AN EMPIRICAL ANALYSIS OF REAL EXCHANGE RATE MISALIGNMENT AND EXPORT DIVERSIFICATION IN NIGERIA

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ABSTRACT

This paper empirically explores the relationship between real exchange rate misalignment and export diversification in Nigeria over the period 1995q1 to 2014q4. The link between exchange rate misalignment and diversification is highly debated and the empirical evidence highly debated. Based on this lack of consensus, this paper used two different measures of real exchange rate misalignment (fundamental equilibrium exchange rate approach and behavioural equilibrium exchange rate approach) to substantiate the robustness of our conclusion. This paper seeks to contribute to the debate by using the Toda-Yomamato causality and bound testing approach to cointegration. The result of the cointegration test shows evidence of long run relationship between our variables of interest. The findings shows that export diversification Granger-cause exchange rate misalignment, this suggest that export diversification effort could reduce unwarranted movement in real exchange rate, thereby reducing exchange rate misalignment. The result also suggest that there is causality running from misalignment (feer) to export diversification, which provide ample evidence that deliberate effort to alter the equilibrium exchange rate (misalignment) could yield positive result in the export diversification effort. The policy implication of the result is that export diversification is a viable option for Nigeria to reduce unwarranted movement in exchange rate.

JEL Codes: O24, F10, 014

1. Introduction

DIVERSIFICATION is a process whereby an economy expands its range of products, markets and sources of income. Export diversification has remained an important policy issue not only for commodity exporting countries like Nigeria, but also for many countries that are poor in natural resources and have low shares of sophisticated manufactures in total export (Sekkat, 2016). There are several reasons to study export diversification in a commodity exporting country like Nigeria: First is that oil resources are finite and evidence has shown that both the price of and the demand for oil have fluctuated considerably in the last few decades, resulting short-run export revenue volatility which has detrimental effects on domestic investment. Second, vertically diversified exports, especially export of manufactured products, are likely to grow faster when the global economy is expanding, because of the higher income elasticity of demand for manufactures (Nouira, Plane and Sekkat, 2010). In addition, dynamic productivity gains are much higher in manufacturing than non-manufacturing production (UNIDO, 2013). Other reasons are: improvement in terms of trade, economies of scale and external economies, especially those associated with manufacturing, foreign exchange risk due to supply gap in the foreign exchange market, as well as depletion of foreign reserves. All these have provided the rationale to pursue export diversification as an expedient policy to achieve higher growth and exchange rate stability.

Export diversification has been considered a crucial factor to development process in Nigeria; as such, several policies have been implemented in the past as an attempt to engender structural shift from oil to non-oil export. For instance, the import substitution strategy is an attempt to achieve higher growth through industrialization. However, the failure of the import substitution strategy due to high trade barriers and distorted relative prices led to a major policy shift in the mid-1980s that saw the implementation of structural adjustment programme (SAP). Subsequently, trade liberalization policy and exchange rate management were seen as an instrument to enhance growth by moving from primary commodity exports to manufactured exports. This is because currency misalignments disrupt the pattern of specialization and trade based on comparative advantage and can lead to the adoption of dangerous protectionist measures (Salvatore, 2005).

Earlier literature on exchange rate management viewed it as an instrument to adjust the whole economy to changes in variables affecting a country's long term internal and external balance (see Edward, 1988). The philosophical trust of this approach is that actual exchange rate should be as close as possible to its equilibrium value. Although, other mainstream economist challenge this equilibrium thesis by opting for the disequilibrium approach also known as misalignment (see Rodrik, 2008; Freund and Pierola, 2012; Rajan and Subramanian, 2011). The failure recorded in the diversification effort of many developing countries in the 1980s has been attributed to exchange rate overvaluation (Sekkat, 2016). Empirical study by Wondemu and Potts (2016) found support for harmful effect of overvaluation to export while undervaluation boost export supply as well as export diversification.

The literature on the link between exchange rate misalignment and export diversification is limited especially in Nigeria. This issue has been considered within the context of cross-country studies without accounting for country-specific characteristics—see Wondemu and Potts (2016) for Ethiopia and Tanzania; Sekkat and Varoudakis (2000) for 22 African countries; Nouira, Plane and Sekkat (2010) for 52 developing countries; Sekkat (2016) for 55 Africa, Latin America and Asian countries. To my knowledge, no previous research has been carried out in Nigeria on the crucial nexus between diversification and exchange rate misalignment. In this regard, Bassey (2012) and Osakwe (2007) analysed the issue of diversification with no emphasis on exchange rate misalignment, while Yusuf and Edom (2007), Rano (2007) and Folawuyo and Olakojo (2010) analysed export demand and supply function with little emphasis on export diversification. These studies did not take into cognizance the disruptive effect of currency misalignments on the pattern of specialization, trade and diversification. As such, this work contributes to the debate on exchange rate misalignment and diversification nexus by considering two different measures of exchange rate misalignment: behavioural equilibrium exchange rate (BEER) and the fundamental equilibrium exchange rate (FEER).

To achieve the objective of this paper, the methodological approach is carried out in two stages. First, the auto-regressive and distributed lag method ARDL is use to estimate the (BEER) model, while the fundamental equilibrium exchange rate (FEER) model is estimated with the use of vector auto-regressive method VAR, the misalignment series is computed there-after from both models. Second, the Toda and Yamamoto (1995) vector autoregression-based granger non-causality test is used to ascertain the causal link between the misalignment series and export diversification. This becomes necessary since the misalignment series are $I(0)$ and the procedure is applicable regardless of whether a series is $I(0)$ or $I(1)$.

The contribution of this work to the debate is that it used two different measures of misalignment to evaluate its effect on export diversification, these include; behavioural equilibrium exchange rate BEER and the fundamental equilibrium exchange rate FEER, using both causality tests and standard regression analyses. A number of robustness checks have been conducted. To achieve the objective, the paper is structured into five sections: Section one deals with the introduction, while section two is concerned with styled facts and literature review. Section three looks at the methodology; in four, the empirical results are presented and discussed, while five concludes the paper.

2. Stylized Fact and Literature Review

Figure 1 plots the trends of manufacturing value added (output) as a percentage of GDP. The data show that manufacturing value added as a percentage of GDP (MVA) did not change significantly from 1981 to 2014. For instance, between 1981 and 1985, the MVA was 9.64% of GDP, falling drastically to 3.31% of GDP between 2006 and 2010. However, between 2011 and 2014 it increased to 8.00% of GDP. Agricultural value added as a percentage of GDP shows a similar trends indicating that there is no significant changes from 1981 to 2014, its share GDP stood at 35.11% between 1981 and 1985 it rose to 38.40% between 2001 and 2005, and later fell to 21.78% of GDP between 2001 and 2005. However, trends in the manufactured export as a percentage of total merchandise export grew marginally between 1981 and 2014, which suggests that the contribution the contribution of the manufacturing sector to total export has been marginal throughout the study period. The share of oil export as a percentage of total export ranged between 93.36% and 97.68% of total export.

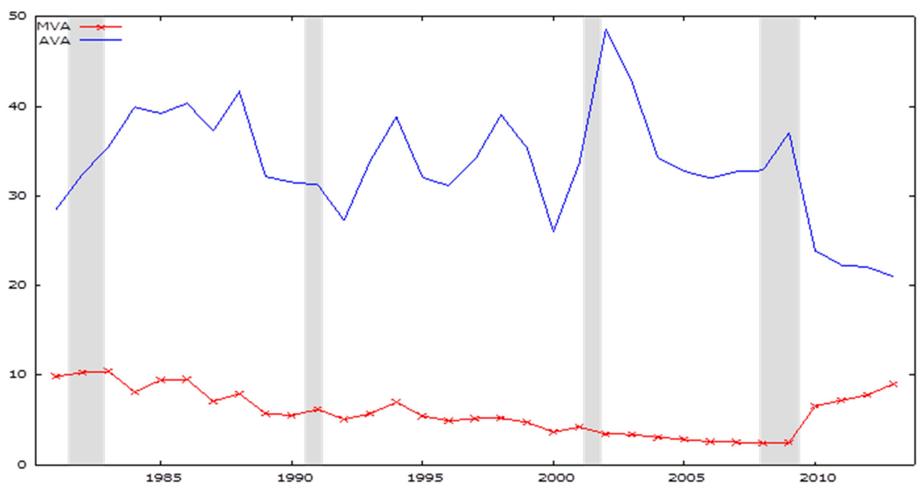

Figure 1: Trends of manufacturing value added and agricultural value added

As countries develop, the manufacturing and service sector tend to grow faster, compared with the primary sectors. If this pattern is not reversed, the structure of the economy will continue to be dominated by the oil sector, thus hurting future growth prospects. Overall, the trend shows that Nigeria has made little progress towards increasing the share of manufacturing in GDP during the sample period. This is indicative of low level of industrialization in Nigeria, as the structure of the economy changes, more industries will spring up bringing about growth in the country's income and thus, improvements in standard of living. High-income countries usually are more industrialized, and the manufacturing sector's share in GDP is higher in these countries, compared to less developed ones. As countries develop, the manufacturing and service sectors tend to grow faster, compared to the primary sectors.

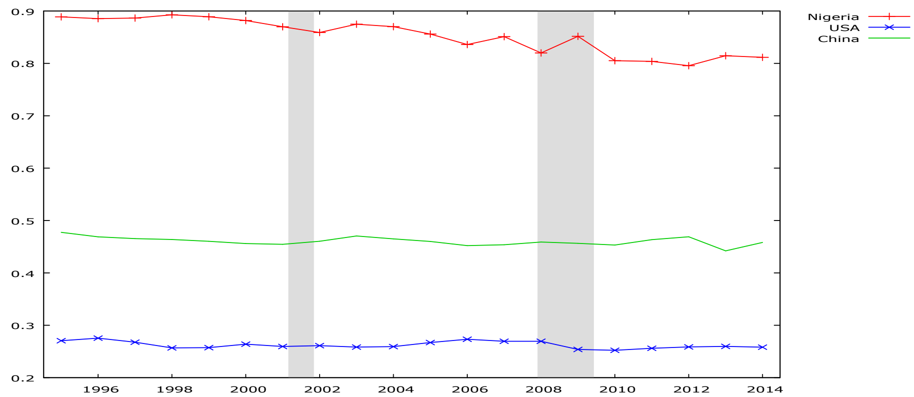

Figure 2: Trends of diversification for Nigeria, USA and China
Source: UNCTAD Statistics

Figure 2 shows the trend in the diversification index[1]. The index is bounded by 0 to 1, and a high value of the index indicates that the country is specialized in the production of a few goods. The index is simply the sum of the squares of the market shares for each industry and it is always less than one. The export diversification index illustrated in figure 2 for an emerging market is represented by China, while a resource-based developing economy is Nigeria. From the index, Nigeria is high-up close to 1 indicating high level of concentration on commodity export. The low value of the index in both emerging and developed countries shows high level of technological sophistication of the products from these countries, indicating a highly diversified export base. The relation between diversification and real effective exchange rate (REER) show some remarkable pattern. For instance, a rise in REER in most of the periods is related to a rise in diversification index (high concentration of export), while a fall in REER leads to a fall in diversification index (low concentration of export). This suggests a link between real exchange rate and export diversification. In addition to the graphical exposition of the variables of interest, a tabular representation of manufactured export, manufacturing value added, agricultural value added and oil export is presented in table 1. A close inspection of the table reveals that there is high oil export intensity throughout the study period compared to manufactured export that accounted for marginal contribution.

[1]UN Council on Trade and Development's (UNCTAD) export diversification index is based on the Herfindahl-Hirschman index given as $\frac{\sum_{k=1}^{k}(S_k)^2-\frac{1}{k}}{1-\frac{1}{k}}$

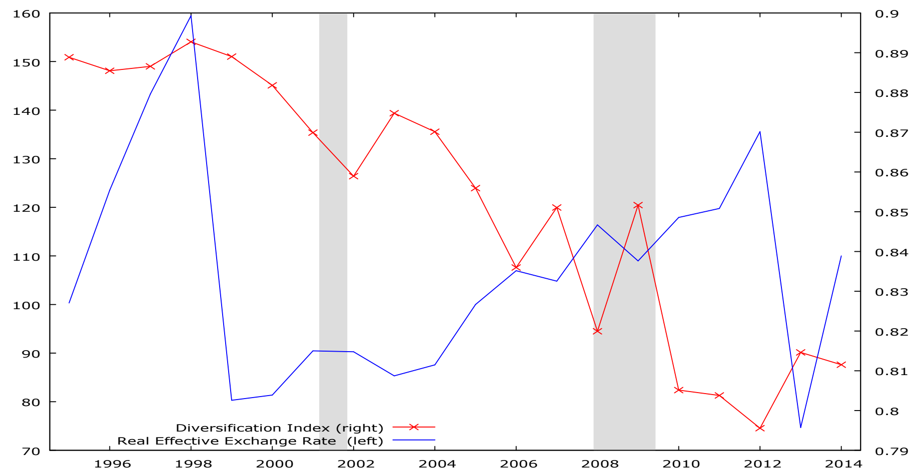

Figure 3: Trend of diversification and real effective exchange rate

Table 1: Trends of manufactured export (MX), manufacturing value added (MVA), agricultural value added (AVA) and oil export (OX) in percentages

Year	*MX*	*MVA*	*AVA*	*OX*
1981-1985	0.05	9.64	35.11	96.69
1986-1990	0.22	7.16	36.58	93.96
1991-1995	0.50	5.88	32.65	97.36
1996-2000	1.55	4.74	33.11	97.68
2001-2005	2.61	3.38	38.40	97.22
2006-2010	3.86	3.31	31.70	95.80
2011-2014	2.94	8.00	21.78	93.36

Source: Computed based on data from World Development Indicators (WDI data base, 2015)

The theoretical relationship between trade and economic growth is deeply rooted in Adams Smith's theory of absolute advantage in the late eighteenth century. Smith stated that increasing specialization and division of labour, coupled with international exchange would contribute to raise welfare and growth of a nation. To him, a sudden shift in trade policy that opens up new trade provides an immediate gain in real per capita income, which, in turn, accelerates technological progress and increases the rate of economic growth (Van den Berg and Lewer, 2007). David Ricardo's theory of comparative advantage showed that under perfect competition and the full employment of resources, countries engaged in trade can obtain gains by specializing in the production of those goods with the lowest opportunity cost, and trading the surplus of production over domestic demand (Thirlwall 2000). In other words, diversification plays no role in the standard neoclassical model (Adams Smith-David Ricardo and the standard Heckscher-Ohlin trade models).

This is because the underlying building block of these models is the idea that countries should specialize domestically according to comparative advantage. Under the classical model, a country will specialize in sectors in which it has a comparative advantage.

The shift[2] in emphasis from the static gains from trade to dynamic ones in which the increased investment, knowledge and technology associated with increased productivity growth can transform trade patterns and accelerate overall economic growth constitutes the theoretical basis for the new trade theory à la Helpman and Krugman (1985) and generalized by Grossman and Helpman (1991). In the new theory, specialization is a result of scale and concomitant efficiencies. The debate over the quality of growth in Africa has continued to dominate mere increase in gross output in both commodity and non-commodity export (Vera and Winkler, 2012). The need for Africa to diversify its export base away from less sophisticated primary commodities into high-productivity sectors such as manufacturing in order to enjoy faster growth is popularized by the work of Hausman, Hwang and Rodrik (2006) who developed an indicator that measures the productivity associated with a country's export basket. Diversification is a process whereby an economy expands its range of sectors/product, markets as well as its sources of income. The main objective of diversification is to create a stable and sustainable level of income at a relatively high level.

The last few decades have witnessed tremendous growth success of some middle income countries, with the exception of some few Asian countries that could not sustain the growth process to move beyond the middle income status. This trend, according to Lin and Treichel (2012), is due to lack of diversification towards more differentiated and technologically intensive goods that can help trigger dynamic and sustainable growth processes. There are two contending views in favour of higher export diversification: Portfolio and dynamic views, the former more related to the stability and the latter to the long-term sustainability of growth. A 'better' export portfolio can improve long term growth by reducing its volatility along its trend. The 'dynamic' argument is related to 'Schumpeterian' long-term growth, based on a permanent structural transformation, where new products are continually renewing an economy's productivity growth potential (Goya, 2014). There is growing empirical evidence suggesting that competitive and stable real

[2]The theoretical argument underlying the need to shift resources from the primary to secondary sector as the key driver of the development process is attributed to the works of Lewis (1954), Nurkse (1967) and Chenery (1986).

exchange rates (RER) as well as higher export diversification are both associated with output growth. For instance, Eichengreen (2008) and Rodrik (2009) concluded that both real exchange rate level and volatility matter for growth, while evidence on the diversification-growth link is provided by Funke and Ruhwedel (2005) and Mudenda, Choga and Chigamba (2014), among others. Osakwe (2007) and Bassey (2012) opined that export diversification is associated with minimum fluctuations in foreign exchange earnings, increase output, enhance value added and improve the quality of manufactures in Nigeria. Similar study by Songwe and Winkler (2012) used a panel of 30 selected sub-Saharan African countries over the period 1995-2008. The result showed that export diversification has a positive impact on value added, labour productivity and labour demand.

According to Nelson (2013) a currency is said to be misaligned when an actual exchange rate differs from its fundamental or equilibrium value. More specifically, when it is below or above the equilibrium values, the currency is said to be undervalued or overvalued respectively. Some economists, especially with the World Bank and IMF, believe that a currency is misaligned when the exchange rate set by the government, or the official rate, differs from what would be set by the market if the currency were allowed to float freely. By this reasoning, governments that take policy actions to sustain an exchange rate peg, such as intervening in currency markets, most likely have misaligned currencies. Additionally, this view suggests that floating currencies, by definition, cannot be misaligned, since their values are determined by market forces. While export diversification is defined as a change in the composition of a country's existing export product mix or export destination (Ali et al., 1991), 'diversification' is defined in a variety of ways, according to the field of application. The political economy view of diversification refers to exports, and specifically to policies aiming to reduce the dependence on a limited number of export commodities that may be subject to price and volume fluctuations or secular declines (Routledge Encyclopedia, 2001 cited in Hvidt, 2013).

Diversification can take place through either horizontal diversification (new opportunities are sought for new products within the same sector, e.g. mining, energy or agriculture) or vertical diversification, which entails adding more stages of processing of domestic or imported inputs (Hvidt, 2013). The recent focus on diversification is motivated by multiple problems which arise from the developmental issues, particular to the oil and gas-driven economy like Nigeria. This 'allocation state' model, as compared to the productive state model, relies on the sale of hydrocarbons and is characterized by a significant underdevelopment of productive assets. In particular, the presence of abundant natural resources hurts macroeconomic stability, crowds out the manufacturing sector, increases the likelihood of civil unrest, and undermines democratic institutions (Mehlum, Moene and Torvik, 2006; Corden and Neary, 1982; Ross, 2006). It should be noted that this is based on Luciani's distinction between allocative and productive states, as cited in Hvidit (2013). Luciana had said that, because the former relies on exports of oil and gas, the state is not forced to tax the local economy to finance its activities. Thus, because the state has a rent income, it is not under pressure to develop an efficient economic foundation for the society. In contrast, a productive state creates a solid economic foundation for society, which determines the state's ability- through taxation- to strengthen its power nationally and internationally

The literature on exchange rate misalignment is driven by two contesting views: first, the 'Washington consensus' view posits that the value of a currency should be set at a level that is consistent with both internal and external balances. In other words, both overvaluation and undervaluation are inimical to growth (see Williamson 1994, Edwards, 1989). Second, a number of economists (e.g. Rodrik, 2008; Freund and Pierola, 2012; Rajan and Subramanian, 2011) suggest that a disequilibrium situation, generally referred to as misalignment (i.e., letting the actual exchange rate move away from its equilibrium level), might be a second best approach in countries facing other distortions which is the case of many developing countries. This view emanated from the tremendous success recorded in the last few years by China and other East Asian countries and the ensuing debate about the undervaluation of the Chinese Renminbi, compared to the value of the US dollar.

The impact of exchange rate misalignment on export diversification in developing countries is debated and the empirical evidence is conflicting. Sekkat (2016) found some support for the effect of undervaluation on the share of manufactures in total exports. However, no support is found for the effect of misalignment (neither over nor undervaluation) on exports diversification within manufactures; it follows, therefore, that misalignment of any types is not helpful in meeting the major challenge of export diversification. Also, similar studies (Nouira, Plane and Sekkat, 2011) do not reject the hypothesis that, on the average, the countries studied used undervaluation to foster the price competitiveness of manufactured exports within the 1991–2005 sample period. Similar results on the causal link between diversification and exchange rate misalignment were obtained by Freund and Pierola (2012) and Rajan and Subramanian (2011). However, the empirical evidence by Agosin, Alvarez, and Bravo-Ortega (2012) and Levy-Yeyati, Sturzenegger and Gluzmann (2013) failed to establish a clear causal effect of exchange rate misalignment on export diversification.

Using fixed effect model, Wondemu and Potts (2016) assessed the role of real exchange rate in enhancing export supply and promoting export diversification in Ethiopia and Tanzania for the period 1980-2011. The empirical results suggest that, while overvaluation is harmful to exports, undervaluation of the real exchange rate boosts export supply as well as export diversification. Similar result was obtained by Sekkat and Varoudakis (2000) who examined the link between exchange rate management and manufactured export for 22 African countries. Their result suggests that exchange rate management matters for export performance in SSA. In other words, African countries that have been successful in significantly expanding manufactured exports have implemented cautious exchange rate policies, inducing a steadily declining trend in RER overvaluation. Mauritius and Tunisia are good cases in point.

The literature on the link between exchange rate misalignment and export diversification is limited especially in Nigeria. This issue has been considered within the context of cross-country studies without accounting for country-specific characteristics. The literature on diversification-exchange rate misalignment in Nigeria is scarcely pursued. In this regards Bassey (2012) and Osakwe (2007) analysed the issue of diversification with no emphasis on exchange rate misalignment, while Yusuf and Edom (2007), Rano (2007), Folawuyo and Olakojo (2010) analysed export demand and supply function with little emphasis on export diversification. Also, Adenugba and Dipo (2013), Osuntogun, Edordu and Oramah (1997) examined the link between diversification and non-oil export. These studies did not take into cognizance the disruptive effect of currency misalignments on the pattern of specialization, trade and diversification.

3. Methodology

3.1 Data issues and model specification

Quarterly data covering the period 1995-2014 are utilized for the empirical analysis and the variables of interest are as follows: *REER* is real effective exchange rate; *OILB* is oil balance as a percentage of *GDP*; *TOT* is terms of trade; R-R* is real interest rate differential, defined as the differences between the real interest rate of Nigeria and USA; *OPV* is oil price volatility generated on a quarterly basis using the GARCH approach; *RP* is the relative price defined as the ratio of domestic *GDP* in *US*$ and *GDP (PPP)* standard over *US CPI*; *RGDP* is the relative productivity, measured by the ratio of domestic GDP per capita (PPP) standard and the US *GDP* per capita (*PPP*) standard. The data for these 7 variables were obtained from World Economic Outlook (WEO) database published by IMF, while *CAGDP* is current account as a percentage of GDP; *MPR* represents the monetary policy rate; *OPEN* is the openness ratio of the country, defined as *X+M* over *GDP*. These were computed from Central Bank of Nigeria's statistical bulletin of various issues. Finally, the diversification index was obtained from UNCTAD statistical database.

3.2 **Analytical framework and model specification**

Model 1: Behavioural Equilibrium Exchange Rate (BEER)

This paper adopts a modified version of Clark and Macdonald (2004) model of behavioural equilibrium exchange rate (BEER) which identifies an estimated equilibrium relationship between the real effective exchange rate and economic fundamentals. The model departs from the aforementioned by adding oil price volatility, which matters in the determination of real effective exchange rate for an oil-dependent economy like Nigeria. The model is specified as follows:

$$\Delta(reer)_t = \beta_0 + \beta_1(opv)_{t-1} + \beta_2(opp)_{t-1} + \beta_3(mpr)_{t-1} + \beta_4(gcons)_{t-1} + \beta_5(nfa)_{t-1} + \beta_6(\text{tot})_{t-1} + \beta_7(rpro)_{t-1} + \beta_8(\text{r})_{t-1}$$
$$+\beta_9(reer)_{t-1} + \sum_{i=0}^{r}\beta_{10}\Delta(opv)_{t-i} + \sum_{i=0}^{r}\beta_{11}\Delta(opp)_{t-i} + \sum_{i=0}^{r}\beta_{12}\Delta(mpr)_{t-i}$$
$$+ \sum_{i=0}^{r}\beta_{13}\Delta(gcons)_{t-i} + \sum_{i=0}^{r}\beta_{14}\Delta(nfa)_{t-i} + \sum_{i=0}^{r}\beta_{15}\Delta(\text{tot})_{t-i} +$$
$$\sum_{i=0}^{r}\beta_{16}\Delta(rpro)_{t-i} + \sum_{i=0}^{r}\beta_{17}\Delta(\text{r-r*})_{t-i} + \sum_{i=0}^{r}\beta_{18}\Delta(reer)_{t-i} \quad 1$$

The a priori expectation following Clark and Macdonald (2004) and Macdonald (2003) was:

$$REER = f(\overset{+}{nfa}, \overset{\pm}{tot}, \overset{+}{opv}, \overset{+}{mpr}, \overset{-}{opp}, \overset{+}{rpro}, \overset{+}{r - r*}) \qquad 2$$

The use of bounds technique in the estimation of the BEER model is premised on the existence of the mixture of I(1) and I(0) variables as regressors (Pesaran et al., 2001), that is, the order of integration of appropriate variables may not necessarily be the same. Therefore, the ARDL technique has the advantage of not requiring a specific identification of the order of the underlying data. The building blocks for the ARDL approach constitute two steps: First, the long-run relationship (cointegration) among all variables must be established. Second, the long-run and short-run coefficients are jointly estimated using the associated ARDL and error correction models (ECM). The variable OPV represents oil price volatility; OPP is openness, MPR is the monetary policy rate, GCONS represents government consumption, relative prices is RP, MPR is the monetary policy rate, while R-R* represents the real interest rate differentials.

Model 2: Fundamental Equilibrium Exchange Rate (FEER)
The FEER approach has different variants, which differ on the basis of the type and size of modelling (general equilibrium, partial equilibrium, reduced form relationship) on the determination of the sustainable current account in the medium term (econometric estimates, judgmental assessment, arithmetic average) and on the trade elasticities (calibration to balance the trade model in volume and value, econometric estimates in a panel setting to ensure consistency of the world trade model) (see Saadaoui, 2015). However, the fundamental equilibrium exchange rate (FEER) is a normative measure of equilibrium RER as it involves some notion of 'ideal' economic circumstances of internal and external balances. In particular, defining external balances, i.e., sustainable CA balance, tends to be controversial. In addition, to determine FEER, trade elasticity needs to be calculated to determine the response of exports and imports to relative price changes. Different forms of CA equations could lead to different values of the trade elasticity. Over-reliance on trade elasticity may generate an inaccurate estimate of the FEER trajectory.

Therefore, the approach used in this work is a new alternative empirical methodology developed by Egert and Lahreche-Revil (2003), which combines the fundamental equilibrium exchange rate (FEER) methodology with the behavioural equilibrium exchange rate (BEER) approach to estimate internal and external balances defined respectively in terms of the relative price of non-tradable goods and the long-run sustainability of the current account position. The empirical implementation is carried out in the framework of a VAR-based 3-equation cointegration system. Estimated long-term values for relative prices and the current account are then substituted in the simultaneously estimated relationships connecting the real effective exchange rate with relative prices and the current account. The following cointegration vectors are estimated and respectively normalised to relative prices (RP), the current account (CA) and the effective real exchange rate (REER) as presented in equation 3-5:

Internal balance
$$RP + \beta_{11}RGDP + \beta_{12}PCONS + \beta_{13}GCONS \quad 3$$

External balance
$$CA + \beta_{21}TOT + \beta_{22}OPEN + \beta_{23}OILB \quad 4$$

Real effective exchange rate

REER +β_{31}*RP* +β_{32}*CA* 5

Where:

RP is the relative price, defined as the ratio of domestic *GDP* in *US*$ and *GDP (PPP)* standard over *US CPI*. Therefore, these relative price levels can be assimilated to deviations of the exchange rates to PPP (Coudert and Couharde, 2005). *RGDP* stands for relative labour productivity, defined as the ratio of domestic GDP per capita (PPP) standard and the US GDP per capita (*PPP*) standard, as suggested by Chinn and Prasad (2003). An increase in Nigeria's relative productivity will strengthen economic activity and may boost wages, which could result in an appreciation of REER. A priori, the sign on this variable is expected to be positive. PCONS represents private consumption expenditure as percentage of *GDP; GCONS* represents government consumption expenditure as percentage of *GDP*; CA is the current account as a percentage of *GDP*, while *TOT* is the terms of trade and OPEN is the openness ratio of the country, defined as *X+M* over *GDP. OILB* is the oil balance as a percentage of *GDP*. This variable captures the sensitivity of the current account and the economy to changes in oil prices. An increase in oil prices should improve the current account for oil-exporting countries and depreciate that of oil-importing countries (Gnimassoun, 2015). All variables are transformed in natural logarithms. *REER* is the CPI-based real effective exchange rate.

3.3 Exchange rate misalignment and export diversification

Toda-Yomamato Granger-Causality

To apply the Toda and Yamamoto (1995) version of granger non-causality test, we summarize the exchange rate misalignment–export diversification model in the following VAR system:

$$beer_t = \emptyset_0 + \sum_{i=1}^{k} \emptyset_{1i} beer_{t-i} + \sum_{j=k+1}^{dmax} \emptyset_{2j} beer_{t-j} + \sum_{i=1}^{k} \partial_{1i} exdiv_{t-i} + \sum_{j=k+1}^{dmax} \partial_{2j} exdiv_{t-j} + \varepsilon_t \quad 6$$

$$exdiv_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} exdiv_{t-i} + \sum_{j=k+1}^{dmax} \alpha_{2j} exdiv_{t-j} + \sum_{i=1}^{k} \beta_{1i} beer_{t-i} + \sum_{j=k+1}^{dmax} \beta_{2j} beer_{t-j} + \varepsilon_t \quad 7$$

$$feer_t = \delta_0 + \sum_{i=1}^{k} \delta_{1i} feer_{t-i} + \sum_{j=k+1}^{dmax} \delta_{2j} feer_{t-j} + \sum_{i=1}^{k} \rho_{1i} exdiv_{t-i} + \sum_{j=k+1}^{dmax} \rho_{2j} exdiv_{t-j} + \varepsilon_t \quad 8$$

$$exdiv_t = \theta_0 + \sum_{i=1}^{k} \theta_{1i} exdiv_{t-i} + \sum_{j=k+1}^{dmax} \theta_{2j} exdiv_{t-j} + \sum_{i=1}^{k} \omega_{1i} feer_{t-i} + \sum_{j=k+1}^{dmax} \omega_{2j} feer_{t-j} + \varepsilon_t \quad 9$$

In equation 6, granger-causality from $exdiv_t$ to $beer_t$ implies $\partial_{1i} \neq 0 \forall_i$; similarly in equation 7, $beer_t$ granger-causes $exdiv_t$ if $\beta_{1i} \neq 0 \forall_i$. Granger-causality between export diversification and the misalignment series generated with the fundamental equilibrium exchange rate is obtained from the estimation of equation 8 and 9. The causality from $exdiv_t$ to $feer_t$ implies $\rho_{1i} \neq 0 \forall_i$ is presented in equation 8. Similarly in equation 9, $feer_t$ granger-causes $exdiv_t$ if $\omega_{1i} \neq 0 \forall_i$. The Toda and Yamamoto (1995) test involves estimation of a vector autoregressive (VAR) model in levels, in order to minimize the risks associated with incorrect identification of the order of integration of the respective time series and cointegration among the variables. VAR is estimated not with its true lag order k but with lag order $k+d$, were d is the maximal potential order of integration of variables (d_{max}). Afterwards, granger-causality is formulated by carrying out hypothesis tests in the VAR ignoring the supplementary $k+1, k+2, k+3 - - - k+d$ (Elian and Adil, 2015).

4. Empirical Results

4.1: Augmented Dickey Fuller (ADF) and Phillips Peron (PP) unit root tests

The standard Augmented Dickey-Fuller (ADF) and Philip-Perron unit root test were conducted to check the order of integration of these variables. The results obtained are reported in table 2.

Table 2: Unit root test

Augmented Dickey Fuller Test					*Philips Peron Test*				
Variables	*Levels*		*First Difference*		*Levels*		*First Difference*		*OOI*
	With C	*With C and T*	*With C*	*With C and T*	*With C*	*With C and T*	*With C*	*With C and T*	
REER	-2.3841	-1.9800	-3.6817	-3.8461	2.0844	1.7381	4.8310	4.8636	I(1)
RGDP	-2.4861	-2.6124	-2.6659	-3.0504	1.8773	1.6055	4.7374	5.1077	I(1)
MPR	-2.4454	-0.9762	-8.0695	-8.5349	2.6560	0.7822	7.9776	8.1450	I(1)
RP	-2.6529	-0.9388	-2.3774	-3.3210	2.7221	1.8277	4.9477	5.4137	I(1)
CAGDP	-2.1658	-2.2941	-3.0866	-3.1407	2.4554	2.6249	5.2570	5.2285	I(1)
GCON	-0.6391	-1.9152	-1.9992	-2.0579	1.7289	2.3456	6.3595	7.0983	I(1)
OILB	-2.0539	-2.4705	-3.7165	-3.7721	1.9459	2.5696	5.7794	5.7377	I(1)
OPP	-1.7603	-2.2525	-3.8320	-3.8730	1.1741	2.8112	7.1950	7.1205	I(1)
TOT	-0.9070	-2.7880	-3.6631	-3.5833	1.3834	2.1828	5.3787	5.2585	I(1)
PCON	-1.9790	-1.7414	-3.0240	-3.2811	1.8401	1.9307	7.1847	10.5783	I(1)
R	-3.0576	-3.9803	-6.2042	-6.1729	2.2948	2.9861	13.7619	13.6408	I(0)
OPV	-2.5564	-1.6929	-3.9713	-4.1421	2.6968	2.6473	7.4222	8.5545	I(1)
DIV	-0.7297	-3.1298	-3.6426	-3.6133	1.1735	3.1680	5.9752	5.9377	I(0)
MISALBEER	-6.1764	-6.3664			9.4177	9.4473			I(0)
MISALFEER	-6.7688	-6.6895			5.4494	5.4331			I(0)

Source: Computed by the Authors

Note: The ADF and Philip Perron test statistics for the null hypothesis of a unit root process for the variables in the levels and in first differences. The critical value at 1% significance level is 4.05 if a constant and a linear trend (*c* and *t*) are included in the regression, 3.49 with only a constant term (*c*). At the 5% significance level, these values are 3.45, 2.89 and 1.94, respectively (MacKinnon, 1996). *OOI* means order of integration.

4.2 Estimation result for fundamental equilibrium exchange rate (FEER)

To provide an empirical insight into the relationship between CA OILB OPP and TOT, a cointegration test is conducted; the result is presented in table 3. The Johansen test indicates the presence of no cointegration in the current account (external balance) specification which led to the estimation of an unrestricted VAR for the current account equation.

Table 3: Johansen cointegration test for CA OILB OPP TOT

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*0.05 Critical Value*	*Prob.***
None	0.178212	42.65885	47.85613	0.1411
At most 1	0.069343	17.33967	29.79707	0.6149
At most 2	0.037979	8.069100	15.49471	0.4581
At most 3	0.023551	3.074398	3.841466	0.0795
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	*Eigenvalue*	*Max-Eigen Statistic*	*0.05 Critical Value*	*Prob.***
None	0.178212	25.31918	27.58434	0.0948
At most 1	0.069343	9.270571	21.13162	0.8100
At most 2	0.037979	4.994701	14.26460	0.7425
At most 3	0.023551	3.074398	3.841466	0.0795

Both Trace Test and Max-eigenvalue test indicates no cointegration at the 0.05 level

Having tested for cointegration, the study estimated unrestricted VAR in levels using one lag of each variable and including a constant. In the literature it has been demonstrated that VAR model can be applied in levels irrespective of whether the variables are *I(0)* or *I(1) (*Pesaran and Pesaran, 1997*)*. The model explains changes in current account well with an adjusted R-square of 93%; the coefficient on the lagged one period of oil balance is 1.03, reflecting an improvement in the current account as a result of oil price changes. Oil exporters have large oil surpluses, amounting to tens of percent of GDP, but spend a large part of them on imports of goods and services, leading to a much smaller current account surplus. The coefficient of openness variable negative consistent with our a priori expectation, this implies that, openness variable exerts worsening effect on the current account, an increase in the openness variable is assumed to be arising from a decline in tariff rates, leading to a fall in domestic prices of importable. This will lead to high demand for foreign currency to take advantage of cheaper imports compared to domestically produced goods. The resulting depreciation of domestic currency will worsen the current account in the short run. The coefficient of the TOT is negative implying that the volume effect outweighs the value effect leading to worsening of current account.

The result from the relative price equation reveals that the trace and the maximal eigenvalue statistics show the existence of one cointegrating relationship between relative price RP, RGDP GCONS and PCONS at the 5% level of significance (table 6). The conclusion drawn from this result is that there exists a unique long run relationship between relative prices and its determinants. Since there is one cointegrating vector, an economic interpretation of the long run relative prices can be obtained by normalizing the estimate of the unconstrained cointegrating vector on the relative prices.

Table 4: Vector autoregression estimates of CA OILB OPP and TOT

	CA	*OILB*	*OPP*	*TOT*
CA(-1)	0.954180	0.000460	0.000615	-0.000146
	(0.03694)	(0.00077)	(0.00070)	(0.00052)
	[25.8325]	[0.60154]	[0.88003]	[-0.28150]
OILB(-1)	1.034252	0.960184	0.005604	0.006287
	(2.12771)	(0.04407)	(0.04028)	(0.02992)
	[0.48609]	[21.7876]	[0.13910]	[0.21011]
OPP(-1)	-0.049543	0.007547	0.971252	0.040717
	(1.58290)	(0.03279)	(0.02997)	(0.02226)
	[-0.03130]	[0.23019]	[32.4077]	[1.82917]
TOT(-1)	-0.986497	-0.039075	-0.042696	0.979231
	(1.08062)	(0.02238)	(0.02046)	(0.01520)
	[-0.91290]	[-1.74581]	[-2.08681]	[64.4387]
C	1.061327	0.127891	0.067461	0.053194
	(3.53316)	(0.07318)	(0.06689)	(0.04969)
	[0.30039]	[1.74761]	[1.00846]	[1.07062]
R-squared	0.931003	0.944589	0.960504	0.975642
Adj. R-squared	0.928847	0.942858	0.959269	0.974881
Sum sq. resids	758.5985	0.325444	0.271939	0.150019
S.E. equation	2.434451	0.050424	0.046093	0.034235
F-statistic	431.7891	545.5054	778.2007	1281.742
Log likelihood	-304.5035	211.1399	223.0842	262.6394
Akaike AIC	4.654189	-3.099848	-3.279462	-3.874277
Schwarz SC	4.762848	-2.991188	-3.170802	-3.765617
Mean dependent	4.968986	1.151799	-0.422047	2.032880
S.D. dependent	9.126501	0.210938	0.228386	0.216006

Source: Author's computation

Table 5: Johansen cointegration test for RP RGDP GCONS and PCONS

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*0.05 Critical Value*	*Prob.***
None *	0.256369	50.51601	47.85613	0.0275
At most 1	0.051921	12.30480	29.79707	0.9207
At most 2	0.038654	5.426840	15.49471	0.7619
At most 3	0.002644	0.341506	3.841466	0.5590

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	*Eigenvalue*	*Max-Eigen Statistic*	*0.05 Critical Value*	*Prob.***
None *	0.256369	38.21120	27.58434	0.0015
At most 1	0.051921	6.877963	21.13162	0.9585
At most 2	0.038654	5.085334	14.26460	0.7310
At most 3	0.002644	0.341506	3.841466	0.5590

Both Trace test and Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

Table 6: Normalized cointegrating vector

1 Cointegrating Equation(s): *Log likelihood* *1703.163*

Normalized cointegrating coefficients (standard error in parentheses)

RP	RGDP	GCONS	PCONS
1.000000	-0.157168	-0.228525	-0.132178
	(0.37789)	(0.17236)	(0.33684)

Table 7: Johansen cointegration test for REER RP* and CA*

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	*Trace* Statistic	*0.05* Critical Value	Prob.**
None	0.065685	17.40099	29.79707	0.6104
At most 1	0.033913	8.636530	15.49471	0.4001
At most 2 *	0.031928	4.185881	3.841466	0.0408

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	*Eigenvalue*	*Max-Eigen Statistic*	*0.05 Critical Value*	*Prob.***
None	0.065685	8.764455	21.13162	0.8510
At most 1	0.033913	4.450649	14.26460	0.8090
At most 2 *	0.031928	4.185881	3.841466	0.0408

Both Trace test and Max-eigenvalue test indicates no cointegration at the 0.05 level

To estimate the equilibrium exchange rate, the estimated coefficient as obtained from the CA and RP equations are estimated in a cointegrating relationship with the real effective exchange rate REER. But the result from the Johansen cointegration test suggests that there is no long-run relationship between REER CA* and RP*. This led to the estimation of unrestricted VAR (table 8). The data in table 8 show the connecting relationship between real effective exchange rate and internal and external balances given by REER CA* and RP*. The signs are in line with expectations. An increase (decrease) in relative prices of non-tradable goods is associated with an appreciation (depreciation) of the real exchange rate, while a worsening (improvement) in current accounts result in depreciation (appreciation) of the real exchange rate. The ensuing exchange rate misalignment series generated from the relationship in table 8 is presented in table 9.

Table 8: Vector autoregression estimates of REER RP* and CA*

	REER	*RP**	*CA**
REER(-1)	0.982435	0.001757	-0.885032
	(0.01523)	(0.00411)	(0.77919)
	[64.4927]	[0.42800]	[-1.13584]
RP(-1)	-0.021582	0.955626	4.188840
	(0.08465)	(0.02281)	(4.32973)
	[-0.25496]	[41.8919]	[0.96746]
CA(-1)	0.000559	-0.000209	0.958720
	(0.00050)	(0.00013)	(0.02547)
	[1.12242]	[-1.55718]	[37.6368]
C	0.016029	-0.031385	4.774669
	(0.06111)	(0.01647)	(3.12556)
	[0.26231]	[-1.90590]	[1.52762]
R-squared	0.973509	0.938704	0.933041
Adj. R-squared	0.972893	0.937279	0.931484
Sum sq. resids	0.261963	0.019025	685.3955
S.E. equation	0.045064	0.012144	2.305026
F-statistic	1580.177	658.5180	599.1861
Log likelihood	225.5695	399.9608	-297.7553
Akaike AIC	-3.331872	-5.954298	4.537674
Schwarz SC	-3.244944	-5.867370	4.624602
Mean dependent	2.103323	-0.633560	4.968986
S.D. dependent	0.273705	0.048492	8.806025

Source: Author's computation

The error-correction term (-0.149) presented in table 10 is correctly signed and significant. This shows that, in the short run, deviation from this relationship could occur due to shock to any of the variables as a result of the differences in the dynamics governing short run real exchange rate and long run real exchange rate. Due to different forces shaping the dynamics of short run and long run, the short run interaction and the adjustment to long run equilibrium are important. The error correction term enables us to gauge the speed of adjustment of real effective exchange rate to its long run equilibrium. The intuition behind the error correction model is the need to recover the long run information lost by differencing the variables. The result shows that the speed of adjustment of the real effective exchange rate to the long run equilibrium path is very low. Specifically, only about 15% of the disequilibrium errors, which occurred in the previous quarter, are corrected in the current quarter.

Table 9: Misalignment series generated by the FEER method

Range	*Min*	*Max*	*Average*
1995:Q1-1995:Q2	-0.04	-4.25	-2.14
1995:Q3-1998:Q1	0.56	3.08	1.28
1998:Q2-1994:Q4	-0.15	-7.69	-2.20
2000:Q1-2001:Q4	0.24	2.4	0.68
2002Q1		-0.05	-0.05
2002:Q2-2002:Q4	0.03	0.09	0.07
2003Q1		-0.53	-0.53
2003:Q2-2005:Q2	0.04	0.99	0.25
2005:Q3-2007:Q3	-0.07	-1.19	-0.36
2007:Q4-2008:Q2	0.14	0.18	0.56
2008:Q3-2009:Q3	-0.02	-1.49	-0.42
2009:Q4-2010:Q4	0.21	1.12	0.47
2011:Q1		-0.36	-0.36
2011:Q2-2012:Q1	0.34	3.5	1.25
2012:Q2-2013:Q3	-0.06	-8.55	-2.39
2013:Q4-2014:Q2	0.72	3.6	2.17

Misalignment rates (%). *Note*: Misalignment rate = (REER−FEER)/FEER*100%; a positive (negative) misalignment rate implies an overvaluation (undervaluation) of the real effective exchange rate.

The signs of some of the coefficients are consistent with what is expected, indicating that the theoretical model is relevant for the Nigeria. In particular, an improvement in the terms of trade leads to an appreciation of the equilibrium exchange rate. The openness (OPP) variable is negatively signed and statistically significant, because an increase in openness variable leads to a decrease in the price of importable goods. The increase in the demand for imports will lead to high demand for foreign currencies compared to the demand for domestic currency, leading to depreciation of the domestic currency. Net foreign asset (NFA), although significant, does not carry its right sign (positive). In other words, a positive sustainable NFA position allows persistent trade deficit to be run, which is associated with an appreciated exchange rate. Government consumption (GCON) has a positive and significant effect on real exchange rate; e.g, exchange rate will appreciate in response to increase in government expenditure, especially when such consumption is directed towards the non-tradable sector.

Table 10: ARDL cointegration and long run form for BEER model

Cointegration Form				
Variable	*Coefficient*	*Std. Error*	*t-Statistics*	*Prob*
D(REER(-1))	0.459597	0.076372	6.017902	0.0000
D(REER(-2))	0.171878	0.071778	2.394965	0.0183
D(OPV)	0.075941	0.027261	2.785651	0.0063
D(OPP)	-0.295504	0.055737	-5.301738	0.0000
D(OPP(-1))	0.153402	0.055826	2.747842	0.0070
D(MPR)	-0.098982	0.066578	-0.028510	0.7761
D(GCONS)	1.268117	0.197934	6.406783	0.0000
D(GCONS(-1))	-0.700556	0.220081	-3.183169	0.0019
D(GCONS(-2))	-0.475478	0.218917	-2.171959	0.0319
D(NFA)	--0.031887	0.015866	-2.009777	0.0468
D(TOT)	0.151410	0.062925	2.406188	0.0177
D(RP)	0.006743	0.267595	0.025198	0.9799
D(R-R*)	0.000520	0.000226	2.301196	0.0232
C	0.052256	0.009339	5.595650	0.0000
CointEq(-1)	*-0.1496*	*0.0242*	*-6.1840*	*0.0000*
*Cointeq=REER – (- 0.1419*OPV - 0.3288*OPP - 0.1242*MPR + 2.0419*GCONS - 0.2596*NFA + 0.4980*TOT + 0.0472*RP + 0.0015*R-R*)*				
Long Run Coefficient				
Variable	*Coefficient*	*Std. Error*	*t-Statistics*	*Prob*
OPV	-0.141911	0.056515	-2.511024	0.0135
OPP	-0.328778	0.178509	-1.841799	0.0681
MPR	-0.124237	0.169866	-0.731384	0.4661
GCONS	2.041943	0.334277	6.108539	0.0000
NFA	-0.259616	0.075074	-3.458135	0.0000
TOT	0.497985	0.108818	4.576307	0.0000
RP	0.047182	0.252769	0.186662	0.8523
R-R*	0.001529	0.000889	1.720591	0.0881

Source: Author's computation

Interest rate differentials are positively signed and statistically significant at the 10% level, which is in line with its a priori expectation. The differential in real interest rate could arise from several factors-aggregate demand, productivity, and monetary policy— all pointing to a positive relationship with the real exchange rate. First, an increase in absorption relative to savings would put upward pressure on the real interest rate in an economy with less than perfect mobility. At the same time, the demand for both tradable and non-tradable goods would increase, inducing an increase in the price of non-tradables, which, in turn, would result in an appreciation of the real exchange rate. Second, real interest differentials may also reflect productivity differentials: to the extent that the measure employed to proxy for the Balassa-Samuelson effect is not perfect, the real interest rate may help capture this empirically; also, if the productivity of capital rises with respect to trading partners, capital will flow to the home country, thereby inducing an appreciation of the real exchange rate. Third, a tightening of monetary policy would raise real interest rate— an outcome that would need to be associated with an expectation of currency depreciation, given the interest parity condition. Hence, the nominal exchange rate would appreciate beyond its long run value, so as to allow the expected depreciation to occur once the monetary policy shock has disappeared (MacDonald and Ricci, 2003).

Table 11: Misalignment series generated from the BEER model

Range	*Min*	*Max*	*Average*	*Range*	*Min*	*Max*	*Average*
1995Q2-1995Q2	-1.03	-0.03	-0.51	2007Q1		-0.82	-0.82
1995Q3-1996Q1	0.14	0.64	0.35	2007Q2-2008Q1	0.26	1.26	0.71
1996Q2-1996Q3	-0.89	-0.67	-0.78	2008Q2		-0.4	-0.4
1996Q4-1998Q3	0.03	1.93	0.55	2008Q3-2008Q4	0.04	0.28	0.16
1998Q4-1999Q1	-2.46	-0.06	-1.26	2009Q1		-0.6	-0.6
1999Q2-2000Q1	0.41	1.6	0.92	2009Q2			0.67
2000Q2		-0.26	-0.26	2009Q3-2009Q4	-0.15	-0.13	-0.14
2000Q3		0.11	0.11	2010Q1		0.76	0.76
2000Q4		-0.09	-0.09	2010Q2-2010Q3	-0.33	-0.04	-0.19
2001Q1		0.96	0.96	2010Q4		0.19	0.19
2001Q2-2002Q1	-0.94	-0.12	-0.55	2011Q1		-0.72	-0.72
2002Q2-2003Q1	0.46	1.09	0.81	2011Q2-2012Q1	0.12	3.28	1.01
2003Q2-2004Q1	-0.5	-0.01	-0.3	2012Q2-2013Q1	-6.95	-0.75	-2.44
2004Q2		0.26	0.26	2013Q2-2013Q3	0.67	2	1.33
2004Q3-2005Q3	-1.12	-0.21	-0.57	2013Q4		-0.23	-0.23
2005Q4-2006Q4	0.05	0.27	0.21	2014Q1-2014Q2	0.18	1.18	0.68

The misalignment series generated by the BEER method (table 11) shows some remarkable dynamics in terms of degree of occurrence of misalignment. The highest misalignment occurs between 2011:Q2 and 2012:Q1 with an average of 1.10% and a maximum of 3.23%. The actual exchange rate was close to its equilibrium in 2000:Q4 and Q3. The duration of misalignment under BEER is short with about 32 episodes of either overvaluation or undervaluation, compared to FEER with 16 episodes.

4.4 Cointegration result

The statistical approach taken in this study involves two steps. First, the existence of long-run equilibrium relationships is tested using the bound testing approach to cointegration. The use of the bounds technique is based on three validations. First, Pesaran et al. (2001) advocated the use of ARDL model for the estimation of level relationships because the model suggests that once the order of ARDL has been recognised, the relationship can be estimated by OLS. Second, the bounds test allows a mixture of I(1) and I(0) variables as regressors; that is, the order of integration of appropriate variables may not necessarily be the same. Therefore, the ARDL technique has the advantage of not requiring a specific identification of the order of underlying data. Third, this technique is suitable for small or finite sample size (Pesaran et al., 2001). Thus, the bound testing was performed for cointegration, which involves the estimation of unrestricted general vector error-correction model (VECM). The result (table 12) shows that the variable in the model are cointegrated. In other words, there is long-run relationship among the variables.

Table 12: Bound testing approach to cointegration

Test Statistic	*Value*	*K*
F-statistic	5.982	1
	Critical Value Bounds	
Significance	*I0 Bound*	*I1 Bound*
10%	3.02	3.51
5%	3.62	4.16
2.5%	4.18	4.79
1%	4.94	5.58

Source: Author's computation

Having established the existence of long-run relationship, the next step is to run causality test. The commonest way to test the causal relationship between two variables is the granger-causality proposed by Granger (1969). Other tests include Sims (1972) and Gwekes et al. (1983). All these tests are based on null hypothesis formulated as zero restrictions on the coefficients of the lags of a subset of the variables; hence, the tests are grounded in asymptotic theory. In addition to its reliance on asymptotic theory, it is only valid for stationary variables, I(0). The standard causality test is invalid if a series of variables is deducted to be non-stationary, 1(1). According to Toda and Yamamoto (1995) and Dash (2009), other alternatives for the testing of non-stationary between economic time series of variables like the error correction model (ECM) and the vector autoregression error-correction model (VECM) are based on the possibility that incorrect inferences could be made about a causality case simply due to the sensitivity of stationary or cointegration tests (Elian and Adil, 2015). The Toda-Yamamoto causality (1995) allows causal inference to be made in level VARs regardless of whether the series of variables are integrated, cointegrated or not. As such, the test outwits the pre-test biases that confront other modelling strategies.

4.5 Toda-Yomamoto granger-causality test

The application of the Toda-Yamamoto approach requires information about the lag length (k) and the maximum order of integration (d) of the variables. The order of integration of each variable as well as the cointegration is examined as a pretest. In this study, the optimal lag length was determined using the AIC. The result of the granger-causality test (table 2) involves 2 steps: The first step is the determination of the true lag length of k and the maximum order of integration (d_{max}) of the variables in the system before an $(k + d_{\max})^{th}$order VAR is estimated. The 2nd step is to apply standard Wald tests to the first k^{th} VAR in other to conduct inference on granger non-causality using modified Wald (MWALD) to test for restriction.

Table 13: Result of Toda-Yamamoto causality test

Dependent Variable	*Independent Variable*	
	beer	*exdiv*
Beer	-	1.4575 (0.0030)
Exdiv	2.6516 (0.1563)	-
Dependent variable	*Independent Variable*	
	feer	Exdiv
Feer	-	0.7421 (0.0472)
Exdiv	3.2106 (0.1180)	-

The result in table 13 shows that at both 1% and 5% levels of significance, the null hypothesis that export diversification ($exdiv$) does not Granger-cause exchange rate misalignment (both *beer* and *feer*) can be rejected, suggesting that export diversification effort could be a means to reduce unwarranted movement in real exchange rate. The result also shows that the null hypothesis that exchange rate misalignment (*beer*) does not granger-cause export diversification (*exdiv*) cannot be rejected, which suggests that there is no causality from misalignment to export diversification. However, the null hypothesis that exchange rate misalignment (*feer*) does not granger-cause export diversification can be rejected at the 10% level of significance. This provides ample evidence that deliberate effort to change the exchange rate (disequilibrium approach) could foster export diversification.

5. Conclusion and Recommendation

In search of economic growth, diversifying the export base of the country has been at the forefront of development policy. A strand of the literature suggests that real exchange rate misalignment might help diversifying exports. Philosophical trust of such suggestions is that exchange rate misalignment could increase export of non-traditional goods than export of traditional goods. However, empirical evidence on the link between exchange rate misalignment and export diversification is conflicting. Based on this lack of consensus, this study used two different measures of real exchange rate misalignment (fundamental equilibrium exchange rate approach and behavioural equilibrium exchange rate approach) to substantiate the robustness of its conclusion. The findings show that export diversification granger-causes exchange rate misalignment, which suggests that export diversification efforts can reduce unwarranted movement in real exchange rate, thereby reducing exchange rate misalignment. The result also suggests that there is causality running from misalignment (*feer*) to export diversification, which provides ample evidence that deliberate effort to alter the equilibrium exchange rate (misalignment) can yield positive result in the export diversification effort. The result supports similar findings (Sekkat 2016; Wondemu and Potts, 2016; Sekkat and Varoudakis, 2000). The policy implication of the result is that export diversification is a viable option for Nigeria to reduce unwarranted movement in exchange rate.

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