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OIL EXPORT REVENUE AND EXCHANGE RATE: AN INVESTIGATION OF ASYMMETRIC EFFECTS ON HOUSEHOLDS' CONSUMPTION EXPENDITURE IN NIGERIA

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Abstract

Oil export constitutes the major source of external revenue, and exchange rate determines the naira amount of the revenue and, thus, is perceived to affect aggregate consumption expenditure in Nigeria. This paper employed Nonlinear ARDL approach to examine the short-run and long-run asymmetric effects of oil export earnings and exchange rate on aggregate consumption in Nigeria from 1981 to 2016. Variables of interest in the paper were oil export earnings (OEE), consumer price index (CPI) as proxy for inflation, nominal effective exchange rate (NEER) and final consumption expenditure (FCE). Based on bounds testing long-run cointegration among the variables was established. Furthermore, Wald test was used to establish the presence of asymmetry between FCE and OEE and NEER. Results from the study indicated that in the short-run, negative shocks to exchange rate exerted significant positive effect on consumption, and negative at a higher lag, while positive shocks to exchange rate exerted negative effect on consumption. Still in the short-run, negative shocks until the first lag exerted a negative and significant effect on consumption; at lag two, the effect became positive and insignificant. In the long-run, positive and negative shocks to both exchange rate and oil export earnings exerted both positive and significant effects on consumption.

Keywords: Oil export, Aggregate consumption, Asymmetry, Nonlinear ARDL
JEL Code: C22, Q40, E21

1. Introduction

Consumption is a prominent economic variable. Aggregate consumption particularly interests macroeconomists for two reasons: First, aggregate consumption and saving are related since savings is the portion of income not consumed. This part of income not consumed is sourced as capital through the intermediation of the financial system by those with capital deficit. Therefore, determining the long-run productive capacity of a country's economy requires a study of the consumption (and savings). Second, aggregate consumption expenditure is of interest to economic analyst because it constitutes a major share of the gross domestic product (GDP) of most economies (Ezeji and Ajudua, 2015). Aggregate consumption is an integral economic indicator of any country. In periods of economic downturns, policy makers adopt measures to nudge consumption, through household and government spending, as a way of stimulating the economy in the Keynesian tradition. Keynes, in his proposal towards solving the problems occasioned by the great depression, advocated that stimulating effective demand was the path to economic recovery. The stimulants are embedded in expansionary fiscal policy measures via

lower taxes and more government spending. Macroeconomists analyse aggregate consumption behaviour by measuring poverty through level of consumption. Analysis of consumption behaviour is useful for determining the readiness of households for retirement or to test competitive theories in retail industries (Ezeji & Ajudua, 2015).

Studies on the relationship between crude oil and macroeconomic variables in Nigeria (to which consumption belongs) have focused more on the oil price-growth nexus or oil price-consumption nexus (see Alley *et al.,* 2014, Zhang *et al.,* 2014 & Zaman, 2015), ignoring the need to explore the crude earnings-consumption nexus. We chose this because besides consumption making up a substantial amount of the GDP of Nigeria, oil export earnings, for which the country depends is as much a valuable variable as the price of crude. Isolating the impact of oil export earnings on consumption in Nigeria has been a lacuna in the literature. This paper argues that for an oil dependent economy, the extent to which earnings from crude export has influenced aggregate consumption is worth examining in an asymmetric framework, since a symmetric time series analysis has the potential to hide the response of aggregate consumption to positive and negative changes in oil export earnings, therefore deviating from previous studies that focused more on the symmetric and asymmetric impacts of international price of crude oil on economic growth and various macroeconomic variables (see Wang, 2012). Additionally, Pavlidis, Paya and Peel (2015) emphasised the need to account for nonlinearities in estimating the relationship between exchange rate consumption. Hence, we will fulfill our objective of comparing the nonlinear/asymmetric impact of oil export earnings and exchange rate on consumption by employing the nonlinear ARDL estimation technique. This is with the knowledge that crude oil export has contributed immensely in raising revenue for the Government of Nigeria. The oil industry has contributed immensely to the revenue generation of the government of Nigeria. Three factors are attributed to the substantial rise in oil receipts to the economy of Nigeria, namely: They are: increases in both crude oil production and price and better favorable fiscal management (Odularu, 2008).

As an open economy, with crude as a major export and heavily dependent on consumption and capital import, it will be expected that consumption will respond to movements in exchange rate. This link between consumption and exchange rate was evident in the recession of 2016 to 2017.

Following from the aforementioned, this study is set out to compare the asymmetric effects of crude export earnings and exchange rate with a view to determining which of the two has a more significant asymmetric effect on aggregate consumption in Nigeria.

The paper is structured in five sections. Section one is the introduction. Following the introduction is section two, which is the review of related literature. The methodology employed in the paper is discussed in section three. The data used for the analysis as well as empirical findings are discussed in section four. Finally, the conclusion and policy implications are articulated in section five.

2. Literature Review

Outcomes of investigations about the effects of exchange rate and oil export earnings, as documented in the literature, show that consensus has not yet been reached. Bahmani-Oskooee and Xi (2011) investigated the effects of exchange rate volatility on domestic consumption in a sample of 21 industrialised countries for the period of 1964-2008. Based on results of analysis

anchored on error correction model, the results were positive and significant effect on domestic consumption in 7 of the countries in the long-run, negative effect in 2 countries, but significant positive effect in the remaining countries in the short-run. Bahmani-Oskooee, Kutan and Xi (2015) found a relationship between exchange rate and consumption in a sample of 12 emerging countries. Effect of exchange rate on consumption was positive and significant in almost all the countries in the short-run. But in the long-run, the effect was positive and significant in half the countries.

Adewuyi and Akpokodje (2013) deployed random effects models and GMM estimator to examine economic activities in relation to exchange rate volatility in Africa for 1986-2011 period, with exchange segmented into anticipated and unanticipated depreciation. Effect of the later on consumption was positive and significant, while the effect of the former was negative and significant. Pavlidis, Paya and Peel (2015) emphasised the need to account for non-linearities when studying the relationship between real exchange rate and consumption, which was contrary to studies that hitherto seemed to erroneously assumed linearity and thus increased the acceptance of the null hypothesis of Granger non-causality. Therefore, the authors examined the 14 OECD economies in a nonlinear framework, and rejected the null of no Granger causality from real exchange rate to real consumption. This finding is one of the engenders our motivation to including nonlinear effect of exchange rate on consumption in Nigeria which, as an economy, depends heavily on imported consumer goods and export of crude oil.

Within the framework of Generalised Method of Moments, Oseni (2016) examined the relationship between exchange rate volatility and private consumption in countries of 19 SSA for the period of 1999 to 2014. The study found significant negative effect of exchange rate volatility on private consumption in SSA. Iyke and Ho (2017) employed ARDL estimation technique, and found negative and significant long-run effect of exchange rate on consumption in Ghana for the period of 1980-2015. Similarly, based on 1980-2014 data for Pakistan in ARDL estimation procedure. Kumar, Bhutto, Mangrio and Kalhoro (2019) found significant positive effect of exchange rate on consumption in the long-run, but negative effect of exchange rate volatility on consumption in the short- and long-run. Bonsu and Muzindutsi (2017) used multivariate cointegration analytical model to examine the determinants of household consumption in Ghana or the period of 1961 to 2013. The finding showed insignificant negative effect of exchange rate on household consumption in the short-run, but significant positive effect in the long-run.

Available literature also documents that some other factors that affect consumption expenditure include inflation and income expectations. Income affects personal consumption positively, but not significantly (Nwabueze, 2009). In Germany, households expecting an increase in inflation have 8% chance of spending more on consumer durables than other households (D'Acunto, 2015). On the frontier of empirics, Bahmani-Oskoee and Xi (2015) demonstrated that exchange rate uncertailty, with attendant inflationary pressure, had short-run impact on consumption expenditure of 12 out of sampled 17 European countries. Duca *et al.* (2016) found support for the positive relationship between expected inflation and household consumer spending for the Euro Area.

Some previous studies analysed consumption in relation to movements in oil prices. For example, Mehra and Peterson (2005) used the OLS estimation technique to investigate the impact of oil prices on consumer spending. The study found that oil price increases have negative effect on consumption expenditure, while decreases have no effect. The study asserted

that oil price rises occurring after a period of oil price stability mattered more than oil price increases that reversed previous declines. Based on logistic smooth transition model for open industrialised economies, Wang (2012) found a nonlinear and asymmetric linkage between oil price changes and personal consumption expenditures. With failing oil prices as reference point, the results further showed that oil price rises had more significant effect on personal consumption expenditures. Similarly, Zhang *et al.* (2014) employed error correction model (ECM), and found that increasing oil prices do not have significant impact on household consumption while falling prices have significant impact on household consumption in China. A related study for 5 OECD countries by Zaman (2015), via Vector Autoregressive (VAR) econometric methodology, showed that shocks in international oil price had a significant short-run impact on consumption spending.

Other studies have traced the impact of oil prices on macroeconomic indicators. For instance, the study by Iwayemi and Fowowe (2010), using granger causality test, impulse response functions and variance decomposition analysis, found that shocks in oil price did not significantly cause any of the selected macroeconomic variables, namely: output, government expenditure, inflation and real exchange rate. However, negative shocks to oil price significantly caused output and real exchange rate. Mordi and Adebiyi (2010) studied the asymmetric effects of oil price shocks on output and prices in Nigeria using the Structural VAR econometric methodology. The study demonstrated that oil price shocks impacted output and prices asymmetrically, with the impact of oil price decrease found to be significantly greater than oil price increase. Katricioglu *et al.* (2014) in a study of 26 OECD countries found that the price of oil exerted significant negative impact on GDP, CPI and unemployment in the sampled countries. The findings also showed that a long-run relationship exists between oil prices and the macroeconomic variables considered in the analysis. Olomola (2006) adopted the VAR methodology in investigating the relationship among oil price shocks, output, inflation and real effective exchange rates. Findings indicate that oil price shock does not affect output and inflation in Nigeria but significantly impacts real effective exchange rate.

It is seen from the review that, through price shocks, effects of oil export earnings and exchange rate differ on macroeconomic variables in general and on household consumption expenditures in particular, depending on some country0specific conditions. It is also evident that there is no consensus yet about the oil export earnings and exchange rate-nexus in the literature. Therefore research effort in the area, though ongoing, remains hitherto understudied.

3.0 Methodology

3.1 Theoretical Framework

Some scholars have postulated theoretical linkage between consumption spending and income. Keynes (1936) in his theory of consumption related consumption to the absolute levels of income. The theory posits that consumption is a function of current disposable income. Modigliani and Brumberg (1954), in the Life Cycle Hypothesis, explain that consumption depends on a person's life time income. Friedman (1957), on the other hand, related consumption to permanent and transitory components of income, with the permanent component being more significant in explaining consumption.

Analysis in this paper is anchored on Friedman's consumption hypothesis for two reasons. First, over the years, export earnings from crude oil have come to be relied upon to drive aggregate consumption in the Nigerian economy. Therefore, in the Friedman's tradition, current aggregate consumption function for the Nigerian economy can take the form:

$$C_t = \alpha_0 + \alpha_1 Y_t \quad (1)$$

where, C_t is aggregate consumption at present, Y_t is the amount of income at present (earnings from crude oil export as a proxy) , $_0$ is consumption level when income (crude oil export revenue) is zero and $_1$ is the magnitude of the effect of income at present (crude oil export revenue) on current consumption.

Second, current consumption in Friedman's theory is recognised by Liviatan (1965) as being influenced by its lag. That is, past consumption behaviour of people would influence their present consumption decisions. This is expressed in the following linear model:

$$C_t = \alpha_0 + \alpha_1 C_{t-1} + \alpha_2 Y_t \quad (2)$$

where α_1 is the influence of past consumption behaviour on present consumption decisions, and C_{t-1} is the level of past or previous consumption. That is, C_{t-1} is one-period lag in consumption.

Bahmani-Oskooee and Xi (2011) included exchange rate in the Keynesian consumption equation. Similarly, we include the exchange rate variable in the Friedman model. Thus, equation (2) becomes:

$$C_t = \alpha_0 + \alpha_1 C_{t-1} + \alpha_2 Y_t + \alpha_3 E_t \quad (3)$$

In equation (3), α measures the effect that exchange rate, E, has on aggregate consumption at time t, while other things remain the same as in equation (2).

3.2 Analytical Framework

From equation 3, the econometric form of the model applied in this analysis is given as follows:

$$FCE_t = \alpha_0 + \alpha_1 FCE_{t-1} + \alpha_2 CPI_t + \alpha_3 NEER_t + \alpha_4 OEE_t + \mu_t \quad (4)$$

where FCE_t is final consumption expenditure, FCE_{t-1} is final consumption expenditure in the immediate past period, CPI_t is consumer price index, $NEER_t$ is nominal effective exchange rate, and OEE_t is oil export earnings. The subscript, t, indicates point in time at which series values of the variables are considered. The model parameters are α_0, α_1, α_3 and α_4, while μ_t represents the white noise error term, which accounts for other factors that explain consumption not specified in the model.

To account for the asymmetry in the NEER and OEE series, we re-specify equation (4) thus:

$$FCE_t = \alpha_0 + \alpha_1 FCE_{t-1} + \alpha_2 CPI_t + \alpha_3^{+} NEER_t^{+} + \alpha_4^{-} NEER_t^{-} + \alpha_5^{+} OEE_t^{+} + \alpha_6^{-} OEE_t^{-} + @Trend + \mu_t \quad (5)$$

Here, $NEER^{+}$ and $NEER^{-}$ are positive and negative partial changes, respectively, in nominal effective exchange rate. Similarly, OEE^{+} and OEE^{-} are positive and negative partial changes, respectively, in oil export earnings. α_j $(j = 1, 2, 3, \ldots, 6)$ is the vector of the coefficients of the model. Each depicts the effect of the associated explanatory variable on final consumption expenditure. @Trend is the time effect in the model while μ_t is the error term, which is assumed to to be white noise, introduced in the model to accommodate the influences of other variables

that affect final consumption expenditure behaviour but which are not explicitly included in the model. The subscript *t* indicates the point in time period at which values of the variables are taken.

The pre-estimation expectations are that positive final consumption expenditure would subsist at zero value of the explanatory variables, and that rising consumer price index *(CPI_t)* or inflation would lead to decrease in final consumption expenditure. Positive change in nominal effective exchange rate *($NEER^+_t$)* would bring about a decrease in consumption. Given that the Nigerian economy depends very much on importation for consumption, a negative change in nominal effective exchange rate *($NEER^-_t$)* would exert the opposite effect of a positive change. Furthermore, a negative change in oil export earnings *(OEE^-_t)* would result to decline in final consumption expenditure *(FCE_t)*, while a positive change *(OEE^+_t)* would result to increase in final consumption expenditure. The *a priori* expectations are symbolized as: $\alpha_0 > 0$, $\alpha_2 < 0$, $\alpha_3 < 0$, $\alpha_4 > 0$, $\alpha_5 < 0$ and $\alpha_6 > 0$.

The asymmetry is simply used to account for differences in the responses of aggregate consumption to positive and negative changes in oil export earnings and exchange rate. Hence, following Salisu and Isah (2017), the positive and negative partial sums of $NEER_t$ and OEE_t are computed as follows:

$$neer_t^+ = \sum_{k=1}^{t} \Delta neer^+_k = \sum_{k=1}^{t} \max(\Delta oee_{k,} 0)$$

$$neer_t^- = \sum_{k=1}^{t} \Delta neer^-_k = \sum_{k=1}^{t} \min(\Delta neer_{k,} 0)$$

$$oee_t^+ = \sum_{k=1}^{t} \Delta oee^+_{ik} = \sum_{k=1}^{t} \max(\Delta oee_{ik,} 0)$$

$$oee_t^- = \sum_{k=1}^{t} \Delta oee^-_k = \sum_{k=1}^{t} \min(\Delta oee_{k,} 0)$$

Since we set out to determine the asymmetric effects of oil export earnings and exchange rate on aggregate consumption in Nigeria, we used the Non-linear Asymmetry Autoregressive Distributed Lag (NARDL) bounds framework. NARDL bounds testing approach developed by Shin *et al.* (2014) is employed in estimating both short- and long-run dynamics in series, when the series is integrated at order one or less. Cointegration on the series is performed on their partial positive and negative components (Granger and Yoon, 2002); if it is established, then there is the case of nonlinear cointegration (Raza *et al.*, 2016).

3.3 Data and Sources

Yearly data for Nigeria were used for the analysis. The data were sourced from the Central Bank of Nigeria's Statistical Bulletin (CBN, 2017) and World Bank's World Development Indicators (WDI, 2017). The analysis covered the period from 1981 to 2016. Data on final consumption expenditure (FCE) were in constant local currency unit. FCE is the sum of household (private) and government consumption as defined by the World Bank's World Development Indicators (WDI). Oil export earnings *(OEE)* were in billions of Nigeria naira. Consumer price index *(CPI)* was considered as proxy for inflation rate. CPI (proxy for inflation) as used in this analysis is measured by the yearly percentage change in consumer spending on a basket of goods and services as defined by WDI. Nominal Effective Exchange Rate *(NEER)*

index for Nigeria measures the average change of Nigeria's naira against all other currencies, and is as defined by the Central Bank of Nigeria (CBN).

3.4 Specification of Asymmetric Effect Model in ARDL Framework

We will now re-specify equation 5 to account for possible asymmetry in oil export earnings *(OEE)* and nominal effective exchange rate *(NEER)* in the ARDL form. Hence, the asymmetric autoregressive distributed lag (ARDL) of equation 5 is thus expressed:

$$\Delta Infce_t = \alpha_{0i} + \alpha_1 \ln fce_{t-1} + \alpha_2 \Delta \ln cpi_t + \alpha_3^+ \Delta neer_t^+ + \alpha_4^- \Delta neer_t^- + \alpha_5^+ \Delta oee_t^+ + \alpha_6^- \Delta oee_t^- +$$
$$\sum_{j=1}^{N1} \alpha_{7j} \Delta \ln fce_{t-j} + \sum_{j=1}^{N2} \alpha_{8j} \Delta cpi_{t-j} + \sum_{j=1}^{N3} \alpha_{9j}^+ \Delta neer_{t-j}^+ + \sum_{j=1}^{N4} \alpha_{10j}^- \Delta neer_{t-j}^- +$$
$$\sum_{j=1}^{N5} \alpha_{11j}^+ \Delta oee_{t-j}^+ + \sum_{j=1}^{N6} \alpha_{12j}^- \Delta oee_{t-j}^- + \varepsilon_t \quad (6)$$

In equation (6), oee^+, oee^-, $neer^+_t$ and $neer^-_t$ are positive and negative exchanges in oil export earnings and exchange rate, respectively. fce_t is the change or shock the explanatory variables, particularly oil export earnings and exchange rate, induce in financial consumption expenditure. The long-run coefficient for oee^+, oee^-, $neer^+_t$ and $neer^-_t$ are:

$$-\frac{\alpha_3^+}{\alpha_1}, -\frac{\alpha_4^-}{\alpha_1}, -\frac{\alpha_5^+}{\alpha_1} \text{ and } -\frac{\alpha_6^-}{\alpha_1}$$

The error correction version of equation (6) is specified thus:

$$\Delta Infce_t = \kappa \chi_{t-1} + \sum_{j=1}^{N1} \alpha_{7j} \Delta Infce_{t-j} + \sum_{j=1}^{N2} \alpha_{8j} \Delta cpi_{t-j} + \sum_{j=1}^{N3} \alpha_{9j}^+ \Delta neer_{t-j}^+ + \sum_{j=1}^{N4} \alpha_{10j}^- \Delta neer_{t-j}^- +$$
$$\sum_{j=1}^{N5} \alpha_{11j}^+ \Delta oee_{t-j}^+ + \sum_{j=1}^{N6} \alpha_{12j}^- \Delta oee_{t-j}^- + \mu_t \quad (7)$$

In equation 7, χ_{t-1} represents the error correction term, which is used to capture the long-run equilibrium in the asymmetric model. The parameter *K* is used to measure the speed with which the system adjusts to a short-run shock. To test for the presence of asymmetry in the *NEER* and *OEE* series, we conducted Wald tests for each series. The results are presented in Table 6.

4.0 Analysis and Discussion

4.1 Descriptive statistics

Descriptive statistics of the variables are shown in Table 1.

Table 1: Descriptive Statistics

	fce	*cpi*	*neer*	*oee*
Mean	2.32E+13	42.74450	67.23776	3823.662
Median	1.62E+13	26.19865	88.95123	1212.499
Maximum	4.75E+13	158.9435	113.2000	14323.15

Minimum	1.04E+13	0.493799	0.741667	7.201200
Std. Dev.	1.28E+13	47.71125	42.37331	4886.111
Skewness	0.769930	1.018523	-0.521907	1.027825
Kurtosis	1.981875	2.860792	1.534520	2.585040
Jarque-Bera	4.969632	6.079703	4.720890	6.413582
Probability	0.083341	0.047842	0.094378	0.040486
Observations	35	35	35	35

Source: Authors' computation (2019)

From the table, maximum CPI of 158.9 was recorded in 2015 and a minimum of about 0.49 recorded in 1981. With standard deviation at about 47.7, CPI can be said to be stable, within the period under review, as this does not deviate significantly from the mean. Final consumption expenditure stood at a maximum of about 475,000 billion naira in 2013, just two years after oil export earning stood a maximum of about 1,4323 billion naira. This goes to establish a close relationship between consumption and oil export earnings. The disparity in the minimum and maximum of exchange rate, within the review period, goes to show how much depreciation has occurred to the naira over the years. The standard deviation of about 42.37, which is distant from the average of about 67.24 further buttresses the extent of depreciation of the naira in the naira-dollar exchange rate

4.2 Correlation Analysis

Partial correlation coefficients was used to ascertain the suitability of bringing independent variables together in our econometric model, to avoid the problem of multicollinearity. The partial correlation coefficients showing the relationship between any pairwise set of the variable series values are shown in Table 2.

Table 2: Matrix of Partial Correlation Coefficients

	fce	*oee*	*oee*	*cpi*	*neer*	*oee*	*neer*	*neer*
fce	1							
oee	0.412992	1						
oee	-0.524519	0.185143	1					
cpi	0.970996	0.331550	-0.595697	1				
neer	0.597033	0.335670	-0.216044	0.550109	1			
oee	0.949514	0.478817	-0.316331	0.933354	0.552372	1		
neer	0.174592	0.074903	-0.122208	0.181796	0.150615	0.111910	1	
neer	0.005789	0.047391	-0.085700	0.036266	0.109823	-0.053170	0.188031	1

Source: Authors' computation (2019)

It is obvious from the table that the correlation between oil export earnings and inflation is very high. Therefore, we considered it appropriate not to combine them linearly in the model. Rather, we used positive and negative changes in exchange rate.

4.3 Unit Root Test

The Augmented Dickey-Fuller (ADF) stationary test was used to examine the series' stationarity. Results of the unit root test for the individual series of the variables in the model are shown in Table 3.

Table 3: Unit Root Test Results for the Individual Series

Variable	Level			First Difference			*I(d)*
	None	Constant	Constant and Trend	None	Constant	Constant and Trend	
ln *fce*	2.3399	0.1112	-2.0875	-5.8702***	-6.7703***	-6.9522***	*I(1)*
ln *cpi*	0.8343	-1.245	-1.0455	-1.4680	-3.4866***	-3.6183*	*I(1)*
ln *neer*	-0.5062	-1.6125	-2.1025	-7.0191***	-6.9119***	-6.9981***	*I(1)*
ln *oee*	1.8842	-1.3017	-0.8021	-5.0110***	-6.0616***	-5.0703***	*I(1)*

Source: Authors' computation (2019)

Note: **"***", "**"** and **"*"** indicates significance at the 1%, 5% and 10% levels respectively.
I (d) represents the order of integration of the series.

From the test result, the first difference of all the variables is stationary. Results of the stationarity test presented in Table 3 show that time series values of the variables were integrated at first differencing, *I(1)*. Next, we carried out a bounds test on the series to determine whether or not there could be a linear combination of the time series values of the variables in the long-run.

4.4 Cointegration Test Results

Results of the bounds test are presented in Table 4.

Table 4: Cointegration Test Results for Long-run Relationship between the Variables

Bounds test for Cointegration		
Test Statistic	Value	k
F-statistic	10.90602	5
Critical Value Bounds		
Significance	I(0) Bound	I(1) Bound
5%	3.12	4.25

Source: Authors' computation (2019)

The results show that value of F-statistic is greater than the upper critical value bound. This provides empirical statistical evidence that there is long-run relationship between household consumption expenditure, on the one hand, and oil export revenue and exchange rate, on the other hand.

4.5b Short- and Kong-run Asymmetric Effects

For clarity of the asymmetric analysis, this study disaggregates the impact of oil export earnings (OEE) and exchange rate (NEER) on aggregate final consumption expenditure (FCE) behaviour

into their positive and negative values following Salisu and Isah (2017). Results of short-run shocks on household aggregate consumption expenditure induced by positive and negative changes in oil export revenue and exchange rate are presented in Table 5.

Table 5: Short-run and Long-run Asymmetric Effects
Dependent Variable: ΔFCE

Short-run Estimates				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
Constant	46.87378	4.857634	9.649507	0.0000
$\Delta \ln fce_{t-1}$	0.111999	0.114818	0.975450	0.3486
$\Delta \ln fce_{t-2}$	-0.202448	0.086448	-2.341843	0.0373
$\Delta \ln cpi_t$	0.370572	0.079492	4.661777	0.0005
$\Delta \ln neer_t^+$	-0.015800	0.017820	-0.886635	0.3927
$\Delta \ln neer_{t-1}^+$	-0.051193	0.012598	-4.063568	0.0016
$\Delta \ln neer_{t-2}^+$	-0.104053	0.021000	-4.954958	0.0003
$\Delta \ln neer_t^-$	0.494599	0.050607	9.773293	0.0000
$\Delta \ln neer_{t-1}^-$	-0.163513	0.047275	-3.458744	0.0047
$\Delta \ln oee_t^+$	0.520599	0.084128	6.188141	0.0000
$\Delta \ln oee_t^-$	-0.478131	0.116962	-4.087922	0.0015
$\Delta \ln oee_{t-1}^-$	-0.475198	0.114450	-4.152017	0.0013
$\Delta \ln oee_{t-2}^-$	0.178720	0.082914	2.155492	0.0521
κ	-1.550153	0.161002	-9.628143	0.0000
@TREND	0.067522	0.006993	9.656020	0.0000
Long-run Estimates				
$\ln cpi_t$	-0.083230	0.075460	-1.102973	0.2917
$\ln neer_t^+$	0.066338	0.025227	2.629617	0.0220
$\ln neer_t^-$	0.335165	0.038649	8.671992	0.0000
$\ln oee_t^+$	0.335837	0.052793	6.361439	0.0000
$\ln oee_t^-$	0.795663	0.175734	4.527663	0.0007
Overall Significance				
Adjusted R-squared: 0.837609		F-statistic: 12.90302		Prob(F-statistic): 0.000002
Serial Correlation				
Durbin-Watson stat: 2.590514				

Source: Authors' computation (2020)

The results show that the immediate effects of the positive shock in exchange rate on household consumption expenditure was negative, but not statistically significant. However, as the lag orders increased up to two lags, the effects became negative and statistically significant. This is evidence that a rise in naira exchange rate to the dollar takes time to negatively affect the consumption spending of economic agents in Nigeria.

From the results, negative change in exchange rate exerts positive and significant effect on household consumption expenditure, but reverses to significant negative effect at higher lag order. The short-run, instantaneous, significant positive effect of exchange rate depreciation is greater than the insignificant negative effect of exchange rate appreciation on household aggregate consumption expenditure ($\alpha_3 = 0.494599 > \alpha_4 = -0.015800$, with p-values = 0.0000 and 0.3927, respectively). Overall, aggregated exchange rate appreciation coefficients come to - 0.171046, while the aggregated exchange rate depreciation coefficients come to 0.331086. The coefficient for exchange rate depreciation is still higher than exchange rate appreciation. This provides empirical evidence of significant positive asymmetric effect of exchange rate on household aggregate consumption expenditure, in the short-run. Implication of the positive asymmetric effect may be explained in the contexts of consumption preference for imported products over domestic goods, even at worsening exchange rate of the naira vis-à-vis the US dollar. Also, inability of domestic supply to meet domestic demand, especially for manufactured products, may be the reason for the positive asymmetric effect.

In the long-run, the results show that both positive and negative changes in oil export revenue and effective exchange rate, respectively, have positive and significant effects on household aggregate consumption expenditure ($\alpha_9 = 0.066338$, $\alpha_{10} = 0.3351865$, with p-values = 0.0220 and 0.0000, respectively; and ($\alpha_{11} = 0.335837$, $\alpha_{12} = 0.795663$, with p-values = 0.0000 and 0.0007, respectively). This provides empirical evidence. However, the positive effect of depreciation in exchange rate is greater than the positive effect of appreciation in the exchange rate (($\alpha_{10} = 0.3351865 > \alpha_9 = 0.066338$). Similarly, the positive effect of decrease in oil export revenue exceeds the positive effect of increase in oil export revenue ($\alpha_{12} = 0.795663 > \alpha_{11} = 0.335837$). This is an empirical evidence that changes in exchange rate and oil export revenue has significant positive asymmetric effect on household aggregate consumption expenditure in the long-run.

The negative effect of positive change in exchange rate on household aggregate consumption expenditure, which is not significant at zero lag, remains negative, but becomes statistically significant at one- and two-period lags. But the effect of negative change in exchange rate on household aggregate consumption expenditure, which is positive and significant at zero lag, reverts to significant negative effect at the first difference. Negative effect of decrease in oil export revenue, which is significant at zero lag, remains negative and significant at one-period lag. Magnitude and nature of the effects vary over time. This shows that, in the context of timeframe, positive and negative changes in oil export revenue and exchange rate have symmetric effects on household aggregate consumption expenditure in Nigeria.

The probability of the F-statistic indicates that, at the 0.05 level, the combined effect on aggregate final consumption expenditure of the explanatory variables in the model is statistically significant. However, the value of the adjusted R-square (0.837609) shows that only about 22% of changes in aggregate final consumption expenditure is explained by the regressors in the model. The Durbin-Watson statistic value (2.590514) provides statistical evidence that the

explanatory variables in the model are free from the problem of serial correlation or multicollinearity.

Table 6: Wald Test of Asymmetry (Oil export earnings)

Short run Asymmetry Test for OEE			
Test Statistic	Value	DF	Probability
F-statistic	4.275832	(1, 12)	0.0609
Chi-square	4.275832	1	0.0387
Short run Asymmetry Test for NEER			
F-statistic	17.34536	(1, 12)	0.0013
Chi-square	17.34536	1	0.0000

Source: Authors' computation (2019).

WALD restriction test of the presence of asymmetry, presented in Table 6, confirms the presence of asymmetry in the in the shocks to aggregate consumption expenditure induced by positive and negative changes in oil export earnings and exchange rate.

The probability value of both the F-statistic and Chi-square statistic for exchange rate, and chi square statistic for oil export earnings are all below the 0.05 benchmark chosen as the threshold criteria for decision in this paper.

4.6.1 Results of Post-Estimation Tests

The relevant post-estimation tests are for normality of distribution of the model residual, serial correlation or multicollinearity of the explanatory variables in the model, and homoscedasticity or constant variance of the model error term. Results of the post-estimation tests are presented in Table 7.

Table 7: Post-Estimation Test Results

Diagnostic	**Statistic**	**Interpretation**
Normality	J-B Statistic 4.091460 (0.129286)	Model residual is normally distributed
Serial Correlation: Breusch-Godfrey Serial Correlation LM Test	F-statistic 1.019791 (0.4285)	No evidence of serial correlation
Heteroscedasticity (ARCH LM Test)	F-statistic 0.442159 (0.9428)	Variance of error term is homoscedastic

Source: Authors' computation (2019). Note: Figures in parentheses are probability values.

Results of the post-estimation tests show that model residual is normally distributed. The results also show that there is no evidence of the problem of serial correlation, and that variance of the error term is homoscedastic. These attest to the robustness of the estimates.

4.6.2 Parameter stability

Teat results of the parameter stability are shown in figures 1 and 2. he test of parameter stability shows that that residual mean and variance are within the 5% significance lines, as shown in figure 1 and 2. This shows that the parameters are stable within the sample period.

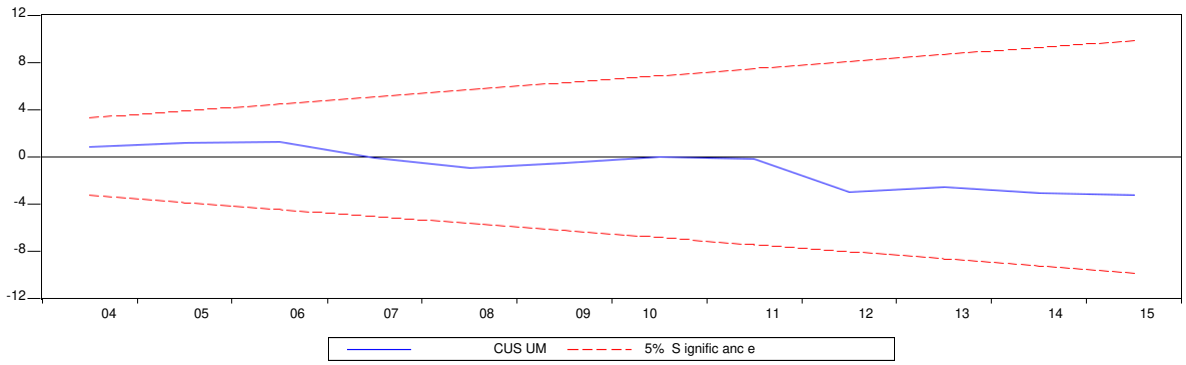

Figure 1: CUSUM Mean
Source: Authors' computation (2019) from NARDL estimates in Table 5

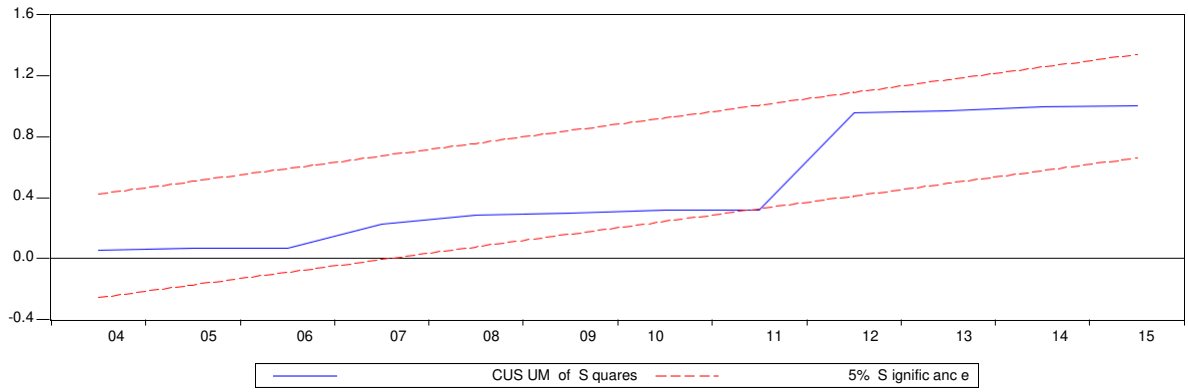

Figure 2: CUSUM variance
Source: Authors' computation (2019) from NARDL estimates in Table 5

The results in figures 1 and 2 show that that residual mean and variance are within the 5% significance lines. Therefore, the parameters of the model are stable within the sample period.

5. Conclusion and Policy Implications

In this paper, we set out to determine whether or not the dynamics of oil export revenue and exchange rate have asymmetric effects on aggregate consumption expenditure of households in Nigeria. In the short run, results showed that the response of aggregate consumption expenditure in Nigeria to exchange rate appreciation was not instantaneous. At first, it was negative but not significant. However, results confirmed that lags of two period had a negative and significant effect on aggregate consumption expenditure. On the other hand, naira exchange

rate depreciation against the dollar had an instantaneous positive and significant effect on consumption expenditure, but the effect turned negative after a one- period lag. The short run positive change in oil export earnings exerts instantaneous positive and significant shock on aggregate consumption expenditure. A decrease in oil export earnings equally has immediate significant negative shock on aggregate consumption expenditure in Nigeria. The significant negative shock lingers from the immediate past year (one-period lag) to current year. Farther into the past, the shock induced by the negative change in oil export earnings wanes and reverses to

marginal positive shock. The long run estimate shows that both positive and negative changes in oil export earnings and exchange rate induce significant positive shock on aggregate consumption expenditure of the households. In both the short run and long run, the shocks differ in magnitudes, thereby providing the basis to conclude that changes in export earnings and exchange rate have asymmetric effects on aggregate consumption expenditure of the households in Nigeria.

The policy implication of the findings in this study is that short term currency appreciation, having a negative effect on consumption may be a pointer to falling income in the competitive sector of the economy, which can lead to falling consumption - a major component of the gross domestic product. In the longer term though, the positive effect on consumption, of a currency appreciation points to a possible shift, away from scarce domestic supply, to imports. Since the long run currency depreciation does not discourage aggregate consumption expenditure, price stability-targeting policy stance must take this phenomenon into cognisance. This is more so because rising consumption in the circumstance of depreciating exchange rate has the tendency to induce appreciable rise in domestic price level.

The negative shock of decrease in oil export revenue on aggregate consumption expenditure and its subsequent long-run positive shock are pointers to a possible downward sticky nature of short-term policy response mechanism in mitigating the short-term effects of initial negative shocks. Therefore, the implication is the need for in-built swift and flexible response mechanisms in short run fiscal and exchange rate policy formulation and implementation processes.

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