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ASYMMETRIC IMPACT OF OIL PRICE VOLATILITY ON HOUSEHOLD CONSUMPTION EXPENDITURE IN NIGERIA: A NON-LINEAR ARDL APPROACH

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ABSTRACT

This study investigates the impact of oil price volatility on household consumption expenditure, employing a non-linear Autoregressive Distributed Lag (NARDL) model. Using annual data from 1980 to 2022, the study examines the long-run and short-run relationships between oil price volatility and consumption per capita. The results reveal a significant long-run relationship between the variables. The long-run coefficient estimates indicate that a 1% increase in positive oil price volatility (OPV+) leads to a 0.005% decrease in consumption per capita, statistically significant at the 1% level. In the short run, the coefficient of positive oil price volatility (OPV+) shows that a 1% increase in OPV+ results in a 0.29% decrease in consumption per capita. Also, the coefficient of long-run negative oil price volatility (-OPV) indicates that a 1% increase in negative oil price volatility leads to a 0.015% decrease in consumption per capita in the long run. However, this result is not statistically significant. The Wald test confirms a statistically significant long-run asymmetric relationship between oil price volatility and consumption per capita as the probability of the F-statistic (0.0001) is significant at the 1% level. The findings suggest that households respond differently to positive and negative oil price shocks, highlighting the importance of accounting for asymmetry in oil price volatility. The study's results have implications for policymakers seeking to mitigate the adverse effects of oil price volatility on household consumption.

Keywords*:* Oil Price Volatility, Household Consumption, Non-Linear ARDL, Asymmetry inflation.

1.0 Introduction

Crude oil is not only the most traded commodity in the world, but also the most important energy resources in economic activity. The long-term trend of oil prices is determined by supply and demand, which is accompanied by frequent oil-related events (Zavadska et al., 2020) and increasing speculation in crude oil financialized product. At the same time, fluctuations in oil prices have been amplified, and instability in the oil market has increased. The uncertainty caused by oil price fluctuations will affect economic development through increasing production cost or investment behavior, causing a negative impact on economic activities (Van et al., 2019).

The impact of oil prices on economies, especially in developing countries like Nigeria, is multifaceted. While developed oil producers benefit from value addition and stability, Nigeria, primarily exporting crude oil, faces challenges (Ikechi and Anthony 2020: Akinola, 2022). In the middle East, Asia and Eastern Europe countries, where oil is found have their growth rates between 15 % to 30 % of their gross domestic product (GDP) with increasing employment opportunities, favourable balance of payments. However, being a global product, it is high influenced by OPEC quota and regulations in international market activities as these activities determines oil price (Abaas, et al., 2018: Osintseva, 2021). Nigeria's economy heavily relies on oil, with crude oil exportation being the main source of revenue for the country. Fluctuation in the international crude oil prices have significant implications for the Nigeria's economic growth (Gbadamosi et al., 2022). The consequence of oil price changes has become more pronounced in recent years in Nigeria, especially in the aftermath of covid-19 pandemic, the ongoing conflict in Ukraine, global financial crisis, instability in the middle East due to Gaza conflict and unconventional monetary policy (Bello & Gidgibi 2022: Moshiri & kheirandish, 2024).

Furthermore, oil price volatility can also affect household consumption expenditure. As Akomolafe (2020) argues that Consumption holds a paramount position within the realm of macroeconomics due to its nexus and linearity shock on oil price volatility and consumer price index. In Nigeria, oil price volatility determines a large share of the final consumption, likewise the consumer price index. Relatively, oil price volatility and consumer price index influence household consumption through inflationary pressure, and cost of energy consumption which in turn leads to income distribution and substitution effects on consumption of goods and services. Additionally, an interrelationship emerges between the price of oil and the price of goods. Given these circumstances, the linkage between goods prices, petroleum prices, and consumption expenditure plays an indispensable role in driving economic activities and fostering growth in both developing and developed economies (Sambo & Deng, 2018; Babalola & Salau, 2020).

Huang and Guo (2007) also assert that higher oil prices may positively impact inflationary pressures in an economy. As a result, this leads to a decline in households' real incomes; hence, private consumption, a significant component of aggregate output, reduces significantly. Also, unexpected changes in oil prices are related to higher energy, like an increase in petroleum prices (Herrera et al., 2019). The higher the price of petroleum, the higher the cost of transportation and the lower the disposable incomes of households, hence, establishing the impact of oil price fluctuation on both the demand and supply side of the economy (Herrera et al., 2019).

This study investigates the impact of oil price volatility on household consumption expenditure is crucial for understanding the broader implications of fluctuating oil prices on economic stability. Given that oil is a key input in various sectors, its price fluctuations have a direct impact on production costs, inflation, and overall economic growth. By analyzing these effects, this research provides policymakers with valuable insights into how oil price volatility can influence macroeconomic indicators such as GDP, inflation rates, and unemployment levels, which are critical for economic planning and development (Sun et al., 2022).

Moreover, household consumption expenditure is a major component of aggregate demand, and it is directly affected by changes in oil prices. Rising oil prices increase transportation and energy costs, leading to higher living expenses and a reduction in disposable income for households. By examining how these changes in oil prices affect consumption patterns, this study contributes to a deeper understanding of the mechanisms through which oil price volatility influences the overall economy. This is particularly important for low- and middle-income households, who are disproportionately affected by such price shocks (Khan et al., 2021).

Lastly, the research has broader policy implications, especially for oil-importing countries that are more vulnerable to oil price volatility. It highlights the need for targeted fiscal and monetary policies that can mitigate the adverse effects of such volatility on household welfare and macroeconomic stability. By shedding light on these dynamics, this study can help inform the design of strategies to enhance economic resilience and protect vulnerable households from the negative consequences of oil price shocks.

The rest of this paper is structured as follows: Section 2 reviews the existing literature to establish the theoretical foundation and identify gaps in current research. Section 3 outlines the methodology, detailing the techniques used in this study. Section 4 presents the data analysis and findings, offering a comprehensive examination of the results. Finally, Section 5 concludes the paper by summarizing the key findings, drawing conclusions, and providing policy recommendations based on the research outcomes.

2.0 Literature Review

This section is divided into three parts, which are the conceptual literature review, the theoretical literature review and the review of other empirical literatures. The conceptual literature review discusses various concept and definition relating to oil price fluctuation, household consumption expenditure and economic growth. In the theoretical review, different existing theories linking oil price fluctuation and macroeconomic performance are discussed while the empirical review discusses various empirical investigations carried out by other researchers in the past.

Fundamental empirical questions arise in macroeconomics on issues regarding the relationship between oil price volatility and macroeconomic performance. Given that most oil producing countries depend on oil price as a major source of revenue, fluctuations in oil is capable of distorting planning process as these countries, particularly Nigeria, uses oil price as a benchmark for planning. As mentioned earlier, the bulk of the literature that focuses on oil price shocks have come to focus on general macroeconomic activities. Since Hamilton (1983) found a Granger-causality relationship between oil price changes and several macroeconomic variables, numerous papers have focused on the links between oil shocks and variables such as stock market, international trade, GDP growth, and net export. (Bjørnland, 2009; Jiménez-Rodrıguez & Sanchez, 2005; Mehrara, 2008; Kilian et al., 2010).

The study by Blanchard (2007) for example, finds that the oil shocks differ in their impact on general macroeconomic performance and compares the shocks during the '70s against the ones observed at the beginning of the 21st century. Blanchard argues that factors such as smaller share of oil production and stronger independent central banks in advanced countries are the main reason why the relationship has weakened.

However, since most of the literature focuses on the impact of oil shocks on general economic activity, another branch of research has come to direct their attention towards household consumption. The work by Mehra and Peterson (2005) and Kilian (2008) studies the effects on household consumption from unexpected oil price changes.

In the study by Mehra and Peterson (2005), a model was developed based on the life-cycle hypothesis of Consumption (Modigliani and Brumberg 1954). Their study is based on data from households in the US, an oil-importing country, and identifies the direct effects of oil price shocks in the model. By including income, wealth and interest rate with a Vector Error Correction model, they find that oil shocks don´t have any effect on household consumption in the long-run but that the effect is significant in the short-run. Furthermore, by using "net oil price increases" and "positive oil price increases" as proxy´s for oil shocks, they find that the relationship is negative which is line with earlier results. Extending their work, Zhang and Broadstock (2014) exclude interest rates in their model and find a similar negative relationship for the countries in the ASEAN region.

Ibrahim (2021) examined the asymmetric impacts of oil prices on inflation in Egypt. He applied a non-linear ARDL to explore the positive and negative changes in oil prices. He found that the result of linear ARDL was inconclusive in detecting the existence of co-integration. However, the result on NARDL model confirmed the existence of co-integration which means there is a long-run equilibrium relationship between inflation, oil prices, GDP, and money supply, in the Egyptian economy.

Similarly, Kilinc-Ata, (2022) investigated the effect of oil prices on selected macroeconomic variables such as economic growth, inflation, interest rate, unemployment, and import in Turkey. Johansen cointegration and vector error correction model (VECM) were used for yearly data from 1990 to 2020. According to the findings, the rise in oil prices in the short term has a positive impact on unemployment and economic growth, which are among the selected variables. However, it is observed that a rise in oil prices in the long term has an unstable volatile effect on selected macroeconomic variables.

Besides, it seems plausible to a large extent that empirical literature has thrived on the empirical relationship between changes in oil prices and economic forces; the empirical assessment focuses on the implications of the volatilities of oil prices on aggregate consumption has been relatively scarce. This study extends the literature on the impact of oil price volatility on the economic output by converging on household consumption expenditure that perhaps is the principal constituent of gross domestic product. This study investigates the impact of oil price volatility on household consumption spending in Nigeria, noting the general slowdown in household consumption spending compelled by the global financial crisis in 2008 and due to Nigeria's excessive records of remarkable income disparity and poverty index classification. The current status of the country shows that there are inequalities in income. This study is the first to investigate the oil price volatility and household consumption expenditure nexus in Nigeria using the nonlinear ARDL and Toda Yamamoto causality.

Explicitly, the study also investigates the causal relationship between oil price, gross domestic product, consumer price index, real effective exchange rate, household consumption expenditure and disposable income using the Toda Yamamoto causality.

Unlike, the previous studies (Narayan & Narayan, 2007; Wang and Wu, 2012; Salisu & Fasanya, 2013; Narayan & Gupta, 2015) that modeled oil price volatility around the GARCH-family models, this study explored realized volatility (RV) model to measure oil price volatility. The RV is estimated as the sum of squared intra-day returns (Andersen & Bollerslev, 1998), and provides an unbiased and highly efficient estimator of the volatility of returns (Chen & Hsu, 2012). The study also examines the possible effect of oil price volatility on Nigeria's household consumption expenditure using time series data from 1980 to 2022. However, this study's ingenuity will help policymakers with the crucial tools for developing policy responses that mitigate the hostile effects of oil price volatility on consumption expenditure in Nigeria.

2.1 Theoretical Literature Review

In the last few decades considerable number of theories relating to the issue of oil price fluctuation and economic growth has emanated. Traditional growth theories concentrate on primary inputs of factors of production such as Capital, labour & land, while failing to recognize the role of primary energy inputs such as; oil deposits Ndungu (2013). However, economists and social scientists in the last few decades have made efforts at evolving some theories which capture impact and roles of oil price on economic performance, thereby integrating the linkage between energy resources and economic growth. Dominantly, the

Linear/Symmetric relationship oil price transformation and asymmetry/nonlinear transformation are popular theories that links oil price fluctuations and economic growth.

The life-cycle hypothesis of consumption function was developed mainly by Franco Modigliani and Richard Brumberg in 1954 (Modigliani and Brumberg, 1954). Its underlying conceptual basis is that individuals maximize their utility of consumption over their life cycle, and not over their disposable income over, say, a year. In this sense, the basic tenet of the theory is the mainstream model of utility-maximizing agents, which is based on the theory of rational consumer of mainstream microeconomics: rational beings can only choose to maximize their utility. In the framework of consumption function, individuals maximize utility that is expressed as a function of the individual's consumption stream over the span of his/her lifetime: $U_j = U_j (C_t, C_{t+1}, C_{t+2}, \ldots, C_L)$, where U_j is the utility of individual $_j$, C_t is present consumption, C_{t+1} is next year's consumption and so on, until the end of lifetime C_L.

The above utility function is maximized subject to the present value or worth of total resources, current and future, which will accumulate over the individual's working life or up to his/her retirement. These resources can be identified as the sum of the individual's present assets plus the present value of the stream of his/her annual disposable income until retirement. This setting implies that the individual will be able to maintain a stable pattern of consumption throughout his/her lifetime. In addition, income from employment will behave in a fairly predictable manner.

Apart from the life-cycle theory, the other attempt to criticize Keynes's approach to consumption was made by Milton Friedman with his permanent-income hypothesis (Friedman, 1957), where permanent income is an individual's income over his/her lifetime. In his attempt to define a consumption function, Friedman (1957) rejects Keynes's use of current income as the determinant of consumption expenditure, based on the idea consumers are forward-looking meaning future concerns affect current consumption decisions. Forward-looking consumers is a common point between Friedman's theory and the lifecycle theory. However, according to Friedman current income is subject to random, transitory fluctuations while according to life cycle theory, current income changes systematically as people move through their life cycle.

Further, the permanent income hypothesis is a special case of an intertemporal optimization model of consumer behaviour, where agents maximize the sum of their expected utility subject to a life-time budget constraint (Meghir, 2004). Consumers use their savings (or borrow) in an attempt to smooth consumption between good and bad years. These imply that current income differs from permanent income: $Y_t = Y^P + Y^T$, where Y is current income at time t, Y^P is permanent income projected at time t and Y^T is transitory (or unexpected changes in) income. The transitory component has an expected value of zero reflecting the notion that over time transitory gains are offset by future transitory losses and vice versa. Thus, in the long run observed levels of income (Y) are equal to permanent income (Y^P).

An important part of Friedman's theory was his assumption that permanent income is an average of income over the last several years. This implies that if there is a sudden rise in current income, there would be only a small increase in permanent income, contrary to Keynes's theory. Income would have to increase for several years continuously before people would expect permanent income to increase. In other words, consumers correct their previous estimates of permanent income by the amount of deviation of current income from previous period estimated permanent income (adaptive expectations).

3.0 Data and Methodology

The dataset spans from 1980 to 2022, sourced from world development indicators (WDI) data base. The study utilizes annual data for the following variables: real GDP (RGDP), oil price volatility (OPV), consumption per capita (CPC), real effective exchange rate (REER), consumer price index (CPI), and unemployment rate (UNR). These variables are selected based on their significant role in representing macroeconomic performance and household economic conditions.

The variable selection in this study is based on the work of Hone and Marisennayya, 2019; Bonsu and Muzindutsi, 2017; De Michelis, 2020.

Oil price volatility

Oil price volatility is the main independent variable, capturing the fluctuations in oil prices. Including it in the model allows us to analyze its impact on macroeconomic performance. Including oil price volatility as an independent variable allows us to capture the unpredictable fluctuations in oil prices, which can have far-reaching impacts on the economy. This variable is crucial in understanding how oil price shocks affect macroeconomic performance.

Real GDP

Real GDP represents the overall economic output, making it a crucial indicator of macroeconomic performance. Including Real GDP enables us to examine the effect of oil price volatility on economic growth. Real GDP is a broad indicator of economic activity, making it a vital variable in understanding the impact of oil price volatility on economic growth. By including Real GDP, we can assess whether oil price fluctuations lead to changes in economic output.

Consumption per capita

This variable measures the average consumption expenditure per person, reflecting the standard of living. Including it in the model helps us understand how oil price volatility affects household consumption and welfare. Consumption per capita represents the average household's purchasing power and standard of living. Including this variable helps us understand how oil price volatility affects household consumption patterns, which account for a significant portion of aggregate demand.

Consumer Price Index (CPI)

CPI measures inflation, which is a critical macroeconomic indicator. Including CPI enables us to analyze the impact of oil price volatility on inflation and price stability. CPI measures the general price level of goods and services, making it a critical indicator of inflation. By including CPI, we can examine whether oil price volatility leads to changes in inflation rates, which can have implications for monetary policy.

Real effective exchange rate

This variable captures the value of the currency relative to other currencies, adjusted for inflation. Including it in the model helps us understand how oil price volatility affects the exchange rate and trade. The real effective exchange rate captures the value of the currency relative to other currencies, adjusted for inflation. Including this variable helps us understand how oil price volatility affects trade balances, export competitiveness, and investment decisions.

Unemployment rate

This variable measures the percentage of the labor force without employment. Including the unemployment rate enables us to examine the impact of oil price volatility on the labor market and employment. The unemployment rate is a key indicator of labor market performance. By including this variable, we can assess whether oil price volatility leads to changes in employment levels, which can have social and political implications.

This study employs the nonlinear Autoregressive Distributed Lag (NARDL) model to investigate the impact of oil price volatility on macroeconomic performance, with a particular focus on household consumption expenditure. The NARDL approach is chosen due to its flexibility in capturing both short- and long-term asymmetric relationships between variables. It allows for the differentiation between the effects of positive and negative changes in oil price volatility on key macroeconomic indicators.

The model specification involves testing for both long- and short-run asymmetries in the relationships between oil price volatility and macroeconomic variables. The NARDL model is estimated using a two-step procedure, starting with the determination of the optimal lag structure based on information criteria such as AIC and SBC, followed by testing for cointegration among the variables. The model allows us to distinguish between positive and negative changes in oil price volatility and their differing impacts on real GDP, consumption per capita, and other macroeconomic indicators. The analysis is conducted using time-series econometric techniques, including unit root testing, error correction modeling, and impulse response analysis, to ensure robustness and validity of the findings.

3.1 Model Specification

Specifically, this study adopts and modified the empirical model used by (Manasseh, et al., 2019; Nwaoha et al., 2018; Charfeddine et al., 2018). The model was used to examine the impact of oil price fluctuation on the growth of the Nigerian economy and it is specified as;

$$CPC = f(OPV) \quad (3.1)$$

Extending the model to incorporate additional control variables yields the following equation;

$$CPC = f(OPV, RGDP, CPI, REER, UNR) \quad (3.2)$$

Equation (3.2) can simply be expressed as

$$CPC_t = \alpha + \beta_1 OPV_t + \beta_2 RGDP_t + \beta_3 CPI_t + \beta_4 REER_t + \beta_5 UNR_t + \mu_t \quad (3.3)$$

where CPC is consumption per capita, OPV is oil price volatility, RGDP is real Gross Domestic Product, CPI is consumer price index, REER is real effective exchange rate, UNR, is unemployment rate, *ln* depicts natural logarithm, the intercept becomes $ln\beta_0 = \alpha$ $\beta = 1 - 4$ are the elasticities of parameter estimates μ_t, as the white noise error term and other variables as previously explained. The residuals μ_t are assumed to be normally distributed and white noise.

The Nonlinear Autoregressive Distributed Lag (NARDL) methodology offers significant advantages over alternative approaches in capturing asymmetric relationships between variables, making it particularly suitable for economic studies where such dynamics are theoretically or empirically plausible. Unlike traditional linear ARDL models, which assume symmetric adjustments, NARDL explicitly accounts for positive and negative changes in independent variables separately, allowing for a more nuanced understanding of how shocks or changes propagate over time. This is particularly valuable in contexts where economic variables, such as consumption or investment, respond differently to increases and decreases in income, prices, or other determinants. Furthermore, NARDL retains the strengths of ARDL models, including robustness to small sample sizes and the ability to model variables with mixed integration orders (I(0) and I(1)), while extending its applicability to more complex real-world phenomena by incorporating nonlinearities. This methodological flexibility enhances its explanatory power and relevance in contemporary economic research.

The nonlinear ARDL (NARDL) model is designed to capture both the long run and short run asymmetric effects of oil price volatility on macroeconomic variables, particularly focusing on household consumption expenditure. The general form of the model is expressed as:

$$LCPC_t = \gamma_0 LOPV_t^{+} + \gamma_1 LOPV_t^{-} + \mu_t \quad (3.4)$$

Where, LCPC is the log of consumption per capita used as the dependent variable, LOPV is the log of oil price volatility. Following Shin et al. (2014), we decompose the oil price volatility series into positive and negative partial sums to capture these differing impacts. Equation 3.4 can be incorporated in an ARDL form as thus:

$$LCPC_t = \gamma + \gamma_0 LCPC_{t-1} + \gamma_1 LOPV_{t-1}^{+} + \gamma_2 LOPV_{t-1}^{-} + \sum_{i=0}^{a} \propto LCPC_{t-1} + \sum_{i=0}^{b} (\beta_i^{+} \Delta LOPV_{t-1}^{+} + \beta_i^{-} \Delta LOPV_{t-1}^{-}) + \sum_{i=0}^{e} (\Phi_i^{+} \Delta LCPC_{t-1}^{+} + \Phi_i^{-} \Delta LCPC_{t-1}^{-}) \quad (3.5)$$

Where all the variables are as previously defined, $\Upsilon_1 = \frac{-\Upsilon_1}{\Upsilon_0}, \Upsilon_2 = \frac{-\Upsilon_2}{\Upsilon_0}$ are the long run impacts of oil price volatility on the variables mentioned, $\sum_{i=0}^{b} \beta_i^{+}$ measures the short run impacts of the increase in oil price volatility, $\sum_{i=0}^{b} \beta_i^{-}$ measures the short run impacts of the decrease in oil price volatility. Therefore, as provided above, both the asymmetric long-run relation and the asymmetric short-run influences of oil price volatility on the variables mentioned are captured.

4.0 Results and Discussion

Table 1: Unit Root Test Result

	Augmented Dickey Fuller (ADF)		Kwiatkowski-Phillips-Schmidt-Shin (KPSS)		
	Levels	**First Difference**	**Level**	**First Difference**	**Order of integration**
LCPC	-0.7966	- 6.8731***	0.6812**	0.2796	I(1)
LCPI	- 2.5600	-3.0400**	0.2749	0.5000**	I(1)
LRGDP	- 1.1816	- 4.7186***	0.6186 **	0.3393	I(1)
UNR	-3.4748**	- 3.3678	0.4293	0.2589**	I(0)
LOPV	-1.0719	-5.0821***	0.5548**	0.1435	I(1)
REER	-2.0064	- 4.4740***	0.3889*	0.0607	I(1)

Note: *, ** and * imply significance at 1%, 5% and 10%, respectively**

Source: Authors Computation using EViews 10, 2024

Table 4 presents the results of unit root tests using both the Augmented Dickey-Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root tests. These tests are essential tools in time series analysis, offering insights into the stationarity properties of the data under study. The ADF test, assuming non-stationarity under the null hypothesis that unit root exists. The result reveals that consumption per capita, consumer price index, real GDP, oil price volatility, and real effective exchange rate are non-stationary at levels but become stationary after first differencing I(1). Conversely, the KPSS test, assuming stationarity under the null hypothesis that series is stationary. The result for KPSS indicates that consumption per capita, real GDP, oil price volatility, and real effective exchange rate are stationary at levels I(0), while consumer price index and unemployment rate require first differencing to achieve stationarity I(1). These mixed results underscore the complexity of economic data and highlight the importance of employing multiple stationarity tests.

The results indicate a mixture of order of integration I(0) and order of integration I(1) variables. This mixture is suitable for running nonlinear Autoregressive Distributed Lag (ARDL) bound test. The nonlinear ARDL bound test is appropriate for models with a combination of I(0) and I(1) variables, allowing for the estimation of long-run relationships among the variables.

Table 2: NARDL Bound Test

Critical value bounds of the F-statistics: F_{LCPC} (LOPV, LCPC, LCPI, LRGDP, UNR, REER)						
F-statistics	1% critical value		5% critical value		10% critical value	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
4.516**	4.31	5.544	3.1	4.088	2.592	3.454

Note: ** represent significance level at 5%. The critical values are based on the underlying data for N = 40 due to the small sample size of the study. Source; Researchers computation using Eviews10, 2024

The result presented in Table 2 shows that there exist a cointegrating vector in the model. It can be clearly seen that the F-statistic is greater than the critical values of the upper bound at 1%, 5% and 10% level of significance. This implies changes in oil price volatility, consumer price index, real GDP, unemployment rate, and real effective exchange rate have a long run relationship.

Table 3: NARDL Long Run Coefficients: CPC = LOPV, LCPC, LCPI, LRGDP, UNR, REER

Variables	**Coefficient**	**Std-Error**	**T-stat**	**Prob.**
LOPV+	*-0.0058*	0.0010	-5.4609	0.0028
LOPV-	-7.9900	3.3400	-2.3902	0.0624
LCPI	-0.0198	0.0088	- 2.2414	0.0517
LRGDP	0.2334	0.0869	2.6836	0.0251
UNR	0.3042	0.1463	2.0798	0.0673
REER	- 0.0427	0.0172	- 2.4740	0.0353

Source: Authors computation using Eviews 10, 2024

Table 3 shows the result for long run coefficient. the nonlinear ARDL long run coefficients show the relationship between consumption per capita and oil price volatility. The result shows that 1% increase in positive oil price volatility is estimated to decrease consumption per capita by 0.005%, and this effect is statistically significant at the 5% level. Conversely, a 1% increase in negative oil price volatility is associated with a 7.990% decrease in consumption per capita. However, this result is not statistically significant.

Additionally, a 1% increase in CPI results in a 0.0198% decrease in consumption per capita, without statistical significance. However, a 1% rise in real GDP significantly increases consumption per capita by 0.2334%, with significance at the 5% level. Unemployment shows a positive association; a 1% increase raises consumption per capita by 0.3042%, though this is statistically insignificant. Lastly, a 1% increase in the real effective exchange rate decreases consumption per capita by 0.0427%, a result that is statistically significant at the 5% level.

Research by the Federal Reserve (2017) found that positive oil price shocks reduce consumption due to rising inflation and economic uncertainty, which corresponds to the finding of a statistically significant negative impact of positive oil price volatility on consumption per capita. A World Bank (2022) report also identified an asymmetric effect, showing that while oil price increases often reduce consumption, decreases do not lead to a corresponding increase, similar to the findings on negative oil price volatility.

Table 4: NARDL Short Run Coefficients: LCPC = LOPV, LCPC, LCPI, LRGDP, UNR, REER

Variables	Coefficient	Std-Error	T-stat	Prob.
LOPV+	-0.0177	0.0033	-5.3161	0.0006
LOPV-	0.1087	0.0278	3.9032	0.0036
LCPI	0.0022	0.0025	0.9004	0.3913
LRGDP	0.2334	0.0522	4.4647	0.0016
UNR	-0.2334	0.0387	-6.7131	0.0001
REER	-0.0016	0.0034	-0.4672	0.6514
CointEq(-1)	-0.8003	0.0817	-9.7916	0.0000
R-Square	0.9473			
Adjusted R-Square	0.8782			
Durbin Watson Statistics	2.6592			

Source: Author's computation using EViews 10, 2024

The coefficient of positive oil price volatility in table 4 suggests that OPV+ has a statistically significant negative impact on consumption per capita. For each percentage increase in positive oil price volatility, consumption per capita decreases by approximately 0.0177% in the short run. Similarly, negative oil price volatility has a statistically significant positive impact on consumption per capita. Each percentage increase in negative oil price volatility is associated with an increase of approximately 0.1087% in consumption per capita in the short run. The coefficient of Consumer Price Index shows an insignificant effect on consumption per capita in the short run, as the p-value is above typical significance levels.

Real GDP has a positive and statistically significant effect on consumption per capita, with a coefficient of 0.2334 (p-value = 0.0016). This suggests that increases in GDP lead to higher consumption per capita in the short run. The unemployment rate has a significant negative effect on consumption per capita, with a coefficient of -0.2603 (p-value = 0.0001). This indicates that rising unemployment is associated with a decrease in consumption per capita. Real effective exchange rate does not show a significant impact on consumption per capita.

The error correction term has a coefficient of -0.8003 (p-value = 0.0000), indicating a strong and highly significant adjustment speed towards the long-run equilibrium. This suggests that any deviations from the long-term consumption per capita level are corrected at a rate of 80%

in each period. The model explains a high proportion of the variance in consumption per capita, as indicated by the R-squared of 0.947 and the adjusted R-squared of 0.878. The Durbin-Watson statistic of 2.659 indicates that there is minimal autocorrelation in the residuals, supporting the model's reliability.

Table 5: Long run Asymmetric Test

Test Statistic	Value	Df	Probability
t – statistic	4.493336	34	0.0001
F- statistic	20.19007	(1,34)	0.0001
Chi - statistic	20.19007	1	0.0000

Source: Authors computation using Eviews 10.

The Wald test results on table 13 above reveal a statistically significant long-run asymmetric relationship between oil price volatility and consumption per capita. This finding suggests that the impact of oil price volatility on consumption per capita is not uniform in both directions, implying a non-linear relationship. Specifically, the relationship may be characterized by a threshold effect, where the impact of oil price volatility on consumption per capita is significant only when the volatility exceeds a certain threshold.

Moreover, the asymmetric relationship may be characterized by an asymmetric adjustment process, where the adjustment to changes in oil price volatility is slower in one direction than the other. This implies that the impact of oil price increases on consumption per capita may be different from the impact of oil price decreases. The relationship may be more sensitive to oil price increases than decreases, or vice versa. The asymmetric relationship has important implications for policy and decision-making. Policy responses to oil price volatility may need to consider the asymmetric nature of the relationship to effectively manage its impact on consumption per capita. For instance, policymakers may need to implement different policies in response to oil price increases versus decreases. The findings of this study highlight the need for a more detailed understanding of the relationship between oil price volatility and consumption per capita, and suggest that policymakers should consider the asymmetric nature of this relationship when making decisions.

Table 6: Diagnostic Test Result for Model II

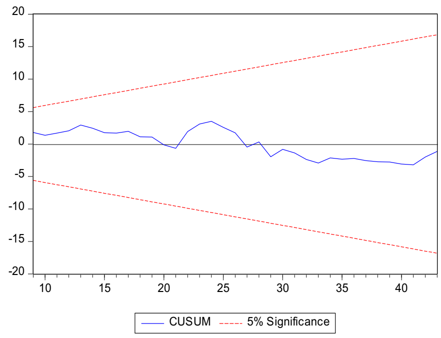
Test Statistic	**Chi-Square/LM Test**	**Probability**
Serial Correlation	0.7152	0.7607
Functional Form	2.0324	0.1628
Normality	1.4524	0.4837
Heteroskedasticity	0.2337	0.6370

Source: Authors computation using Eviews 10.

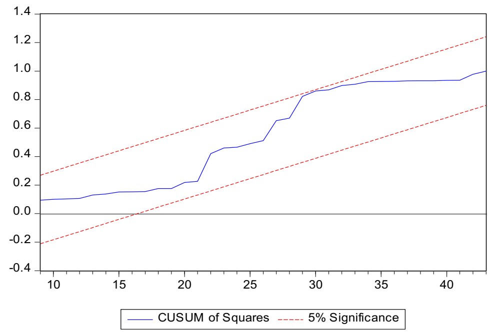
From the result on table 14 above, the probability value of 0.7607 indicates that there is no significant serial correlation in the residuals, suggesting that the model has adequately addressed any autocorrelation issues. The Ramsey reset test probability value of 0.1628 indicates that the functional form of the model is adequately specified, and there is no evidence of misspecification. Also, the probability value of 0.4837 suggests that the residuals are normally distributed, meeting the assumption of normality. Lastly, the probability value of 0.6370 indicates that there is no significant heteroskedasticity in the residuals, suggesting that the model's variance is homogenous.

Overall, these diagnostic test results suggest that the nonlinear ARDL model is well-specified, and the residuals exhibit desirable properties, including no significant serial correlation, normality, and homoscedasticity. These results provide confidence in the reliability of the model's estimates and inferences.

Figure 1: Cusum and Cusum of Squares



CUSUM



CUSUM Squares

The CUSUM and CUSUM of squares tests on figure 6 indicate that the model's parameters are stable over time, with both plots falling within the stability boundaries. This suggests that the model is robust and reliable. The random distribution of the residuals, as confirmed by the CUSUM of squares plot, further supports the model's validity. These findings provide confidence in the accuracy of the model's predictions and robustness of the estimates, ensuring that the results can be reliably used for policy analysis and forecasting purposes. Overall, the stability of the model's parameters and residuals suggests that the model is a reliable tool for understanding the relationships between the oil price volatility and consumption per capita.

5.0 Conclusion

The findings from this research provide strong evidence of a long-run relationship between oil price volatility and consumption per capita. The F-statistic exceeds both the lower and upper critical bounds, confirming the existence of cointegration among the variables. This implies that changes in oil price volatility, particularly positive oil price volatility (OPV+), have a lasting impact on consumption per capita. Specifically, the coefficient of the long-run relationship indicates that a 1% increase in OPV+ results in a 0.005% decline in consumption per capita, a result that is statistically significant at the 1% level. This negative relationship underscores the importance of oil price fluctuations in determining long-term consumption patterns.

In the short run, the influence of OPV+ on consumption per capita is more pronounced. A 1% increase in OPV+ leads to a 0.29% decrease in consumption per capita, highlighting the immediate impact of oil price volatility on economic behavior. Additionally, the Wald test confirms a significant long-run asymmetric relationship between oil price volatility and consumption per capita. This suggests that both positive and negative changes in oil prices affect consumption per capita differently over time. These results emphasize the need for policymakers to consider oil price volatility's impact on consumption when formulating economic policies.

Based on the findings of this research, it is recommended that policymakers develop strategies to mitigate the negative impact of oil price volatility on consumption. Given the significant long-run and short-run effects of positive oil price volatility (OPV+) on consumption per capita, governments should consider implementing stabilization mechanisms, such as fuel subsidies or price controls, during periods of high oil price volatility. These measures could help cushion households from the adverse effects of rising oil prices and maintain stable consumption levels, particularly for low-income households that are more vulnerable to economic shocks.

Additionally, it is recommended that countries diversify their energy sources to reduce reliance on oil. Since oil price fluctuations have such a pronounced impact on consumption per capita, especially in the short run, transitioning to alternative energy sources such as renewables could help reduce this dependency. By investing in renewable energy infrastructure, governments can create a more resilient economy that is less susceptible to the detrimental effects of oil price volatility. This will not only promote sustainable growth but also enhance energy security in the long term.

Finally, it is important for policymakers to consider the asymmetric nature of the relationship between oil price volatility and consumption. The Wald test results indicate that positive and negative oil price shocks affect consumption differently, suggesting that policy responses should be tailored to the direction of the price change. In the case of rising oil prices, targeted interventions such as social safety nets or temporary tax relief could help mitigate the negative effects on consumption. Conversely, during periods of falling oil prices, policymakers could focus on fostering savings or investments that enhance long-term economic growth.

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