Exchange Rate Policy and Non-Oil Exports in Nigeria: Evidence of Asymmetric Effects

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ABSTRACT

This study is aimed at delineating the asymmetric effects of exchange rate policy on non-oil exports in Nigeria. Monthly time series data for the period, January 2008 to M, 2024, a total of 196 observations were obtained from Central Bank of Nigeria, Trading Economics and National Bureau of Statistics. The Cointegrating Nonlinear ARDL model with partial sum decomposition of exchange rates was employed. To capture the effect of other relevant macro-economic variables, relative prices, world income, and Nigeria's foreign reserves representing its capacity to produce exports, entered the model as fixed regressors. The cumulative dynamic multiplier (CDM) was employed to assess the overall impact of the exchange rate shock in order to decipher how non-oil exports adjust to equilibrium after a shock. The study found that there exists a nonlinear and asymmetric relationship between exchange rates and non-oil exports in the short-run. The error correction term (ECM) was appropriately negatively signed and highly statistically significant at the 1% level, implying that non–oil exports and exchange rates are nonlinearly cointegrated in the long-run. The symmetry test rejected the null hypothesis of symmetry in the response of non-oil exports to positive and negative changes in the short run, but failed to reject it in the long run, suggesting that in the short run exchange rate has asymmetric effect on non-oil exports. The results further show that both positive and negative changes in exchange rate were contractionary, probably due to structural, infrastructure and supply side constraints. Asymmetric plot of the CDM confirms the existence of asymmetric effects of exchange rate changes on non-oil exports in Nigeria with the impact of the negative shocks on non-oil exports being much higher than those of the positive shocks. The policy implication is that policy makers may have to consider exchange rate stabilization in order to expand and diversify non-oil exports in Nigeria.

Keywords: Non-oil, Exports, Exchange rates, Asymmetry, Nonlinear, partial sum decomposition.

INTRODUCTION

Nigerian economy has long struggled with diversification of its export products. The economy has been heavily dependent on oil exports which currently makes up 88% of total exports while non-oil exports constitute only 12% (42). The volatility of global oil prices, the need to promote economic growth, eliminate economic distortions and strengthen the fiscal outlook make it imperative to focus on the development of exports and non-oil exports in particular.

Exchange rate policies play a crucial role in promoting exports, as they affect the competitiveness of Nigerian Products in the global market. Exchange rate management has been used in the past as a tool to influence the competitiveness, growth and enhance a more predictable environment for non-oil exporters. Nigeria's experience with exchange rate policies dates back to the 1960s with varying regimes adopted from 1960 to date. In its effort to find an optimal exchange rate policy to boost exports and enhance economic growth, Nigeria has gone from fixed exchange rates in the 1960s, to managed float regime of the 1980s, introduction of interbank foreign exchange market in 1990s, multiple exchange rate regime to unified free market determined exchange rate policy in 2023. The free market determined exchange rate has led to massive depreciation of the Nigerian Naira and has been very volatile.

From economic theory and some empirical studies, it has been gathered that some macroeconomic variables such as the exchange rates, inflation and the rate of interest demonstrate nonlinear behaviour and may impact other variables asymmetrically (24, 19). According to Hasanov, (24) an asymmetric relationship between the variables may lead to an asymmetric adjustment towards their equilibrium. In this respect one may expect that the relationship between exchange rate and non – oil exports to be asymmetric. Important observation is that empirical studies have shown that asymmetric adjustment of international trade variables due to changes in exchange rate provide further justification to investigate asymmetric relationship between exchange rate and exports (19, 5 and 8). However, the result of a linear estimation will be misleading if in fact the relationship is asymmetric.

Economic theory expects a depreciation in the domestic currency exchange rate to lead to increase in exports and a decrease in imports because exports become cheaper while imports become more expensive. The Nigerian Naira is a weaker currency in relation to the US Dollar. In depreciation more Naira is given in exchange for the US Dollar, while in the appreciation of the Naira, less of it is given in exchange for the US Dollar. The implication is that positive changes occur during depreciation, while negative changes occur when the Naira appreciates in relation to the US Dollar. For instance, in January 2008 the exchange rate which was N117.70 = 1USD depreciated to N1364.75 = 1USD on the 27th, February 2026 (15). Exchange rate policy plays a crucial role in determining the competitiveness of a country's total exports. In the case of Nigeria that is a major oil exporting country, the exchange rate policy has significant implications for its non-oil exports sector.

Nigeria has been a monocultural economy as total exports is made up of 88% oil and oil related products, while non-oil exports make up the remaining 12%. Agricultural exports constitute 71% of Nigeria's non-oil exports (42). Nigeria's non-oil exports have been seen to have negative long-run income elasticity of demand, but high long-run price elasticity of demand, such that prices rise and fall in response to the highly volatile global commodity prices, (2, 17, 9, 27, 32, 33, 34, and 38).

Nigeria's non-oil components of exports are not likely to respond spontaneously to devaluation of its currency because the component of imported inputs is quite high leading to higher cost of production which may discourage further investment in export production. The implication is that changes in exchange rate may not completely pass through to trade balance according to Aliyu and Tijani, (6). Hence, the relationship between exchange rate and exports in Nigeria may not be symmetrical. The positive changes are likely to affect exports differently from negative changes of exchange rates. The speed of adjustment of export to exchange rate variation towards the long-run equilibrium may differ from a priori expectations as changes in exchange rates may lead to nonlinear dynamics and exhibit a regime switching behavior. There are however very few studies that have adopted the NARDL model to carry out a direct analysis of long run and short run relationships between Nigeria's exchange rate policies and the non – oil exports.

The major objective of the study is to delineate the long run relationship between non-oil exports and exchange rate changes in Nigeria with a view to ascertain whether they are symmetrical or otherwise. The specific objectives are to:

(1) determine the long run or otherwise relationship between exchange rate and non – oil exports;

(2) identify asymmetry or otherwise in the long run and short run dynamics of non-oil exports and exchange rates;

(3) examine the impact of positive and negative changes in exchange rates on the value of non-oil exports; and

(4) decipher how non-oil exports adjust to equilibrium after a perturbation.

This study employed the nonlinear autoregressive distributed lag model (NARDL) with partial sum decomposition of positive and negative changes in exchange rates to study their varied (or otherwise) asymmetric effects on non-oil exports, as well as adjustment of non-oil exports to disequilibrium occasioned by changes in exchange rate regimes in Nigeria. The major advantage of the nonlinear autoregressive distributed lag (NARDL)

model over previous approaches is that it generates more efficient short-run and long-run estimates, and permits a single common co-integrating vector through the distributed lag and long-run dynamics with the assumption that the relationship between real exchange rate and exports are symmetric (43). As enunciated by Jordan and Philips (26), one major advantage of the dynamic NARDL over the traditional ARDL framework lies in its capacity to provide useful and robust interpretation of the impact of positive and negative changes of a variable in the short and long-run. The procedure is unique (22, 1, 26, 41).

The literature is awash with articles that have explored the relationship between exchange rate (or its volatility) and total exports, non-oil exports, oil exports and balance of trade around the world and Nigeria; (2, 3, 5, 28, 30, 43, 8, 6, 24, 16, 31, 4, 32). The results from these studies are diverse with no concise conclusions. However, studies that employed nonlinear ARDL and asymmetric adjustments in the cointegration seem to be more robust and consistent in their results. A number of important findings can be gleaned out from the review of studies on the dynamics of exchange rate regimes and their impact on exports. The studies generally indicate that exchange rate (increase and decrease) have significant and asymmetric effects on exports. Specifically, a good number of studies employing nonlinear ARDL found evidence of a negative long-run relationship between exchange rate changes and trade balance performance (28, 31, 6, 16). Muoneke, Okere and Onuoha (28) found asymmetric effects of exchange rate on trade balance for Nigeria in the short run but symmetric effect in the long run.

Most of the studies found out that exchange rate appreciation may not affect non – oil exports the same way a currency depreciation would. For instance, Arize, Malindrestos and Igwe (8) found that long-run and short-run cointegration analysis and half-lives all provide evidence that when depreciation is separated from appreciation, in an asymmetric model, it has significant effect on trade balance. Also studies on the volatility of exchange rate and its impact on exports in Nigeria show that the competitiveness of exports is hampered by high exchange rate volatility, supply irresponsiveness occasioned by structural bottlenecks (43, 31, 16, 11).

Several reasons have been adduced for the negative impacts of exchange rates volatility on non-oil exports. Given the Marshal – Lerner Condition, it is expected that the depreciation of the Naira should directly boost Nigeria's non-oil export competitiveness by making local goods cheaper and more attractive to foreign buyers, the appreciation of the Naira should make the local goods more expensive for foreign buyers and hence reduce their competitiveness. This is because foreign buyers should get more value when the Naira weakens, and less value when it is stronger, *ceteris paribus*. However, chronic price volatility and hyperinflation have often blunted the expected gains as the rising cost of local inputs and logistics offset the price advantage. The effectiveness of Naira depreciation in enhancing the competitiveness of non-oil exports in Nigeria is also hampered by structural bottlenecks and challenges, such as heavy reliance on imported inputs (machinery, agrochemicals, other raw materials, and packaging materials priced in USA Dollars) and poor infrastructure facilities, such as poor power supply, bad roads and port congestion leading to higher costs. In this respect, depreciation significantly increases the costs of production which eventually negate whatever competitive gains that may have been achieved by currency depreciation. Importantly, the low non-oil exports value addition of 50% and by implication, the remaining 50% that is made up of unprocessed raw materials, miss out on premium pricing in the global commodity market, and is highly susceptible to volatile global commodity prices that make them uncompetitive (2, 9, 10, 12, 17, 25 27, 29, 31, 32, 38).

Another dimension observed in the studies on exchange rates and its relationship with non – oil exports, identified differences in the behaviour of the exports and non-oil exports in response to changes in exchange rate regimes. They noted that exports respond differently to shocks in changes in exchange rate regimes. This range of studies employed threshold estimation and asymmetric adjustments in cointegration. Their findings suggest that exports and non-oil exports are more sensitive to exchange rate movements when estimated thresholds are crossed (10, 7, 11). Studies on exchange rate regime change and its relationship with non-oil exports have not been given the attention it deserves in Nigeria where myriad exchange rate forms and regimes have been adopted with attendant shocks to the system since 1960 when Nigeria obtained Political Independence.

This study adopts Nonlinear ARDL approach and examines positive and negative changes in exchange rate and their impact on non-oil exports with a view to provide empirical evidence of asymmetric response and adjustment in Nigeria, for evidence based policy making.

In addition to this introductory section, methodology, data and model specifications are in section two, results and discussion are in section three, while conclusions and policy recommendations are in section four.

METHODOLOGY

The estimation starts with the analysis of the time series properties of the data, including test for Unit Roots for all the macroeconomic variables in the model.

Characteristics of the Time Series Data:

Monthly time series data for the period, January 2008 to May, 2024, a total of 196 observations were obtained from Central Bank of Nigeria, National Bureau of Statistics, and Trading Economics.

Model Specification

Conditional Error Correction Model:

It begins with the estimation of the Conditional Error Correction Model (CECM). The linear Autoregressive Distributed Lag model was employed for the analysis using the EViews 14 package. Following the standard international trade theory and the constant elasticity function, (34, 24) the CECM model for this study is specified thus:

$$LNOE = f(LEXRATE, Rit) \qquad -(1)$$

Where:

LNOE = the dependent variable, is the value of the non-oil exports (in billion Naira);

LEXRATE = the independent variable, the exchange rate (in Naira) is the value of the Naira in relation to the US Dollar, a decrease in its numerical value means an appreciation of the Naira against the USD, and the opposite is also true;

R_{it} = is a vector of exogenous variables that entered the model as fixed regressors, which include: $LRP, Y_N, Y_F\$$;

Where, LRP = Export commodities Relative Prices (LRP). To enhance the robustness of the model relative prices between Nigeria and the world, here proxied by Netherland's CPI was included in the model as a fixed variable. Its coefficient estimates the elasticity of demand for Nigeria's exports;

$LRP = {}^{LCPI_{nt}}/_{LCPI_{ft}}$;

$LCPI_{nt}$ = is the log of Nigeria's CPI in time t;

$LCPI_{ft}$ = is the log of World CPI proxied by Netherland's CPI in time t

LY_N, = Log of Domestic Income (LY_N). This is the value of Nigeria's real foreign reserves was used as a proxy for Nigerian income. The LY_N in the model represents the capacity to export products by Nigerian firms (34).

$LY_F\$$ = this study used the values of the foreign reserve of Netherlands (in US $), (24), the highest importer of Nigeria's export to Proxy World income and capacity to import. It represents its capacity to import Nigerian goods. The data on the foreign reserves of the Netherlands was obtained from Trading Economics (July, 2024). Its coefficient estimates the income elasticity of demand for Nigeria's exports.

Nonlinear Autoregressive Distributed Lag (NARDL) model:

The Nonlinear ARDL model employed in this study is specified in line with a standard ARDL model but includes partial sums of positive and negative changes in exchange rates in Nigeria as exogenous variables to capture the asymmetric effects. The Model is specified in its general form as follows:

$$\Delta LNOE_t = \alpha + \sum_{i=1}^{p} \beta_i \, \Delta LNOE_{t-i} + \sum_{j=0}^{q} \gamma_j^{+} \Delta LEXRATE_{t-j}^{+} + \sum_{k=0}^{q} \gamma_k^{-} \Delta LEXRATE_{t-k}^{-} + \nwarrow_1 \; LNOE_{t-1}$$

$$+ \nwarrow_2^{+} \; LEXRATE_{t-1}^{+} + \nwarrow_3^{-} \; LEXRATE_{t-1}^{-} + \sum_{i=1}^{3} \delta_i R_{it} + U_t \qquad - (2)$$

Where: LNOE and LEXRATE are as defined in 2.2.1;

LEXRATE = for NARDL model the dynamic independent variable $LEXRATE_t$ was decomposed for this study into its positive and negative changes. This procedure is known as the partial sum decomposition which is defined as follows (41):

(i) $LEXRATE_t^{+}$ = The partial sum of positive changes representing periods of depreciation in the exchange rate.

(ii) $LEXRATE_t^{-}$ = The partial sum of negative changes, in $LEXRATE_{\square}$, representing periods of appreciation of the exchange rate.

These are calculated as:

$$LEXRATE_t^{+} = \sum_{i=1}^{t} \max(\Delta LEXRATEi_{t,}\, 0) \qquad - (3)$$

$$LEXRATE_t^{-} = \sum_{i=1}^{t} \min(\Delta LEXRATEi_{t,}\, 0) \qquad - (4)$$

$\Delta LNOE_t =$ is first difference of the dependent variable total non-oil exports; $\Delta LEXRATE_t^{+}$ =is the first difference of the positive changes in the exchange rate; $\Delta LEXRATE_t^{-} =$ is the first difference of the negative changes in the exchange rate; P and q are the lags of the dependent and independent variables (LNOE and LEXRATE), respectively. $\beta_i =$ are the autoregressive parameters, γ_j^{+} and γ_k^{-} are the short-run asymmetric effects of positive and negative changes in $LEXRATE_i$ on $LNOE_i$). $R_{it} =$ is a vector of exogenous variables that entered the model as fixed regressors as earlier defined. $\nwarrow_1$, $\nwarrow_2^{+}$ *and* $\nwarrow_3^{-}$, represent the long-run coefficients for the levels of the dependent variable LNOE and independent variables, $LEXRATE_t^{+}$ *and* $LEXRATE_t^{-}$, accounting for the cointegrating relationships; δ_i are the coefficients of the fixed regressors.

This study adopts the simplest case where the long-run relationship is defined between $LNOE_t$, $LEXRATE_t^{+}$ *and* $LEXRATE_t^{-}$ as noted by Shin, Yu and Greenwood-Nimmo (41) for the estimation of the NARDL.

The $R_{it} =$ variables enter the model as fixed regressors in line with Webber, (44). The coefficient of LRP, δ_1, measures the price elasticity of demand for Nigerian exports. By assumption of the standard theory, demand for exports is elastic hence $\delta_1 \geq 1$. δ_2 *is* the coefficient of Nigeria's Income. It measures the capacity to produce exports and respond to changes in the demand for exports as a result of changes in the exchange rate, hence $\delta_2 > 0$, apriori.

δ_3 *is* the coefficient of world income $LYF\$_t$. It measures the income elasticity of demand for exports, $\delta_3 > 0$.

The model permits the testing of whether there is a difference between the short-run and long-run effects of positive $(LEXRATEi_t^{+})$ and negative $(LEXRATEi_t^{-})$ changes in exchange rate on LNOEit. Thus our model with $\Delta LEXRATEi_t^{+}$ *and* $\Delta LEXRATEi_t^{-}$ captures regime switching cointegrating relationship in which regime transitions are governed by the sign of $\Delta LEXRATE_t$ (41).

Estimation of the Co-integrating Nonlinear ARDL Model:

The estimation of the NARDL co-integration model proceeded in the following steps:

Step 1: Selection of the appropriate lags for the dependent and independent variables using the Akaike information criteria (AIC) and a dynamic lag structure to capture the relationship.

Step 2: Estimate the Conditional Error Correction model (CECM) starting with ARDL model, within the framework of ordinary least squares (OLS) as all the variables in the model are linear in coefficients and NARDL, like ARDL, can estimate variables of order 1(0) and 1(1) by OLS.

Step 3: Test for co-integration using the Bound Test as specified by Pesaran, Shin and Smith (40). This step is necessary to determine whether a long-run relationship exists between the dynamic dependent, $\Delta LNOE_{it}$ variable and dynamic regressors, which are, $\Delta LEXRATEi_{\square}^{+}$ □□□ $\Delta LEXRATEi_{\square}^{-}$.

Test the hypothesis of no co-integration:

HO: $\lambda_1 = \lambda_2^{+} = \lambda_3^{-} = 0$

HA: $\lambda_1 \neq 0 \; and/or \; \lambda_2^{+} \neq 0 \; and/or \; \lambda_3^{-} \neq 0$

The bounds test critical values provided by Pesaran, Shin, and Smith (40) were employed.

Decision Rules:

(a) If F-statistic exceeds the upper bounds reject the HO of no co-integration between the variables $LNOE_t$ and $LEXRATE_t$. The implication is that a long-run relationship exists between the variables.

(b) If the F-statistic falls below the lower bound, the HO cannot be rejected. The indication is that there is no co-integration.

(c) If the F-statistic falls between the bounds the test is inconclusive (40).

Step 4: Estimation of the long-run and short-run Asymmetric effects:

After confirmation of co-integration the next step is to estimate the long-run and short-run asymmetric effects.

(a) If F-statistic exceeds the upper bounds reject the HO of no co-integration between the variables $LNOE_t$ and $LEXRATE_t$. The implication is that a long-run relationship exists between the variables.
(b) If the F-statistic falls below the lower bound, the HO cannot be rejected. The indication is that there is no co-integration.
(c) If the F-statistic falls between the bounds the test is inconclusive (40).

Step 5: Cumulative Dynamic Multiplier:

The cumulative dynamic multipliers (DCM) graphs show the pattern of adjustment of dependent variable, $LNOE_t$, to its new long-run equilibrium following a positive or negative unitary shock in the regressor, $LEXRATE_t$. The DCM reveals the true nature of the dynamic relationship between $LNOE_t$ and $LEXRATE_t$. The DCM curves trace the path from the initial short run impact to the final long-run equilibrium.

RESULTS AND DISCUSSIONS

The Time Series Characteristics of the Data

The time series used for this study were all of first order autoregressive processes and all had unit roots and are integrated of order one. The Jacque Bera test showed that none of the series were normally distributed. To capture

this all the series were transformed into natural logarithm. Following the standard ADF test for unit roots, all the variables in the model, with the exception of LYN, were non stationary at levels. They became stationary at the first difference level. The LYN was stationary only at the 5% and 10% critical values. It became completely stationary at the first difference level. The plots of the series are shown in Figure 1. The results of the standard ADF test for unit roots are in table 3.1.

Table 3.1: Tests for Unit Roots:

	Level				**First Difference**
VARIABLES	ADF STAT I(0)	CRITICAL VALUE (1%)	CRITICAL VALUE (5%)	CRITICAL VALUE (10%)	ADF STAT I(1)
LNOE	-2.528 (0.110)	-3.465	-2.876	-2.575	-12.183 (0.000)
LEXRATE	2.072 (0.999)	-3.464	-2.876	-2.575	-13.043 (0.000)
LYN	-3.072 (0.031)	-3.466	-2.877	-2.575	-4.003 (0.002)
LYF$	- 0.232(0.931)	-3.464	-2.876	-2.575	-14.018 (0.000)
LRP	-0.800 (0.993)	-3.464	-2.876	-2.575	-14.691 (0.000)
LREER	-1.540 (0.511)	-3.467	-2.878	-2.575	-12.432 (0.000)
LNEER	-0.848 (0.803)	-3.467	-2.877	-2.575	-11.860 (0.000)

Notes: ADF statistic probabilities are in parentheses.

H_o: series has unit roots

Source: Author's Computations

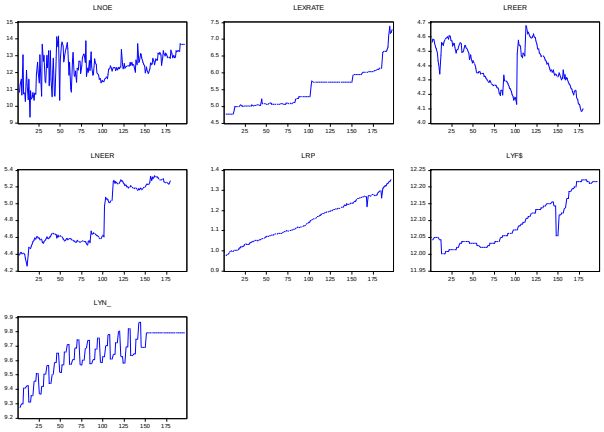

Figure 1: Plots of the series

Estimation of the Co-integrating Nonlinear ARDL Model:

Estimation of the Conditional Error Correction model (CECM):

The results of the CECM are shown in Table 3.2. The long run coefficient for the dependent variable is negative and highly statistically significant. This suggests the presence of co-integration in the model. The long run asymmetric coefficients of the independent variables, were negatively signed but not statistically significant. It therefore suggests that the positive and negative changes in exchange rates do not affect the non-oil exports differently in the long run.

The value of the Error Correction Term (ECT) was -0.5112, properly signed and highly statistically significant. This suggests that 51% of the last period's disequilibrium in the system is corrected each month. This implies that non-oil export returns to its long run equilibrium, reasonably quickly, after a short run shock occasioned by changes in the exchange rate.

The short run effects are captured by the coefficients of the differenced and lagged differenced variables. The coefficients of the lagged differences non-oil exports were all negatively signed and highly statistically significant at the 1% level. This suggests that the delayed short run effects of LNOE impacts its self negatively. The results further showed that the coefficients of the differenced asymmetric variable $LEXRATE^{+}_{\square}$ was small, positive but not statistically significant, while the coefficient of $LEXRATE^{-}_{\square}$ was -6.3433 and statistically significant at the 5% level. This suggests that 1% decrease due to negative shock to exchange rate immediately reduces the non-oil export by 6.34%. The coefficients of the lagged and differenced $LEXRATE^{+}_{\square}$ were all not statistically significant, while all of the coefficients of $LEXRATE^{-}_{\square}$ were all negative and highly statistically significant. The implication is that the delayed short run effects on LNOE are negative and they increase in impact as the lags of the shock to $LEXRATE^{-}_{\square\square}$ increase.

The coefficients of two of the fixed variables, LRP and LYF$, were statistically significant. The relative price (LRP) was positive at 3.18. It corroborates the apriori expectation that the demand for Nigerian non-oil exports is elastic. The implication is that one unit change in the price of non-oil exports will result in a more than proportionate change in the demand for non-oil exports. The coefficient of the foreign income was 2.87. The implication is that demand for Nigerian non-oil exports is income elastic, and a one percent change in income leads to a more than proportionate change in demand. This however did not corroborate the findings of Okoh (33 and 34).

TABLE 3.2 **Conditional Error Correction model (CECM)**

VARIABLES	**COEFFICIENTS**	**T - STAT**	**PROBABILITY**
LONG RUN REGRESSORS			
Linear: Dependent			
LNOE(-1)	-0.5112	-5.3568	0.0000
Asymmetric:			
@CUMDP($LEXRATE^{+}_{\square}$ (-1))	-0.6848	-1.3387	0.1824
@CUMDN($LEXRATE^{-}_{\square}$ (-1))	-0.9724	-1.1081	0.2693
C	-36.2931	-1.3481	0.1793
	Cointegrating Equation		
COINTEQ	-0.5112	-5.7062	0.0000
	Short-run Regressors		
Linear: Dependent			
D(LNOE(-1))	-0.3329	-3.6950	0.0002
D(LNOE(-2))	-0.2687	-3.1145	0.0021
D(LNOE(-3))	-0.1855	-2.5537	0.0115
Asymmetric:			
@DCUMDP($LEXRATE^{+}_{\square}$)	0.0275	0.0331	0.9736
@DCUMDN($LEXRATE^{-}_{\square}$)	-6.3433	-2.2399	0.0263
@DCUMDP($LEXRATE^{+}_{\square}$ (-1))	0.5173	0.5689	0.5700

@DCUMDN(LEXRATE^{-} (-1))	-9.1100	-3.1630	0.0018
@DCUMDP(LEXRATE^{+} (-2))	-0.3486	-0.3659	0.7148
@DCUMDN(LEXRATE^{-} (-2))	-8.8604	-3.1767	0.0018
@DCUMDP(LEXRATE^{+} (-3))	-0.7720	-0.8049	0.4219
@DCUMDN(LEXRATE^{-} (-3))	-14.5739	-3.3580	0.0009
Fixed Variables			
LRP	3.1786	3.7165	0.0002
LYN_	0.4711	0.7964	0.4268
LYF$	2.8712	4.2647	0.0000
R2	0.4580		
F-stat	10.6829		0.0000
Source: Author's Computations			

Test for Cointegration using the Bound Test:

To ascertain whether the long-run relationship exists between the dynamic dependent variable non-oil export and the dynamic regressors, which are the partially decomposed positive and negative changes is exchange rate, indicative of exchange rate depreciations and appreciations, respectively, Bounds Test typically tests the null hypothesis of no co-integration. The result shows that the computed F-Statistic of 8.0024 was higher than the upper bounds critical value, 5.000 at 1% significant level. Hence, we reject the null hypothesis of no co-integration between the variables $LNOE_{t,,}$ $LEXRATE^{+}$ and $LEXRATE^{-}$. The implication is that a long-run relationship exists between the variables. Co-integration between them is possible. The results are in Table 3.3.

Table 3.3 Bounds Test of Co-integration

ITEMS	F-Statistic	Bounds Critical Values		
F-Statistic	8.0024	10%	5%	1%
I(0) Asymptotic		2.630	3.100	4.130
I(1) Asymptotic		3.350	3.870	5.000
Note: Null hypothesis: No levels (long run) relationship Source: Author's Computations				

Estimation of the long-run and short-run Asymmetric effects:

The result of the Non Linear Autoregressive Lagged coefficient symmetry test failed to reject the null hypothesis of symmetry in the response of non-oil exports to positive and negative changes in the long run. In the short run, the null hypothesis was rejected.

The implication is that in the short run, the exchange rate has asymmetric effect on non-oil exports. The joint test of long run and short run, however, rejected the null hypothesis of symmetric effects. The rejection of HO using the F-Bound PSS (40) critical values provides strong evidence of the existence of a short run relationship between non-oil exports and exchange rates in Nigeria.

Hence, we conclude that the exchange rate has asymmetric effects on non-oil exports in Nigeria. The results are in Table 3.4. These results corroborate the findings of (28, 31, 6, and 16).

Table 3.4: NARDL Coefficient Symmetry Tests

VARIABLE	Statistic	Degree of Freedom	Value	Probability
	Long run			
LEXRATE	t-statistic	174	0.3411	0.7335
	F-statistic	(1, 174)	0.1163	0.7335
	Chi-square	1	0.1163	0.7331
	Short Run			
LEXRATE	t-statistic	174	5.01244	0.0000
	F-statistic	(1, 174)	25.1245	0.0000
	Chi-square	1	25.1245	0.0000
	Joint Long run and short run			
LEXRATE	F-statistic	(2, 174)	12.8200	0.0000
	Chi-square	2	25.6406	0.0000
Note: Null Hypothesis: Coefficient is symmetric Source: Author's Computations				

Cumulative Dynamic Multiplier – Exchange rate on Non-oil Exports:

The cumulative dynamic multiplier (CDM) is the sum of all marginal period-by- period effects of one unit shock to exchange rate on the non-oil exports for each additional time period. It is the overall impact of the shock up to a given horizon (192 for this study – length of time series used for the CDM analysis). The CDM plot is shown in Figure 2.

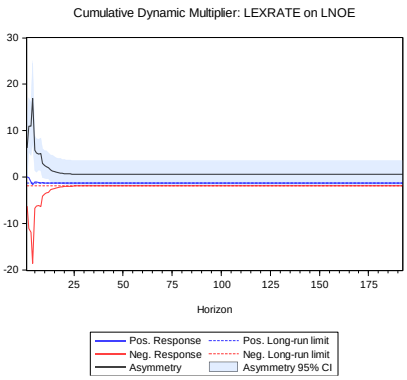

Figure 2: The Plot of CDM – Exchange Rate on Non-oil Export

Asymmetric plot falls within the boundary of the 95% confidence interval and the zero line is clearly outside the boundary, hence we conclude that the asymmetric plot line is statistically significant. This confirms the existence of asymmetric effects of exchange rate changes on non-oil exports in Nigeria. The positive and negative lines show how much the non-oil export changes as a result of a positive or negative change in exchange rate. The negative shock impact measured -19 at the highest point at horizon 4, reaching its long run limit at horizon 18 with a magnitude of -2 (in their absolute terms) till horizon 192. The positive shocks impact had a magnitude of 0 at horizon 1, reaching its peak of -1 at horizon 3 and remained at -1 till horizon 192. Its long run limit at horizon 3. The impact of the negative shocks on non-oil exports were much higher than those of the positive shocks. It is worthy of note that both positive and negative shocks were negatively signed, indicating that the effects of the shocks were contractionary for non-oil exports. The negative shocks are more contractionary than the positive shocks. The slope and convergence of the negative shocks are greater and more persistent. The implication is that adjustment to equilibrium is much slower. The full impact of the negative shock to exchange rate on non-

oil exports is not only felt immediately, but they also accumulate over several months. The slope and convergence of the positive shock suggests that the impact is low and it fades away quite quickly. This suggests that the policy of currency devaluation and appreciation will impact negatively on non-oil exports, but the impact of currency appreciation will have a more profound negative impact on non-oil exports. These findings may seem counterintuitive but is well supported by existing literature as enunciated in the introductory section of this paper (2, 9, 10, 12, 17, 25 27, 31, 32, 38).

Diagnostics

Test for stability using Ramsey RESET Test showed that the model was stable, as the null hypothesis that the model is stable could not be rejected. Serial correlation test was conducted using Breush-Godfrey serial correlation LM test and the result showed that there is no serial correlation in the residuals as the null hypothesis of no serial correlation could not be rejected up to 1 lag. The Harvey test for homoscedasticity, also showed that there is no heteroscedasticity in the residual as the null hypothesis of homoscedasticity could not be rejected at the 1% level. The results are shown in table 3.6.

Table 3.6: Diagnostics

TEST STATISTIC	VALUE	DEGREE OF FREEDOM	PROBABILITY
Ramsey RESET Test for stability of the model:			
t-statistic	0.4057	173	0.6854
F-statistic	0.1646	(1, 173)	0.6854
Likelihood ratio	0.1826	1	0.6691
Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	1.9789	(1,173)	0.1613
Obs*R-squared	2.1714	Chi-Square(1)	0.1406
Heteroskedasticity Test: Harvey			
F-statistic	1.6319	(156,35)	0.04505
Obs*R-squared	168.7945	Chi-Square (156)	0.2287
Scaled explained SS	188.1323	Chi-Square (156)	0.04058
Source: Author's Computations			

CONCLUSION AND POLICY RECOMMENDATIONS

A Long-run relationship between exports and exchange rates with asymmetric adjustment to equilibrium has been confirmed by this study. The result implies that non-oil exports and exchange rates are nonlinearly cointegrated in the long-run. It is obvious from the findings that non-oil exports in Nigeria respond to changes in exchange rate policies asymmetrically, noting that both currency depreciation and appreciation have contractionary impact on the non-oil exports. Also of significance is the finding that foreign income is inversely related to non-oil exports. Obviously, the Nigerian non-oil export products are classified as inferior goods, the demand for which falls as income increases. The implication is that policy makers may have to reconsider policy options in order to expand non-oil exports. The solution to desired expansion of non-oil exports may not rest in the manipulation of exchange rate as this might be contractionary for non-oil exports. Exchange rate stability may resolve the challenge. Policy makers need to implement structural reforms to enhance productivity, improve the business environment, and reduce costs of doing business in Nigeria. This will make non-oil exports more

competitive in the long-run. Also, it is necessary to invest in trade infrastructure, such as, transportation and logistics, to reduce costs and improve efficiency.

Ethical approval: Not applicable to this study.

Conflict of Interest: The Author declares no conflict of interest.

Statement: Time series data used for the study are available. Enquiries may be sent to the Author.

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