

Interactive Effect of Crude Oil Price and Exchange Rate on Food Price Index in Nigeria

Dennis Brown EWUBARE¹, Sonny Nwonodi AMADI², Sancho Nwobuisi CHUKWU³ & Victor Oyaretor EBOHOIN⁴

^{1,2,3,4}Department of Economics, Faculty of Social Sciences, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt, Rivers State, Nigeria.
dennis.ewubare@ust.edu.ng¹, watiamadii@yahoo.co.uk², sancho.chukwu@rsu.edu.ng³

Corresponding Author: victor.ebohoin@ust.edu.ng^{4*}

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Abstract

This study empirically evaluated the effects of oil price and exchange rate on food price index in Nigeria from 2001Q1 to 2023Q4. The study proxied oil price and exchange rate by crude oil price and real exchange rate interaction, crude oil price and real exchange rate. In order to achieve the objectives of the study, quarterly data were used and these data were sourced from the Central Bank of Nigeria (CBN) statistical bulletin, World Development Indicators (WDI) of the World Bank and International Energy Agency. The techniques of data analysis adopted are the Autoregressive Distributed Lag (ARDL) processes. The key findings of this study showed that crude oil price interaction with real exchange rate, and real exchange rate indicated significant positive effects on food price index. On the other hand, crude oil price showed significant negative effects on food price index. Therefore, the study concluded that oil price and exchange rate have exerted significant upward influence on food price index in Nigeria over the sampled period. It was therefore recommended among others that economic diversification, to reduce the economy's vulnerability to crude oil price shocks. The development of non-oil sectors like agriculture, manufacturing, and technology will reduce the dependency on oil revenues and insulate the real exchange rate from oil price volatility thereby leading to more stable consumer prices. It was further recommended that Policy makers should ensure the emplacement of a robust and transparent foreign exchange market, devoid of speculative activities and improve liquidity as well as remove artificial controls that distort the real exchange rate.

Keywords: Crude Oil Price, Real Exchange Rate, Interaction, Nigeria, ARDL Model

JEL Classification: Q41, F31, E31

INTRODUCTION

Crude oil is a crucial energy source and a key raw material in the petrochemical industry. It is classified into different types based on its physical characteristics, including density and sulfur content. Major classifications include light, medium, heavy, and sweet or sour crude. Crude oil plays a vital role in the global economy as the primary source of energy for transportation, heating, and electricity generation. It is also a significant input in the production of numerous everyday products, from plastics to pharmaceuticals. The strategic importance of crude oil cannot be overstated, given its impact on national security, economic stability, and global trade (Yergin, 2014). Crude oil prices are determined by various factors including supply and demand dynamics,

geopolitical events, production costs, and the policies of major oil-producing countries. These prices are quoted in major commodities markets, with benchmarks like Brent Crude, West Texas Intermediate (WTI), and Dubai Crude being the most widely recognized. The price of crude oil is a crucial economic indicator as it influences the cost of energy, transportation, and production processes across the global economy. Therefore, the price of crude oil has a direct and indirect impact on consumer prices. Directly, it affects the cost of gasoline, diesel, and other fuels, which are essential for transportation and logistics. Indirectly, it influences the cost of goods and services through transportation and production costs. High crude oil prices can lead to increased inflation, reducing consumers' purchasing power and potentially slowing economic growth (Blanchard & Gali, 2007). In addition, Energy Information Administration (2019) reported that crude oil prices directly influence the cost of gasoline, diesel, and other fuels. When oil prices rise, fuel costs increase, leading to higher transportation and heating costs for consumers. This increase is directly reflected in the consumer price indices under categories such as transportation and housing. Also, higher fuel prices increase the cost of transporting goods. This can lead to higher prices for a wide range of consumer goods, from food to clothing, as businesses pass on the increased transportation costs to consumers. Additionally, higher fuel costs can raise production costs for goods that require significant energy inputs, such as manufactured products and agricultural goods (Hamilton, 2019). According to Obi, Oniore and Nnadi (2016), as oil prices are denominated in U.S. dollars, significant changes in oil prices can impact exchange rates, especially for oil-importing countries. A higher oil price can weaken the currency of an oil-importing country, making imports more expensive and contributing to higher consumer price indices through imported inflation. The exchange rate can significantly impact the consumer price indices through various channels, influencing inflation and the overall economic stability of a country. Also, weaker domestic currency makes exports cheaper and more competitive in the international market. While this may boost export volumes, it can also lead to higher demand for domestically produced goods and services. Increased demand can drive up prices, contributing to inflation and an increase in the consumer price index. Conversely, an appreciation of the domestic currency makes exports more expensive and less competitive, potentially reducing demand and exerting downward pressure on domestic prices (Dornbusch, 2017). In Nigeria, exchange rate fluctuations affect the cost of production for domestic firms, especially those reliant on imported raw materials and intermediate goods. A depreciation of the Nigerian Naira increases the cost of these inputs, which can lead to higher production costs. Firms usually pass these increased costs onto consumers in the form of higher prices, contributing to an increase in consumer price index (International Monetary Fund, 2020). Olamileke and Joshua (2020) noted that exchange rate movements influence inflation expectations among consumers and businesses in Nigeria. A persistent naira depreciation is often leads to expectations of higher future inflation. This, in turn, drives businesses to preemptively raise prices, and consumers to accelerate their purchases, further increasing the consumer price indices in Nigeria.

Statement of the Problem

Nigeria heavily relies on oil exports as a major source of revenue, making its economy vulnerable to fluctuations in global oil prices. When oil prices decline, government revenue decreases, leading to budget deficits and reduced fiscal capacity to invest in infrastructure, social programs, and economic diversification efforts. The World Bank (2022) reports that Nigeria's foreign exchange reserves declined from \$45.1 billion in 2009 to \$35.2 billion in 2019, reflecting volatility in oil prices and exchange rates. Oil price and exchange rate fluctuations contribute to inflationary

pressures, affecting food price index in particular and consumer prices across various sectors of the economy as a whole. Higher oil prices increase production costs, transportation expenses, and energy prices, leading to increase in food price index. According to the National Bureau of Statistics (NBS) of Nigeria, the country's inflation rate rose from 11.37% in April 2019 to 12.56% in June 2021, partly driven by food and energy price inflation linked to oil price and exchange rate dynamics. Rising inflation erodes consumer purchasing power, particularly for essential goods and services. As consumer prices increase, households allocate more income to basic necessities, leaving less disposable income for savings and discretionary spending. National Bureau of Statistics (NBS) data further showed that Nigeria's real GDP growth rate declined from 2.27% in 2019 to -1.92% in 2020, reflecting the adverse impact of the COVID-19 pandemic compounded by oil price shocks and exchange rate volatility. Drawing from the identified problem, this study examined the interactive effects of oil price and exchange rate on food price indices in Nigeria.

Aim and Objectives of the Study

The aim of the study is to examine the interactive effects of oil price and exchange rate on food price indices in Nigeria from 2001Q1 to 2023Q4. Specifically, the study seeks to:

- i. Examine the effect of crude oil price interaction with real exchange rate on food price index,
- ii. Determine the effect of crude oil price on food price index,
- iii. Evaluate the effect of real exchange rate inter on food price index,

LITERATURE REVIEW

Theoretical Framework

The adopted suitable theories to provide theoretical justifications for the relations between oil prices, exchange rate and food price index are the Asymmetric Price Transmission (APT) Theory and the Purchasing Power Parity (PPP) Theory. These theories are reviewed in this section as follows:

Asymmetric Price Transmission (APT) Theory

One of the theories on which this study is premised is Asymmetric Price Transmission (APT) theory. The theory accentuates Rocket and Feather Effect (RFE), and dwells on the pass-through mechanism of changes in the price of energy resources such as crude oil to the price of gasoline due to changes in other input costs commonly attributed to (Bacon, 1991). Therefore, the energy prices, like the trio of crude oil and natural gas prices and electricity tariff, as a segment of energy market economy, change due to many other factors that are both structural and market inclined, exerts direct and indirect effects (Zhang, 2015). In Nigeria, like most other net energy export and import economies, crude oil and natural gas prices greatly influences the performance of the economy especially in meeting government economic responsibilities and hence influences prices of other goods and service (Iwayemi & Fowowe, 2010). However, critics of the rocket and feather hypothesis (RFH) and market structure assumptions in Nigerian economy like Aregbeyeni and Kolawole (2015) argued that law of equilibrium price may fail due to factor pricing, heterogeneity of product, price and state policies, which also affects social capital investment.

Purchasing Power Parity (PPP) Theory

The Purchasing Power Parity (PPP) theory was propounded by Professor Gustav Cassel of Sweden in 1918. The PPP theory has a long history in economics, dating back several centuries, but the

specific terminology of purchasing power parity was introduced in the years after World War I during the international policy debate concerning the appropriate level for nominal exchange rates among the major industrialized countries after the large-scale inflations during and after the war (Cassel, 1918). Purchasing Power Parity (PPP) is an economic theory that states that the nominal exchange rate between two currencies should be equal to the ratio of aggregate price levels between the two countries, so that a unit of currency of one country will have the same purchasing power in a foreign country. The exchange rate between two currencies is equal to the ratio of the currencies' respective purchasing power. The theory assumed that in some circumstances (for example, as a long-run tendency) it would cost exactly the same number of, for example, US dollars to buy Euros and then to use the proceeds to buy a market basket of goods as it would cost to use those dollars directly in purchasing the market basket of goods. A fall in either currency's purchasing power would lead to a proportional decrease in that currency's valuation on the foreign exchange market (Ohiria, Saliu & Schuller, 2008).

The concept of purchasing power parity allows one to estimate what the exchange rate between two currencies would have to be in order for the exchange to be at par with the purchasing power of the two countries' currencies. Using that PPP rate for hypothetical currency conversions, a given amount of one currency thus has the same purchasing power whether used directly to purchase a market basket of goods or used to convert at the PPP rate to the other currency and then purchase the market basket using that currency. PPP exchange rates help costing but exclude profits. So, it is reckoned as more efficient methodology than the use of market exchange rates suppose that two countries produce the same physical amounts of goods as each other in each of two different years (Engle & Rogers, 2011). Since market exchange rates fluctuate substantially, when the Gross Domestic Product (GDP) of one country measured in its own currency is converted to the other country's currency using market exchange rates, one country might be inferred to have higher real GDP than the other country in one year but lower in the other; both of these inferences would fail to reflect the reality of their relative levels of production. But if one country's GDP is converted into the other country's currency using PPP exchange rates instead of observed market exchange rates, the false inference will not occur. Essentially, GDP PPP controls for the different costs of living and price levels, usually relative to the United States Dollar, thus enabling a more accurate depiction of a given nation's level of production (Engle, 2011). According to David and Arthur (2013) transfer of purchasing power is necessary because international trade and capital transactions usually involves party's resident in countries with different national currencies, that each part eventually would like to hold its own currency, although the trade could be involved in any continent currency. PPP theory suggests that the equilibrium exchange rate will adjust by the same magnitude as the differential in inflation rates between two countries. Giving the volatile nature of exchange rate, this theory is relevant to this study as it one to estimate what the exchange rate between Nigeria currency (Naira) and other countries' currencies would have to be in order for the exchange to be at par with the purchasing power of the Nigeria currency and that of other countries.

Empirical Review

Having evaluated how crude oil price and exchange rate influenced commodity price in Nigeria from 1990 to 2022, Ewubare, Akidi, and Ebohoin, (2025) reported from their Autoregressive Distributed Lag (ARDL) result that crude oil price contributed long-run direct and substantial

effects on commodity price index but negatively in the short-run, as official exchange rate positively and substantially contributed long-run and short-run effects.

Examining the effects of fuel prices and exchange rate changes on food inflation using a Structural Vector Autoregressive (SVAR) model Akidi and Ikue, (2024) provided insights into both immediate and long-term impacts. The findings reveal that increases in fuel prices, particularly for petrol and diesel, drive up cost of food production and transportation, with noticeable impacts appearing within three to six months. Similarly, shifts in exchange rates raise cost of imported foods, with evident effects in about two to ten months.

In similar study, Akidi, Ikue and Ewubare, (2024) revealed that energy price increases significantly raise food production and transportation costs, with a 3–6-month pass-through period to food inflation. A depreciating Naira exacerbates inflation by increasing import costs, with a 2–4-month pass-through period. Also, the Consumer Price Index (CPI) influences current and future food inflation, indicating persistent inflationary pressures. Initially, household kerosene prices negatively impact inflation due to substitution effects, but this stabilizes over time. Kpagih, Chinda, and Akidi, (2022) established the causality relation between energy price fluctuations and inflation in Nigeria, using data from 1985 to 2018. Employing oil price, gas price, exchange rate and inflation rate as the variables, the pairwise granger causality test shows that inflation is not caused by oil price or gas price fluctuations.

Ademola, Ditimi and Johnson (2022) evaluated the nexus between crude oil price, natural gas price and electricity tariff in Nigeria. The study adopted Bound test approach of Autoregressive Distributed Lag (ARDL), Vector Autoregressive (VAR) model and pairwise causality test to determine the variables' cointegration, relationship and causal effects. The study found that the trio of crude oil price, natural gas price and electricity tariff as energy resources are cointegrated with long run relationship but with no significant causal effect amongst them. The study concluded there is existence of relationship but disproportional effects between the trio of Natural Gas Price (NGP), Electricity Tariff (EET) and Crude oil Price (COBP) in Nigeria's energy market.

Siyakudumisa, Kin and Yiseyon-Sunday (2022) empirically investigated the causal relationship between energy prices and economic performance in South Africa by employing the autoregressive distributed lag (ARDL) bounds test technique for the period 1994 to 2019. The empirical evidence that was reviewed used a different methodology and covered different periods, particularly in the South African context. The study also made use of ARDL model that is capable of detecting hidden cointegration relationships and works even in series that are integrated of different orders. The study established a long-run relationship between the variables. The findings revealed that electricity prices have a significant negative impact on economic growth in the long and short run, while crude oil prices show a significant positive linkage with economic growth in the long and short run. The Granger causality analysis did not establish a causal relationship between energy prices and economic growth in South Africa.

Muhammad (2022) examined the relationship between crude oil price and education cost index in Malaysia for the period of 1980–2019. The study applied combined cointegration test to examine the relationship between the variables in the long run. For robustness' sake, the ARDL bounds testing method was also employed to test for a possible long run relationship in the presence of

structural breaks. The study found a validity of cointegration between the variables. The study found that crude oil price exerted a significant positive influence on education cost index in Malaysia. The result supported the presence of feedback hypothesis between crude oil price and education cost index. The policy implications of these results are provided.

Akokaike, Adenikinju, Ekpe, Eleri, Ajulo and Gini (2021) evaluated crude oil price and growth of educational sector in African countries from the period of 1992 to 2018 using Nigeria, Algeria, Egypt, South Africa, Gabon and Angola. The study employed panel data. The relationship between crude oil price and growth of educational sector is determined with the Fixed Effect and Least Squares Dummy Variable panel techniques. The main findings from this test show that all variables are significant at 95 percent confidence interval ($P < 0.05$). Specifically, the finding shows positive relationship between crude oil price and growth of educational sector under Fixed effect and Least Square Dummy variables respectively. In the case of oil, the results show negative relationship for all panel techniques used but also statistically significant at 95 percent confidence interval ($p < 0.05$) in Nigeria, Angola, Gabon, Algeria, South Africa, and Egypt.

Meleni (2021) investigated the effect of oil price changes on the inflationary dynamics in Nigeria using data from April 1991 to April 2021. Auto regressive distributed lag and unit root test were used to find the effect impact of oil price changes on the inflation. It was found that the oil price changes have positive impact on inflation and exchange rate on long run. Anthony (2021) examined the effect and causal relationship between petroleum consumption and economic growth in Nigeria during the period of 1980 to 2016. Non autoregressive distribution lag, vector error correction model and causality test were used to determine the effect and causality between petroleum consumption and economic growth of Nigeria. The author found the co-integration and non-linearity between the petroleum products consumption in Nigeria and the economic growth. There was causality between economic growth and the consumption of petroleum products. Ologbenla (2021) examined the determinants of Nigerian energy prices using data of 1980 to 2020. Autoregressive distributed lag model was used. It was found that the price of petroleum products and inflation rate have positive relationship. The prices of energy are affected by oil price, input, and output as a factor.

Mamdouh and Mohamed (2021) aimed to explore the extreme effect of crude oil price fluctuations and its volatility on the economic growth of Middle East and North Africa (MENA) countries. The study used a panel quantile regression approach with other linear models such as fixed effects, random effects and panel generalized method of moments. The panel quantile methodology is an extension of traditional linear models and it has the advantage of exploring the relationship over the different quantiles of the whole distribution. The study summarized the results as following: changes in oil price and its volatility have an opposite effect for each oil-export and oil-import countries; for the former, changes in oil prices have a positive impact but the volatility a negative effect. While for the latter, changes in oil prices have a negative effect but volatility a positive effect. Further, the impact of oil price changes and their uncertainty are different across different quantiles.

Abner, Izuchukwu, Eneoli and Udo (2021) analyzed the causal relationship between energy pricing and economic growth in Nigeria using the multivariate framework from 2000Q-12018Q4, the Autoregressive Distributed Lag (ARDL) bounds test approach, Error Correction Model

(ECM), and the Clemente-Montanes-Reyes unit root for structural breaks in the series. Findings revealed a co-integrating relationship, a bidirectional relationship between petroleum, liquefied natural gas, and electricity prices; a unit increase in energy consumption stimulates economic growth through product and service value addition; a unit decrease in electricity consumption increases petroleum consumption while decreasing economic growth as a result of distribution failure, estimated billing system and over-dependence on generating set as an alternative energy source. The non-causal relationship can be accredited to the energy demand-supply gap.

Ighosewe, Akan and Agbogun (2021) examined the effect of crude oil fluctuation on the Nigerian economy: A resource-dependence approach covering a study period of 35 years (1984-2018). Variables used include: Fluctuation in Oil Price per Barrel (FOBP), Diesel Pump Price Fluctuations (PPPF), Petrol Pump Price Fluctuations (DPPF), Kerosene Pump Price Fluctuation (KPPF), and Real GDP. The data were gotten from the CBN Statistical Bulletin, World Bank Report, and Oil Producing Exporting Countries Annual Report while it was analyzed using Auto-Regressive Distributed Lag Model. Various diagnostic tests proved that the model is fit for the study. However, the Pearson correlation coefficient substantially attests to a strong linear relationship between the regressed and the regressors. Particularly, the individual results restated that in the short run only Fluctuation in Oil Price per Barrel (FOBP) improved the Nigerian economy significantly. However, in the long run, both Fluctuation in Oil Price per Barrel (FOBP) and Kerosene Pump Price Fluctuation (KPPF) improve the Nigerian economy significantly.

Olamileke and Joshua (2020) investigated the impact of oil price and exchange rate fluctuations on health care costs in developed countries. Using a panel vector autoregression (PVAR) model, the results indicate a statistically significant positive relationship between oil price movements and health care costs, suggesting that higher oil prices are associated with increased health expenditures. Furthermore, the study explores the role of exchange rate dynamics in mediating this relationship, finding that currency depreciation amplifies the effects of oil price shocks on health care prices.

Ifeonyemetalu and Ogu (2020) examined the impact of oil price fluctuation on economic growth in Nigeria. The study made use of Generalized Auto-Regressive Conditional Heteroskedasticity GARCH (1,1) model. The results showed that oil price has positive and significant effect on the economic growth in Nigeria; Fluctuations in oil prices, though has positive effects on economic growth but insignificant; Exchange rate has positive and significant effect on economic growth in Nigeria. It was recommended that since oil price is positively related to economic growth, government should utilize properly the proceeds received from oil occasioned by oil price increase to basic and improve basic infrastructures like good and motorable roads, quality education and stable power supply.

Siok (2020) examined the effects of changes in oil prices on the in two groups of countries. The classification of the counties was those with high dependence and those with low dependence on oil importation. The variables considered were real exchange rate, production cost domestic input. Data from 1980 to 2010 were used. Autoregressive distributed lag was used. The authors found that oil price changes have a direct effect on education in countries that has low dependence on oil while the effect is indirect on the countries that have high oil dependency.

Al-Mulali (2019) examined the effect of oil price on the growth of educational sector 16 developing countries. The study made use of educational sector gross domestic product by collecting the data from 16 developing countries. The study utilized the panel model from the time period 1980 to 2010. Results of the research showed that crude oil price has a cointegration with educational sector gross domestic product. Additionally, Granger causality tests revealed a two-directional causal association between crude oil price and educational sector gross domestic product in the 16 developing countries.

Augustine and Damilola (2015) examined the Granger causality of energy consumption, oil price and education cost in Nigeria. Two sub-categories of energy (kerosene and electricity) were equally considered. The error correction model framework was used to test the granger causality of the variables. The results for the total energy showed bidirectional causality between energy consumption and education cost. As regards electricity, bidirectional causality was found between electricity consumption and education cost as well as between electricity consumption and electricity cost. No causal relationship exists among kerosene consumption, kerosene price and education cost.

METHODOLOGY

Research Design

For the purpose of this study, the *ex-post facto* research design is used. This research design, also known as an observational or retrospective design, is a type of research design where researchers analyze existing data or events to draw inferences about possible causes or effects. It involves studying variables that have already occurred naturally without any manipulation by the researcher

Data Collection Method and Sources

Quarterly data were used in this study and these data were obtained from Central Bank of Nigeria (CBN) statistical bulletin, World Development Indicators (WDI) of the World Bank and International Energy Agency. In evaluating this study also, the data covered the period from 2001Q4 – 2023Q4 indicating ninety-two (92) sample observations.

Model Specification

The analytical framework of this study was based on Asymmetric Price Transmission (APT) theory. Empirically, the model of this study is built on the work of Ogbuabor and Egwuchukwu (2017) in their work on the impact of oil pricing and price stability in Nigeria. However, the model was significantly modified not only to incorporate all the variables adopted but also to remove variables that are not included in this study. Thus, the model is expressed in its functional, mathematical and econometrical respectively:

Functional Model Specifications

$$FPI = f(COP * RER, COP, RER) \quad (1)$$

Mathematical Model Specifications

$$FPI_t = \beta_0 + \beta_1 COP_t * RER_t + \beta_2 COP_t + \beta_3 RER_t \quad (2)$$

Econometric Model Specifications

$$FPI_t = \beta_0 + \beta_1 COP_t * RER_t + \beta_2 COP_t + \beta_3 RER_t + e_{it} \quad (3)$$

Where: δ_0 = Regression intercept, FPI = Food Price Index, $COP * RER$ = Multiplicative product of crude oil price and real exchange rate defining their interactions, COP = Crude oil price, RER = Real exchange rate, $\delta_1 - \delta_3$ = Coefficients of the regressors in Food Price Index Model, t = Time, e_{it} = Error term

A Priori Expectation: The parameters or coefficients of crude oil price and real exchange rate interaction and real exchange rate are expected to have positive signs and thus denote positive relationship with food price index while the parameter or coefficient crude oil price is expected to have a negative sign and thus denotes negative relationship with food price index. This is mathematically shown as: $\delta_1 > 0$; $\delta_2 < 0$; $\delta_3 > 0$.

Data Analysis Techniques

This study adopted Autoregressive Distributed Lag (ARDL) approach. The ARDL approach is especially relevant in this study since the variables under investigation are integrated at different orders, such as $I(0)$ or $I(1)$, meaning they are stationary in levels and in first differences. Long-run ARDL model is specified as follows:

$$\begin{aligned} \Delta(FPI_t) = & \delta_0 + \delta_{1i}\Delta(FPI_{t-1}) + \delta_{2i}\Delta(COP * RER_{t-1}) + \delta_{3i}\Delta(COP_{t-1}) + \delta_{4i}\Delta(RER_{t-1}) \\ & + \sum_{t=1}^p \vartheta_{1i}\Delta(FPI_{t-1}) + \sum_{t=1}^q \vartheta_{2i}\Delta(COP * RER_{t-1}) + \sum_{t=1}^q \vartheta_{3i}\Delta(COP_{t-1}) \\ & + \sum_{t=1}^p \vartheta_{4i}\Delta(RER_{t-1}) + \phi ECM_{t-1} + \mu t \end{aligned} \quad (4)$$

Where: $\delta_1 - \delta_4$ = long-run elasticities in the model, $\vartheta_1 - \vartheta_4$ = Short-run elasticities, while ECM_{t-1} = Lagged error correction term, ϕ = Speed of adjustment, Δ = Difference operator, and μt = error term with other notations as defined earlier.

DATA ANALYSIS AND DISCUSSION

Descriptive Analysis

The descriptive statistics for the study variables are summarized in Table 1:

Table 1: Descriptive Statistics

	FPI	TPI	COP*RER	OIP	EXR
Mean	196.4949	169.7216	16056.91	66.29288	233.4918
Median	134.8500	135.8200	12939.09	65.00625	157.3813
Maximum	770.5100	544.2100	66266.11	109.4500	745.8200
Minimum	33.67000	37.34000	2588.053	23.12000	111.9400
Std. Dev.	170.7952	121.1956	12913.11	24.93691	146.8868
Skewness	1.470927	1.173624	1.910171	0.042565	1.673888
Kurtosis	4.538146	3.734673	6.591938	2.067944	5.391713
Jarque-Bera	42.24484	23.18904	105.4053	3.357905	64.89028
Probability	0.000000	0.000009	0.000000	0.186569	0.000000
Sum	18077.53	15614.39	1477236.	6098.945	21481.24
Sum Sq. Dev.	2654561.	1336643.	1.52E+10	56588.31	1963392.
Observations	92	92	92	92	92

Source: Authors' Computation, 2025 (EViews 12.0).

The table showed that food price index (FPI) recorded a mean value of 196.49% with a maximum of 770.51% and minimum of 33.67% per annum. The standard deviation of volume of food price index (FPI) is 170.80% and this also indicates that volume of food price index (FPI) has low dispersion. In furtherance, crude oil price-real exchange rate interaction (COP*EXR) recorded over the period a mean value of 16056.91% with a maximum of 66266.11% and minimum of 2588.05% per annum. The standard deviation of crude oil price-real exchange rate interaction (COP*EXR) is 12913.11% and this also indicates that crude oil price-real exchange rate interaction (COP*EXR) has high dispersion from the mean. In addition, crude oil price (COP) recorded over the period a mean value of 66.29% with a maximum of 109.45% and minimum of 23.12% per annum. The standard deviation of crude oil price (COP) is 24.94% and this indicates that crude oil price (COP) has low dispersion from the mean over the study period (2001Q1 - 2023Q4). Finally, real exchange rate (RER) recorded over the period a mean value of 233.49% with a maximum of 745.82 and minimum of 111.94% per annum. The standard deviation of real exchange rate (RER) is 146.89% and this indicates that real exchange rate (RER) has high deviation from the mean over the study period (2001Q1 - 2023Q4).

Unit Root Test

Testing of the unit roots of a series is a precondition to the existence of cointegration relationship. Therefore, this study first employed the popular Augmented Dickey-Fuller (ADF) unit root test to investigate the stationarity of all the variables used. The results of the unit root test are presented in Table 2 below:

The unit root test results showed that real exchange rate (RER) was stationary at levels attained stability at level. This is because the test statistic value of real exchange rate (RER) is greater than the Mackinnon critical value at 5% level of significance at level.

Table 2: Augmented Dickey-Fuller (ADF) Test Results

Variables	Level	ADF			Integration @	Stationary @
		Critical Value @ 5%	1 st Difference	Critical Value @ 5%		
FPI	0.551	-2.895	5.665**	-2.895	I(1)	1 st Diff.
COP*EXR	2.835	-2.894	-7.478**	-2.894	I(1)	1 st Diff.
COP	-2.694	-2.894	-3.381**	-2.894	I(1)	1 st Diff.
RER	3.019**	-2.896	-	-	I(0)	Level

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

Source: Authors' Computation, 2025 (EViews 12.0).

This further indicates that real exchange rate (RER) was stationary at order zero [i.e., I(0)]. On the other hand, food price index (HPI), crude oil price-real exchange rate interaction (COP*EXR) and crude oil price (COP) attained stability after first differencing. This is because their test statistic values are greater than the Mackinnon critical value at 5% level of significance at first difference. This further indicates that food price index (HPI), crude oil price-real exchange rate interaction (COP*EXR) and crude oil price (COP) were integrated at order one [i.e., I(1)].

Correlation Analysis

For the purpose of this study, correlation matrix is used to detect multi-collinearity. The correlation matrix involves examination of correlation coefficients between pairs of dependent and independent variables. The results of the correlation are presented in Table 3:

Table 3: Correlation Matrix

	FPI	COP*EXR	COP	RER
FPI	1			
COP*EXR	0.218913	1		
COP	0.295671	0.470663	1	
RER	0.966069	0.228852	0.159551	1

Source: Authors' Computation, 2025 (EViews 12.0).

The result of the correlation matrix in Table 3 indicated that crude oil price-real exchange rate interaction, crude oil price and real exchange rate) all have weak positive relationships with food price index (FPI). Hence, there is sufficient statistical evidence to conclude that there is absence of multicollinearity problem among the independent variables.

Bounds Cointegration Test

Given that the variables have mixed stationarity, that is, integrated of order zero $[I(0)]$ and integrated of order one $[I(1)]$, we therefore proceed to establish or ascertain the existence or nonexistence of long-run cointegrating relationship among the variables in the equation using Autoregressive Distributed Lag (ARDL) bounds cointegration test. The result of ARDL cointegration test is presented in Table 4:

Table 4: Bounds Cointegration Test

	Critical Value Bound		F-Statistics
$F_{FPI}(COP*EXR, COP, RER)$			8.457293**
K = 3			
Significance	I(0) Bound	I(1) Bound	
10%	2.37	3.2	
5%	2.79	3.67	
2.5%	3.15	4.08	
1%	3.65	4.66	

Note: Null hypothesis: No level relationship; K = number of regressors; *, ** and *** denote significance at 10%, 5% and 1% level, respectively.

Source: Authors' Computation, 2025 (EViews 12.0).

In order to determine if there is cointegration among food price index (FPI), crude oil price-real exchange rate interaction (COP*EXR), crude oil price (COP) and real exchange rate (RER), bounds test was conducted. The result of bounds correlation test in Table 4 showed that bounds test indicates presence of long run relationship among food price index (FPI), crude oil price-real exchange rate interaction (COP*EXR), crude oil price (COP) and real exchange rate (RER) given that the F-statistics value of 8.457293 is higher than the 5% upper bound critical value of 3.67. By this, the null hypothesis is rejected, which leads to the study concluding that there is cointegrating relationship among the variables. The confirmation of long run dynamics among the variables

further necessitated the estimation of the extent of the relationship between the dependent and independent variables through estimation of Autoregressive Distributed Lag (ARDL) model.

Autoregressive Distributed Lag (ARDL) Long-Run and Short-Run Dynamics

The long-run and the short-run econometric model which was specified in chapter three is estimated in this section using Econometric Views (E-Views) 12 statistical software. The results obtained are hereby presented in Table 5 below:

Table 5: Results of Long-Run and Short-Run ARDL FPI Model Estimation

Dependent Variable = FPI				
Long-Run Results				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
COP*EXR	0.018066	0.004518	3.998295	0.0002
COP	-1.721431	0.659261	-2.611154	0.0113
RER	0.934462	0.183546	5.091176	0.0000
C	-63.14127	31.96147	-1.975543	0.0526
EC = FPI - (0.0181*COP*RER -1.7214*COP + 0.9345*RER - 63.1413)				
Short-Run Results				
D(FPI(-1))	-0.040470	0.104621	-0.386824	0.7002
D(FPI(-2))	-0.198712	0.102637	-1.936065	0.0573
D(FPI(-3))	-0.406307	0.104441	-3.890307	0.0002
D(COP*RER)	0.003481	0.000736	4.731613	0.0000
D(COP*RER(-1))	0.002761	0.001037	2.663229	0.0098
D(COP*RER(-2))	-0.001132	0.000904	-1.252024	0.2152
D(COP*RER(-3))	0.000477	0.000939	0.508682	0.6128
D(COP)	-0.439210	0.168136	-2.612227	0.0112
D(COP(-1))	-0.056297	0.207397	-0.271448	0.7869
D(COP(-2))	0.216553	0.168607	1.284362	0.2037
D(COP(-3))	-0.109959	0.174636	-0.629647	0.5312
D(RER)	0.151787	0.069930	2.170565	0.0337
D(RER(-1))	0.070026	0.056399	1.241617	0.2190
CointEq(-1)*	-0.367734	0.102438	-3.589834	0.0006
R-Squared	0.765695			
Adjusted R-squared	0.756478			
Durbin-Watson stat	2.171195			

Source: Authors' Computation, 2025 (EViews 12.0).

Interpretation of Long-Run and Short-Run ARDL Model Estimation Results

Crude Oil Price-Real Exchange Rate Interaction (COP*EXR) and Food Price Index (FPI)

The long-run estimates of the ARDL model are shown in Table 5. The results revealed that at crude oil price-real exchange rate interaction has a positive and significant effect on food price index in Nigeria. This is evidenced by the positive coefficient value (0.018066) of crude oil price-real exchange rate interaction and its p-value (0.0002) which is less than 0.05. This implies that a percentage increase in crude oil price-real exchange rate interaction will lead to 1.8% significant increase in food price index in the long run. Also, the short-run estimates of the ARDL model

results revealed that crude oil price-real exchange rate interaction has a positive and significant effect on food price index in Nigeria. This is evidenced by the positive coefficient value (0.003481) of crude oil price-real exchange rate interaction and its p-value (0.0000) which is less than 0.05. This implies that a percentage increase in crude oil price-real exchange rate interaction will lead to 0.3% significant increase in food price index in the short run.

Crude Oil Price (COP) and Food Price Index (FPI)

Furthermore, the results of the long-run estimates of the ARDL model revealed that crude oil price has significant negative effect on food price index in Nigeria. This is evidenced by the negative coefficient value (-1.721431) of crude oil price and its p-value (0.0113) which is less than 0.05. This implies that a percentage increase in crude oil price will lead to 172.1% significant decrease in food price index in the long run. Also, the results of the short-run estimates of the ARDL model revealed that crude oil price has significant negative effect on food price index in Nigeria. This is evidenced by the negative coefficient value (-0.439210) of crude oil price and its p-value (0.0112) which is less than 0.05. This implies that a percentage increase in crude oil price will lead to 3.7% significant decrease in food price index in the short run.

Real Exchange Rate (RER) and Food Price Index (FPI)

Moreover, the results of the long-run estimates of the ARDL model revealed that real exchange rate has positive and significant effect on food price index in Nigeria. This is evidenced by the positive coefficient value (0.934462) of real exchange rate and its p-value (0.0000) which is less than 0.05. This implies that a percentage increase in real exchange rate will lead to 93.4% significant increase in food price index in the long run. Also, the results of the short-run estimates of the ARDL model revealed that real exchange rate has a positive and significant effect on food price index in Nigeria. This is evidenced by the positive coefficient value (0.151787) of real exchange rate and its p-value (0.0337) which is less than 0.05. This implies that a percentage increase in real exchange rate will lead to 15.2% significant increase in food price index in the short run.

Interpretation of CointEq(-1) Result

The results of the short run dynamic coefficients associated with the long run relationships obtained from the error correction model are given in Table 5. The signs of the short run dynamic interactions are consistent with that of the long run relationship. The estimated error correction coefficient of -0.367734 (with p-value of 0.0006) is highly significant, has the correct sign, and imply a slow speed of adjustment to equilibrium after a shock. This implies that approximately 37% of disequilibria from the previous year's shock converge back to the long run equilibrium in the current year.

Interpretation of Adjusted R-Squared (Adj. R²) Value

The Adjusted R-squared value of 0.756478 from the results of the short-run estimates of the ARDL model in Table 5 indicated that the estimated model is well fitted as the systematic changes in explanatory variables (crude oil price-real exchange rate interaction, crude oil price and real exchange rate) explained approximately 77 percent (R-squared) variation in food price index while the remaining 23% is explained by other variables of factors outside the model.

Interpretation of Durbin-Watson Statistic Value

Lastly, Durbin-Watson stat of 2.171195 which is greater than 2 indicates the absence of serial autocorrelation.

Post-Estimation Tests of Food Price Index Model

The results of the post-estimation tests are presented and discussed below:

Table 6: Post-Estimation Tests Results

Test	Null Hypothesis	X ² Value	X ² Prob	Remark
Jarque-Bera	Normal distribution exists	2.636724	0.080332	Normal residuals
Breusch-Godfrey LM	Serial correlation does not exist	1.699386	0.1913	Serial independence
Breusch-Pagan-Godfrey	Homoscedasticity exists	0.428307	0.9852	Constant Variance
Ramsey RESET	Model is stable	0.159228	0.2025	correctly specified model

Source: Authors' Computation, 2025 (EViews 12.0).

The Jarque Bera (Normality) test result in Table 6 shows that the model is normally distributed. Also, the Breusch-Godfrey Serial Correlation LM test result reveals that the model has no serial correlation problem. In addition, the Breusch-Pagan-Godfrey heteroskedasticity test implies that relevant variables were not omitted. Lastly, the Ramsey RESET test result indicates that the model is correctly specified. This implies that the functional form of the model is correct.

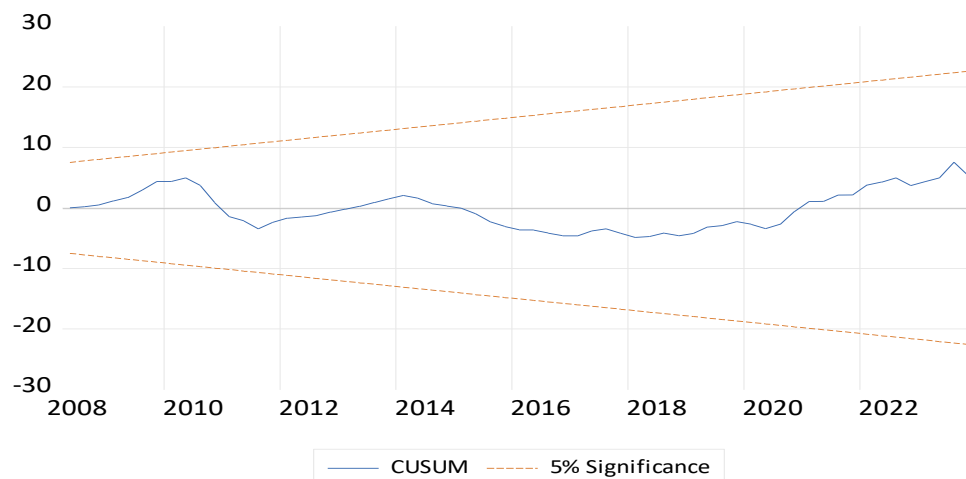


Figure 1: Stability Cusum Test

The cumulative sum (CUSUM) indicates that the CUSUM line stayed within the 5 percent critical bound while neither did CUSUM plot crosses the 5 percent critical lines. The implication of this

Discussion of Findings

This study has empirically analyzed the time series data in its determination of the effect of oil price and exchange rate on consumer price indices in Nigeria from 2001Q1 to 2023Q4 using Autoregressive Distributive Lag (ARDL) estimation technique and E-Views 12 statistical package to run the analysis. The findings obtained from the analyses of the long-run and the short-run estimates revealed that crude oil price had significant ($p = 0.0000 < 0.05$ / $p = 0.000 < 0.05$) and negative (-0.418920 / -0.037359) relationship with education price index in Nigeria. This implies that a Dollar increase in crude oil price per barrel resulted in about 0.419 (42%) and 0.037 (4%) decrease in education price index in the long-run and short-run respectively over the data period covered in the study. This discovery agreed to the outcome of Muhammad (2022). Muhammad (2022) in his study on the relationship between crude oil price and education cost index in Malaysia for the period of 1980–2019 found that crude oil price exerted a significant positive influence on education cost index in Malaysia. Also, Siok (2020) found that oil price changes had a direct effect on education in countries that has low dependence on oil while the effect is indirect on the countries that have high oil dependency.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary of Findings

The findings obtained are summarized as follow:

1. First, real exchange rate was stationary at level and integrated at order zero, that is, $I(0)$ while food price index, crude oil price-real exchange rate interaction as well as crude oil price were stationary at first difference and integrated at order one that is, $I(1)$.
2. There is cointegration among food price index, crude oil price-real exchange rate interaction, crude oil price and real exchange rate.
3. Crude oil price-real exchange rate interaction has a positive and significant effect on food price index in Nigeria.
4. Crude oil price has a significant negative relationship with food price index in Nigeria.
5. Real exchange rate has a significant positive effect on food price index in Nigeria.

Conclusion

This study empirically examined the effect of oil price and exchange rate on food price index in Nigeria. Therefore, the study concluded that oil price and exchange rate both have significant effect on food price index in Nigeria.

Recommendations

The following recommendations are proffered based on the findings of this study:

1. One major issue with crude oil price fluctuations is that Nigeria remains highly dependent on oil exports. To reduce the Nigerian economy's vulnerability to crude oil price shocks, there must be a strong focus on economic diversification. Developing non-oil sectors like agriculture, manufacturing, and technology will reduce the dependency on oil revenues and insulate the real exchange rate from oil price volatility, leading to more stable consumer prices.
2. Policymakers should work on building a more robust and transparent foreign exchange market. This can be done by reducing speculative activities, improving liquidity, and removing artificial controls that distort the real exchange rate. When the foreign exchange market is strong and well-regulated, the negative interaction between crude oil price changes

and the real exchange rate can be minimized, leading to less fluctuation in consumer prices, implementation of financial instruments such as hedging strategies to protect itself against the risks of volatile crude oil prices. Through hedging contracts or derivatives, Nigeria can lock in oil prices, thus shielding its economy from short-term oil price shocks, which typically lead to swings in the exchange rate and inflation. This will also help stabilize the cost of consumer goods influenced by imported materials and products.

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