Are the Contentious Issues of Exchange Rate Misalignment in Nigeria a Prelude to the Country's Currency Crisis?

Abdulkadir Abdulrashid Rafindadi[1,2]*

[1]Department of Economics, Usmanu Danfodiyo University, Sokoto, Nigeria, [2]Department of Economics, University of Malaya, Kuala Lumpur, Malaysia. *Email: aarafindadi@yahoo.com

ABSTRACT

Several pioneering studies have established that the period of exchange rate misalignment is characterized by currency appreciation and depreciation. These studies conclusively assert that if currency overvaluation occurs beyond a minimum threshold it can render an economic system vulnerable to currency crisis, in view of this, is the Nigerian economy in a state of currency crisis? What impact does the period of currency crisis have on the Nigerian economy and what factors are responsible in aggravating the position of the crisis within the context of the Nigerian economy? To ensure this, we applied the permanent equilibrium exchange rate and the behavioral equilibrium exchange rate in estimating the misalignment in Nigeria. While the logit and probit models were used to determine the impacts of the crisis on the Nigerian economy. The study used quarterly data from 1980Q1 to 2011Q4. The findings of the study established the existences of high degree of currency overvaluation reaching an unprecedented level above 46% in the last quarter of 2011. A similar worsening trend was observed in the case of undervaluation. The results of the logit and probit models, on the other hand, reveal that the Nigerian economy is in a state of currency crisis. The study discovered how external debt, money growth rate and domestic credit growth rate to be the more likely compounding factors to the crisis in Nigeria. Although the study discovered that the momentum of the crisis has no effect on the county's gross domestic product growth rate. Nevertheless, these problems were discovered to be the aggravating agents of the crisis in Nigeria. We recommend the establishment of frameworks that are consistent with boosting productivity and the application of synergistic monetary policy models that will not only ensure a sustainable and improved value of the local currency, but that which could create its foreign demand, among other things.

Keywords: Behavioral Equilibrium Exchange Rate, Permanent Equilibrium Exchange Rate, Exchange Rate Misalignment, Currency Crisis
JEL Classifications: F3, F4, F31, F40

1. INTRODUCTION

Studies by Omotosho and Wambai (2005), Agu (2002), Obaseki (2001), Soludo and Adenikinju (1997), and Rano (2009) have established that the West African country of Nigeria has been subject to the incessant occurrence of exchange rate misalignment. In a related development, the Central Bank of Nigeria (CBN, 2007a; 2007b; 2008) confirmed the recurring trend of exchange rate misalignment in the country. Following to this, assessing whether Nigeria is in a state of currency crisis is what these studies have failed to establish thus leaving a gap that is detrimental to efficient policy action. Currency crisis or balance of payment problem is a typical financial economic phenomenon that cause strong decline in monetary value that undermines the potency of the national currency to serve its function as a store of value and

medium of exchange. In essence, currency crisis does not result directly into financial crisis with aggravating negative economic effect similar to those in period of the financial crisis. However, when currency crisis is accompanied by harsh macroeconomic conditions, then financial crisis could result. The pervasiveness and severity of the crisis in terms of adverse economic consequences, spillovers, and contagion, defend on a nation's trading strength with other countries, region, or the globe at large.

The menace of the currency crisis positively affects the national economy through persistent exchange rate instability, investment instability and can result into eventual market failure. These phenomenon's will precipitate into massive financial dissaving; weakening of international and domestic trade and often time creates enormous capital repatriation by foreign investors due to

the loss of confidence in the national investment outlook. Cavallo et al. (2002) in his research finding, documented that during, the period of currency crisis, productive entities with substantial foreign currency liabilities tends to have a whopping increase in the value of their gearing relative to revenues, thereby, crippling insufficiently hedged debtors that in turn lead to the contraction of investment fortunes and production optimality possibilities. Advancing the menace of exchange rate misalignment as the pioneering source of currency crisis, Frankel and Rose (1996), Kaminsky and Reinhart, (1999) argued that the periods of exchange rate misalignment is not only a prelude to the crisis but an impending moment where the dwindling nature of the national financial values creates massive economic disequilibrium which in turn renders the efficient and effective economic arrangement of a developing country fragile. In another perspective, which support this proposition is the theorization of the first, second and third-generation theories of currency crises by Krugman (1999) and Aghion et al. (2000; 2001). These theories provided the formidable intuition that the period of currency crisis are causative agents to strategic decline in national economic strength, as a result of the remarkable influence of the crisis to have the ability of breeding preference shocks (ii) investment shocks and (iii) fiscal and monetary imbalance. Following to this, the tradable and non-tradable sector of the economy that propels the prospects of sustainable economic features will be distorted.

From a retrospective view of most periods of currency crises, it suffices for us to argue that neither regulations nor novel financial, economic theories will be capable of preventing future crises. It is against this backdrop that this study aim to investigate whether the Nigerian economy is in a state of the currency crisis? If so, what effects can this have on the country's economy and what combination of other macroeconomic factors are responsible in aggravating the position of the crisis in Nigeria. From the introduction, Section 2.0 of this paper contains an empirical and theoretical literature review. Section 3.0 presents the theoretical framework of the study while Section 4.0 is the data source, methodology and model estimation procedure. While, in Section 5.0, we present the results and discussion, finally in Section 6.0 is the conclusion and recommendations to policy action.

2. THEORETICAL AND EMPIRICAL REVIEW

Kaminsky and Reinhart (2003) characterized the positions of the currency crisis by the degree of episodes warranting the arousal of the crisis. In her own term, the author established that six types of currency crisis are commonly identifiable; the first arising as a result of real appreciation was termed as *Crises with Current Account Problems*, others are crisis that contributes to the buildup of economic fragilities and these are associated with booms in the financial markets. The author cataloged them as *Crises of Financial Excesses*. The third form of crisis as according to the author are those that tend to arise when the fragilities of an economic system are associated with "unsustainable" foreign debt; these translate into what is termed as *Crises of Sovereign Debt Problems*. The

fourth variety of crisis is related to expansionary fiscal policy. These crises are labeled as *Crises with Fiscal Deficits. Sudden-Stop Crises,* on the other hand*,* constitute the fifth variety. This type of crisis is associated with reversals in capital flows triggered by hikes in world interest rates. Finally, *Self-fulfilling Crises* are those types of crisis that does not exhibit any evident vulnerability. Advancing the reason on why exchange rate misalignment is the leading prelude to the currency crisis Kemme and Roy (2005) conducted an empirical investigation in Russia and Poland. The results of their study established that liberalized capital account policies, within the transition economies, significantly warranted large capital inflows in the early transition period that resulted in high rates of inflation and overvalued real exchange rates (RERs). The results also confirm the claim that productivity growth in the traded goods sector tends to create an appreciation of the RERs in the transition economies. In another related development, Jeong et al. (2010) using the fundamental equilibrium exchange rate (FEER) approach studied the position of exchange rate misalignments for the whole world and European levels. In their objective, the authors aim at examining how financial imbalances in the selected continents could lead to exchange rate misalignments for each "national euro" country. The results of their study confirmed the existence of overvaluation of the dollar and undervaluation of the euro during the first half of the 2000s. In addition to this, The estimation results of the FEER showed significant disparities between "national euros." The degree of misalignments appeared more important for each euro area member than for the whole euro Zone.

Similar in line to the above study, Sidek and Yusoff (2009) investigated the impacts of exchange rate misalignment on capital inflows in Malaysia, using a specific and precise threshold that aims at uncovering the degree by which misalignment can suppresses capital inflows. The findings of their study reveal that the misalignment in terms of currency overvaluation has a positive effect particularly when overvaluation is more than 15%. This estimate was found to be consistent and robust despite the changes in the choice of explanatory variables. The study also showed that misalignments hurt capital inflows in the high misalignment regime. Re-affirming the above developments the Jongwanich, J. (2009), examined the behavioural equilibrium of real exchange rate (RER) and RER misalignment in eight Asian economies - namely, PRC; Hong Kong, China; India; Indonesia; Korea; Malaysia; Singapore; and Thailand, during the period 1995-2008. The impact of RER misalignment on export performance is further examined. The absolute value of RER misalignment is included in the export model, together with the RER, WD, PC, and inflows of FDI. In the lead-up to the 1997-1998 financial crisis. The finding of the authors exhibited how RER persistently yielded strong overvaluation in crisis-affected countries. The finding of the study further established how real overvaluation increased to around 10-15% in 1997 in Korea, Malaysia, and Thailand, and over 20% in Indonesia. The study also showed that, for other countries, i.e. PRC; Hong Kong, China; and India, the RER tended to exhibit undervaluation in the lead-up to the crisis period.

Bénassy-Quéré et al. (2004) on their part conducted a study on the burden sharing and exchange rate misalignment within the

G20 countries. The aim of the study was to examine the effects of currency overvaluation on key selected Asian continents. The result of their study found that if the Yuan and other Asian currencies had been revalued in an attempt for these currencies to reach an equilibrium level, this action will instigate the exchange rate between the US dollar and the euro to be close to equilibrium; this crucial finding was later on thought to be an important synergistic strategy that could have been implemented to avert the 1997 Asian financial crisis to a very large extent, particularly in the case of 2001, and to a lesser degree in 2003. The authors further established that the failure of significant financial adjustment in the Asian currency during this period yielded the magnification or the overvaluation of the dollar. In contrast to the case of the Euro, the Asian currency appreciation was found to generate the possibility that could enable the euro to attain an effective equilibrium terms. The study further showed that, the situation in the case of Japan, did not create much panic, and the yen/dollar misalignment was found to be close to equilibrium in effective terms in 2001. In another perspective, a study by Aflouk et al. (2010) examined the effects of exchange rate misalignments and world imbalances. The finding of their study discovered that, in the case of Russia, the country's currency crisis could be attributable to the rigidity in the nominal exchange rate, misconceived macroeconomic policies and substantial overvaluation of the ruble in the lead-up period. They also found that, at the time of the crisis, there was pressure for the ruble to be devalued. A study by Frankel and Rose (1996) presented an interesting insight into currency crashes in emerging markets economy. In the study, the authors used annual data of more than 100 developing economies over a period of more than 20 years. Their empirical findings were that there tend to be currency crashes when there is overvaluation of the RER, when there is a rise in nominal interest rates, when there is a high level of domestic credit growth, when there are low reserves, and when there is a drying up of FDI inflows. The authors further discovered that currency crashes are typically associated with severe recessions. Interestingly, they found that government budget deficits and current accounts did not appear to play important role in typical currency crashes.

Fratzscher (2009) conducted a research to investigate what explains global exchange rate movements during the financial crisis? In his view, the author explained that an unexpected and quite striking characteristic of all the financial crises he studied was that the US dollar tends to appreciate sharply against all global currencies in the preceding period. In addition to this, and from his research findings, he was able to establish that the pattern in global exchange rate configurations was among the clearest explaining factor that led to the anchoring of global, national currencies to the peculiarities of the US dollars; this situation makes it impossible for continents to eliminate US-specific shocks on their exchange rates. The author continued to assert that the worse the crisis became, and thus the greater the need for capital and US dollar liquidity; the stronger appear to have been the pressure on the US dollar to appreciate. The research also tested whether differences in countries macroeconomic fundamentals and financial (and real) exposure to the United States Dollar can account for cross-country differences in exchange rate movements, both unconditionally and when conditioning on US-specific shocks. The research confirmed that countries fundamentals and financial exposure were highly relevant transmission channels: in particular countries with high direct financial exposure towards the United States, and with low foreign exchange reserve coverage, as well as weak current account positions suffered substantially more in terms of currency depreciation.

An empirical study by Rano (2009) established another landmark in the study of exchange rate in Nigeria. The author in his research mechanics applied the permanent equilibrium exchange rate (PEER) in order to study the dynamic behavior of the RER misalignment in Nigeria. The finding of the study established that Nigeria's RER is affected in a positive way by an index of monetary policy performance, an index of volatility of the crude oil price, the terms of trade, and net foreign assets. In another development and using panel data approach Cham (2010), studied the behavioural effects of RER misalignment in relation to the West African Monetary Zone (WAMZ) integration prospects. The empirical exercise of the author discovered that between 2000 and 2005, there was a substantial increase in the variability of RERs in the WAMZ, but that such variability occurred unevenly across member countries. In particular, he found that, in Ghana, there was a fall in variability, compared to the rest of the zone, in which there was an increase in variability. The increase in variability was discovered to be higher in Guinea and Nigeria which almost doubled the average for the entire of the zone. An implication of Cham's (2010) study is that the rise in misalignment that has occurred since 2000 indicates that there is an increased cost associated with joining a monetary union. His work also shows that there is a negative correlation amongst the member countries in terms of the money supply and the percentage of their gross domestic product (GDP), same inferences is also found with respect to trade balance, and the terms of trade. In Contrast, Nigeria was found to be the only country with a better standing when compared to other WAMZ countries in terms of its trade balance. Following to this, and from the findings of his study the author concluded that the WAMZ cannot be regarded as an optimum currency area because of the negative correlation of certain structural variables more so, that the zone's average RER overvaluation was discovered to be high. In this respect he concluded that because of the high costs involved, the choice to step on the path towards a unified monetary area should be a matter for each individual country and also that each country should attempt to deal with its own macroeconomic problems so as to avoid negative spillovers to other zones.

While exposing the menace of the periods of crisis on real sector entities, Rafindadi and Yusof (2014a) studied the effects of exchange rate exposure in crisis and non-crisis periods using the data set of 102 real sector corporate entities comprised of multinational and indigenous companies operating in Nigeria. The authors applied the autoregressive distributed lag and the U-shaped methodology. The findings of the study established the existence of monotonic and non-monotonic conditions with respect to the behaviour of the entities values. In addition to that the study pointed out that the relationship between the corporate value of multinational companies in Nigeria and official exchange

rate is only having a linear relationship. This means that these entities cannot be threatened by bankruptcy in both the crisis and non-crisis periods. This development was in contrast to the discoveries obtained on indigenous entities. In another related development, Rafindadi and Yusof (2014b) while applying the theoretical concepts of catastrophe theory to the three regions of Africa, Asia and the Middle East exposed how the significant dangers of the periods of exchange rate misalignment, currency collapse and macroeconomic volatility, to have the abilities of posing significant threat to entrepreneurial quality, prosperities and survival. The study of the authors predicted that in theory, the establishment of a common position that could be an entrepreneurial haven in crisis periods is almost impossible. However, in practical realities the study discovered how the African region was found to possess some characteristics that could be regarded as an entrepreneurial haven when compared with the other three regions. Table 1 shows reliable early warning signals that herald to currency crisis.

In Figure 1 the frequency of banking crisis, currency crisis, twin crisis, tripple crisis from 1880-1997 was depicted by the Figure 1. The figure indicates how the magnitude of the crises affected 55 countries. While in Figure 2, the frequency of the effect of the banking crisis, currency crisis, twin crisis, tripple crisis from 1880 to 2009 was compared with that of Figure 1. The two respective episodes as argued by Bordo et al. (2015) pointed out that the 5 episodes of global financial crises from the periods of 1890-1891, 1914, 1929-30, 1980-81, 2007-2008, demonstrates how the banking crises is having more grevious effect to indigenous banks and those banking institutions that are outside the originating zone of the crises through contagion all within the same year. The

authors continue to point out that the episodes of banking crisis and the financial crisis tend to create wide spread of insolvency as a result of critical liquidity strain. In addition to that, they pointed out that interest rates is the critical factor that continue to escalate the tension in the crises thereby, dousing the global and continental financial stress of emerging markets economies and those in the third world.

Table 1: Reliable early warning signals of crisis

| Signal	Warning is issued when
RER misalignment	The home currency is overvalued
The home currency is overvalued	M2 multiplier
	Domestic credit-to-GDP ratio
	Domestic and external financial liberalization
Bank runs	Dwindling bank deposits
Monetary policy	"Excess" M1 balance
Current account problems	Low exports
	Excessive imports
	Deteriorating terms of trade
Capital account problems	Reserves
	M2-to-reserves ratio too low
	Wide real interest rate differential
	World real interest rate
	High foreign debt
	Excessive capital flight
	High short-term foreign debt
Growth slowdown	Low output
	High domestic real interest rate
	Lending-to-deposit interest rate ratio
	Stock market index decline

Sources: Kaminsky and Reinhart (2003). RER: Real exchange rate, GDP: Gross domestic product

Figure 1: The frequency of banking crisis, currency crisis, twin crisis, tripple crisis from 1880 to 1997 and affecting 55 countries
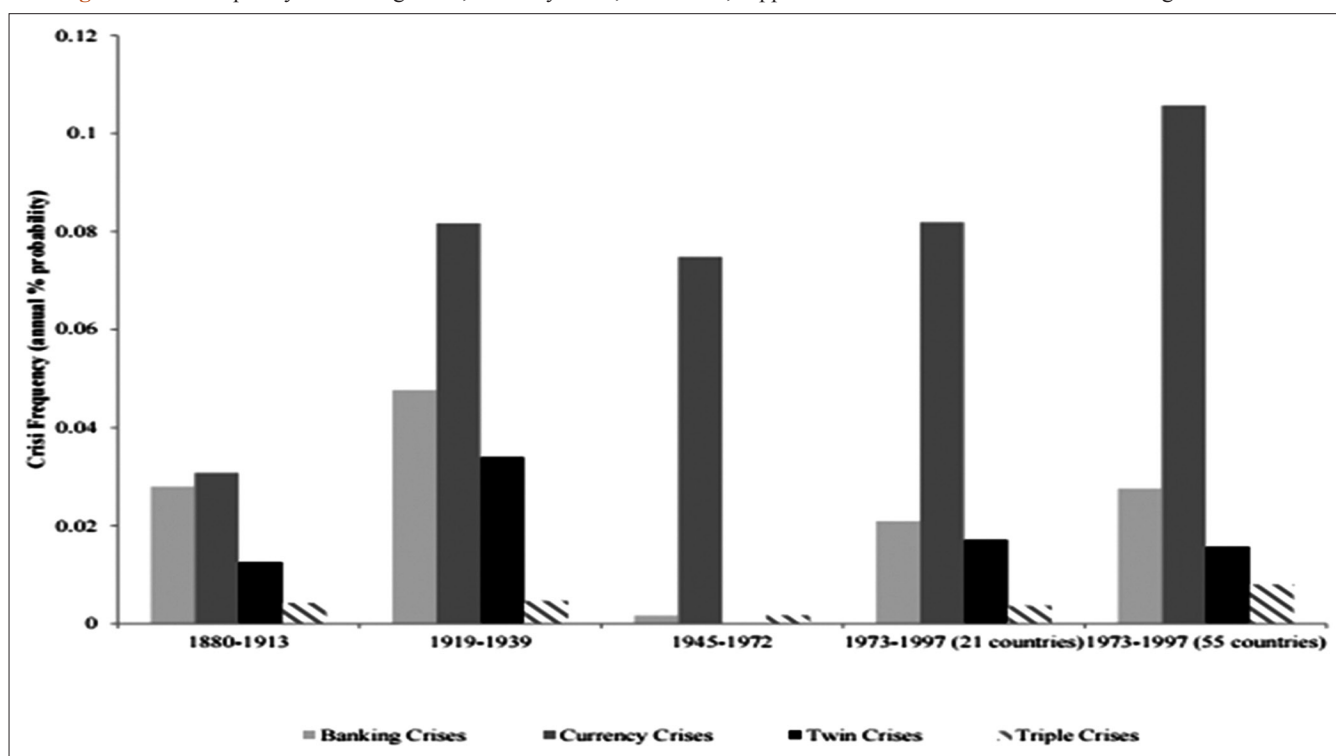
Source: Bordo et al. (2015)

Figure 2: The frequency of banking crisis, currency crisis, twin crisis, tripple crisis from 1880 to 2009
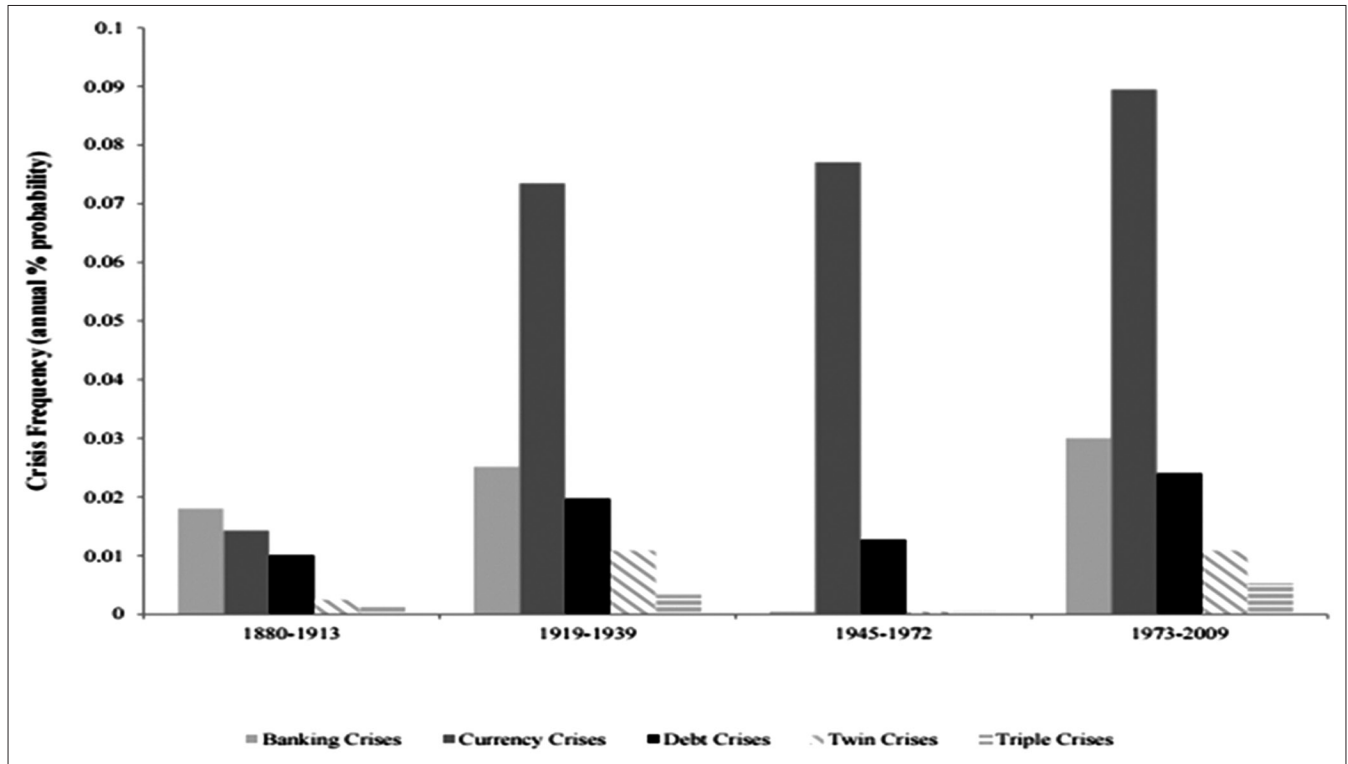
Sources: Bordon et al. (2015)

3. THEORETICAL FRAMEWORK

To develop an understanding of the behavioral dynamics of exchange rate misalignment we use Edward's (1988), theoretical model. The author raised key theoretical assumptions by considering that the economic system is a constituent of the tradable and non-tradable sector. He pointed out that the tradable sector is comprised of aggregate importable and exportable sectors that a country produce and consume. Following to this, it is assumed that only two goods exist in the economy i.e. tradable (ξ) and non-tradable (ψ) and that the country's nationals hold either foreign currency ($\acute{\omega}$) or domestic (Υ) money. It is further assumed that there is a government that consumes (ξ) and (Ω) goods which also make use of both domestic credit creation and non-distortionary taxes in order to finance its expenditure. Another key assumption is that, in the case of commercial transactions, there is a nominal exchange rate that is fixed ($\acute{a}$), and that, for any financial transactions; there is a nominal exchange rate that is freely floating (ϑ). The assumption is also made on the basis that the price of (ξ) goods in terms of foreign currency equals 1 (Pt*=1) and that it is fixed.

Portfolio decisions

$$\tilde{A}=\Upsilon+\vartheta\acute{\omega} \tag{2}$$

$$\tilde{A}=m+\rho\acute{\omega} \tag{3}$$

Where,

$\tilde{a}=\tilde{A}/\acute{a}$; $m=\Upsilon/\acute{a}$; $\rho=\vartheta/\acute{a}$

$$m=\rho(\vartheta'/\vartheta)\,\rho\,\acute{\omega}; \theta<0 \tag{4}$$

$$\acute{\omega}'=0 \tag{5}$$

Demand side

$$e=\acute{a}/P_{\Omega} \tag{6}$$

$$\varpi_{\xi}=\varpi_{\xi}(e,a); \partial\varpi_{\xi}/\partial e<0, \partial\varpi_{\xi}/\partial a<0 \tag{7}$$

$$\varpi_{\Omega}=\varpi_{\Omega}(e,a); \partial\varpi_{\Omega}/\partial e<0, \partial\varpi_{\Omega}/\partial a<0, \tag{8}$$

Supply side

$$\chi_{\xi}=\chi_{\xi}(e); \partial\chi_{\xi}/\partial e<0 \tag{9}$$

$$\chi_{\Omega}=\chi_{\Omega}(e); \partial\chi_{\xi}/\partial e<0 \tag{10}$$

Government sector

$$G=P_{\Omega}G_{\Omega}+G\,\acute{a}_{\xi} \tag{11}$$

$$\acute{a}\,\frac{G}{\xi}-G\pi \tag{12}$$

$$G = t + D' \tag{13}$$

External sector

$$\varpi\,\tilde{A} = \chi\xi_{(e)-\varpi\xi(e,a)-G\xi} \tag{14}$$

$$\eta' = \varpi\,\tilde{A} \tag{15}$$

$$\Upsilon' = D' + \acute{a}\,R' \tag{16}$$

Equation (2) shows that total assets (given by $\tilde{A}$) in the domestic currency are equal to the total of the domestic money (given by Υ) and foreign money (given by $\acute{\omega}$) multiplied by the free-market

nominal exchange rate (ϑ). Equation (3) provides a definition of real assets expressed in terms of ξ goods; in the equation, $\acute{\alpha}$ is the fixed commercial rate and $\rho=\vartheta/\acute{\alpha}$ refers to the spread that exists between the commercial and free nominal exchange rates. The portfolio composition equation is shown in Equation (4). This equation reveals that the ratio of domestic to real foreign money desired is related in a negative way to the expected rate of depreciation of the free rate δ. Equation (4) assumes perfect foresight and, for this reason, actual depreciation ϑ'/ϑ replaces expected depreciation. Equation (5) shows that there is an absence of capital mobility. It also shows that there are no any commercial transactions that are subject to the financial rate ϑ. A key assumption, however, is that the economy is in the inheritance of a stock of money that is positive; accordingly, $\acute{\omega}_0 \neq 0$.

Equations (6-10) are summaries of the demand and supply sides of the economy. Demand for ψ and ξ goods is dependent upon the RER. Such demand is also dependent upon the level of real assets. The supply functions, by contrast, depend only on the RER. A significant simplification in the model is that the demand functions do not have taxes. Equations (11-13) summarize the government sector. Here, $G_\xi + G_\Omega$ are the government's consumption of ψ and ξ. Real government consumption expressed in terms of T goods can be conveniently expressed as $g = g_\xi + g_\alpha'$ (Equation [11]), where $g=G/\acute{\alpha}$, $g_\xi = G_\xi$ and $g_\Omega = P_\Omega \varpi_\Omega / \acute{\alpha} = \varpi_\Omega / e$. Equation (12) shows the ratio of government consumption to ξ goods as λ, which is also equal to g_ξ/g). The government budget constraint is shown in Equation (13). It shows that government consumption needs to be financed through either or both taxes that are non-distortionary (given by t) or creation of domestic credit (given by D). When there is a fixed nominal exchange rate for commercial transactions, however, it is not sustainable in the long run for there to be a positive growth rate of domestic credit (i.e. D'). Then, there is an achievement of stationary equilibrium whenever $G=t$ and $D'=0$. However, if it is assumed that there is a crawling peg for the commercial rate (in other words, $\acute{\alpha}'/\acute{\alpha} > 0$), there can be a positive value of D' that is consistent with the crawl rate.

The external sector is described in Equations (12, 15 and 16). The current account in terms of foreign currency is defined in Equation (14) as being the difference that exist between the output of tradable and total (public and private sector) consumption of ξ. Equation (15) shows that in this model (which has a freely determined financial exchange rate and no capital mobility), the balance of payments (given by η') is the same as the current account (and η is the stock of international reserves (η_0). Equation (16) closes the model and establishes the linkage between variations in the domestic stock of money, variations in domestic credit, and variations in international reserves.

There is attainment of long-run sustainable equilibrium when there is simultaneous equilibrium in the non-tradable goods market and the external sector (balance of payments and current account). In the model developed, this has the outcome that when there is long-run sustainable equilibrium, this has the implication that, in each period, the current account is in equilibrium. That said, however, in the short run and the medium run, it is possible for there to be a departure from $\varpi \tilde{A} = 0$, in which case there will be

an accumulation of international reserves. There is clearing of the non-tradable goods market when

$$\varpi_\Omega(e, \ a) + eg_\Omega = \chi_\Omega(e) \tag{17}$$

Given that, g_Ω is real government consumption of Ω expressed in terms of tradable goods, then from Equation (17), it can be seen that there is an equilibrium relationship between e, a and g_Ω e=v(a g_Ω)

$$(\vartheta\upsilon/\vartheta a < 0, \ \partial v / \partial g_\Omega < 0) \tag{18}$$

When the value of real assets rises, there is increased demand for non-tradable goods. This in turn requires, for maintenance of equilibrium, either a higher P_Ω or a lower RER. It is equivalent in the case of g_Ω. It should be observed that Equation (18) provides the value of e that brings about equilibrium in the non-tradable goods sector, without referring to the external sector. To ascertain the long-run equilibrium RER, it is necessary to examine the equilibrium in the current account and balance of payments. Given that the commercial rate is fixed, in the money demand Equation (5) it is possible to substitute (ϑ'/ϑ) by the rate of change that exist in the spread (θ/ρ). Accordingly, it is possible to have $m/\rho \ \acute{\omega} = \sigma (\theta/\rho)$. By inversion of this equation and then solving it for θ, it is possible to obtain Equation (19):

$$\theta = \rho L(m/\rho \ \acute{\omega}); \ L'() < 0 \tag{19}$$

Equations (11), (14), (15) and (16) combine to give the following expression form:

$$m' = \chi_\xi(e) - \varpi_\xi(e,a) + G\frac{\Omega}{e} - \frac{t}{\delta} \tag{20}$$

For there to be external sector equilibrium, it is necessary for $m'=0$. When there is full financing of government expenditures with taxes, the $\eta'=0$ and $m'=0$ schedules will coincide. If there is no coincidence, then it indicates problematic exchange rate misalignment. This is because whenever; there is a negative change in wealth then undoubtedly that will create tremendous effects on relative prices that will in turn affect the current account. As a result, if m increases, real wealth (a) increases, but a decrease will cause misalignment of the currency. In a similar fashion, if there is a current account deficit occurring in an attempt to bring back the equilibrium wealth position, ϑ will fall, which again result in an automatic currency misalignment.

4. DATA, MODEL SPECIFICATION, AND ESTIMATION PROCEDURE

The data and definition of variables: In this research, the variables adopted in the determination of exchange rate misalignment are the RER (*RER*) as the dependent variable while net foreign assets (*NFA*), terms of trade shocks *(TOT)*, Index of crude oil price volatility *(IOV)*, government fiscal stance (*GOV*), monetary policy (*MOP*) and productivity (*PRO*) are the respective independent variables. These variables were selected following the pioneering studies of MacDonald, (1997), MacDonald and Ricci, (2003) Dibooglu (1996) and Iossifov and Loukoianova (2007); Frenkel and Mussa (1988) and Rano (2009). Following to this, we obtain the data with respect to the outlined variables from different

sources, for instance data for the RER, trade openness and net foreign asset, was obtained from the CBN. Following to this, the data for net foreign asset was converted into real terms by first dividing it by the US wholesale price index and then converted it into a natural log. The data sources on terms of trade shocks *(TOT)* and Index of crude oil price volatility *(IOV)* on the other hand, were obtained from the World Economic Outlook (WEO) database while the variable (NFA) was used because it create the possibility for real currency depreciation and appreciations, due largely to its properties of substitution and income effects.

The index of crude oil price volatility (*IOV*): Was used considering its importance in enabling us to ascertain what effect the volatility in the crude oil price has on the RER. This is especially very significant with the case of Nigeria, which is an oil-producing country. In addition to that there is usually a significant degree of variation tend to arise as a result of the real appreciation of the dollar in response to a rise in the price of oil (The crude oil price was determined using the simple average of the spot prices, in \$US/barrel, of West Texas Intermediate, Dated Brent, and the Dubai Fateh). The index of Government fiscal stance (*GOV*) was used to enable us established the way in which the government's fiscal stance affects the RER. This is because exchange rate is a function of the extent to which any additional fiscal stimulus is devoted to expenditure on both tradable and non-tradable goods, particularly on the possibility that the government expends money on non-tradable goods, this will have a tendency to appreciate the RER; if government spends money on tradable goods, conversely, this will have another tendency of depreciating the RER if it fails to do so. In addition to this, tightening of fiscal policy will lead to a permanent rise in the country's net foreign asset position and, as a result, there will be a longer-term appreciation of the equilibrium exchange rate. The CBN was the source of data on the government's fiscal stance.

The index of monetary policy (*MOP*): was included because a sound monetary policy creates the conditions needed to free up and direct resources from surplus to investment units at rates that are affordable and consistent with the market and converse will be the result of an unsound monetary policy. In order to obtain a measurement of the monetary policy variable, we deflated domestic savings by the lagged money supply in the Nigerian economy between the first quarter of 1980 and the fourth quarter of 2011. The CBN was the source of data to this index formation. The variable of productivity (*PRO*), on the other hand, was used in order to show how the effect of RER will be on national productivity differential, and this is predicted to follow the Balassa-Samuelson doctrine. Data for this variable encompass both direct and indirect measures. In this research, we used an indirect measure which permits us to apply the relative price differential between traded and non-traded goods both domestic and abroad. Data were sourced from the WEO.

4.1. Behavioral Equilibrium Exchange Rate (BEER)/PEER Model Derivation and Estimation Procedure

In this research, the study adopts the BEER and PEER modeling approach in estimating the equilibrium exchange rate. The BEER approach is following the generic model of Clark and Macdonald

(1998) in our case we define Z_{1t} as those economic fundamental that have persistent effects on the long-run base of the RER system in the case of Nigeria. While, Z_{2t} on the other is defined in this context as those medium term fundamentals that have a persistent effect on Nigeria's RER system. Following to this definition, the actual RER can be determined as follows:

$$q_{1=}\beta_1^T Z_{1t} + \beta_1^T Z_{1t} + \tau^T T_t + \mu \qquad (21)$$

From the above equation T_t, may be seen as a set of short-run, fundamentals or variables and μ is the error term (Clark and Macdonald 1998) we then define the equilibrium exchange rateas:

$$\bar{q}_t = \beta_1^T Z_{1t} + \beta_1^T Z_{2t} \qquad (22)$$

While the related current misalignment, *cm,* is as follows:

$$cm = q_1 - \bar{q}_t = q_1 - \beta_1^T Z_{1t} - \beta_1^T Z_{2t} = \tau^T T_t + \mu \qquad (23)$$

The above equations explains how as a result of the deviation of the current value of economic fundamental can result in total misalignment. In addition to this, Clark and Macdonald further defined total misalignment as:

$$tm = q_1 - \beta_1^T \bar{Z}_{1t} - \beta_1^T \bar{Z}_{2t} \qquad (24)$$

And this can be decomposed in two components by adding $\bar{q}_t$ to the above equation, following to this we will have:

$$tm = (q_1 - \bar{q}_t) + [\beta_1^T (Z_{1t} - \bar{Z}_{1t}) + \beta_2^T (Z_{2t} - \bar{Z}_{2t})] \qquad (25)$$

Therefore, with $q_1 - \bar{q}_t = \tau^T T_t + \mu$ we can proceed to re-write the total misalignment in the case of Nigeria as:

$$tm_t = \tau^T T_t + \mu + [\beta_1^T (Z_{1t} - \bar{Z}_{1t}) + \beta_2^T (Z_{2t} - \bar{Z}_{2t})] \qquad (26)$$

To solidify this approach Clark and Macdonald (1998) further established the risk adjustment prima of interest rate parity this was found to be consistent with Faruquee (1995) Clark and Macdonald (1998)

$$\Delta q_{1+k}^e = -(r_t - r^*_t) + \lambda_t \qquad (27)$$

Re-arranging this to conform with our definition of RER as in the case of Nigeria's home currency we will end up having:

$$q_t = q_{1+k}^e - (r_t - r^*_t) + \lambda_t \qquad (28)$$

In the above equation, we interpret q_{1+k}^e as the long run or the systematic component or RER, and this will yield:

$$q_t = \tilde{\bar{q}}_t - (r_t - r^*_t) + \lambda_t \qquad (29)$$

In this case, we hold the assumption that $\tilde{\bar{q}}_t$ is a function of net foreign asset *NFA* following to this; we will end up invoking the Blassa-Samuelson effect as in equation 30:

$$q_t = f[r_t - r^*_t, nfa, tot, bs, ...\lambda_t] \qquad (30)$$

The PEER methodology, on the other hand, follows the presentation mechanics of Maeso-Fernandez et al. (2002). At this juncture, it is important to note that whereas the BEER establishes equilibrium using actual fundamentals, the PEER, on the other hand, superimposes equilibrium conditions on the fundamental within the BEER specification; in this regard the PEER can be seen to be an augmented BEER representation. The PEER equations, on the other hand, can be drawn as follow:

$$RER_t = \beta_1 Z_{1t} + \beta_2 Z_{2t} + \gamma T_t + \mu \tag{31}$$

$$RER = BEER_t + \gamma T_t + \mu \tag{32}$$

β_1, β_2 and γ are termed to be the real vectors. As demonstrated by Clark and Macdonald (1998), a Hodrick–Prescott (H-P) filter will be applied in the estimation process in order to attain the LR trend on the selected fundamentals.

4.2. Model Estimation Procedure
4.2.1. Unit root analysis
In time series analyses, it is necessary to test the unit root properties of the variables to attain reliable and efficient empirical results. Spurious results are not helpful in actualizing comprehensive economic policies that could be accurate in ensuring the right objective in the long run. To overcome this empirical issue, we applied the most robust econometric unit root test developed by Ng and Perron (2001) which is also suitable for small sample data sets. The traditional unit root tests such as the Augmented Dickey-Fuller, Dickey-Fuller-GLS and Kwiatkowski-Phillips-Schmidt-Shin tests are low-power tests. These units root tests over-reject the null hypothesis when it cannot be rejected and vice versa. Intuitively, the Ng and Perron unit root test has superior properties and provides better empirical results for small sample data sets. The results are reported in Table 2. Next to this, the study discovered that all the variables have a unit root problem at level with intercept and trend. At first difference, all the series

are found to be stationary, this implies that all the variables are stationary at first difference (i.e. integrated at I[1]). The unique order of integration of the variable warranted the application of the Johansen cointegration method; this will allow us to examine the long-run relationship between the variables. The H-P filter is required to smooth the values of the RER equilibrium (Rano, 2009). In addition to this, the study will also use the H-P filter to enable the actualization of the long-run steady state of the permanent values of the selected economic variables. This can be obtained through a decomposition analysis of the time series data into a trend μ_t and the stationary component, $x_t - \mu_t$ by minimizing.

$$\sum_{t=1}^{T} (x_t - u_t)^2 + \lambda \sum_{t=1}^{T-1} \left[(x_{t-1} - u_t) - (x_t - u_{t-1}) \right]^2 \tag{33}$$

where λ is an arbitrary constant which reflects the penalty of incorporating fluctuations into the trend. If $\lambda=0$, the sum of squares is minimized when $x_t - \mu_t$ and the trend is x_t itself. As $\lambda \to \infty$, the trend approaches linearity. HP suggested a λ to be 1600 for quarterly data. However, different numbers should be used depending on the data frequencies. The number is much larger when the data set is monthly ($100,000 < \lambda < 140,000$), and much smaller when the data set is annual ($6 < \lambda < 14$). In addition to this, decomposed permanent components will be considered by this research as the LR PEER, and this is consistent with Clark and Macdonald (1988) in the end we will match this estimation to figure out the respective periods of over and overvaluation of Nigeria's currency in the long-run. According to the theorization of MacDonald (1997) and MacDonald and Ricci (2003), the fundamental variable used in the estimation should have the following expected sign

$$rer = f(\overset{+}{nfa}, \overset{\pm}{tot}, \overset{+}{iov}, \overset{-}{gov}, \overset{+}{rsv}, \overset{+}{mop}, \overset{-}{opn}, \overset{+}{pro}) \tag{34}$$

The long run relationship in this study was expressed in the form of dynamically stable steady state. In this respect we incorporated the long run fundamentals in the form of a vector autoregression (VAR) of finite order p, with an unrestricted vector error-correction representation of the following form:

$$\Delta y_t = \vartheta y_{t-1} + \sum_{t-1}^{r-1} \eta_j \Delta y_{t-i} + CX_{t-k} + \varepsilon_t \tag{35}$$

From the above, and following Granger's representation theorem, which maintain that if the coefficient matrix ϑ has reduced rank

Table 2: Unit root analysis

Variables	MZa	MZt	MS$_B$	MP$_T$
ln RER_t	−12.4463 (9)	−2.3367	0.1877	8.1873
ln NFA_t	−10.2766 (1)	−2.2617	0.2200	8.8917
IOV_t	−8.0599 (4)	−1.5307	0.1899	12.5954
TOT_t	−14.0790 (9)	−2.0213	0.1435	9.7932
ln $GOVT_t$	−4.41604 (4)	−1.4066	0.3185	19.9857
ln RSV_t	−12.9330 (4)	−2.5374	0.1962	7.0778
MOP_t	−2.23352 (3)	−0.6601	0.2955	24.6945
OPN_t	−11.8691 (2)	−2.4183	0.2037	7.7747
PRO_t	−2.00682 (4)	−0.8577	0.4274	37.1320
Δln RER_t	−32.5234 (4)*	−4.0281	0.1238	2.8270
Δln NFA_t	−19.7031 (1)**	−3.1161	0.1581	4.7650
ΔIOV_t	−27.9766 (4)*	−3.6585	0.1307	3.7371
ΔTOT_t	−46.7929 (3)*	−4.6776	0.0999	2.7532
Δln $GOVT_t$	−19.4360 (5)**	−3.1165	0.1603	4.6939
Δln RSV_t	−29.5911 (4)**	−3.8422	0.1298	3.1044
ΔMOP_t	−45.5945 (1)*	−4.7551	0.1042	2.0994
ΔOPN_t	−47.9897 (2)*	−4.8921	0.1019	1.9309
ΔPRO_t	−40.0016 (2)*	−4.4717	0.1117	2.2804

* and ** show significant at 1% and 5% levels respectively. () are lag length of the variables based on AIC criteria, AIC: Akaike information criterion

Table 3: Lag length selection

VAR lag order selection criteria					
Lag	LogL	LR	FPE	AIC	SC	HQ
---	---	---	---	---	---	---
0	−4283.069	NA	3.62e+25	78.7168	78.8897	78.7869
1	−3163.537	2074.728	1.07e+17	59.0740	60.4567	59.6348
2	−3036.611	218.9178	2.59e+16	57.6442	60.2368*	58.6956
3	−3011.641	39.86131	4.13e+16	58.0851	61.8876	59.6271
4	−2998.099	19.87810	8.34e+16	58.7357	63.7480	60.7684
5	−2785.024	285.4024	4.49e+15	55.7252	61.9474	58.2485
6	−2632.602	184.5850	7.71e+14*	51.8275*	61.2596	56.8415*
7	−2602.097	33.0239	1.32e+15	54.1669	62.8088	57.6715
8	−2528.232	70.4760*	1.12e+15	53.7106	63.5625	57.7059

*Indicates lag order selected by the criterion LR: Sequential modified LR test statistic (each test at 5% level) FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion HQ: Hannan-Quinn information criterion

$r < k$, then there exist $k \times r$ matrices α and β each with rank r such that $\vartheta = \alpha \beta'$ and $\beta' y_t$ is I(0). r is the number of cointegrating relations (*the cointegrating rank*), and each column of β is the cointegrating vector. The elements of α are known as the adjustment parameters in the VEC model. Johansen's method is to estimate the ϑ matrix from an unrestricted VAR and to test whether we can reject the restrictions implied by the reduced rank of ϑ. Lastly, ε_t is the disturbance term distributed as $N(0, \Omega)$, where Ω_i is the variance-covariance matrix of the elements of the residuals. Finally, the following long-run empirical equation will be used to estimate exchange rate misalignment in Nigeria:

$$\ln REER_t = \beta_1 + \beta_2 \ln NFA_t + \beta_3 IOV_t + \beta_4 TOT_t$$
$$+ \beta_5 \ln GOVT_t + \beta_5 MOP_t + \beta_6 OPN_t + \mu_i \qquad (36)$$

Where, μ_i is an error term assumed to be having normal distribution.

5. EMPIRICAL RESULTS AND DISCUSSION

In Table, 2 is the unit root analysis, and the study applied the Ng and Perron (2001) unit root test. The results of the analysis showed the unit root problem at level with intercept and trend, but all variables are found to be stationary at first difference and integrated at I (1). Before proceeding to determine the cointegration between the variables, it is necessary to choose an appropriate lag length. This is because the results of Johansen cointegration are sensitive to lag length selection (Lütkepohl, 2006). To overcome this issue, we followed the Akaike information criterion (AIC) for lag length selection. Although there are many lag length criteria reported in Table 3. As a result, we applied the AIC due to its superior properties. In addition to this, it was pointed out by Acquah and Carlo (2010) that the AIC performs better compared to other lag length selection criteria. Our results indicate that lag order six is suitable in the sample size as it shown by the AIC (Table 3).

After selecting the optimum lag order, we proceed to estimated equation 36 using the OLS approach. The results of the

cointegration test using the trace and eigenvalue statistics, as well as the normalized Johansen cointegration results, are presented in Table 4 the models confirm the existence of the cointegration relationship among the variables through normalization process. The cointegration test results in the lower part of the table reveal the existence of three and two cointegrating equations in the first and second models respectively and at 1 percent level of significance. Following to this, the null hypothesis of no cointegration was rejected. With the attainment of this result, it is evident that long run association exists between the RER and its key determinants in the case of Nigeria.

The results of cointegration are reported in Table 4. In model 1 we found that there are three cointegrating vectors as our calculated trace statistics are greater than critical values at 1% level of significance (see results of Model 1). The same inference is drawn for maximum likelihood test. It also shows three cointegrating vectors. This confirms the existence of cointegration between the variables over the period of 1980Q1-2010Q4. In addition to this, the results of Model 2 also confirm the presence of cointegration as four cointegrating vectors are confirmed both by trace test and maximum likelihood test. The upper part of Appendix Table A1 is reporting the results of cointegrating vectors and adjustment coefficients. We find that included variables in long run vector are significant. It is noted that all the variables have a significant impact on real effective exchange rate. The impact of $\ln NFA_t$ is negative, and it is statistically significant at 5% level of significance. The relationship between IOV_t and $\ln RER_t$ is positive and significant, and the same is true for TOT_t and $\ln RER_t$. Similarly, the impact of $\ln GOVT_t$ on $\ln RER_t$ is positive, and it is statistically significant at 1% level of significant. The MOP_t and OPN_t seem to positively linked with $\ln RER_t$, but it is statically insignificant.

Table 5 shows a summary of the result of the degree of exchange rate misalignment the findings from the table indicate the existence of (overvaluation) between 1989 (first quarter) and 1990 (fourth

Table 4: Results of cointegration analysis

Variables	Model 1			Model 2		
	Cointegrating vector	Adj. coefficient	Test for exclusive	Cointegrating vector	Adj. coefficient	Test for exclusive
Ln RER_t	1.0000	−0.1019	12.1008	1.0000	−0.0973*	8.87219
Ln NFA_t	−0.8003*	0.0199	13.6873	−0.0010*	−1.8635	20.5138
IOV_t	0.3896*	−0.3668*	29.3995	−0.2645	0.0186	26.2829
TOT_t	0.0093*	−30.0004*	13.7923	−7.05E−06*	15890.33	50.7326
$\ln GOVT_t$	6.2321*	−0.0098*	28.2914	1.63E−05*	−13274.07	38.0216
MOP_t	4.70E−06	1326.499	51.8660	7.69E−05*	−548.9058	1.1763
OPN_t	2.04E−06	263.2365	34.3744	9.901	0.889	0.33
PRO_t				−0.441	0.901	2.091
Number of CE (s)	**Maximum eigen value**	**Trace statistics**	**Critical values**	***P* values**	**Maximum eigen value**	**Trace statistics**	**Critical values**	***P* values**
r=0	270.90**	198.57**	44.09	0.001	150.46**	104.89**	11.090	0.007
r=1	249.35**	127.67**	33.10	0.012	144.97**	94.43**	89.001	0.005
r=2	140.94**	78.31**	21.98	0.016	22.42	19.45	49.001	0.368
r=3	18.60	37.37	59.00	0.662	21.24	27.02	87.004	0.119
r=4	12.02	18.76	48.90	0.765	4.91	5.77	88.009	0.909
r=5	5.66	6.74	98.00	0.840	0.85	19.85	78.009	0.355
r=6	1.08	2.08	3.09	4.297				

*Denotes rejection of the hypothesis at 1%, **Number of cointegrating equations at 1%

quarter); the degree of overvaluation was found to be 16%, in that quarter. This trend of overvaluation continued from 1994 (fourth quarter) up to 1995 (first quarter), and further accelerated between 1996 (first quarter) and 1998 (fourth quarter). The situation of overvaluation in Nigeria was again seen to take effect between 2001 (first quarter) and 2003 (second quarter) and did not change much until the period between 2005 (first quarter) and 2011, which is during the 2007/2008 financial crisis. The case of the undervaluation, on the other hand, was witnessed in 1980 (first quarter) and 1989 (second quarter) and between 1991 (second quarter) and 1993 (third quarter). The high degree of overvaluation was in 2008 (third quarter) - 2011 (fourth quarter), reaching an unprecedented peak of 46.87%.

Comparing the results on Table 5 with past studies such as the studies of, Agu (2002), the author reported that the degree of misalignment in that period to be between 1.4% in 1970 in contrast to this, Rano (2009) identified the average misalignment in his study to be between −1.64 and −14.9. The peak degree of misalignment, according to the author occurred between 2003Q3 and 2004Q4 and was reported to be within the range of 20.3% while the minimum of 0.28 was recorded between 1996Q1 and 1998Q4 in that study. In addition to that Rano (2009) also reported in his study that, during the guided deregulation introduced in 1994, the exchange rate in Nigeria remained overvalued to an average of 8.49%. In another related development, Omotosho and Wambai (2005) applied the fundamental and purchasing power parity methodology in studying the position of exchange rate misalignment in Nigeria, the results of their study showed varying degree of misalignment ranging from 2.8% to 5.2% in the case of the fundamental approach and 35.6% and 44.2% was observed from the result of the PPP approach. In contrast to the research findings of Agu (2002), Omotosho and Wambai (2005) and Rano (2009), Dufrenot and Yehoue (2005) in a panel cointegration analysis for 64 countries (Nigeria inclusive) discovered that Ghana had the most substantial degree of overvaluation during the period 1979-85, with an average of about 54% and a maximum of 120%. The author reported that, in that period, the situation of Nigeria was close to that of Ghana with the most alarming degree of misalignment to occur in the first Quarter of 1985. This was traced to be due to the inability of the government to moderate

the RER closer to the BEER and PEER as was the case in Ghana during that period.

The literature on currency crisis established three basic standard approaches to the empirical assessment of the position of currency crisis in a country, and these are the logit and probit approach, the signaling approach and the descriptive approach. In consideration of these approaches, we applied the logit and probit approach due to its wide scientific application and the parsimonious treatment of time series variables by this model to attain robust result. Using the logit and probit model in this study we modeled currency crisis on widely subsisting variables that best explain the dynamics of the phenomenon. The variables selected in this study are the real GDP growth rate, the external debt value, the ratio of the money supply to international reserve; domestic credit growth rate to the private sector and the degree of RER overvaluation. The selection of these variables and use of the logit and probit model were adopted following Kaminsky and Reinhart (2003) Glick et al. (2006) Frankel and Rose (1996) and Eichengreen et al. (1995). All the variables were obtained from the CBN, and the data range is from 1980 to 2011 i.e. in line with the earlier selected variables on the study of exchange rate misalignment.

The intuition behind the selection of these variables is the conviction that a significant rise in credit growth is a direct pointer to an expansionary central bank policy following to this; there will be an undoubted future prices increase and an expansionary fiscal policy will directly or indirectly lead to an unsustainably overheated economy. In addition to this, a large current account surplus-to-GDP ratio would be expected to lessen the likelihood of a currency crisis. We also expect relatively large exchange rate overvaluation and declining real output growth to be associated with an increased likelihood of a currency crisis. Furthermore, a substantially overvalued exchange rate may lead to the expectation that a large adjustment may occur, and declining real GDP growth may signal worsening economic conditions and undermine investor confidence in home country investment opportunities. In another related development, the literature and subsequent empirical studies have set out the definition of currency crisis on the basis of an observed benchmark for instance Frankel and Rose

Table 5: Episodes of RER misalignment in Nigeria

Range	Outcome	Minimum	Maximum	Average
1980Q$_1$-1989Q$_2$	Undervaluation	−20.8119	−26.27	−0.7591
1989Q$_3$-1990Q$_4$	Overvaluation	14.4543	16.4369	15.1154
1991Q$_1$-1993Q$_3$	Undervaluation	−18.0016	−28.3648	−23.7700
1994Q$_1$-1995Q$_1$	Overvaluation	5.2885	10.4905	7.8895
1995Q$_2$-1995Q$_4$	Undervaluation	−0.5981	−8.3700	−9.6189
1996Q$_1$-1998Q$_4$	Overvaluation	4.3273	16.1187	7.1861
1999Q$_1$-2001Q$_1$	Undervaluation	−5.2971	−6.0411	−0.1796
2001Q$_2$-2003Q$_2$	Overvaluation	4.4564	7.0864	6.1563
2003Q$_3$-2004Q$_4$	Undervaluation	−4.3323	−7.0620	−5.2545
2005Q$_1$-2011Q$_4$	Overvaluation	12.2270	46.8728	6.9632

Negative sign indicates undervaluation of the RER while positive sign denotes overvaluation of the RER. This is in line with Edwards (1989) where they defined misalignment as the percentage deviation of the actual RER from the fitted. See Appendix Table A1 for the full result of this section: Estimated by the researcher using Eviews 7, RER: Real exchange rate

Table 6: Indicating the determinants of currency crises in Nigeria

Variables	Logit (1)	Probit (2)
Real GDP growth rate	−32.68	−33.24
	(9.02)	(11.2)
External debt value	0.0090**	0.0048**
	(53.33)	(88.01)
Money growth rate	0.0072**	0.0081**
	(051.11)	(062.9)
Domestic credit growth to private	0.0010***	0.0006**
	(123.56)	(188.89)
Misalignment	0.00012**	0.00011**
	(210.98)	(259.98)
Constant	−409.89	−516.89
	(−335.11)	(−380.80)
R^2	0.80	0.77
Pseudo R^2	0.406	0.517

Standard error in parentheses, *p<0.10, **p<0.05, ***p<0.01. GDP: Gross domestic product

(1996) established that any nominal depreciation of 25% or more, particularly if it is at most 10% higher than the depreciation in the preceding year, with this fact in existence a country could be labeled as in a state of currency crisis. Milesi-Ferretti and Razin (1996), on the other hand, argued that 25% is quite a high margin and allowed this to reach such unprecedented level particularly in developing economies may lead to excessive economic inconvenience. Following to this, the author argued that a 15% minimum rate of depreciation and a minimum of 10% in inflation is more intuitive in both empirical and theoretical consideration. This line of development was also supported by Kaminsky and Reinhart (2003). Following to this, we adopt the Frankel and Rose definition considering the developing nature of the Nigerian economy. Accordingly the independent variables which are trend deviations of the real equilibrium exchange rate and other macroeconomic variables are treated as lagged variables in the currency crises model this is in order to establish whether they are leading indicators of the currency crises in the case of Nigeria.

The model of the currency crisis

$$CC = \lambda_0 + \lambda_1 \hat{Y}_{t-1} + \lambda_2 Misal_{t-1} + \lambda_3 \hat{M}_{2t-1} + \lambda_4 EXTD_{t-1} + \varepsilon \qquad (37)$$

In this model CC=currency crises with 1=currency crisis and 0 otherwise, Misal. is the variable of misalignment that is also defined as 1=overvaluation and 0 otherwise. M2 is the growth rate in money supply, and EXTD is the value of external debt as a percentage of GDP; Y is the growth rate of GDP. The empirical result of the determinant of the currency crisis in Nigeria is shown in Table 6.

From the above, it is evident that Nigeria has witnessed the traumatic effects of the currency crisis in the periods under survey. Table 6 is the empirical results of the logit and probit model. The finding confirms that exchange rate misalignment is a prelude to currency crisis in Nigeria. Following to this, the study discovered that external debt, money growth rate and domestic credit growth rate are more likely to have aggravating effects on the crisis in Nigeria. In the Table 6, the study made one of the most startling empirical discoveries which is contrast with most recent empirical studies in the field of currency crisis. In this finding, it was discovered that the real GDP growth rate in Nigeria is not affected by the momentum of the currency crisis as at the period under survey. We attributed this fact to be due to the possible rise in oil prices which substantially helped in cushioning the dereliction of Nigeria's international reserve, increased inflow in FDI, significant reduction in government spending on public sector enterprises through the recently completed privatization and commercialization exercise and the renewed effort in the restructuring of the banking and financial sector which took place recently in the country. In addition to this, the country has in 2008 wiped away its foreign debt with the Paris club and is also undergoing similar effort in reducing most of its domestic debt. In another related development, Rafindadi and Yusof (2015) found that the Nigerian economy is not suffering from excessive monetary dilation as compared to the case of South Africa as in Rafindadi and Yusof (2013). See other reasons also in the conclusions below.

6. CONCLUSIONS AND RECOMMENDATIONS FOR POLICY

In this study, we re-investigated whether the contentious issues of exchange rate misalignment in Nigeria is a prelude to the country's currency crisis, in addition to that, what are the effects of the period of currency crisis to the Nigerian economy among others. To ensure this, the study used quarterly data from 1980 to 2011. While the PEER and BEER, methodologies were applied in the estimations of exchange rate misalignment in Nigeria. In the determination of the country's position with respect to currency crisis, the logit and probit models were used. The results of the BEER and PEER estimation confirmed that Nigeria is experiencing high degrees of currency overvaluation and undervaluation (Appendix A) with an unprecedented peak of 46.87% in 2008Q3-2011Q4. This result was in contrast to the findings established by Rano (2009) and many other studies on exchange rate misalignment in Nigeria. In line with this development, the study discovered that the Nigerian RER is affected positively by the index of monetary policy performance, and index of crude oil price volatility, the terms of trade, and net foreign assets. These findings are in line with the study of Rano (2009). Surprisingly the study discovered that Nigeria's RER appreciates with changes in terms of trade conditions, monetary policy, volatility in oil prices, and changes in net foreign assets but that it depreciates when there are low foreign reserves and high levels of government spending.

From the findings of the study on exchange rate misalignment, an investigation into whether the Nigerian economy is in a state of currency crisis is determined; this also enabled the assessment of the impact of the period of currency crisis on the Nigerian economy. In addition to that, the factors that are responsible in aggravating the position of the crisis within the context of the Nigerian economy were also identified. To ensure the robust accomplishment of these objectives, currency crises was modeled on a set of explanatory variables that include the degree of exchange rate misalignment, real GDP growth rate, the external debt value, the ratio of money supply to international reserve and domestic credit growth rate to the private sector. The Milesi-Ferretti and Razin, (1998) definition of currency crisis was used as the gauge point. In that model specification, currency crisis is defined at a 15% rate of appreciation. The finding from this analysis confirms that exchange rate misalignment is a prelude to currency crisis in Nigeria and that external debt, money growth rate and domestic credit growth rate were found to be the more likely compounding factors to the crisis in Nigeria. The startling discovery of this study was the finding that the momentum of the crisis as at the period under survey has no effect on the county's GDP growth rate. This result is largely attributed to the fact that crude oil is the dominant exporting commodity in Nigeria. Oil and gas accounted for about 97.4% of the nation's GDP in 2011. In addition to that, the Vanguard (2015a) established that in 2014 the contribution of oil to the Nigerian economy amount to over $73 billion to the GDP. In comparison with the non-oil and gas sector, on the other hand, it was discovered that in 2013 a contribution of 2.6% - GDP was recorded from the non-oil sector (Vanguard 2015b). From this analysis, it is apparently clear that the Nigerian GDP strength is derived from oil revenues and that

the contributions of the real sector economy in Nigeria is quite negligible. With this analysis one can argue on the fact that the cumulative contributory impacts of non-oil sector in Nigeria are not sufficient to drive the country's GDP growth rate up or down but could only help sustain internal demand and reduce import at a minimal rate (FinItell, 2014). Same conclusion was observed in the study of Ugbede et al. (2013) were the authors established that the non-oil balance of trade and the private sector in Nigeria provides an insignificant contribution to the GDP.

To support the arguments above, FinItell (2015) reported that the recent development in the international fall in oil prices, Nigeria lost N77.2 billion (i.e.,USD38.6b) from oil revenue in 1-month in 2014. In addition to that the CBN lamented that the development in continued oil price surge will undoubtedly bring down the progressive growth rate of the country's GDP if the trend in oil prices continue to deteriorate. Income from crude oil sales in the month of September, 2014 was reported to have dropped by 14.11% i.e. from N547.2b to N470b. This situation created a very difficult economic moment to the country, suggesting that it is only oil revenue that has the potency of driving and sustaining Nigerian GDP up or down considering the negligible contributions of the country's real sector.

Finally from the lessons discovered in this study, it is apparently clear to mention that, maintaining a feasible and effective money growth rate could be the cardinal factor towards minimizing real overvaluation particularly if supported by in increased productivity and significant reduction in the dependence of oil price revenue (which is very difficult in the short-run and very difficult for a developing country). To ensure this, we propose that Nigeria should diversify its economy, eliminate all forms of capital control as this will greatly reduce the sensitivity of currency crises to changes in real factors that spur RER overvaluation; doing so will, to a large extent, decrease the sensitivity of currency crises to variations in RER and variations in real GDP growth. This study also indicates that there is a pressing requirement for increased flexibility of exchange rates, as this is known to assist in preventing sustained overvaluation. In addition to this, the buildup of international reserves should be encouraged as this will help in limiting the vulnerability of the country to major forms of financial shock. Finally, we recommend the establishment of frameworks that are consistent to spurring the international demand of the local currency as this will help greatly in enhancing international competitive wherewithal of the country and will enable the revitalization of the economy and the local currency. For all this to happen, the country need to invest heavily in internal security issue, provide infrastructural base that are necessary to the fulcrum of successful economic activities and that will help regain back international investors' confidence to partake in rejuvenating the productive sectors of the Nigerian economy.

REFERENCES

Acquah, H., Carlo, M. (2010), Comparison of Akaike information criterion (AIC) and Bayesian information criterion (BIC) in selection of an asymmetric price relationship. Journal of Development and Agricultural Economics, 2(1), 1-6.

Aflouk, N., Jeong, S., Mazier, J., Saadaou, J. (2010), Exchange rate misalignments and world imbalances: a FEER approach for emerging countries, online. Available from: http://www.univ-paris13.fr/CEPN/IMG/pdf/wp2010_12.pdf.

Aghion, P., Bacchetta, P., Banerjee, A. (2000), Currency crises and monetary policy in an economy with credit constraints. European Economic Review, 45(7), 1121-1150.

Aghion, P., Bacchetta, P., Banerjee, A. (2001), A Corporate Balance-Sheet Approach to Currency Crises (CEPR Discussion Papers. 3092).

Agu, C. (2002), Real exchange rate distortions and external balance position of Nigeria: issues and policy options. Journal of African Development, 5(2), 20-47.

Bénassy-Quéré, A., Duran-Vigneron, P., Lahrèche-Révil, A., Mignon, V. (2004), Burden-sharing and exchange rate misalignments within the Group of Twenty, CEPII Working Paper No. 2004-13, Paris.

Bordo, M.D., Meissner, C.M. (2015), Fiscal and Financial Crises. Available from: http://www.mysearch.sweetpacks.com/?barid=1590556327151992831&src=95&&st=23&i=48&did=10844. [Last retrieved on 2015 Apr 22].

Cavallo, M., Kisseleve, K., Perry, F., Roubini, N. (2002), Exchange rate overshooting and costs of Floating. New York: Mimeo, New York University.

CBN. (2007a), Brief on the determination of the optimum exchange rate band under the IFEM, External Sector Division of the Research Department, Central Bank of Nigeria.

CBN. (2007b), The extent of Naira exchange rate misalignment, Research and Statistics Department, Central Bank of Nigeria, October.

CBN. (2008), The changing structure of the Nigerian economy and implications for development, Revised edition, Research Department, Central Bank of Nigeria (forthcoming).

Cham, T. (2010), Real exchange rate misalignment in WAMZ countries. Journal of Economic Cooperation and Development, 31(4), 77-102.

Clark, P.B., MacDonald, R. (1998), Exchange rates, and economic fundamentals: a methodological comparison of BEERs and FEERs, Working Paper Rep. No. 98/67, Washington, DC: International Monetary Fund.

Dibooglu, S. (1996), Real disturbances, relative prices and purchasing power parity. Journal of Macroeconomics, 18, 69-87.

Dufrenot, G., Yehoue, E. (2005), Real Exchange Rate Misalignment: a Panel Co-Integration and Common Factor Analysis (IMF Working Paper 05/164). Washington: an International Monetary Fund.

Edwards, S. (1988), Macroeconomic policies, real exchange rate misalignment and devaluation, National Bureau for Economic Research, UCLA Working Paper No. 509.

Edwards, S. (1989), Tariffs, capital controls and equilibrium real exchange rates. The Canadian Journal of Economics, 22(1), 79-92.

Eichengreen, B., Rose, A., Wyplosz, C. (1995), Exchange market mayhem: the antecedents and aftermath of speculative attacks. Economic Policy, 10, 249-312.

Faruquee, H. (1995), Long-run determinants of the real exchange rate: a stock-flow perspective. IMF Staff Papers, 42(1), 80-107.

FinItell. (2014), Structural analysis of the Nigerian economy. Available from: http://www.myfinancialintelligence.com/banking-and-finance/sectoral-analysis-nigeria s-economy. [Last retrieved on 2015 May 11].

FinItell. (2015), Nigerian oil revenue dip by N77billion. Available from: http://www.myfinancialintelligence.com/banking-and-finance/nigeria-oil-revenue-dips-n77billion. [Last retrieved 2015 May 11].

Frankel, J.A., Rose, A.K. (1996), Currency crashes in emerging markets: an empirical treatment. Journal of International Economics, 41(3), 351-366.

Frankel, J.A., Rose, A. (1996), Currency crashes in emerging markets: empirical indicators, NBER WP5437.

Fratzscher, M. (2009), US shocks and global exchange rate conjurations. Economic Policy, 2008, 363-409.

Frenkel, J.A., Mussa, M. (1988), Exchange rates and the balance of payments. In: Jones, R., Kenen, P., editors. Handbook of International Economics. Vol. 2. Amsterdam: Elsevier Science.

Glick, R., Guo, X., Hutchison, M. (2006), Currency crises, capital-account liberalization, and selection bias. The Review of Economics and Statistics, 88(4), 698-714.

Iossifov, P., Loukoianova, E. (2007), Estimation of a behavioral equilibrium exchange rate model for Ghana, IMF Working Paper WP/07/155, Washington: International Monetary Fund.

Jeong, S.E., Mazier, J., Saadaoui, J. (2010), Exchange rate misalignments at world and European levels: a FEER approach. International Economics, 121(1), 25-58.

Jongwanich, J. (2009), Equilibrium real exchange rate, misalignment, and export performance in developing Asia. Asian Development Bank Economics Research Paper Series. (151).

Kaminsky, G., Reinhart, C. (1999), The twin crises: the causes of banking and balance-of-payments problems. American Economic Review, 89, 473-500.

Kaminsky, G., Reinhart, C. (2003), The center and the periphery: the globalization of Financial turmoil. NBER Working Paper 9479, February.

Kemme, D.M., Roy, S. (2005), Real exchange rate misalignment: prelude to crisis? Fogelman College of Business and Economics, The University of Memphis, Memphis, TN 38152, United States, Online. Available from: http://www.elsevier.com/locate/ecosys/2010/9.

Krugman, P. (1999), Balance sheets, the transfer problem, and financial crises. In: International Finance and Financial Crises. Netherlands: Springer. p31-55.

Lütkepohl, H. (2006), Structural vector autoregressive analysis for cointegrated variables. Berlin Heidelberg: Springer.

MacDonald, R. (1997), What determines real exchange rates? The long and short of it, IMF Working Paper WP/97/21. Washington, D.C: International Monetary Fund.

MacDonald, R., Ricci, L. (2003), Estimation of the equilibrium real effective exchange rate for South Africa, IMF Working Paper WP/03/44, Washington: International Monetary Fund.

Maeso–Fernandez, F., Osbat, C., Schnatz, B. (2002), Determinants of the euro real effective exchange rate: a BEER/PEER approach. Australian Economic Papers, 41(4), 437-461.

Milesi-Ferretti, G.M., Razin, A. (1996), Current account sustainability: selected East Asian and Latin American experiences, NBER Working Paper No. 5791.

Milesi-Ferretti, G.M., Razin, A. (1998), Current account reversals and currency crises: empirical regularities, NBER Working Paper No. 6620.

Ng, S., Perron, P. (2001), Lag length selection and the construction of unit root tests with good size and power. Econometrica, 69(6), 1519-1554.

Obaseki, P.J. (2001), The purchasing power parity (PPP) measure of Naira's equilibrium exchange rate. CBN Economic and Financial Review, 36(1), 1-21.

Omotosho, B.S., Wambai, M.U. (2005), Is the Naira misaligned? Central Bank of Nigeria.

Rafindadi, A.A., Yusof, Z. (2013), Is financial development a factor to the leading growth profile of the South African economy? measuring and uncovering the hidden secret. International Journal of Economics and Empirical Research, 1(9), 99-112.

Rafindadi, A.A., Yusof, Z. (2014a), Are the periods of currency collapse an impediment to entrepreneurship and entrepreneurial haven? evidence from regional comparison. International Journal of Economics and Financial Issues, 4(4), 886-908.

Rafindadi, A.A., Yusof, Z. (2014b), Are linear and nonlinear exchange rate exposures aggravating agents to corporate bankruptcy in Nigeria? new evidence from the "U" test analysis. International Journal of Economics and Financial Issues, 5(1), 212-229.

Rafindadi, A.A., Yusof, Z. (2015), Do the dynamics of financial development spur economic growth in Nigeria's contemporal growth struggle? a fact beyond the figures. Quality and Quantity, 49(1), 365-384.

Rano, S.U. (2009), Real exchange rate misalignment: an application of behavioral equilibrium exchange rate (BEER) to Nigeria. Available at Social Science Research Network. SSRN-id1333642

Sidek, N.Z.M., Yusoff, M. (2009), An empirical examination of Ringgit (RM) equilibrium exchange rate and misalignment, 10th International Business Conference, Dubai, UAE. 16-17 April.

Soludo, C.C., Adenikinju, A.F. (1997), Exchange rate misalignment and investment in Nigeria, Paper Presented to OECD Development Centre, Paris.

Ugbede, O., Lizam, M., Kaseri, A., Robert, M.S. (2013), Does oil and non-oil balance of trade impact similarly on Malaysia and Nigeria GDP? International Conference on Economic, Finance and Management Outlook (ICFEMO) 6-8th December, 2013. Pearl International Hotel, Kuala Lumpur.

Vanguard. (2015a) Oil sector's contribution to GDP drops to 8.97%. Available from: http://www.vanguardngr.com/2015/02/oil-sectors-contribution-to-gdp-drops-to-8-97/. [Last retrieved on 2015 May 13].

Vanguard. (2015b), Petroleum to contribute $108bn to Nigeria's GDP — McKinsey Report. Available from: http://www.vanguardngr.com/2014/07/petroleum-contribute-108bn-nigerias-gdp-mckinsey-report/. [Last retrieved 2015 May 13].

APPENDIX A

Appendix Table A1: Trends in BEER, PEER and degree of exchange rate misalignment

Year	REER	BEER	PEER	Residual	Misalignment	Outcome
1980Q1	4.3913	3.5366	3.8179	0.8547	15.0194	Overvaluation
1980Q2	4.4359	3.6369	3.8628	0.799	14.8379	
1980Q3	4.4736	3.7352	3.9075	0.7383	14.4877	
1980Q4	4.505	3.8311	3.9517	0.6739	14.0006	
1981Q1	4.5306	3.9239	3.995	0.6067	13.407	
1981Q2	4.5509	4.0129	4.0369	0.538	12.7337	
1981Q3	4.5662	4.0969	4.0768	0.4693	12.0048	
1981Q4	4.5767	4.1734	4.1142	0.4034	11.2418	
1982Q1	4.5454	4.1652	4.1485	0.3802	9.5657	
1982Q2	4.5617	4.2324	4.1793	0.3294	9.1506	
1982Q3	4.5879	4.3034	4.206	0.2845	9.0795	
1982Q4	4.623	4.37	4.2281	0.253	9.34	
1983Q1	4.6509	4.4287	4.2453	0.2222	9.5543	
1983Q2	4.7078	4.4612	4.2572	0.2467	10.5843	
1983Q3	4.7755	4.4714	4.2637	0.3041	12.0043	
1983Q4	4.8517	4.4614	4.2646	0.3903	13.7675	
1984Q1	5.0273	4.4058	4.26	0.6215	18.0113	
1984Q2	5.0736	4.3825	4.2501	0.6911	19.3762	
1984Q3	5.095	4.3547	4.2352	0.7403	20.3013	
1984Q4	5.0929	4.3213	4.2156	0.7717	20.8119	
1985Q1	5.0553	4.3364	4.1917	0.7189	20.6026	
1985Q2	5.0086	4.2651	4.1641	0.7435	20.2823	
1985Q3	4.9382	4.179	4.1332	0.7591	19.4753	
1985Q4	4.8387	4.0882	4.0999	0.7505	18.0212	
1986Q1	4.6117	3.9414	4.0646	0.6703	13.4595	
1986Q2	4.4444	3.8832	4.0282	0.5612	10.3322	
1986Q3	4.2538	3.8412	3.9912	0.4126	6.5812	
1986Q4	4.0313	3.8128	3.954	0.2185	1.9541	
1987Q1	3.598	3.8142	3.9172	−0.2163	−8.1494	Undervaluation
1987Q2	3.2791	3.8041	3.881	−0.525	−15.509	
1987Q3	2.9914	3.7973	3.8456	−0.8059	−22.212	
1987Q4	2.8101	3.7929	3.8113	−0.9828	−26.27	
1988Q1	3.2359	3.846	3.7783	−0.6101	−14.355	
1988Q2	3.2301	3.8203	3.7467	−0.5902	−13.788	
1988Q3	3.2171	3.7799	3.7168	−0.5627	−13.442	
1988Q4	3.1967	3.7318	3.6887	−0.5351	−13.338	
1989Q1	3.1416	3.7105	3.6627	−0.5689	−14.229	
1989Q2	3.1146	3.6487	3.6393	−0.5341	−14.417	
1989Q3	3.0901	3.5809	3.6187	−0.4907	−14.606	
1989Q4	3.0683	3.5089	3.6013	−0.4405	−14.799	
1990Q1	3.0689	3.3699	3.5874	−0.3011	−14.454	
1990Q2	3.0454	3.3217	3.5773	−0.2764	−14.869	
1990Q3	3.0167	3.2892	3.5711	−0.2725	−15.527	
1990Q4	2.9823	3.27	3.5689	−0.2877	−16.437	
1991Q1	2.9276	3.2334	3.5703	−0.3058	−18.002	
1991Q2	2.8851	3.2501	3.5751	−0.3649	−19.299	
1991Q3	2.8414	3.2887	3.5826	−0.4473	−20.69	
1991Q4	2.7962	3.3539	3.592	−0.5578	−22.156	
1992Q1	2.7063	3.7222	3.6024	−1.0159	−24.875	
1992Q2	2.6742	3.8838	3.6126	−1.2096	−25.976	
1992Q3	2.6603	4.0645	3.6216	−1.4042	−26.542	
1992Q4	2.6655	4.2613	3.6284	−1.5958	−26.538	
1993Q1	2.6021	3.5723	3.6324	−0.9702	−28.365	
1993Q2	2.6815	3.5712	3.6336	−0.8897	−26.203	
1993Q3	2.8026	3.6253	3.6315	−0.8227	−22.826	
1993Q4	2.9515	3.755	3.6259	−0.8035	−18.6	
1994Q4	3.4253	4.0994	3.6165	−0.6741	−5.2886	
1995Q1	3.2251	3.8972	3.6031	−0.6721	−10.491	
1995Q2	3.2058	3.8021	3.5858	−0.5963	−10.598	

(Contd...)

Appendix Table A1: Contd....

Year	REER	BEER	PEER	Residual	Misalignment	Outcome
1995Q3	3.2123	3.7202	3.5648	−0.5079	−9.8886	
1995Q4	3.2443	3.6315	3.5406	−0.3873	−8.3701	
1996Q1	3.3616	3.3684	3.5136	−0.0069	−4.3273	
1996Q2	3.4089	3.3125	3.4845	0.0964	−2.1692	
1996Q3	3.4524	3.2816	3.4536	0.1708	−0.0353	
1996Q4	3.4925	3.2727	3.4214	0.2198	2.0772	Overvaluation
1997Q1	3.5298	3.3435	3.3881	0.1864	4.1835	
1997Q2	3.5638	3.3561	3.3538	0.2077	6.2615	
1997Q3	3.5951	3.3678	3.3188	0.2273	8.3273	
1997Q4	3.6239	3.3785	3.283	0.2454	10.3837	
1998Q1	3.7392	3.576	3.2468	0.1632	15.1674	
1998Q2	3.7277	3.5013	3.2103	0.2264	16.1187	
1998Q3	3.6792	3.3737	3.1739	0.3055	15.9207	
1998Q4	3.5879	3.216	3.1383	0.3719	14.3258	
1999Q1	3.1929	2.8526	3.1042	0.3403	2.8575	
1999Q2	3.0285	2.7487	3.0723	0.2798	−1.4281	Undervaluation
1999Q3	2.9029	2.6849	3.0434	0.218	−4.6191	
1999Q4	2.8356	2.6591	3.0179	0.1765	−6.0411	
2000Q1	2.992	2.7707	2.9959	0.2213	−0.1276	
2000Q2	3.0016	2.8192	2.9774	0.1825	0.8154	Overvaluation
2000Q3	3.0173	2.8655	2.9622	0.1518	1.8599	
2000Q4	3.0388	2.9021	2.9502	0.1367	3.003	
2001Q1	3.0967	2.9709	2.9409	0.1258	5.2972	
2001Q2	3.1157	2.9886	2.9341	0.127	6.1887	
2001Q3	3.1279	2.9839	2.9293	0.144	6.7799	
2001Q4	3.1338	2.9569	2.9264	0.1769	7.0864	
2002Q1	3.1255	2.7621	2.925	0.3635	6.8568	
2002Q2	3.1217	2.7631	2.9248	0.3586	6.7316	
2002Q3	3.1146	2.8044	2.9256	0.3102	6.4592	
2002Q4	3.1041	2.8841	2.9269	0.22	6.0538	
2003Q1	3.0685	3.2227	2.9281	−0.1541	4.794	
2003Q2	3.0593	3.2874	2.9288	−0.2281	4.4564	
2003Q3	3.0554	3.3031	2.9285	−0.2477	4.3323	
2003Q4	3.0567	3.2737	2.9271	−0.2169	4.4287	
2004Q1	3.058	3.0563	2.9247	0.0017	4.5594	
2004Q2	3.0721	3.0092	2.9216	0.0629	5.1502	
2004Q3	3.0931	2.9785	2.9182	0.1146	5.9947	
2004Q4	3.1207	2.9631	2.9149	0.1577	7.062	
2005Q1	3.1801	2.9965	2.9122	0.1836	9.199	
2005Q2	3.2084	2.9949	2.9107	0.2136	10.2294	
2005Q3	3.2326	2.9949	2.9108	0.2377	11.0541	
2005Q4	3.2529	2.9977	2.9133	0.2552	11.6568	
2006Q1	3.2749	2.9694	2.9188	0.3055	12.2026	
2006Q2	3.2859	2.9968	2.9279	0.2891	12.227	
2006Q3	3.2915	3.0396	2.9415	0.252	11.8982	
2006Q4	3.2918	3.0967	2.9604	0.1952	11.1951	
2007Q1	3.253	3.2324	2.9854	0.0206	8.9627	
2007Q2	3.2561	3.2929	3.0175	−0.0368	7.9082	
2007Q3	3.2674	3.3421	3.0577	−0.0747	6.8584	
2007Q4	3.2866	3.3798	3.1073	−0.0932	5.7698	
2008Q1	3.3588	3.4121	3.1679	−0.0533	6.0266	
2008Q2	3.3735	3.4245	3.2409	−0.051	4.0922	
2008Q3	3.378	3.4228	3.3282	−0.0449	1.4952	
2008Q4	3.3723	3.4069	3.4317	−0.0346	−1.7311	Undervaluation
2009Q1	3.3068	3.2863	3.5532	0.0205	−6.9345	
2009Q2	3.2992	3.278	3.6948	0.0212	−10.708	
2009Q3	3.301	3.2918	3.8582	0.0092	−14.443	
2009Q4	3.3121	3.328	4.0449	−0.0159	−18.116	
2010Q1	3.3638	3.4866	4.256	−0.1228	−20.965	
2010Q2	3.3795	3.5295	4.4923	−0.15	−24.772	
2010Q3	3.3915	3.5543	4.754	−0.1628	−28.659	
2010Q4	3.4	3.5609	5.0406	−0.1609	32.547	
2011Q1	3.4051	3.5501	5.3511	−0.145	36.367	
2011Q2	3.4067	3.5232	5.6834	−0.1166	40.059	

(Contd...)

Appendix Table A1: Contd....

Year	REER	BEER	PEER	Residual	Misalignment	Outcome
2011Q3	3.4049	3.482	6.0343	−0.0771	43.574	
2011Q4	3.3998	3.4279	6.3993	−0.0281	46.873	

The variations in residual can be seen to be very volatile and makes our equilibrium unbalanced. We have used HP filter to smoothen the BEER to attain PEER. The measurement of misalignment depends upon the permanent or unstable values of the determinants. We have measured degree of exchange rate misalignment using the formula [(RER)-(PEER)/PEER]*100. We have reported the degree of misalignment on Nigeria in Appendix Figure A4 and Table 4 were both indicates the maximum, minimum and average values of degree of overvaluation and undervaluation in the case of Nigeria and this was derived from Appendix A following the trend of BEER and PEER and exchange rate misalignment in Nigeria. BEER: Behavioral equilibrium exchange rate, PERR: Permanent equilibrium exchange rate
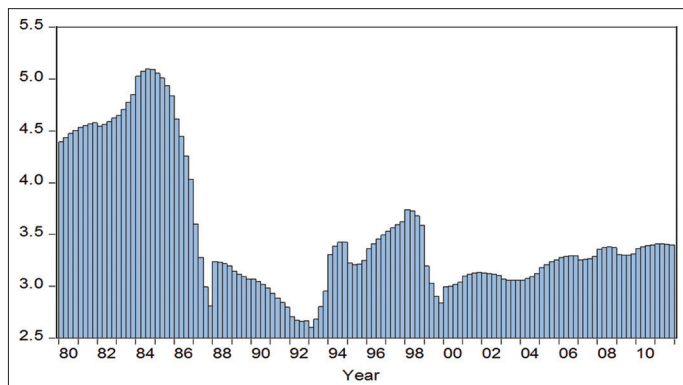
Figure A1: Real equilibrium exchange rate
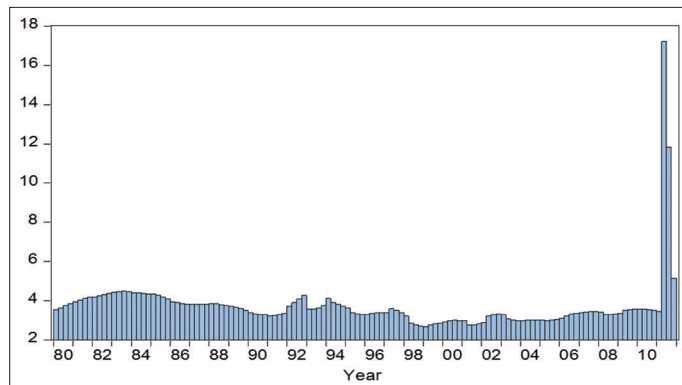

Figure A2: Behavioral equilibrium exchange rate

Figure A3: Permanent equilibrium exchange rate
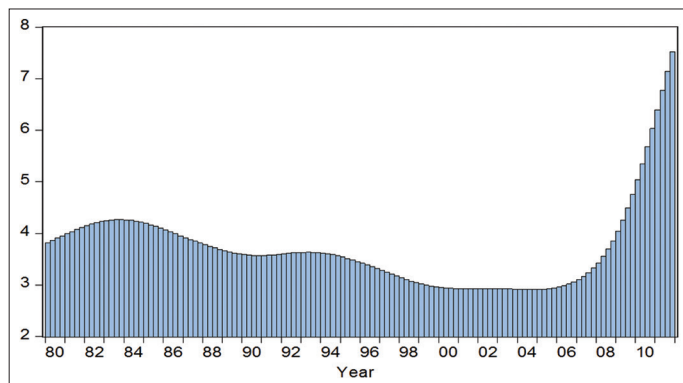

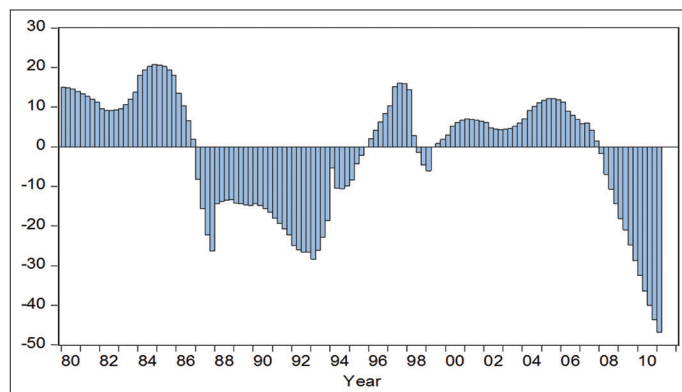**Figure A4:** The degree of exchange rate misalignment

Figure A5: The difference between real equilibrium exchange rate and behavioral equilibrium exchange rate