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NON-OIL EXPORTS, EXCHANGE RATE VOLATILITY AND COINTEGRATION: EVIDENCE FROM NIGERIA

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Abstract

This study analyzes the relationship between exchange rate volatility and non-oil exports in Nigeria using annual data covering the period of 1970 to 2015. Specifically, it seeks to: investigate the existence of a longrun relationship between exchange rate volatility and non-oil exports in Nigeria; and determine the nature of the causal relationships between exchange rate and non-oil exports in Nigeria. The study employed the Johansen test of Cointegration, Error Correction Model (ECM), and the Granger Causality test to achieve the objectives. The results indicate that there exists a long run relationship between Exchange rate and Non-oil Exports in Nigeria. The result of the ECM reveals that in the longrun, exchange rate accounts for 81% of the deviations of non-oil exports from its equilibrium value. However, 25% of the displacement of non-oil exports from its equilibrium value as a result of the changes in exchange rate is corrected annually. This result shows that it will take non-oil exports four years to return back to its equilibrium value when displaced by the volatility in exchange rate. The Granger Causality test reveals that there exists uni-directional causality between Exchange rate and Non-oil Exports in Nigeria with the direction of causality running from Exchange rate to Non-oil Exports. The study recommends that exchange rate should be closely monitored and effectively managed. Specifically, policies that seek to maintain the exchange rate at a very minimal level should be promoted. The government and monetary authorities should seek to employ and implement policies that stabilize the exchange rate given its significant impact on non-oil exports in Nigeria.

Keywords: Exchange Rate, Non-oil exports, Cointegration, Causality, Nigeria

INTRODUCTION

In the management of the macro-economy of any country, the exchange rate is a very important policy instrument whose effect cuts across every sector of the economy. It is one of the most important price variables in every country that operates an open economy because it does not only serve as a signal of strength and stability of a country's economy in the face of its international equivalents, but it also is a determinant on the domestic price level (inflation) in a country. Its effect on the level of imports and exports determine the position of the balance of trade, the current account and the level of foreign reserves. Hence, the management of the currency is very crucial for the macroeconomic stability of countries.

Exchange rate helps to connect the price system of two different countries by making it possible for international trade to take place, having an effect on imports and exports, as well as the country's Balance of Payment position. Hence, the need for an effective management of a country's currency. Currency management is very crucial yet very cumbersome especially in developing countries such as Nigeria. This is evident in the diverse regimes that have been adopted by the Nigerian government together with the Apex regulatory agency (Central Bank of Nigeria) to manage the Nigerian currency (Naira).

In the 1970s, the fixed exchange rate regime transited into a pegged regime which lasted until the year 1986. In 1986, as one of the conditions laid down to the Nigerian government during the introduction of the Structural Adjustment Programme (SAP), the foreign exchange market was deregulated, the currency was floated such that its exchange rate could be determined by the interaction of the market forces(the forces of demand and supply). At the introduction of this system, the exchange rate depreciated from N0.89/$1 in 1985 to N2.02/$1 in 1986. Since then, the exchange rate has been quite volatile. As a result of the ineffectiveness of the floating exchange rate regime amongst other factors, the Autonomous Foreign Exchange Market (AFEM) was introduced in the year 1995 to promote the stability of the exchange rate.

At the introduction of the Autonomous Foreign Exchange Market (AFEM) in the year 1995, the exchange rate was fairly stable at the rate of N21.88/$1. The stability of the exchange rate was sustained until 1999 when the Inter-bank Foreign Exchange Market (IFEM) was adopted. This transition caused a very high fluctuation in the exchange rate as it depreciated from N21.88/$1 to N92.69/$1. In 2000, the exchange rate reached a triple digit of N102/$1. It continued to depreciate until 2005 when it further depreciated from N132/$1 to N128/$1 in 2006. In 2002, there was a reintroduction of the Dutch Auction System(DAS). This was done for the purpose of conserving the external reserves, reducing parallel market premium and to achieve a realistic exchange rate for the naira. The efforts proved futile as the exchange rate was still not fairly stable during this period.

In 2006, the Central Bank of Nigeria introduced the Wholesale Dutch Auction System (WDAS) in order to liberalize the market and narrow the gap between the official market exchange rate and the parallel market exchange rate. However, this system, transited into the Retail Dutch Auction System (RDAS) which was introduced on October 2, 2013. The purpose of the Retail Dutch Auction System was to ease the access of end users to direct sales of Foreign exchange by the Central Bank of Nigeria through the Commercial Banks. The Central Bank of Nigeria saw the need to make Foreign exchange available to the end users because of the high demand for it. Whenever there is a scarcity of Foreign exchange in the market, its price just like any other commodity, drastically increases which will in turn register its effect on other macroeconomic variables in the country. The Retail Dutch Auction System lasted until the year 2015.

At some instances, the government has deliberately reduced the value of Naira as an export promotion strategy. These efforts have however proven futile as the stock of exports have not significantly improved as desired. Rather, it reduces its value and makes imports more costly. Furthermore, the volatility of exchange rate has created distortive innovations to the flow of exports in Nigeria in the sense that a major part of raw materials and expertise(both of which are usually imported), used for producing export commodities, usually have high and unstable prices. Likewise, poor infrastructure, low level of technology and lack of adequate basic amenities have also contributed to the slow pace in the value of non-oil exports in Nigeria via the manufacturing sector. In addition, the direct cost of operating a manufacturing firm in Nigeria is very high because of the difficulty in accessing foreign exchange at the official rate and basic amenities that would minimize the cost of local production for exports. If this problem is not solved inclusively, the demand for imported goods will continuously increase which would eventually lead to currency depreciation.

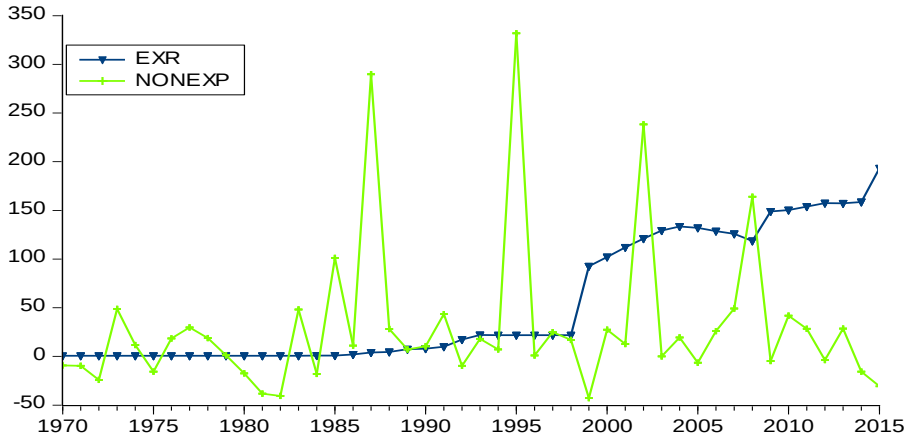

Figure 1: Trends in exchange rate and non-oil exports in Nigeria (1970-2015)

Source: Central Bank of Nigeria Statistical Bulletin (2015)

Non-oil exports constitute a major part of a country's economic output. It is very vital in order to maintain a current account surplus. Any country that pays much attention to its exports usually has a healthy economy. There is a consensus in the literature that an expansion in the export base of any nation as well as an increase in its value of exports, is capable of improving the value of the country's currency causing it to appreciate. There is also a general consensus that the behaviour of the exchange rate of the domestic currency in relation to foreign currencies, has important implications for the value of both oil exports and non-oil exports. Ironically, a cursory look at the trends of exchange rate and non-oil exports as shown in Figure 1 reveals that there is no correlation between exchange rate and non-oil exports in Nigeria. As indicated by the behaviour of the trends, the growth in the value of non-oil exports fluctuated actively while the exchange rate was on a steady path from 1970 to 2015.

Is there any relationship between non-oil exports and exchange rate in Nigeria? Do the fluctuations in exchange rate have long run implications for non-oil exports in Nigeria? Is there any causal relation between non-oil exports and exchange rate in Nigeria? These and more are the questions which this paper seeks to answer. Thus, the major objective of this study is to analyse the relationship between exchange rate and non-oil exports in Nigeria using annual data covering the period 1970 to 2015. Specifically, it seeks to: investigate the existence of a longrun relationship between exchange rate volatility and non-oil exports in Nigeria; and determine the nature of the causal relationships between exchange rate volatility and non-oil exports in Nigeria.

This study is relevant to government and policy makers as it will provide the required information needed for their work. In addition, it will serve as a reference material for students and researchers who are interested in this area of studies. This study will also help to enlighten the importers and exporters, businessmen, and indeed the general public about the apparent exchange rate - export nexus in order to guide their investment decisions. The paper is organized in five sections. Section 1 is the Introduction while section 2 contains the Literature Review. Section 3 presents the Methodology of Research employed in this study. The Empirical Results and Findings are presented in section 4. Finally, section 5 of this study presents the Summary, Conclusion and Recommendations.

LITERATURE REVIEW

Theoretical Framework

There are several theories on the subject of exchange rate and exports. However, the theory that is relevant in developing countries like Nigeria is the Marshall Lerner condition (MLC). Therefore, this study has as its main theoretical framework, the Marshall Lerner Condition,

(MLC). The Marshall-Lerner condition (also called the Marshall-Lerner-Robinson, hereafter, MLR, condition) is at the heart of the elasticity's approach to the balance of payments. It is named after the three economists who discovered it independently: Alfred Marshall, Abba Lerner and Joan Robinson. The condition seeks to answer the following question: when does a real devaluation (in fixed exchange rates) or a real depreciation (in floating exchange rates) of the currency improve the current account balance of a country?

For simplicity, assume that trade in services, investment-income flows, and unilateral transfers are equal to zero, so that the trade account is equal to the current account. In its simplest version, the MLR condition states that a real devaluation (or a real depreciation) of the currency will improve the trade balance if the sum of the elasticities (in absolute values) of the demand for imports and exports with respect to the real exchange rate is greater than one, ($\varepsilon + \varepsilon^* > 1$). [Note: the real exchange rate is the relative price of foreign goods in terms of domestic goods. A real depreciation is equal to a nominal depreciation if the domestic price and the foreign price levels remain unchanged]. The mathematical derivation of the model is thus,

The trade balance denominated in domestic currency (with domestic and foreign prices normalized to one) is given by: $N_x = x - Qe$……..…(1)

Where, X= exports and Q= imports.

e is defined as the price of one unit of foreign currency in terms of the domestic currency.

Differentiating with respect to e gives: $\delta X/\delta e = \delta X/\delta e - e\delta Q/\delta e - Q$……....(2)

Dividing Equation (2) through by X:

$\delta Nx/\delta e \cdot 1/X = \delta X/\delta e \cdot 1/X - e/X \cdot \delta Q/\delta e - Q/X$…….,,….(3)

At equilibrium X= eQ……..……..……...(4)

Therefore,

$\delta Nx/\delta e \cdot 1/X = \delta X/\delta e \cdot 1/X - 1/Q \cdot \delta Q/\delta e - 1/e$……....(5)

Multiply through by e:

$\delta Nx/\delta e \cdot e/X = \delta X/\delta e \cdot e/X - \delta Q/\delta e. e/Q - 1$……..……...(6)

Equation 6 can also be expressed as.

$\delta Nx/\delta e \cdot e/X = nXe - nQe - 1$……..…….(7)

Where nXe and nQe are common notation for the elasticity of exports and imports with respect to the exchange rate respectively.

In order for a rise in e to have a positive effect on that country's trade balance, the left hand side of the Equation must be positive i.e., for a rise in e to cause a rise in nXe.

Therefore, $nXe - nQe - 1 > 0$……..…….(8)

To see this, suppose that the trade balance is expressed in units of the home currency. At one extreme, if the demand for imports has zero elasticity, then the value of imports in home

currency will go up by the full percentage of the real devaluation/depreciation. For the trade balance to improve, the value of exports in home currency has to go up by more than the full percentage of the real devaluation/depreciation. This is the case when the export elasticity is greater than one.

At the other extreme, suppose the elasticity of demand for exports is zero. Then, following a real devaluation/depreciation, the value of exports in home currency will remain the same. For the trade balance to improve following a real devaluation/depreciation, the value of imports in home currency has to go down. This is the case when the elasticity of demand for imports is greater than one. So what the MLR condition states is that, in the event of a real devaluation, if each elasticity is less than one, but the sum is greater than one, then the increase in imports (measured in home currency) will be more than offset by the increase in exports (also measured in the home currency) and the trade balance will improve.

This elementary condition rests on two assumptions. First, is that we start from a situation of balanced trade. The second assumption is that the supply elasticities are infinite. It remains to examine each of these assumptions in turn. If the initial situation is a trade deficit, then the MLR condition is a necessary, but not sufficient, stability condition (when measured in home currency). Indeed, consider (again) the case where elasticity of demand for imports is zero. Thus, the value of imports in home currency will go up by the full percentage of the real devaluation/depreciation. But, because of the trade deficit, the initial value of imports was greater than the value of exports. To improve the trade balance, the required percentage increase in exports has to be larger than the percentage of the real devaluation (in part to compensate for the relative smaller size of exports). It should be noted that when the trade balance is expressed in the foreign currency, and if the initial situation is a trade deficit, then the MLR condition is a sufficient, but not necessary, stability condition. (Marshall, 1923)

This theory is very applicable to the Nigerian economy being that the Nigerian economy is import dominated and this has registered its effect on the country's currency. Sometime in the past, the Nigerian effort had put up effort to promote exports and also discourage import by devaluing the country's currency. But has this strategy really been effective for the purpose which it was being carried out? This is the same view presented in the Marshall-Lerner condition. Therefore, to have a logical conclusion, it is important to carry out an empirical analysis of the situation.

Empirical Literature Review

Chukuigwe and Abili (2008) empirically examined the impact of monetary and fiscal policies on non- oil exports in Nigeria Using Ordinary Least Squares (OLS) estimation, the study revealed

that exchange rate, being proxies for monetary policy, negatively affect non-oil exports and concluded that exchange rate as a major price that affects all sectors of the economy and all economic agents, it is imperative to monitor the movements in the real exchange rate in order to foster competitiveness and improve the supply of exports in the medium to long term. Policies that at worst, keep the exchange rate stable are desirable. In this regard, The Central Bank of Nigeria should continue to intervene in the foreign exchange market to maintain stability.

Shehu (2012) quantitatively assess the impact of exchange rate volatility on non-oil export flows in Nigeria. Employing quarterly data for twenty years, vector co-integration estimate revealed that the naira exchange rate volatility decreased non-oil exports and recommended measures that would promote greater openness of the economy and exchange rate stability in the economy. Ettah, Akpan and Etim (2010) focused on the effects of price and exchange rate fluctuations on Agricultural exports (cocoa) in Nigeria. An export supply function for cocoa was specified and estimated using the Ordinary Least Squares Regression. Results showed that exchange rate fluctuations positively and significantly affect cocoa exportation in Nigeria and recommended that there should be free market determination of exchange rate for export of cocoa in the country.

Opaluwa, Umeh and Ameh (2010) examined the impact of exchange rate fluctuations on the Nigerian manufacturing sector during the period 1986–2005. The results showed that fluctuations in exchange rate adversely affect output of the manufacturing sector. This is because Nigerian manufacturing is highly dependent on import of inputs and capital goods. These are paid for in foreign exchange whose rate of exchange is unstable and concluded that there need to strengthen the link between agriculture and the manufacturing sector through local sourcing of raw materials there by reducing the reliance of the sector on import of inputs to a reasonable level. Samadova (2012) Study the impact of the real exchange rate on non-oil exports in Azerbaijan using annual data spanning the period 1970 to 2008 applying Vector Error Correction Model. The results showed that appreciated real exchange rate is one of major factors that impede non-oil export growth.

Adebiyi and Dauda (2009) using error correction model argued on the contrary that trade liberalization promoted growth in the Nigerian industrial sector and stabilized the exchange rate market between 1970 and 2006. To them, there was a positive and significant relationship between index of industrial production and real export. A one per cent rise in real export increases the index of industrial production by 12.2 per cent. By implication, it means that the policy of deregulation impacted positively on export through exchange rate depreciation. Ogun (2006) studied on the impacts of real exchange rate on growth of non-oil export in Nigeria highlighted the effects of real exchange rate misalignment and volatility on the growth of non-oil

exports. He employed the standard trade theory model of determinants of export growth and two different measures of real exchange misalignment, one of which entails deviation of the purchasing power parity (PPP), and the other which is model based estimation of equilibrium real exchange rate (ERER). His results revealed that exchange rate positively affects non-oil exports in Nigeria.

Nonejad and Mohammadi (2016) investigated the effect of exchange rate fluctuations on gross domestic product (GDP), private consumption, exports, imports and investment. In addition, we applied the time series data of 1978-2010 and an auto-regressive model with Distributed Lags (ARDL) to find the relation between variables. The main findings of the model from a positive shock (increase in exchange rate or decrease in money value), negative shock (decrease in exchange rate or increase in money value) and exercising fiscal and monetary policies show that the expected fluctuations have a negative effect on GDP, private consumption, exports, imports and investment. On the other hand, positive unexpected fluctuations (positive shock) have a positive effect on exports but they have a negative impact on all other variables. Finally, it was found that negative unexpected fluctuations have a negative effect only on export but they have a positive impact on all other variables.

Akinlo and Adejumo (2014) assessed the impact of exchange rate volatility on non-oil exports in Nigeria for the period of 1986:1-2008:4. The error correction mechanism was used to analyse data. The paper conforms the existence of statistically significant relationship between real exports and exchange rate volatility. The ECM results show that exchange rate, exchange rate volatility and foreign income have significant positive effects on non-oil exports in the long run. In conclusion, the results suggest that the exchange rate volatility is only effective in the longrun but not in the shortrun as in the case of Nigeria. Aziz, Li, and Cheung (2005), using quarterly data from 1995:1 – 2006:3 studied the relationship between exchange rate elasticity and exports in China. Using the elasticity approach to analyse data. They found an aggregate export price elasticity with respect to real appreciation of about -1.5, and disaggregated elasticities of about -2.25 for non-processed exports and about -½ for processed exports. These elasticities were statistically significant. Using rolling regressions, they also found that while the elasticity for non-processed exports has stayed relatively constant, the elasticity for processed exports first decreased and then (in samples that include the period since mid-2005) increased.

Cheung (2008) used a similar empirical specification to research on the relationship between exchange rate and exports in China. The study was based on a sample period that generally uses quarterly data over the period 1993:3- 2006:2. However, he obtained a different result. The specification for exports included a foreign activity variable, a real exchange rate variable, and a supply shift variable, measured as the capital stock in manufacturing. They

found that although real exchange rate appreciation lowers exports as was expected, but the effect is not statistically significant. The income effects were also not generally significant. They also considered a specification that excluded the capital stock, but it resulted in estimates that are very counterintuitive. Exchange rate appreciations in this case have a significantly positive effect on both non-processed and processed exports.

Navidi (2013) investigate the effect of real exchange rate risk on Iran's non-oil export. To do this, the disaggregate data belonging to 13 Iran's trading partners over the period of 1985-2010 was used. The panel data approach was also utilized in the analysis process. Furthermore, to more accurate investigate of this subject, 7 alternative criteria were used to assess the volatility of real exchange rate. The results indicated that the exchange rate risk has a positive and significant effect on Iran's non-oil export in the short-run. This result could be attributed to the positive nature of exchange rate volatility in Iran so that this matter could change the expectations of economic agents, especially exporters, to improve the general trend of real exchange rate.

Imoughele and Ismaila, (2015) examined the impact of exchange rate on non-oil export. They used time series data obtained from CBN for a period of 27 years that is 1986 to 2013. Augmented Dickey-Fuller (ADF) test was used for the unit root test and Johansen's co-integration test was also conducted to establish short and long run relationships between non-oil exports and independent variables. The result showed three co-integrating Equations which establish the existence of long run relationship among the variables. Ordinary Least Square statistical technique was used to assess the determinants of non-oil export in Nigeria. The results showed that effective exchange rate, money supply, credit to the private sector and economic performance have a significant impact on the growth of non-oil export in the Nigerian economy and appreciation of exchange rate has negative effect on non-oil export which is consistent with the economic theory.

Mary and Fagite (2014) examined the relationship between exchange rate volatility and sectoral export in Nigeria using oil and non-oil sectors as a focus. The study employed the econometric method of GARCH, SUR and ARCH models. The GARCH and ARCH model result indicates that exchange rate is volatile for the period reviewed while result of the seemingly unrelated regression (SUR) model shows that exchange rate has negative and insignificant effect on the oil and non-oil sectors of the country. The study recommended that the country should adopt inward looking policy in order to enhance her capability to export and reduce the vulnerability of the country to the external shock so as to improve country's export.

Lawrence and Mohammed (2015) examined the impact of exchange rate on non-oil export in Nigeria from 1986 to 2013 using ordinary least square statistical techniques. The

results show that effective exchange rate, money supply, credit to the private sector and economic performance have a significant impact on the growth of non-oil export in the Nigerian economy and appreciation of exchange rate has negative effect on non-oil export which is consistent with the economic theory. Following this, the study recommended among others that monetary authority should ensure exchange rate stability in order to stem inflationary tendencies in Nigeria which have adverse effect on the growth of non-oil export.

Amir, Roozbeh and Tahere (2015) examined the comparison between effect of foreign exchange rate and its volatility on industrial export using GARCH model as method. The result shows that the increases in real exchange rate volatility reduce volume of industrial export. Instead effect of real exchange rate on export of this section statistically is insignificant. Managing real exchange rate, especially through control of inflation besides other supporting policy is from the political recommendations.

Oaikhenan and Nwokoye (2015) investigated the relationship between exchange rate variability and non-oil exports in Nigeria using ordinary least square method for the analysis. The study finds that exchange rate instability has a significant negative effect on non-oil exports in Nigeria. Exchange rate depreciation affects it positively but in an insignificant way. The results suggest that efforts at boosting the country's non-oil exports may be more successful if efforts are made at arresting the problem of instability in exchange rate rather than promoting its depreciation. Kazeem and Ibrahim (2015) used ARDL econometric approach to examine the impact of exchange rate volatility on non-oil export performance in Nigeria using annual data covering the period 1980 to 2013. The study found from the theoretical point of view that, Nigeria as an exporter is highly risk-averse. This follows from the evidence of long run positive relationship that exist between the Nigerian non-oil export and exchange rate volatility as evidently reported in the long run estimate of the study.

Shagil and Ahmed (2009) investigated the extent of sensitivity of Chinese exports to the changes in exchange rate in China. Using data from 1994:1 to 2009:2, he employed the OLS technique. The results indicate that real exchange rate appreciations have contemporaneous and lagged negative effects. The growth of the foreign direct income capital stock has a first positive effect and then a small, but significant, negative one later on exports growth. Aziz, Li, and Cheung (2005), using quarterly data from 1995:1 – 2006:3 studied the relationship between exchange rate elasticity and exports in China. Using the elasticity approach to analyse data. They found aggregate export price elasticity with respect to real appreciation of about -1.5, and disaggregated elasticities of about -2.25 for non-processed exports and about -½ for processed exports. These elasticities were statistically significant. Using rolling regressions, they also found that while the elasticity for non-processed exports has stayed relatively constant, the

elasticity for processed exports first decreased and then (in samples that include the period since mid-2005) increased.

Cheung and Sengupta (2012) examined the impact of exchange rate movements on exports, analysing the Indian Non-financial sector for the period 2000-2010. Using baseline regression to estimate the model, the results reveal that, on average, there has been a strong and significant negative impact of currency appreciation as well as currency volatility on Indian firms' export shares. While the firm level accounting information and other macro variable have limited implication, there is evidence that Indian firms respond asymmetrically to changes in exchange rate. Thorbecke (2006) estimates income and exchange rate elasticities for China's multilateral exports and for trade with the U.S. (exports and imports). The parameter estimates associated with the multilateral exports were obtained using a panel data that includes trade data of 30 countries from 1982-2003. The trade data are disaggregated across final products, intermediate products and capital goods. He finds that the evidence for China is not conclusive enough to characterize the effect of a change in the exchange rate on China's trade.

Omojimite and Akpokodje (2010) studied the effect of exchange rate reforms on Nigeria's trade performance during the period 1986-2007 and found a small positive effect of exchange rate reforms on non-oil exports through the depreciation of the value of the country's currency and concluded that exchange rate reforms are not sufficient to diversify the economy and there is need for major incentives in the form of conducive environment for domestic production, especially effective infrastructure that could lead to significant improvement in competitiveness are required.

Olufayo and Babafemi (2014) explored the effects of exchange rate volatility on the exports performance of both oil and non-oil sectors from 1980 to 2012. The paper employed the econometrics method of GARCH in measuring volatility of exchange rate and seemingly unrelated regression method (SUR) in estimating the coefficient of the two system Equation. ARCH and GARCH results suggested that the exchange rate is volatile , while SUR model shows that exchange rate has negative effect on the two sectors , though statistically not significant. Therefore, for the country export to improve, the country should adopt inward looking policy in order to enhance her capability to export and reduce the vulnerability of the country to the external shocks.

Baak (2004) examined the relationship between exchange rate volatility and exports from East Asian countries to Japan and the U.S and submitted that there is significant negative relationship between the two variables. Furthermore, Doganlar (2002), used error correction and cointergration method to explored the impact of exchange rate volatility on export, he asserted that the volatility of exchange rate had negative effect on exports .Hook and Boon (2000) also

affirmed the negative effects of volatility on export, likewise , Vergil(2002) who also conducted studies on determining the effect of volatility of exchange rate , he arrives at his conclusion using the standard deviation method and submitted that export had negative effect on the export performance. Anthony (2008) used an error correction model to study the impact of real effective exchange rate volatility on the performance of non-traditional exports for Zambia between 1965 and 1999. Using a generalized autoregressive conditional heteroscedasticity (GARCH) measure of real exchange rate volatility, he finds that exchange rate volatility depresses exports in both the short run and the long run.

RESEARCH METHODOLOGY

Nature and Sources of Data

Data used for this work are purely secondary in nature. They are annual time series data obtained from sources such as: the Central Bank of Nigeria Statistical Bulletin (2015) and the National Bureau of Statistics publication of various issues (2014). The data spanned the period 1970-2015.

Model Specification

The model adopted in this study is drawn from the postulations of the Marshall Lerner condition with some structural modification being that other variables that are considered by theory and other empirical works to be influential to a country's import and export have been added to the original model. Specifically, the study specifies a model in which non-oil exports is expressed as a function of exchange rate. However, in order that the model is not underspecified, other variables that have been identified from the literature as having an influence on non-oil exports are also included in the model. Thus, this study specifies the following model:

NOEXP=F(NOEXP,EXR,OPN,MS,INTR,TGE,INF,RGDP).....(9)

(+) (+) (+) (+/-) (-) (+) (+/-) (+)

Where,

NOEXP = Non-oil exports (%); EXR = Exchange rate;

OPN = degree of openness (imports+exports/GDP) MS = Money supply (GR);

INTR = Interest Rate (prime lending rate); TGE = Total Government Expenditure (% of GDP); INF = Inflation GDP = Gross Domestic Output (%); t-i = the lag term;

Apriori Expectations

The signs in the parenthesis represent apriori expectations of each of the variables used in this study.

Analytical Techniques

The analytical techniques employed for the purpose of this study are based on the specific objectives of the study.

Objective 1

To investigate the longrun relationship between exchange rate volatility and non-oil exports in Nigeria, the Johansen test of Cointegration and the Error Correction technique were employed.

Cointegration

The Johansen test of Cointegration will be carried out in this work to determine whether there exist a longrun relationship between exchange rate volatility and non-oil exports. Cointegration means that while many developments can cause permanent changes in the individual variable, there is some longrun equilibrium relationship tying the individual variables together represented by some linear combinations of them. There is an assumption of non stationarity between exchange rate volatility, non-oil imports, and non-oil exports. The test of cointegration will be carried out based on the Equation 9.

There is an assumption of a non-stationarity nature of the variables used in this study. E_t has zero mean, therefore $E_t \sim I(0)$, but it can cause serial correlation through heteroscadasticity. The Johansen cointegration test approaches the testing for cointegration by examining the number of independent linear combination (k) for an (M) time series variable set that yield a stationary process.

$P = m - k$ ……(10)

Where, p represents the number of common non – stationary underlying processes. M= number of time series variables set that yields stationary process. K= the number of independent linear combinations. The decision criteria is that if k=0, p=0 then the time series are not integrated. If $0<k<m$, $0<p<m$; then the time series variable are stationary I(0). This will help to achieve the first specific objective of this study (Hansen, 2000).

Error Correction Model

The Error Correction model directly estimates the speed at which a dependent variable returns to equilibrium after a change in other variables. The VECM adds error correcting feature to a multi factor model. E.g $Y= 70+0.5X_1 – 0.75\ ECM_{-1.}$ The coefficient of ECM will show how much value it will take the imports and exports to return back to equilibrium after a deviation caused by the volatility in exchange rate. The ECM will be estimated based on Equations 9 and 10 (Hansen, 2000).

Objective 2

To determine the nature of the causal relationships between exchange rate and non-oil exports, the Granger causality test was employed.

Granger Causality Test

The Granger causality test states that the cause and effect relationship is that the past value should affect the present value. The Granger causality Equations for the purpose of this study are specified thus:

$$NOEXP_t = \sum_{i=1}^{n} \alpha_i EXRt_{-1} + \sum_{j=1}^{n} B_j \, NOEXP_{t-1} \, U_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(15)$$

$$EXR_t = \sum_{i=1}^{n} \delta_i EXRt_{-1} + \sum_{j=1}^{n} \lambda_j \, NOEXP_{t-1} \, U_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(16)$$

The $NOEXP_t$ is affected by the past values of EXR and NOEXP, and EXR is equally affected by the past values of NOEXP and EXR. The decision rule is that if $\alpha_i = 0$, then EXR_{t-1} does not granger cause changes in $NOEXP_{t-1}$. if $\delta_j=0$ then $NOEXP_{t-1}$ does not granger cause changes in EXR_t.

EMPIRICAL RESULTS AND DISCUSSIONS

Unit Root Tests

We begin this analysis by examining the time properties of the data. This is done in order to avoid spurious regression. The orders of integration of the variables are examined using the Augmented Dickey-Fuller (ADF) and the Phillip-Perron (PP) test statistics. The results of these tests are presented in Tables 1a and 1b.

The result of the unit root test for both the Augmented Dickey fuller test and the Phillip Perron test show that all the variables used in this study are stationary at various levels of integration as shown in the Tables 1a and 1b. However, none of the variables were stationary at level. This expression satisfies our choice of carrying out the Johansen test of cointegration.

Table 1a: Result of Unit Root Test Based On Augmented Dickey Fuller (ADF)

Variable	**ꚍ ADF**	**1% critical value (**)**	**5% critical value (*)**	**Order of integration**
Rgdp	-6.802**	-4.18	-3.51	I~(1)
Exr	-6.140**	-4.18	-3.51	I~ (1)
Inf	-3.867*	-4.18	-3.51	I~ (1)
Intr	-10.37**	-4.18	-3.51	I~ (1)

Table 1a...

Ms	-4.750**	-4.18	-3.51	I~ (1)
Tge	-6.956**	-4.18	-3.51	I~ (1)
Inv	-7.138**	-4.18	-3.51	I~ (1)
Nonexp	-10.0003**	-4.18	-3.51	I~ (2)
Opn	-8.265927**	-4.18	-3.51	I~ (1)

Source: Authors' computation using (EVIEWS 9)

Table 1b: Result of Unit Root Test Based On Phillip Perron (PP)

Variable	PP adjusted stat	1% critical value (**)	5% critical value (*)	Order of integration
Rgdp	-7.181303**	-4.18	-3.51	I~(1)
Exr	-6.148566**	-4.18	-3.51	I~ (1)
Inf	-3.803509*	-4.18	-3.51	I~ (1)
Intr	-10.28**	-4.18	-3.51	I~ (2)
Ms	-4.804930**	-4.18	-3.51	I~ (1)
Tge	-6.866505**	-4.18	-3.51	I~ (1)
Inv	-6.778792**	-4.18	-3.51	I~ (1)
Nonexp	-7.284198**	-4.18	-3.51	I~ (1)
Opn	-8.235902**	-4.18	-3.51	I~ (1)

Source: Authors' computation using (EVIEWS 9)

Cointegration Results

The cointegration test results are presented in Table 2a and Table 2b. The results of the max Eigen test indicates that at 5% significance level, there are two cointegrating equations and the trace test indicates that there are three cointegrating equations. Hence, we reject the null hypothesis of no cointegration. Therefore, there exists a long run relationship between exchange rate and non-oil exports in Nigeria. Hence we carry out a cointegrating regression and ECM.

Table 2a: Unrestricted Cointergration Rank Test (Trace) NOEXP

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.841783	267.9312	187.4701	0.0000
At most 1 *	0.775996	188.6483	150.5585	0.0001
At most 2 *	0.634247	124.3164	117.7082	0.0178
At most 3	0.551009	81.06710	88.80380	0.1588
At most 4	0.396781	46.63473	63.87610	0.5702
At most 5	0.303366	24.89930	42.91525	0.7948
At most 6	0.139804	9.355007	25.87211	0.9495
At most 7	0.064771	2.879444	12.51798	0.8905

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Table 2b: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.841783	79.28291	56.70519	0.0001
At most 1 *	0.775996	64.33191	50.59985	0.0011
At most 2	0.634247	43.24928	44.49720	0.0679
At most 3	0.551009	34.43237	38.33101	0.1312
At most 4	0.396781	21.73542	32.11832	0.5140
At most 5	0.303366	15.54429	25.82321	0.5855
At most 6	0.139804	6.475563	19.38704	0.9328
At most 7	0.064771	2.879444	12.51798	0.8905

Source: Authors' computation using eviews 9.
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

The result of the cointegrating regression as presented in Table 2c, shows that there is 76.4% impact of exchange rate on non-oil exports in Nigeria. The coefficient of exchange rate indicates a 69% positive relationship, the coefficient of interest rate shows a 109% negative relationship, the coefficient of inflation shows 25% positive relationship, TGE expresses 8% positive relationship, money supply shows 28% inverse relationship, RGDP shows 0.81 inverse relationship, OPN indicates 4.1% positive relationship with non-oil exports in Nigeria.

Table 2c: Cointegration Regression of Exchange Rate and Non-Oil exports

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXR	69.47814	9.690301	7.169865	0.0000
INTR	-109.3636	81.59417	-1.340336	0.1883
INF	25.28785	27.20755	0.929442	0.3587
TGE	8.679186	15.53126	0.558821	0.5797
MS	-28.30193	28.03760	-1.009428	0.3193
RDGP	-0.815717	5.011247	-0.162777	0.8716
OPN	4.117696	85.24858	0.048302	0.9617
C	1182.945	1293.067	0.914836	0.3662
R-squared	0.764592	Mean dependent var		2975.215
S.E. of regression	2426.068	S.D. dependent var		4585.294
Long-run variance	7370861.	Sum squared resid		2.18E+08

Source: Authors' computation using (EVIEWS 9)

Error Correction Model Results

Table 3: Parsimonious ECM Results Of Exchange Rate and Non-Oil Exports

	Coefficient	Std.Error	t-value	t-prob
Constant	22.5995	31.65	0.714	0.480
EXR	0.544201	1.129	0.482	0.033**
INF	0.0732142	0.1244	0.589	0.060*
INTR	-1.24079	1.629	-0.762	0.052*
MS	-0.00815549	0.03017	-0.270	0.089*
RDGP	0.00445646	0.004824	0.924	0.062*
TGE	-0.00302832	0.002996	-1.01	0.019**
OPN	0.360517	0.2811	1.28	0.009**
ECM_{-1}	-0.250859	0.8334	-0.481	0.063*

sigma	49.425	RSS	39085.352
R^2	0.815563	F(25,16)	2.83 [0.017]*
log-likelihood	-203.148	DW	2.52
no. of observations	42	no. of parameters	26

ECM = NOEXP - 51.5303 - 1.02503*EXR + 0.032939*INF + 1.01047*INTR
+ 0.0108447*MS - 0.00209831*RDGP - 0.000394856*TGE - 0.238385*OPN
- 0.25164*ECM_{-1};

The result of the ECM as presented in Table 3, shows that in the longrun, exchange rate accounts for 81% of the deviations of non-oil exports from its equilibrium value. However, 25% of the displacement of non-oil exports from its equilibrium value as a result of the changes in exchange rate is corrected annually. This result shows that it will take non-oil exports four years to return back to its equilibrium value when displaced by the volatility in exchange rate.

Granger Causality Results

To Determine the Nature of the Causal Relationships between Exchange Rate and non-oil Exports In Nigeria, the Granger Causality test was employed.

Table 4: Causality Tests of Exchange Rate and Non-Oil Exports

Null Hypothesis:	Obs	F-Statistic	Prob.
EXR does not Granger Cause NONEXP	44	2.71788	0.0785*
NONEXP does not Granger Cause EXR		0.35722	0.7019

Source: Authors' computation using (EVIEWS 9)

The Granger Causality test reveals that there is uni-directional causality between exchange rate and non-oil exports in Nigeria. With an F-statistic of 2718, exchange rate precedes non-oil exports. This is decided based on the probability value 0.0785 which makes the F-Statistic significant at 10% probability level. Hence, we reject the null hypothesis and conclude that there exists a uni-directional causality between exchange rate and non-oil exports in Nigeria with the direction of causality running from Exchange rate to Non-oil Exports.

POLICY IMPLICATIONS OF FINDINGS

The results of the cointegration analysis indicate that there exists a long run relationship between Exchange rate and Non-oil Exports in Nigeria. The result of the ECM reveals that in the longrun, exchange rate accounts for 81% of the deviations of non-oil exports from its equilibrium value. However, 25% of the displacement of non-oil exports from its equilibrium value as a result of the changes in exchange rate is corrected annually. This result shows that it will take non-oil exports four years to return back to its equilibrium value when displaced by the volatility in exchange rate. The Granger Causality test reveals that there exists a uni-directional causality between Exchange rate and Non-oil Exports in Nigeria with the direction of causality running from Exchange rate to Non-oil Exports.

Based on the findings of this study, the policy implications are discernable. Hence, there is need for the government and the monetary authorities to closely monitor and manage the exchange rate given the implications of its movements on non-oil exports. Exchange rate policies that are growth-friendly should be allowed to hold sway. The Exchange rate should be managed and maintained at a very minimal and single-digit level. The government and relevant monetary authorities should seek to employ and implement policies that stabilize the exchange rate given its significant impact on non-oil exports in Nigeria. This is an imperative given the fact that a greater percentage of the raw material content of non-oil exports are usually imported. Indeed, this will go a long way in ensuring that the unit cost of production of non-oil commodities is brought down to the barest minimum.

CONCLUSION AND RECOMMENDATIONS

This paper sought to analyse the relationship between exchange rate and non-oil exports in Nigeria using annual data covering the period 1970 to 2015. Specifically, it sought to: investigate the existence of a longrun relationship between exchange rate volatility and non-oil exports in Nigeria; and determine the nature of the causal relationships between exchange rate and non-oil exports in Nigeria. The study employed the Johansen test of Cointegration, Error Correction Model, and the Granger Causality test to achieve the objectives. The results of the

cointegration analysis indicate that there exists a long run relationship between Exchange rate and Non-oil Exports in Nigeria. The result of the ECM reveals that in the longrun, exchange rate accounts for 81% of the deviations of non-oil exports from its equilibrium value. However, 25% of the displacement of non-oil exports from its equilibrium value as a result of the changes in exchange rate is corrected annually. This result shows that it will take non-oil exports four years to return back to its equilibrium value when displaced by the volatility in exchange rate. The Granger Causality test reveals that there exists uni-directional causality between Exchange rate and Non-oil Exports in Nigeria with the direction of causality running from Exchange rate to Non-oil Exports.

The study recommends amongst others that the exchange rate should be closely monitored and effectively managed. Specifically, policies that seek to maintain the exchange rate at a very minimal level should be promoted. The government and relevant monetary authorities should seek to employ and implement policies that stabilize the exchange rate given its significant impact on non-oil exports in Nigeria. However, there is need for researchers in related disciplines to further investigate on the sectoral impact of exchange rate volatility on non-oil exports in Nigeria. Indeed, a disaggregated analysis of the impact of exchange rate volatility on non-oil exports in Nigeria is quite necessary.

This study has revealed the critical role that exchange rate plays in a country's economy given its long run relationship with non-oil exports. However, in view of the fact that other factors other than exchange rate movements have important implications for non-oil exports in Nigeria, there should be an appropriate mix of monetary and fiscal policies as well as an effective coordination of public and private sector efforts to ensure that the non-oil sector in Nigeria receives the needed boost that will not only guarantee highly standardized and competitive goods but also guarantees 100% capacity utilization of production plants in the sector. This will not only birth a host of positive multiplier effects such as an appreciable increase in national income, increase in employment opportunities, reduction in unemployment rate and the incidence of poverty, but it will also enhance the production of non-oil commodities at optimal levels sufficient for domestic consumption as well as for exports. This will not only improve the balance of trade as well as the balance of payments position of the nation, it will guarantee a strong domestic currency as well as a gradual appreciation and stability of the exchange rate.

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