An Econometric Analysis Of The Effect Of Real Exchange Rate On Economic Growth In Nigeria

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Abstract
The real exchange rate between naira and dollar varies freely over the years. Presently, it fluctuates on hourly, daily and weekly basis over the years. There is no limit to variability. Thus, this study seeks to re-examine the causal relationship between real exchange rate and economic growth in Nigeria within the period under review (1980 to 2015). Using annual data of selected macroeconomic variables (real exchange rate, degree of openness, broad money supply, consumer price index, real interest rate and real GDP), the study carried out the Unit root test, Co-integration and employing the use of dynamic OLS (DOLS) and Granger Causality test technique and the data were sourced from CBN, Statistical Bulletin and National Bureau of Statistics. The findings of the Unit root test indicated that the variables were stationary and that of co-integration test also showed existence of long run relationship between the variables in the estimated model. Furthermore, the result of DOLS showed that positive relationship existed between real exchange rate, broad money supply and real GDP whereas an inverse relationship existed between degree of openness, consumer price, real interest rate and real GDP respectively. Finally, Granger Causality test confirmed both unit and bi-directional relationship within the model. The study concluded that real GDP is influenced by dynamic variables-real exchange rate, degree of openness, broad money supply, consumer price index, real interest rate in Nigeria. The study therefore suggested that the Central Bank of Nigeria should institute policies that will stabilize the magnitude of the variables and the effectiveness of the management and monitoring of all these vital variables will in no doubt boost real GDP in Nigeria.

Keywords: Real GDP, real exchange rate, degree of openness, dynamic ordinary least square

INTRODUCTION
The relationship between a country’s exchange rate and economic growth is a crucial debate from both the descriptive and policy prescription perspectives over the years. Exchange rate refers to the price of one country’s currency expressed in terms of some other currency. It determines the relative prices of domestic and foreign goods, as well as the strength of external sector participation in the international trade. Exchange rate regime and interest rate remain important issues of discourse in the International finance as well as in developing nations, with more economies embracing trade liberalization as a requisite for economic growth. It is not an overstatement to say that exchange rate behaviour now occupies a central role in policy evaluation and design. A country’s exchange rate is an important determinant of the growth of its cross-border trading and it serves as a measure of its international competitiveness. In Nigeria, exchange rate has varied freely within the time frame from regulated to deregulated regimes. Ewa (2011) stated that the exchange rate of the naira was relatively stable between 1973 and 1979 during the oil boom era and when agricultural output recorded for more than 70% of the nation’s economic growth in the economy. In 1986 when Federal government adopted Structural Adjustment Policy (SAP), the country moved from a peg regime to a flexible exchange rate regime where exchange rate is left completely to be determined by demand and supply but rather the prevailing system is the managed float whereby monetary authorities intervene periodically in the foreign exchange market in order to attain some strategic goals in the economy (Mordi, 2006).

The importance of international trade in economic development has been acknowledged worldwide. This is because it provides opportunities to expand both the production possibilities and consumption basket available to the people within the economy (Adewuyi, 2005). The Nigerian government has over the years engaged in international trade and has been designing trade and
exchange rate regulation to promote trade. As a result, several exchange rate reforms were initiated by successive governments, the extent to which these policies have been effective in promoting export has remained unascertained. This is because despite government efforts, the growth performance of Nigeria non-oil export has been very slow. It grew at an average of 2.3% during the 1960-1990 periods, whereas its share of total export declined from about 60% in 1960 to 3.0% in 1990. Looking at the sectoral contribution to non-oil export in the period before the introduction of the SAP (1975-1985); it can be seen that agricultural sector contributed about 4.0% and 67.0% to total export and non-oil export respectively. The shares of manufacturing sector in these categories of exports are about 1.0 and 12.0% respectively during that same period. Despite various efforts by the government to maintain exchange rate stability (as well as avoiding its fluctuations and misalignment) in the last two decades, the naira exchange rate to the American dollar depreciated throughout the 1980s. For example, the naira depreciated from N0.61 in 1981 to N2.02 in 1986 and further to N8.03 in 1990. Although the exchange rate became relatively stable in the mid 1990s, it depreciated further to N120.97, N129.36 and N133.50 in 2002, 2003 and 2004 respectively (Obadan, 2006). Thereafter, the exchange rate appreciated to N132.15, N128.65, N125.83 and N118.57 in 2005, 2006, 2007 and 2008 respectively (Central Bank of Nigeria, 2008). Some have attributed the recent depreciation to the decline in the nation’s foreign exchange reserves, but others argue that the activities of speculators and banks are responsible for the recent decline in the value of the naira.

The exchange rate between naira and other currencies of the world especially dollar varied freely over the years. Presently, it varies on hourly, daily and weekly basis over the years. There is no limit to variability. This variation has made naira to be very unstable and its value reduced to the barest minimum. This problem of exchange rate variability became too disturbing after the emergence of the generalized floating system in the early 1970’s. It was not however surprising that six different systems were tried between 1986 and 2014. Between 1986 and 1989, the average pricing system, marginal pricing system and the Dutch Auction System (DAS) were used while the Interbank Foreign Exchange Market (IFEM) system was in place between 1989 and 1990. This was replaced by the re-introduction of the Dutch auction system which was tested till March 1992 when a new system based on the interbank foreign exchange market was instituted. Finally, the introduction of the W-DAS in early 2006 was also to deepen foreign exchange market in order to evolve a realistic exchange rate for the naira. Although, the naira firmed up at the end of 1986 relative to its position at the beginning of the second-tier market, the fluctuation from one bidding session to another was large. In support, the Central Bank of Nigeria actually had to intervene on two occasions in order to moderate the amplitude of fluctuation in the exchange rate, so as to enhance economic growth and development in the economy.

Furthermore, the nexus between exchange rate and economic growth have drawn extensive attention of macroeconomists, policy makers and the central bankers of both developed and developing countries. Specifically, the issue that whether exchange rate is necessary for economic growth or it is harmful generates significant debates both theoretically and empirically. The management of the exchange rate is considered to be a major policy objective in Nigeria to attain a set of diverse objectives of economic growth, containment of inflation and maintenance of external competitiveness. Policy discussions regularly emphasize on it as the academic literature provides compelling evidence to suggest that a wrongly managed exchange rate regime can be a major impediment for improved economic performance. In spite the concerted efforts put in place by a supposed-to-be market based mechanism in 2003, Nigeria’s exchange rate regime continues to be characterized by widespread interventions (Hossain and Ahmed, 2009). Indeed, attempts have apparently been made to maintain the nominal exchange rate effectively fixed for as long as possible before external imbalances become unsustainable. This process has disregarded the policy emphasis on maintaining the country’s external competitiveness. The apprehension about currency depreciation is well-understood. For a small country, devaluations will lead to increase in import prices and subsequently prices of other products and services through feedback effects. However, the growth implications of currency adjustments are generally overlooked. According to the ‘orthodox’ economic theory, devaluation of a country’s currency triggers an “expenditure switching” mechanism, which leads domestic demand away from
imports to locally produced import-competing goods. It also improves international competitiveness thereby boosting exports. These two effects together exert an expansionary effect on overall economic activity. In contrast, there are several reasons why devaluation can decrease an economy’s output growth. Amongst them, the rise of prices of imports affecting the domestic production is the most dominant one. Empirical evidence on the effects of currency adjustments on economic growth is mixed and consequently country-specific case studies are the best possible option to guide policy directions. This generates a lack of attention to the role of exchange rate management for promoting economic growth and maintaining the external competitiveness. Thus, this study seeks to examine the relationship between real exchange rate and economic growth in Nigeria. In order to achieve the stated purpose, the following research questions were advanced: what is the relationship between real exchange rate and economic growth? Why has exchange rate stability eluded Nigeria? What are the factors responsible for exchange rate volatility in Nigeria and what have been the effects of real exchange rate on economic growth in Nigerian economy? Following this introduction, the remaining parts of the paper is planned as follows: section two covers the literature review and the theoretical framework. Section three presents the methodology of the study. Data analysis and interpretation of result is the main thrust of section four whereas section five draws up policy recommendations and concludes the paper.

LITERATURE REVIEW

Exchange rate is the rate at which one country’s currency is exchanged for the currency of another country. That is, it is price of one country currency in terms of another currency. Coyle (2000) defines exchange rate as the price at which one currency is traded in exchange for another in the foreign markets. Afolabi (1999) sees exchange rate as the price of one currency in terms of other while Jhingan (2005), exchange rate is the rate at which one currency is exchanged for another. It is the price of one currency in terms of another currency. Thus, the exchange price of the naira in the terms of pound sterling is the unit of Naira. Then Idika (1998) stated that foreign exchange is the means of payment for international transactions. It is made up of convertible currencies that are generally acceptable for the settlement of international trade.

Okororie (2005), the price of unit of currency of one country expressed in terms of units of currency of another is called exchange rate. It represents the number of units of the currency of one country that can be exchanged for another. In the same line, IMF (1985) defined foreign exchange as monetary deposits, treasury bills, short-terms, and long-terms government securities and other claims usable in the event of balance of payment deficit including non-marketable claims arising from inter-central Bank and Inter-governmental arrangement without regard to whether the claim is dominated in the currency of the debtor or creditor. In addition, three main determinants of exchange rate and the allocation of foreign exchange were identified and these include elasticity, income-absorption and monetary approaches all of which are generally derived from balance of payment. The elasticity approach (or the traditional approach) is concerned with the impact of devaluation on a country’s current account. He argued that as the exchange rate of a country is gradually devalued (adjusted downward), the country would be able to export more because export prices will become more competitive and import less and, therefore conserve foreign exchange and cumulate external reserves to see it through its balance of payments.

Exchange Rate Policy in Nigeria

The most important themes that emerge in the discussion of exchange rates and their management in Nigeria include the high volatility, real exchange rate overvaluation albeit in the context of continuous nominal depreciation, and the search for mechanism for market-determined rate where government is the dominant supplier of foreign exchange. Exchange rate stability is one of the goals of monetary policy in Nigeria, and over the years, exchange rate policy has been driven mostly by an obsession to keep the nominal exchange rate ‘stable’. For the general public, the health of the economy is gauged by the nominal exchange rate where a depreciating rate is synonymous with a
weakening economy. Table 1 presents some selected exchange rate indices and highlights the extent of distortions in the exchange rate regimes.

**Table 1: Selected Exchange Rate Indices from 1980-2015**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1980-1985</td>
<td>0.70</td>
<td>108.27</td>
<td>164.24</td>
<td>87.81</td>
<td>1.97</td>
</tr>
<tr>
<td>1986-1990</td>
<td>5.20</td>
<td>19.24</td>
<td>41.22</td>
<td>100.86</td>
<td>6.91</td>
</tr>
<tr>
<td>1991-1995</td>
<td>18.61</td>
<td>3.32</td>
<td>114.73</td>
<td>89.66</td>
<td>42.73</td>
</tr>
<tr>
<td>1996-1999</td>
<td>21.89</td>
<td>0.80</td>
<td>289.78</td>
<td>140.50</td>
<td>85.31</td>
</tr>
<tr>
<td>2000-2008</td>
<td>105.50</td>
<td>0.20</td>
<td>9.83</td>
<td>79.95</td>
<td>114.31</td>
</tr>
<tr>
<td>2009-2012</td>
<td>132.50</td>
<td>0.18</td>
<td>108.90</td>
<td>132.00</td>
<td>142.50</td>
</tr>
<tr>
<td>2013-2015</td>
<td>199.50</td>
<td>4.40</td>
<td>135.10</td>
<td>198.90</td>
<td>201.20</td>
</tr>
</tbody>
</table>

**Source:** CBN Annual Report and Statement of Accounts (various issues)

Another key feature of the exchange rate regime is the huge premium which indicates the extent of distortions in the market. This has been due to the fixed regime until the mid 1980s, the managed float of the SAP era, the re-fixing of the official rate during the Abacha regime (1994-1998) and thus the large disparity between the official and the parallel (free) market rates. Given the huge demand for foreign exchange for imports and sundry reasons, and also the fact that forex at the official rate was rightly regulated with strict documentation requirements, the parallel market boomed (Soludo, 2008).

Prior to SAP (1970 to 1986), banks operated under highly regulated environment, characterized by fixed exchange rate structures guided by official financial markets. In particular, an official foreign exchange market was operated by the central bank which allocated foreign exchange to end users based on import licensing procedures at predetermined rates. Incidentally, this system led to huge unpaid trade arrears and external debts coupled with exchange rate overvaluation. With the adoption of SAP, this procedure was abolished and replaced with a two-tier market structure. While the official window was initially retained for special government transactions and debt service, the Second Tier Foreign Exchange Market, a Dutch-Auction System in which financial institutions bid to purchase foreign exchange at the market-clearing rates for their intended beneficiaries, was introduced. This system laid the foundation for exchange rate devaluation and the emergence of multiple exchange rate systems in Nigeria.

**Fully Deregulated Exchange Rate (1992-1994)**

According to the CBN (2001), in order to reduce the wide divergence between rates in various markets and eliminate the need for foreign exchange abuses, a more de-regulated market-based system was introduced on March 5, 1992. The IFEM rate was depreciated to equate the parallel market rate, which was considered the most appropriate indicator for market perception of the value of the naira in relation to other currencies. Government intention was to reduce the parallel market premium and enhance operational and efficient allocation at the IFEM through adequate participation in the market. Under this system, the Central Bank of Nigeria bought and sold foreign exchange actively in the market and was expected to meet all requests of the authorized dealers. In the same line, Adubi (2002) stated that the domestic currency, the naira, remained under considerable pressure in the local exchange market owing to excess liquidity and speculation influences coupled with foreign exchange shortage. This led to increased pressure in the parallel markets to satisfy additional foreign exchange needs which the official market could not provide. In addition, the political uncertainties that characterized the second-half of 1993 resulted in increased capital flight, which put further pressure on the exchange rate of naira. In the same vein, the amount of foreign exchange released to authorized dealers, however, reduced, resulting in rapid deterioration of the naira (CBN, 2008). Renewed demand pressures and the speculative activities, however, widened the premium and the high margin that resulted, led to the regulation policy of 1994.

**The Dual Exchange Rate System (1995-1999)**
According to Adubi (2002), the fixed exchange rate system or partial regulation of 1994 recorded low economic performance during the period, especially as it related to the growth of non-oil exports. This led to the re-introduction of the dual exchange rate policy in 1995, called ‘guided deregulation’. This new policy focused on reducing the instability of exchange rate in the market and achieving efficient allocation and utilization of resources. As such, the exchange control act of 1962 was replaced, while the foreign exchange (Monitoring of miscellaneous) provision Decree 17 of 1995 was promulgated. The decree established the Autonomous Foreign Exchange Market (AFEM) for trading privately sourced foreign exchange while the fixed exchange rate in the official market (N21, 9960 to $1) remained for constructive government transactions. The ruling exchange rate at AFEM was market determined and the CBN had the discretion to intervene at anytime to regularly monitor developments and ensure stability of the exchange rate in the market. A major change, however, was the procedure for determining foreign exchange rate which was changed from the bidding sessions to intervention exercise. The CBN intervened 35 times (weekly) in 1995. Under the new arrangement, the CBN stopped offering a specified amount of foreign exchange to banks for sale, while the total demand of the banks with adequate naira cover was fully met.

Development in the international foreign exchange market was largely influenced by the domination and appreciation of dollar as well as by the financial crisis in East Asia in 1997, which may have affected the exchange rates as it remained relatively stable during the greater part of 1997. This development was largely attributed to the continued stability in the macroeconomic environment, occasioned by a more effective co-ordination of monetary and fiscal policies. Operation in the AFEM was main anchor for orderly deregulation of the foreign exchange market in 1998. The CBN conducted 51 weekly interventions in the AFEM during which $4,112.1 million was sold to authorized dealers for end users, against $2.939 million in 1997. The dual exchange rate ranged between #81.00 and #86.00 to $1.00. This policy measure of guided deregulation continued until the fiscal year 1999 when the dual exchange rate was harmonized, leading to one single market foreign exchange transactions called the Interbank Foreign Exchange Market (IFEM).

**Fully Deregulated Exchange Rate System (1999-2010)**

According to the CBN (2001), on 25 October, 1999, the AFEM was replaced with IFEM. Participation in the market was broadened in order to deepen market activities, thus relieving the CBN as the major supplier of foreign exchange; the major problem was that the exchange rate was not stable despite several interventions by the Central Bank of Nigeria. The rate which was as low as ₦4.4 to a dollar in 1987 was ₦86.00 to the dollar in 1998 and ₦117 in 2000.

The CBN also started to investigate the operation of some banks suspected to be floating market rules governing the interbank foreign exchange market (IFEM). According to the Business Times of 29 May, 2000, erring banks were banned from IFEM. Also, in CBN rules, banks are to bid for foreign exchange within five days. The failure of some banks to comply with this rule prevented the CBN from properly monitoring the level of foreign exchange in the system. The CBN also moved to prevent banks from trading on the dollar bought from it for customers. This was done to ensure effective use of the scarce dollar.

**The Purchasing Power Parity (PPP) Theory**

The purchasing power parity (PPP) theory was developed by Gustau Cassel in 1920 to determine the exchange rate between countries on inconvertible paper currencies. The theory states that equilibrium exchange rate between two inconvertible paper currencies is determined by the equality of the relative change in relative prices in the two countries.

In other words, the rate of exchange between two countries is determined by their relative price level. Cassel (2001), opined that the nominal exchange rate should reflect the purchasing power rate of one currency against another. His proposal was that a purchasing power exchange rate existed between any two countries, and it is measured by the reciprocal of one country’s price level against another. Aghevli (1991), shared similar view and posited that the central tenet of the PPP is that the equilibrium exchange rate is proportional to the relevant purchasing power parity of national currencies involved. In the same vein, Hakio (1992), observed that the purchasing power parity is predicated on the law of
one price which holds that identical goods should cost the same in all countries, assuming transportation costs are eliminated and tariffs and quota restrictions are removed.
growth in Bangladesh using Granger Causality test. The empirical results show that there is a significant positive correlation between exchange rate and economic growth. The results also advocate the presence of long-run equilibrium relationship between exchange rate and economic growth.

Mungule (2004) sought the determinants of real exchange rate in Zambia using the cointegration technique and he found that the real exchange rate have long run equilibrium relationship with economic growth. Ogun (2004) studied the impact of real exchange rate on growth of non-oil export in Nigeria applying standard trade theory model of determinants of export growth and two different measures of real exchange rate misalignment; one of which entailed deviations of purchasing power parity (PPP) and the other was a model based estimation of equilibrium real exchange rate. He reported that, irrespective of the alternative measures of misalignment adopted, both real exchange rate misalignment and volatility adversely affected growth of Nigeria’s non-oil export.

In a related study, Aliyu et al. (2009) examined exchange rate pass-through in Nigeria for the period 1986 to 2007 using vector error correction model estimation in Nigeria. He found that exchange rate pass-through in Nigeria during the period under consideration was low and declined along the price chain, which partly overturns the conventional wisdom in the literature that exchange rate pass-through is always considerably higher in developing countries than developed countries. In the same vein, Kamin and Klau (1998) using an error correction technique estimated a regression equation linking the output to the real exchange rate for a group of twenty seven countries.

The study by Odusola and Akinlo (2001) examined the linkage among exchange rate, inflation and output in Nigeria employing a structural VAR model. Prices, parallel exchange rate and lending rate were found to be important sources of perturbations in the official exchange rate. In addition, output and parallel exchange rate were significant determinants of inflation dynamics in Nigeria.

In Poland and Russia, Kemme and Roy (2005) sought both the short- and long-run movements in the real exchange rate using both the Engel Granger Causality and the Johansson procedure. They used terms of trade, openness, net capital inflow, the ratio of total government expenditure to GDP, nominal devaluation and excess supply of domestic credit as explanatory variables in an ARIMA and GARCH error correction specification and used OLS estimation techniques to determine the values of the coefficients. Their results showed that an increase in government expenditure and capital inflow led to the depreciation of the real exchange rate, while the terms of trade had an appreciating effect. Openness, on the other hand, was significant at 10 per cent and led to an appreciation of the real exchange rate in both countries. Except for the terms of trade for Russia, the ECM revealed that all the fundamentals were statistically significant for both countries. In addition, nominal devaluation and an excess supply of credit were significant in both countries and caused an appreciation of the real exchange rate.

Eita and Sichei (2006) estimated an equilibrium real exchange rate and real exchange rate misalignment in Namibia during the period 1970–2004 using VAR model approach. They variables tested were terms of trade, openness and investment to GDP as explanatory variables, and found that an increase in openness and the ratio of investment to GDP caused an appreciation of the real exchange rate, while terms of trade caused depreciation. Hyder and Mahbood (2006) conducted a study on equilibrium real effective exchange rate misalignment for Pakistan, using annual data from 1978-2005. Using the Engle Granger cointegration technique, they estimated an ECM, employing an OLS estimation technique. The exogenous variables in their model included openness, terms of trade, real investment to GDP, government consumption as a percentage of GDP, workers’ remittances as a percentage of GDP, long-term capital to GDP, and total factor productivity differential. The long-run result showed that openness, the increase in government consumption and capital inflow caused depreciation in the real effective exchange rate, whereas an increase in real investment to real GDP and improvement in the total factor productivity differential led to real effective exchange rate appreciation.

Another work of Wang (2000) examined purchasing power parity for seven Asian countries-Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, and Thailand against the U.S. Using Johansen long run model, it was found that a long run relationship hold but could not accept the symmetry and proportionality restrictions. In another development, Doğanlar (1999), using quarterly
time-series data from 1980 to 1995 for India, Indonesia, Pakistan, Turkey, and the Philippines accepted the long run relationship in the specified model.

Annsofie (2005) studied the variables that affect exchange rate movement in Sweden, the United Kingdom and Japan against the US dollar for the period 1995 to 2004. The results revealed that interest rate differential is statistically significant in explaining changes in exchange rate in the three countries. In addition, interest rate has negative effects on exchange rate in Sweden and the United Kingdom. However, the influence of differential on exchange rate varies between the countries. Also, Odedokun (1997) studied a group of 38 African countries, by examining the impact of macroeconomic policies, devaluation and fundamentals on exchange rate movement. The author found that public sector fiscal deficits, growth of domestic credits, domestic absorption. GDP ratio, government consumption–GDP ratio, private consumption–GDP ratio, improvement in terms of trade, income per capital and black market exchange rate premium lead to exchange rate appreciation.

Another work of Imed and Rault (2003) analyzed the main determinants of the exchange rate in the Middle East and North Africa (MENA) countries. The findings illustrate that output per capital government consumption, real interest rate differentials, and the degree of openness of the economy influence the exchange rate. MacDonald and Racci (2003) found that terms of trade, real interest rate differential, net foreign assets, and GDP per capita have positive influence on exchange rate in South Africa. On the other hand, the degree of openness and overall fiscal balance has negative impact on exchange rate. Additionally, Frankel (2007) investigated that exchange rate is positively related to terms of trade, real investment differential and lagged real exchange rate. However, capital account liberalization, risk premium and per capita income have negative effect on exchange rate. The study by Gelbard and Nagayasu (2004) examined the determinant of Angola’s exchange rate. They found that the most important determinants of exchange rate are oil prices and foreign interest rate. However, their results did not support the argument that monetary growth influences exchange rate. Thus, they advised that a flexible exchange rate is more appropriate than a fixed exchange rate regime.

In summary, there is no consensus on the actual relationship between exchange rate and economic growth nexus; conclusions of these studies are different, some found positive, negative and little or no relationship due to different countries, different methodologies and different period of covered in different studies. The earlier studies are limited in scope and to make this work different from the previous studies and literature in Nigeria. Thus, the main aim of this study is to re-examine the relationship between exchange rate and economic growth using dynamic ordinary least square and Granger Causality technique in Nigeria. The study intends to lengthen the scope (i.e. 1980-2015) of the study and hence the study fills the gap.

**METHODOLOGY**

**Data Collection**

The type of data for the study was time series-secondary data which were sourced from Central Bank of Nigeria (CBN) statistical bulletin and National Bureau of statistics (NBS) for the period under study. The year 1980 was chosen as base year because this was the period in which oil boom over shadowed the agrarian sector and the oil were majorly exchanged for dollar whereas 2015 as a current year; this is used to provide better understanding up till date for further empirical research.

**Model Specification**

This study adopted Adeniran, Yusuf and Adeyemi (2014) with little modification. According to them, economic growth is a function of exchange rate, inflation rate and interest rate. Mathematically, this is specified as:

\[
RGDP = F (REER, INFR, RIR)
\]

Where,

But for the purpose of this study, this model is modified such that, economic growth is a function of real exchange rate, broad money supply, degree of openness, consumer price index, real interest rate and this is written as:
\[ \text{RGDP} = f (\text{REER}, \text{OPENNESS}, \text{MSR}, \text{CPI}, \text{RIR}) \]  

(ii)

Where;

\[ \begin{align*}
\text{RGDP} &= \text{real economic growth} \\
\text{REER} &= \text{real exchange rate} \\
\text{OPENNESS} &= \text{degree of openness} \\
\text{MSR} &= \text{broad money supply} \\
\text{CPI} &= \text{consumer price index} \\
\text{RIR} &= \text{real interest rate}
\end{align*} \]

Econometrically, the equation (ii) can be mathematically re-specified as:

\[ \text{RGDP}_t = \alpha_0 + \alpha_1 \text{REER}_t + \alpha_2 \text{OPENNESS}_t + \alpha_3 \text{MSR}_t + \alpha_4 \text{CPI}_t + \alpha_5 \text{RIR}_t + \text{U}_t \]  

(iii)

Where \( t \) = time period to be estimated, \( \text{RGDP}_t \) = real economic growth, \( \text{REER}_t \) = real exchange rate, \( \text{OPENNESS}_t \) = degree of openness, \( \text{MSR}_t \) = broad money supply, \( \text{CPI}_t \) = consumer price index, \( \text{RIR}_t \) = real interest rate, and \( \text{U}_t \) = random term respectively.  

\( \alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4 \) and \( \alpha_5 \) = Parameters to be estimated.  

The a-priori expectation is that \( \alpha_1 > 0, \alpha_2 > 0, \alpha_3 > 0, \alpha_4 < 0 \) and \( \alpha_5 < 0 \). This implies that though it is expected that direct positive relationship should exist between real exchange rate, broad money supply, degree of openness and economic growth in the model. This is possible because increase in money supply (\( M_2 \)) tends to increase purchasing power parity (PPP) over a time and thereby increases exchange rate in the economy. Also, it is theoretically expected that consumer price index and real interest rate should be negatively related to economic growth in Nigeria for the period of study in the model.  

**Method of Data Analysis**

This study shall employ fully modified ordinary least square (DOSL) analysis in order to analyze the effect of real exchange rate on economic growth in Nigeria for the period of 1980-2015. The DOLS approach used in this study is a technique for fitting the sum when the squared vertical deviation of point from the line, that is the overall discrepancy between the variables in the model. This means that the sum of all the residual would be a measure of all overall discrepancy of the point from the line. Applying the use of DOLS is very essential in such that the outcome of the residual \( u_t \) is normally distributed in the model when the explanations for the behaviour of the variables are offered. The DOLS is also employed to establish the coefficients or the effects/ type of relationship that exist and the degree of the relationship in the model in Nigeria for the period under study. Furthermore, stationary and co-integration test is useful in this study in order to examine the relationship both the short run and long run between the variables in the estimated model. The stationary test and co-integration test is used to show the short and long run equilibrium relationship respectively; between the variables using Augmented Dickey Fuller (ADF) test and Johansen co-integration test. The short and long run dynamic in the co-integration series is corrected using the error correction mechanism. Finally, the Wise-Pair Granger Causality test is further used to further explain the variables. The Granger Causality test is used to Granger cause the variables (i.e. either direction-bi-directional or uni-directional relationship) between the variables in the model.  

**RESULTS**

**Test for Stationarity-Unit Root Test**

This is conducted using Augmented Dickey Fuller (ADF) test on the data collected to examine whether there is existence of short run equilibrium relationship among the variable(s) in the model: The principle rule of thumb here is that, if the ADF value at level or first difference is greater than the critical values at 5% level. Then, we conclude that the variable(s) has a unit root. That is, there exists a short run equilibrium relationship between the variables in the estimated model.
Table 1: Empirical Result of Unit Root test

<table>
<thead>
<tr>
<th>Variables</th>
<th>Test Statistic</th>
<th>5% Critical Value</th>
<th>Level</th>
<th>S/NS</th>
</tr>
</thead>
<tbody>
<tr>
<td>RGDP</td>
<td>-6.736289</td>
<td>-2.957110</td>
<td>1(1)</td>
<td>S</td>
</tr>
<tr>
<td>REER</td>
<td>-5.567047</td>
<td>-2.951125</td>
<td>1(1)</td>
<td>S</td>
</tr>
<tr>
<td>OPENNESS</td>
<td>-3.849530</td>
<td>-2.981038</td>
<td>1(1)</td>
<td>S</td>
</tr>
<tr>
<td>MSR</td>
<td>-3.315469</td>
<td>-2.948404</td>
<td>1(0)</td>
<td>S</td>
</tr>
<tr>
<td>CPI</td>
<td>-5.879557</td>
<td>-2.951125</td>
<td>1(1)</td>
<td>S</td>
</tr>
<tr>
<td>RIR</td>
<td>-7.208501</td>
<td>-7.208501</td>
<td>1(1)</td>
<td>S</td>
</tr>
</tbody>
</table>


1(0) = @ level
1(1) = @ 1st difference
S = significance

Table 1 showed that only broad money supply data series was found to be stationary at level i.e. 1(0) at 5% critical value greater than t-Statistic. This reveals that broad money supply influenced economic growth within the years of study while real exchange rate, degree of openness, consumer price index and real interest rate data series were found at first difference, i.e. 1(1) at 5% critical value. Thus, the findings implied that there existed short run relationship between real economic growth, real exchange rate, consumer price index and real interest rate in Nigeria within the period of study.

Johansen Co-integration Test

The next step is to test whether the regression residual are co-integrated. That is, to test whether a long run relationship exists among the variables in the model. Johansen Co-integration test will be examined through unrestricted co-integration rank test (trace) statistic by comparing their values with the critical values at 5% level. If the values of the unrestricted co-integration rank test are greater than the critical values, then, we conclude that there is a long run equilibrium relationship; otherwise, the regression residual are not co-integrated in the model.

Table 2: Johansen Co-integration test Result

<table>
<thead>
<tr>
<th>Variables</th>
<th>Trace statistic</th>
<th>5% Critical Value</th>
<th>Hypothesized no of CE(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RGDP</td>
<td>103.5977</td>
<td>95.75366</td>
<td>None**</td>
</tr>
<tr>
<td>REER</td>
<td>72.71013</td>
<td>69.81889</td>
<td>At most 1**</td>
</tr>
<tr>
<td>OPENNESS</td>
<td>34.80112</td>
<td>47.85613</td>
<td>At most 2</td>
</tr>
<tr>
<td>MSR</td>
<td>18.69098</td>
<td>29.79707</td>
<td>At most 3</td>
</tr>
<tr>
<td>CPI</td>
<td>6.211985</td>
<td>15.49471</td>
<td>At most 4</td>
</tr>
<tr>
<td>RIR</td>
<td>0.011298</td>
<td>3.841466</td>
<td>At most 5</td>
</tr>
</tbody>
</table>


(**) denotes rejection of the hypothesis at 5% (1%) significance level. Long run (L.R) test shows 2 co-integrating equation(s) at 5% significance level. The estimated results from the Table 3 provide evidence of statistical long run relationship between real exchange rate, broad money supply, degree of openness, consumer price index and real interest rate in the estimated. From the results in the Table, we can conclude that there is long run equilibrium relationship between the variables in the model, since the values of trace statistic are greater than some of the critical values at 5% level of significance. There is long run relationship between response-real economic growth and independent variables-real exchange rate, broad money supply, degree of openness, consumer price index and real interest rate in the model. This implies that the variables statistically influenced the economic activities in Nigeria for the period under study.
Table 3: The Empirical Dynamic Ordinary Least Square Results
Dependent Variable: RGDP
Method: Dynamic Least Squares (DOLS)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>REER</td>
<td>0.018144</td>
<td>0.004485</td>
<td>4.045521</td>
<td>0.0016</td>
</tr>
<tr>
<td>OPENNESS</td>
<td>-0.020744</td>
<td>0.003439</td>
<td>-6.031986</td>
<td>0.0000</td>
</tr>
<tr>
<td>MSR</td>
<td>0.602939</td>
<td>0.217275</td>
<td>2.775004</td>
<td>0.0093</td>
</tr>
<tr>
<td>CPI</td>
<td>-0.400188</td>
<td>0.330005</td>
<td>-1.212672</td>
<td>0.8667</td>
</tr>
<tr>
<td>RIR</td>
<td>-0.200377</td>
<td>0.114863</td>
<td>-1.744866</td>
<td>0.0802</td>
</tr>
<tr>
<td>C</td>
<td>12.53735</td>
<td>0.311094</td>
<td>40.30087</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

R-squared: 0.909843
Adjusted R-squared: 0.759582
S.E. of regression: 0.497062
Durbin-Watson stat: 2.538025


Table 3 showed that, positive relationship exist between exchange rate and economic growth in the model and this implies that a unit percent increase in real exchange rate will lead to about 18 per cent increase in economic growth in the estimated in Nigeria. Hence, it is statistically significant at 5% level in the model. Thus, this result is consistent with our a-priori proposition and corroborates with Aliyu, et al (2009) which stated that there is a significant effect of real exchange rate and broad money supply and exchange rate on economic growth in Nigeria.

Furthermore, holding other variables constant, degree of openness has an inverse sign and it is statistically insignificant at 5% level in the model. This implied that a unit percent increase in degree of openness inflation rate led to 20% decrease in economic growth in the model. This result is in support with a-priori expectation in the model. Odusola and Akinlo (2001) found that exchange rate and degree of openness influenced economic growth in Nigeria.

Again, the coefficient of broad money supply showed is directly related to economic growth in the model; this means that a unit percent increase in broad money supply will lead to about 60% increase in economic growth in the estimated model.

Finally, the coefficient of consumer price index (CPI) and real interest rate (RIR) are inversely related to economic growth in Nigeria and it is statistically insignificant at the 5% level in the estimated model. This means that there exists an inverse relationship between consumer price index, real interest and economic growth rate in Nigeria. The findings showed that a unit percent increase in consumer price index and real interest rate lead to about 40% and 20% decrease in economic growth in the estimated model in Nigeria respectively. In support, the sign of the variables is in conformity with the a-priori expectation in the estimated model. However, if all the explanatory variables are excluded from the model, the value of the constant value is pegged at 12.53735 positive in the estimated model. This simply implies that, the intercept value ($\alpha_0$) is still positive in the model for the period of study.

**Test for the Goodness of the model (Coefficient of Determination ($R^2$) using Adjusted $R^2$)**

The adjusted $R^2$ shows the predictor power of a model and it is derived to be 0.759582 in the estimated model. This implied that real exchange rate, degree of openness, broad money supply, consumer price index and real interest rate in the model explained about 76% systematic variation on economic growth for the period of study (1980-2015) in Nigeria; whereas the random or stochastic term accounts for the remaining 24% variation in economic growth, outside (exogenous) the estimated model.

**Test for Autocorrelation Using Durbin-Watson Test**
This is used in detecting the presence of auto-correction. Since the Durbin-Watson statistic is marginally above 2, i.e. 2.538025; then, we conclude that there is absence of auto-correction in the estimated model. To confirm this, we compare the Durbin-Watson statistic from the regression residual with their transforms \((d_u)\) and \((6-d_u)\). From the Durbin-Watson table, with 5% level of significance, \(n\) is 35 observations, and \(k = 6\), i.e. \((35-6 = 29)\). Thus, we compare the calculated \((d^*)\) with the critical value at 5% level (0.05). Hence, the parameters estimated variables significantly affect economic growth in Nigerian economy.

**Granger Causality Test**

Granger causality test is conducted to examine the direction of influence and causality between the variables in the model. The findings of the Pair-Wise Granger Causality test between real exchange rate, degree of openness, broad money supply consumer price index, real interest rate and economic growth in the model.

**Table 4: Empirical Results of Granger Causality Test**

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Obs</th>
<th>F-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>REER does not Granger Cause RGDP</td>
<td>34</td>
<td>0.48111</td>
<td>0.6229</td>
</tr>
<tr>
<td>RGDP does not Granger Cause REER</td>
<td></td>
<td>0.24749</td>
<td>0.7824</td>
</tr>
<tr>
<td>OPENNESS does not Granger Cause RGDP</td>
<td>34</td>
<td>26.6469</td>
<td>3.1207</td>
</tr>
<tr>
<td>RGDP does not Granger Cause OPENNESS</td>
<td></td>
<td>60.6149</td>
<td>4.0411</td>
</tr>
<tr>
<td>MSR does not Granger Cause RGDP</td>
<td>34</td>
<td>0.95893</td>
<td>0.3951</td>
</tr>
<tr>
<td>RGDP does not Granger Cause MSR</td>
<td></td>
<td>1.23109</td>
<td>0.3068</td>
</tr>
<tr>
<td>CPI does not Granger Cause RGDP</td>
<td>34</td>
<td>0.17739</td>
<td>0.8384</td>
</tr>
<tr>
<td>RGDP does not Granger Cause CPI</td>
<td></td>
<td>0.07819</td>
<td>0.9250</td>
</tr>
<tr>
<td>RIR does not Granger Cause RGDP</td>
<td>34</td>
<td>1.16616</td>
<td>0.3257</td>
</tr>
<tr>
<td>RGDP does not Granger Cause RIR</td>
<td></td>
<td>0.34183</td>
<td>0.7133</td>
</tr>
<tr>
<td>OPENNESS does not Granger Cause REER</td>
<td>34</td>
<td>0.14720</td>
<td>0.8638</td>
</tr>
<tr>
<td>REER does not Granger Cause OPENNESS</td>
<td></td>
<td>1.71521</td>
<td>0.1977</td>
</tr>
<tr>
<td>MSR does not Granger Cause REER</td>
<td>34</td>
<td>0.07706</td>
<td>0.9260</td>
</tr>
<tr>
<td>REER does not Granger Cause MSR</td>
<td></td>
<td>1.53785</td>
<td>0.2319</td>
</tr>
<tr>
<td>CPI does not Granger Cause REER</td>
<td>34</td>
<td>1.39877</td>
<td>0.2631</td>
</tr>
<tr>
<td>REER does not Granger Cause CPI</td>
<td></td>
<td>0.86408</td>
<td>0.4320</td>
</tr>
<tr>
<td>RIR does not Granger Cause REER</td>
<td>34</td>
<td>0.46522</td>
<td>0.6326</td>
</tr>
<tr>
<td>REER does not Granger Cause RIR</td>
<td></td>
<td>0.40005</td>
<td>0.6739</td>
</tr>
<tr>
<td>MSR does not Granger Cause OPENNESS</td>
<td>34</td>
<td>1.34595</td>
<td>0.2761</td>
</tr>
<tr>
<td>OPENNESS does not Granger Cause MSR</td>
<td></td>
<td>6.19900</td>
<td>3.0057</td>
</tr>
<tr>
<td>CPI does not Granger Cause OPENNESS</td>
<td>34</td>
<td>0.37856</td>
<td>0.6882</td>
</tr>
<tr>
<td>OPENNESS does not Granger Cause CPI</td>
<td></td>
<td>0.36582</td>
<td>0.6968</td>
</tr>
<tr>
<td>RIR does not Granger Cause OPENNESS</td>
<td>34</td>
<td>0.84294</td>
<td>0.4407</td>
</tr>
<tr>
<td>OPENNESS does not Granger Cause RIR</td>
<td></td>
<td>1.19354</td>
<td>0.3176</td>
</tr>
</tbody>
</table>
CPI does not Granger Cause MSR 34 0.93972 0.4023
MSR does not Granger Cause CPI 34 0.02469 0.9756

RIR does not Granger Cause MSR 34 1.02307 0.3721
MSR does not Granger Cause RIR 34 1.36652 0.2709

RIR does not Granger Cause CPI 34 0.08630 0.9176
CPI does not Granger Cause RIR 34 1.42918 0.2559


Table 4 showed the results of the Pairwise Granger Causality tests conducted on the variables. It indicated that, there is bi-directional relationship between degree of openness and economic growth in the model. The causality runs from degree of openness to economic growth. This implied that there was a strong relationship between degree of openness and economic growth in Nigeria for the period 1980-2015.

However, it was also observed that uni-directional causality test existed between degree of openness and broad money supply in the estimated model. The causality test runs from degree of openness to broad money supply. This finding showed uni-directionally relationship between the variables. Hence, this result revealed that degree of openness and broad money supply in the estimated model for the period of study in Nigeria.

POLICY RECOMMENDATIONS AND CONCLUSION

This study examined the linkage between real exchange rate and economic growth in Nigeria using unit root test and co-integration technique as pre-test in the study. Furthermore, Granger Causality test and Dynamic Ordinary Least Square (DOLS) were also specified based on time series data spanned from 1980 to 2015. Again, under this study, the following variables were considered such as real exchange rate, degree of openness, broad money supply, consumer price index, real interest rate and real economic growth in the model. Therefore, the summary of findings is as follows:

i. The findings showed that real exchange rate, degree of openness, broad money supply, consumer price index, real interest rate and real economic growth were stationary and co-integrated in the estimated model. This simply implied that there was existence of short and long run equilibrium between the variables in the model.

ii. There was a direct relationship between real exchange rate, broad money supply and economic growth for period under study; and this is consistent with our a-priori expectation.

iii. It was discovered that degree of openness, consumer price index and real interest rate are inversely related to economic growth and it is statistically significant at 5% level in the model.

In conclusion, one important lesson from the foregoing analysis is that, as Nigeria continues the search for stable and sustainable real exchange rate system-flexible exchange rate in recent times (May, 2016); care must be taken to be as holistic as possible, that is taking care of both micro and macro-economic loopholes (like broad money supply) that have rendered previous approaches futile. In this respect, one would like to suggest that under the IFEM, the premium between the parallel and official rates has considerably narrowed and significant stability has been achieved in the real exchange rate. Essentially, the long-run objective of real exchange rate policy should be achieved, an equilibrium real exchange rate that would guarantee both internal and external balance without undue dependence on equilibrating short term capital flows, acquisition of long-term external loans and abrupt monetary policy interventions through CBN in Nigeria. Based on the findings of this study, the following recommendations are suggested: (i) this study recommend that the Central Bank should institute policies that will minimize the magnitude of real exchange rate, real interest rate and nexus of export-import in the economy; (ii) The fiscal deficit should be minimized. That is, government consumption expenditure should be carried out in a systematic manner and (iii) there should be standard measurements of most of the macroeconomic variables (real exchange rate, money supply, etc) in order to ensure uniformity across
countries of the world. In case where proxies are to be used, there should equally be uniformity. Finally, research on this subject area should be constantly carried out to ensure the formulation of policy over time that will enhance the competitiveness of the economy.

REFERENCES


