate to its sustainable path. Doing this, nonetheless, has serious social and economic implications. For one, inflation is highly driven by exchange rate movements in Nigeria. Thus any attempt to allow exchange rate depreciate in order to adjust it to the sustainable path, hence eliminating the misalignment, would result in substantial gain in inflation. Therefore, the issue turns to a tradeoff, as is always the case with policy. Should the economy entertain more inflation today, for a stronger, more productive, and independent and more employed labor in the future? This is the question policy makers would have to address. Common sense tends to suggests that Nigeria should accommodate more inflation but on a gradual basis today. Indeed, when the economy shifts consumption from imported goods to domestically produced goods, inflation would arguably fall back to normal level

Recommendations

This study shows that Nigeria is characterized by weak institutions. This has made the implementation of programme design suboptimal. The goals of fiscal and monetary policies are constantly shortchanged. It is therefore imperative that the nation makes concerted effort towards engineering strong institutions so as to enhance the attainment of domestic policy objectives. Again, from the analysis, a few recommendations can be put forth to better direct exchange rate management in Nigeria. The earlier discussion of the cost of exchange rate misalignment shows that really there is substantial cost associated with an overvalued currency. Since it has been shown that presently the naira is predominantly overvalued, it is logical and indeed potentially beneficial that monetary policy be targeted at returning the naira exchange rate to its sustainable path. This may warrant some deliberate devaluation, which also has some real economic and social costs for the economy – mainly inflation. However, the view here is that these costs would be of short term, and would generate more luscious long term benefits.

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