



The Asymmetric Effects of Oil Price and Climate Change on Food Prices in Nigeria (1995-2022)

Soliu Hamzat¹, PhD, Musa Isa¹,

Sama'ila Kurfi Lawal¹, and Mubarak Ahmed Aliyu¹

¹Department of Economics, Ahmadu Bello University Zaria, Kaduna, Nigeria.

Abstract

The Nigerian populace have begun to experience the bare vagaries of the changes in crude oil price following the complete stoppage of the subsidy regime especially as it is both crude oil exporting and petroleum product importing economy. In order to offer deeper and relevant information on the consequences of this together with climate changes, this study analyses the asymmetric effects of oil price and climate change on food prices in Nigeria. Increase in oil prices offers more revenue to oil-rich countries like Nigeria but it also puts pressure on the price of food in the country especially as the country gets its own fair share of the pressure of severe climate change making round across the world. However, oil prices also fall and it is not clear whether the impact of such negative changes has the same magnitude of effect as the positive changes. Using a nonlinear autoregressive distributed lag model on a monthly data set of food prices, oil price, average rainfall and other control variables for the period 1995 to 2022, this study concludes that positive changes in the price of crude oil led to a rise in food prices in the long run while positive change in rainfall in the previous month result in a reduction in food prices especially in the short run. Also, negative changes in rainfall result to a slight increase in food price while negative changes in oil price are associated with increase in food prices. Accordingly, the study recommends that Nigeria policymakers should take into consideration changes in oil prices and climate conditions in designing and implementing agricultural policies to achieve national development goals such as food security and sustainable growth to avoid social crises associated with food insecurity.

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Corresponding author

Soliu Hamzat
shamzat@abu.edu.ng
Tel:



1. Introduction

Over the past decades, Nigeria has experienced several episodes of high inflation and hence different explanations have been offered in the

literature as regards to its drivers. Among the factors that have gained prominence as drivers of inflation in Nigeria include weak coordination of monetary and fiscal policies,

weak exchange rate policies and weather shocks (Sani et al., 2016).

From the empirical literature, Apere (2017) identified an inverse relationship between inflation and crude oil price fluctuation in two ways. First, the fiscal channel operates through the expansion of government expenditures funded by revenue generated from oil sales resulting in the expansion of aggregate demand. Second, the cost channel operates through the prices of imported goods and services. This channel worsens the terms of trade and reduces budget size in response to a changes fall in crude oil prices. Moreover, other studies have also identified three more channels through which oil price shocks affect food prices: first, energy prices affect the cost of farm inputs including inorganic fertilizer and fuel for farm machinery (Gilbert, 2010; Dillon & Barrett, 2013); second, the increased production of bio-fuels may have implications for food production and prices due to reallocation of agricultural resources to fuel production (de Gorter et al., 2013; Dillon & Barrett, 2013; Mitchell, 2008; Rosegrant, 2008); third, energy prices can drive up transport costs, which in turn affect the costs of food transportation and distribution (Dillon & Barrett, 2013; Gilbert, 2010; Badiane & Shively, 1998; Mitchell, 2008; Benson et al., 2008).

On the other hand, numerous studies have documented the significant impact of climate variability on food prices. For instance, d'Amour et al. (2016), Wheeler and Von Braun (2013) assert that climate shocks, such as droughts and floods, can cause substantial fluctuations in crop yields, leading to price volatility in global food markets. Similarly, Cottrell et al. (2019) illustrate that the frequency and intensity of these climatic events are projected to rise with global warming, exacerbating food price instability and threatening food security. Also, Notre Dame Global Adaptation Initiative (2023) reports that Nigeria is the 53rd most vulnerable country and the 6th least prepared country in the world in terms of adapting to climate change. Thus, considering the factors that increase the overall

demand for food (e.g. wealth and population growth) together with the factors that reduce overall food supply (e.g. conflicts and pandemics), it can be concluded that the existing incompatibilities between Nigeria's food demand and food supply could have been exacerbated by climate change.

Given that high food prices affect the quantity and quality of consumption, as well as spending in general, the resulting food insecurity can lead to violent protests, thereby escalating local, regional, and global insecurity (McGuirk & Burke, 2020; Bellemare, 2015). Moreover, price volatility makes the income of food producers and others in the food supply chain uncertain and the consumer's expenditure unpredictable (Emediegwu & Nnadozie, 2022). Consequently, the ability to analyze and forecast food prices is fundamental for a functional policy-making mechanism. Based on the issues raised, this study aims to compare the differential impacts of climate change and oil price on food prices and also to explain the effects of changes in oil price and oil export on food prices. This is achieved by examining the asymmetric argument of both the impact of a rise and a fall in the price of crude oil following the advances made by Shin et al. (2014) on asymmetric models in econometrics. The question the study seeks to answer is how do changes in oil prices and climate change impact food prices in Nigeria? In line with the set objective of the study, a hypothesis which states that there is symmetric relationship between climate change and crude oil price on food price in Nigeria was set for testing.

The remaining part of the study is divided into four sections: literature review methodology, result analysis and discussion, and conclusion and recommendations.

2. Literature review

This section examines recent literature related to the objective of the study and also identifies the research gap which the study intends to fill. Starting with the panel studies on the oil price and food price nexus, Nezir and Emre (2022) investigate the effects of the oil price and

temperature on food inflation using monthly data between January 2003 and December 2020 for Latin American countries. The techniques employed by the study were the Structural Vector Autoregression (SVAR) model and panel Granger causality tests. Results from the study show that oil price and temperature can be significant factors for reducing changes in inflation rate while the result of the variance decomposition shows that a considerable portion of food inflation was explained by the exchange rate.

David (2021) investigates the causality between oil and food prices in 21 developing oil-exporting and food-importing countries from 2001 to 2016. Using a panel ARDL analysis and causality test, the study found the existence of a negative relationship between oil price and food prices in the short-run while a positive relationship exists between the variables in the long run. The study also reports a unidirectional causality running from food prices to oil price suggesting that the agricultural market is a significant driver of the energy markets in the sampled countries. Mourad and Ousama (2021) employ both the linear and non-linear ARDL to analyse the aggregated and disaggregated impact of the Brent and West Texas Intermediate (WTI) oil prices on international food prices between January 1990 and October 2017. The findings from the study confirm the presence of asymmetries. While the dairy price index reacts to both positive and negative changes of oil price, the magnitude of the impact of the increase is found to be greater.

Mohamed (2020) investigates the impact of oil prices on world food prices using worldwide monthly data covering crude oil prices wheat, soybeans and rice prices for the period spanning from August, 2013 to June, 2017. The study utilizes Vector-Autoregressive (VAR) model and Granger-causality-test in the analysis. The results from the causality test reveal the existence of a causal link between oil prices and wheat prices while the impulse response results show a negative response of soybean prices and a persistent increase on wheat prices following a shock to the oil price.

Siok (2019) examines the impact of oil price pass-through on domestic price inflation for net oil exporting and net oil importing countries using annual data ranging from 1965 to 2014. The study employs the NARDL model to capture the asymmetric pass-through effects of oil price increases and decreases in consumer price and producer price, respectively. The result from the study reveals that oil price changes have an asymmetric effect on consumer price index (CPI) inflation directly and indirectly with a more influential impact of indirect effect and the result holds for both groups of countries. On the types of commodities, the effect on producer price is much larger especially in the oil-importing group due to the high dependence of these countries on oil.

Cao and Cheng (2019) explore the dynamic relationship between global crude oil price and food price indices using monthly data spanning from January 1990 to June 2017 within a nonlinear ARDL framework, threshold vector autoregressive model (TVAR), and the threshold vector error correction model (TVECM). The findings of the study confirm the existence of nonlinear causal relationship between global crude oil and food price indices. Besides, the study found that co-movement of crude oil and food prices have obvious structural break features, which is relevant to the underlying regime and also, the adjustment process of the food price indices towards equilibrium is highly persistent and grows faster than that of oil price when a threshold is reached.

Afee et al., (2017) employ the NARDL technique to examine the role of asymmetries in oil price-inflation nexus for selected net oil exporting and net oil importing countries using quarterly data from 2000 to 2014. The result from the study reveals a significant long-run positive relationship between oil price and inflation for both categories. The short-run results were mixed while the long-run results indicate that oil price exerts a greater impact on inflation of net oil importing countries than their oil exporting counterparts.

On the other hand, among the country-specific studies that investigated the oil-food prices nexus is Adeosun et al. (2023) which revisits the dynamics of oil and food prices in Nigeria using the time-varying Granger causality algorithms from January, 1990 to February, 2021. The algorithms were obtained from a lag-augmented VAR model. The results estimated by the study indicate bidirectional and feedback influences between Brent oil and six food commodity prices, namely: corn, rice, sugar, coffee, meat, and palm oil, which align with the AFC, the early 2000s recession, the 2000s energy crisis, the 2014 oil price crisis, the GFC and food crisis of 2008, the 2020 oil-price war, the COVID-19 pandemic, etc. Also, the result shows evidence of causality running from wheat and soybean prices to Brent oil prices depicting the importance of the predictive power of food prices in the trajectory of oil prices during periods of critical global events. Similarly, Olasunkanmi and Oladele (2018) analyse the impact of oil price shocks on agricultural commodity prices in Nigeria using monthly data on oil prices, maize, wheat and soybeans and exchange rate from 1997 to 2016. The study uses the linear ARDL and the non-linear ARDL with and without breaks. Asymmetric test using Wald Statistics reveals evidence of asymmetries in all the cases implying that positive and negative shocks of the same magnitude exert unequal impact on agricultural commodity prices. Also, the study found that increase in oil price tends to increase the prices of agricultural commodities and that exchange rate is positively associated with the prices of the agricultural commodities.

Hamid and Alireza (2018) employ the ARDL technique to study the relationship between oil price (or revenue) changes and inflation rate in Iran for the period spanning from 2003 to 2015. The study found that a decrease in oil price significantly impacts inflation rate while increase in oil price exerts no significant impact on the inflation rate. Abdalaziz et al. (2016) examine the relationship between the prices of oil and food price for Indonesia using the non-linear autoregressive distributed lag (NARDL) method for the period

spanning from 1995-2014. The study found a long-run relationship between the variables and that positive change in oil price measured in US Dollar exerts a significant impact on food prices.

Interestingly, there are also panel and country-specific studies that documented the impact of climate change on food prices. Lotanna (2024) for instance, studies the asymmetric effect of global climate anomalies on food prices using time-varying smooth transition autoregressive model. The study focuses on the asymmetric nature of the El Niño Southern Oscillation (ENSO), an exogenous climatic factor with respect to the nonlinear-dynamics of food prices in sub-Saharan Africa. The time range selected was between 1992M1–2020M12. The study found that ENSO (linearly or nonlinearly) affects roughly half of food prices considered, with most nonlinear models exhibiting strong asymmetric properties with shock-inflicted persistence. Moreover, in terms of the location of the burden of ENSO impact, the study found a geographical and food product divide. Specifically, ENSO appears to be more efficacious on maize prices in Southern, Eastern, and some parts of Central Africa. Conversely, local rice, cassava, millet, and animal products are least affected.

Erdogan et al. (2024) analyse the relationship between food prices and climate change in Nigeria using various non-linear and quantile-based methods and data from May, 2008 to December, 2020. The study found evidence of a time and frequency-based dependence between food prices and some explanatory variables, including climate change (i.e. temperature). At higher quantiles, temperature, oil prices, food exports, monetary expansion, global food prices, agricultural prices, and fertilizer prices stimulate food prices. Ichoku et al. (2023) examine the affiliation between climate change shocks and food price inflation in Nigeria using the NARDL approach. The dataset covers the period from January 2011 to December 2022. The finding from the study reveals that climate change shocks significantly contributed to

rising food prices within the study period. Nsabimana and Olivier (2017) investigate the impact of the likely change in rainfall on food crop prices in Rwanda using annual data spanning from 2000 to 2015. The study employed the NARDL technique in the analysis and its key findings suggest that food crop prices are vulnerable to rainfall shocks and that an asymmetric effect exists in both the short and long run. Moreover, the study found evidence of seasonal differences, with prices falling during harvest season and rising thereafter. Mawejje (2016) employs the Vector Error Correction (VEC) model to investigate the effect of shocks to food prices, energy and climate in Uganda using monthly data covering a 12 year period (2000–2011). The results from the study indicate that co-integration exists among the variables. The study further reveals that temperature shocks are more important than rainfall shocks in explaining food price variability.

From the foregoing literature, a general consensus is that there is a positive long-run impact of changes in oil price on food prices. However, there are mixed results for the case of the short-run impact of the changes in oil prices on food prices. Also, there is no consensus concerning the asymmetric nature of the impact of oil price on food prices. To the best of the knowledge of the authors of this study, little empirical attention has been given to analysing the effect of both oil price and climate change on food price, especially in a developing and oil-rich country like Nigeria whose working population are largely engaged in the agricultural sector. Hence, this study contributes to the existing literature by including climate change as a fixed variable in a dynamic non-linear autoregressive distributed lag (NARDL) to estimate the impact of both oil price and climate shock on food price in Nigeria.

3. Methodology

The study used monthly secondary data on crude oil price (OILP), oil pump price (OPP), consumer food price index (CPI), non-food price index (NFCPI), real gross domestic product (RGDP) and rainfall (AVRF). The study used rainfall as proxy for climate change because crop production which is the major component of agriculture in Nigeria mostly depends on rainfall. The study period covered 1995 to 2022 and the data for all the variables were obtained online from the website of the Central Bank of Nigeria (CBN), www.cbn.gov.ng. The sample period was chosen as to capture the recent oil shocks and food price hikes in the country.

To achieve the objective of the study, the NARDL model advanced by Shin et al. (2014) was employed. The NARDL technique is deemed more appropriate than other long-run models as it is efficient in capturing the impact of oil price on food prices while accounting for both dynamic and fixed factors of intervening variables. It also has the advantage of examining the likely asymmetric impact of the independent variables both in the short-run and long-run. Besides, it does not require much attention to the issue of stationarity except for those of higher order of integration such as $I(2)$ series. Moreover, it is also amenable to OLS and its covariance is OLS consistent.

Following Shin et al. (2014) in particular, we consider the NARDL where the likely asymmetric impacts of the five independent variables are examined. Hence, the decomposition of these independent variables into their respective partial sums of positive and negative changes around a threshold of zero allows the estimation of potential long-run and short-run asymmetries as well as dynamic relationship between oil shocks and food prices. The model to be estimated is specified as follows:

$$\begin{aligned}
\Delta \ln CPI_t = & \alpha + \sum_{i=1}^{p-1} \beta_0 \Delta \ln CPI_{t-1} + \sum_{i=0}^q \beta_1^+ \Delta \ln OILP_{t-1}^+ + \sum_{i=0}^q \beta_1^- \Delta \ln OILP_{t-1}^- \\
& + \sum_{i=0}^q \beta_2^+ \Delta \ln OPP_{t-1}^+ + \sum_{i=0}^q \beta_2^- \Delta \ln OPP_{t-1}^- + \sum_{i=0}^q \beta_3^+ \Delta \ln NFCPI_{t-1}^+ \\
& + \sum_{i=0}^q \beta_3^- \Delta \ln NFCPI_{t-1}^- + \sum_{i=0}^q \beta_4^+ \Delta \ln RGDP_{t-1}^+ + \sum_{i=0}^q \beta_4^- \Delta \ln RGDP_{t-1}^- \\
& + \sum_{i=0}^q \beta_5^+ \Delta \ln AVRF_{t-1}^+ + \sum_{i=0}^q \beta_5^- \Delta \ln AVRF_{t-1}^- + \rho \ln CPI_{t-1} + \varphi_1^+ \ln OILP_{t-1}^+ \\
& + \varphi_1^- \ln OILP_{t-1}^- + \varphi_2^+ \ln OPP_{t-1}^+ + \varphi_2^- \ln OPP_{t-1}^- + \varphi_3^+ \ln NFCPI_{t-1}^+ \\
& + \varphi_3^- \ln NFCPI_{t-1}^- + \varphi_4^+ \ln RGDP_{t-1}^+ + \varphi_4^- \ln RGDP_{t-1}^- + \varphi_5^+ \ln AVRF_{t-1}^+ \\
& + \varphi_5^- \ln AVRF_{t-1}^- + \mu_t
\end{aligned}$$

Where Δ represent first difference operator, φ_i^+ and φ_i^- are the positive and negative long-run multipliers. β_i for each positive and negative parameter represent the short-run dynamic coefficient, μ is white noise, α is an example of drift, while p and q are optimal lag lengths for the dependent and independent variables, respectively. The natural log of all values not in percentage form was taken to be able to express the results of the estimations in percentages.

To ascertain the existence of long-run relationships, an F-test for the joint significance of the coefficients of the lagged values of the variables was conducted under the null hypothesis of no co-integration, $H_0 : \rho = \varphi_1^+ = \varphi_1^- = 0$. The NARDL long-run levels by asymmetric coefficients were calculated by dividing the coefficient of $OILP_{t-1}^+$ and that of $\ln AVRF_{t-1}^+$ (i.e. $-\varphi_1^+$) by the coefficient of CPI_t (i.e. β) for the positive long-run multiplier as follows:

$$\frac{-\varphi_1^+}{\beta}$$

And also for the negative long-run multiplier, by dividing the negative of the coefficient of $OILP_{t-1}^-$ and that of $\ln AVRF_{t-1}^-$ (i.e. $-\varphi_1^-$) by the coefficient of CPI_t (i.e. β):

$$\frac{-\varphi_1^-}{\beta}$$

Short-run asymmetric effects of **OIPL** and **AVRF** on **CPI** are represented by $\sum_{i=1}^q \beta_i^+$ and $\sum_{i=1}^q \beta_i^-$

Using Wald test, if the null hypothesis $\frac{-\varphi_i^+}{\beta} = \frac{-\varphi_i^-}{\beta}$ for long-run symmetric and $\sum_{i=1}^q \beta_i^+ = \sum_{i=1}^q \beta_i^-$ for short-run symmetric relationship are rejected, we conclude the impact of **OIPL** and **AVRF** on **CPI** is asymmetric.

Using the Augmented Dickey-Fuller (ADF) unit root test, we obtained the stationarity test of each of dataset and they are all either stationary at levels or at first difference. This enables us to have reasonable ground for employing the NARDL model.

Data Used

This study draws on official data published by the Central Bank of Nigeria (CBN). Data on monthly rainfall intensity from January 1995 to December 2022 for all the geographical areas of Nigeria is used as a proxy for climate change in Nigeria. This is because climate is a long-time summary of weather and rainfall is one of the variables that indicate climate changes of the years. The data set is available at the official website of CBN. Also, monthly Consumer Price Indices (CPI) for food items

reported in the bulletin for the period 1995 - 2022 are taken as prices of food. Our choice of the variables is motivated by the need to make the contribution of this research to be an integral parts of extant literature of food price-oil price- climate change. The same source is used to obtain data on non-food price (i.e. non-Farm CPI) also known as non-food CPI as well as quarterly Gross Domestic Product (GDP) at the 2010 constant price from 2010 to 2022. Similarly, data on bonny light crude oil price and exports were also obtained from the CBN website.

E-views 9.0 was used to convert the quarterly data of GDP to monthly data to have the same order of frequency with other variables in the model. Also, a simple average of the monthly data for all the geographical

areas in Nigeria was taken as there are variations in the amount of rainfall in each of the towns for which rainfall data were collected.

4. Results

This section presents the results of the estimated NARDL specified in the preceding section. The section also contains the results of the diagnostics checks carried out on the data as well as the residuals of the estimated model which includes: stationarity, serial correlation, heteroscedasticity and normality tests.

The results of the unit root test presented in Table 1 indicate that each of the variables incorporated in the model of the study is either stationarity at levels or at first difference and this informs the use of the NARDL model.

Table 1: Result of Unit Root Test

VARIABLES	ADF @Level	P-value	ADF @FirstDiff.	P-value	ORDER OF INTEGRATION
LnCPI	1.721	0.999	-4.039	0.00	I(1)
lnOILP	-1.835	0.3631	-13.302	0.000	I(1)
lnOPP	-0.980	0.761	-20.320	0.000	I(1)
lnNFCPI	-0.939	0.775	-7.911	0.000	I(1)
lnRGDP	-4.321	0.001			I(0)
lnAVRNFL	-3.876	0.003			I(0)

Note: All variables were transformed using natural logarithm.

Source: Authors' estimation

A choice of the most optimal lag length is important for a robust result in the estimation of an NARDL model. Hence, this study employs the AR root test which clearly

indicates that lag 2 falls within the stability region of the AR root circle (see Table 2). Consequently, NARDL of lag two orders was estimated.

Table 2: Result of VAR Lag Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	179.874	NA	5.41e-13	-11.218	-10.940	-11.127
1	363.638	284.539	4.11e-17	-20.75086	-18.808*	-20.118
2	412.018	56.183*	2.45e-17*	-21.550*	-17.941	-20.373*

Source: Authors' estimation

The result of NARDL bounds cointegration test presented in Table 3 shows that the value of the F-statistics, 4.97 exceeds the upper bound critical values at all levels which implies that

the variables are co-integrated and satisfies the requirement of assessing the dynamic effect of oil price shocks and climate changes on food prices in Nigeria.

Table 3: NARDL bounds test for cointegration Model

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	4.969046	10%	1.76	2.77
K	10	5%	1.98	3.04
		2.5%	2.18	3.28
		1%	2.41	3.61

Source: Authors' estimation

4.1. Result of model estimation

The results of the estimated model presented in Table 4 below indicate that in the long-run, a 1% increase in crude oil price will result in a 0.09% increase in prices of food. This parameter (0.09%) is statistically significant as its p-value is 0.03 but the parameter for the decrease in oil price is insignificant with a p-value of 0.78. The table also reveals that changes in crude oil price do not impact food prices in the short-run as the short-run estimate of the variable was omitted in the estimation.

Moreover, the result shows that the long-run impact of climate change on food price is statistically insignificant. The positive and negative estimates of the average rainfall are

0.0002% and 0.005%, respectively, but their respective p-values are greater than 5% level of significance. However, in the short run, previous month 1% increase in the average rainfall decreases food prices by 0.0468% and the estimate is statistically significant at 5% with a p-value of 0.04. Although not statistically significant, the decrease in the previous month average rainfall increases food prices.

Therefore, the results of the asymmetric impact of the oil price and climatic shock on food prices in Nigeria indicate that oil price has asymmetric impact on food prices in the long-run while the asymmetric impact of climate shock on food price exists in the short-run.

Table 4: NARDL Results**Long run results**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCPI(-1)*	-0.129	0.036	-3.615	0.001
lnAVRNFL_POS(-1)	0.000	0.001	0.248	0.805
lnAVRNFL_NEG(-1)	0.001	0.001	0.864	0.389
lnNFCPI_POS(-1)	0.084	0.042	1.971	0.051
lnNFCPI_NEG(-1)	1.949	1.128	1.727	0.086
lnOILP_POS**	0.009	0.003	2.965	0.004
lnOILP_NEG**	0.001	0.002	0.278	0.782
lnOPP_POS**	-0.000	0.005	-0.094	0.925
lnOPP_NEG**	0.003	0.010	0.334	0.739
lnRGDP_POS**	0.006	0.005	1.157	0.250
lnRGDP_NEG**	-0.009	0.006	-1.599	0.112

Short run results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(lnCPI(-1))	-0.100	0.0701	-1.434	0.154
D(lnAVRNFL_POS)	-0.002	0.0025	-0.726	0.469
D(lnAVRNFL_POS(-1))	-0.005	0.0023	-1.989	0.049
D(lnAVRNFL_NEG)	-0.001	0.0013	-0.434	0.664
D(lnAVRNFL_NEG(-1))	0.003	0.001	2.290	0.024
D(lnNFCPI_POS)	0.639	0.081	7.920	0.000

D(lnNFCPI_NEG)	0.091	1.523	0.060	0.953
D(lnNFCPI_NEG(-1))	-3.194	1.321	-2.417	0.017
ECM(-1)*	-0.129	0.016	-8.03	0.0000
Model summary and diagnostic tests				
R-square=0.99, F statistics=62241.99(0.0000),				
D.W=1.87, LM- test=1.931(0.14),				
H-T=6.125 (0.0000),N-T= 62.389(0.0000), R-T				
2.030(0.1565)				

Source: Authors' estimation

Also, the other indicators like the prices of non-food indicate that previous month decrease in price impacts on prices of food in the short run and also in the long run with p-values less than 5% and 10% respectively.

Furthermore, table 4 shows that the ECM for the estimated model is -0.129 and is statistically significant which indicates evidence of adjustment towards long-run equilibrium (i.e. about 12% disequilibrium is

corrected on monthly basis) This implies that in case of distortion away from equilibrium, it takes about six months for equilibrium to be re-established. The result also indicates that the model is well fitted as the independent variables explain about 99% of the variations in food price. The F-statistic is equally significant implying that the explanatory variables captured in the model are jointly significant in influencing food prices.

Table 5: Wald Test Result of Long-run and Short-run Asymmetry

Long run asymmetry

Variable	Test Statistic	Value	Df	Probability
lnNFCPI	F-statistic	1.794479	(1, 140)	0.1826
lnAVRNFL	F-statistic	0.213588	(1, 140)	0.6447
lnOILPF	F-statistic	14.85973	(1, 140)	0.0002
lnOPPF	F-statistic	0.869265	(1, 140)	0.3528
lnRGDPF	F-statistic	6.385866	(1, 140)	0.0126

Short run asymmetry

LNNFCPI	F-statistic	6.088428	(1, 136)	0.0148
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Source: Authors' estimation

The Result from the Wald test in Table 5 above shows the short-run and long-run asymmetry. It can be observed from the table that the probability value for the F-statistic is less than 5% significance level for non-food price in the short-run which means that an asymmetric relationship exists whereas the relationship is symmetric in the long-run since it is insignificant in the long-run. The estimates of other variables like oil export and real gross domestic products are significant in the long-run with probability values of 0.0002 and 0.0126, respectively implying that their changes are asymmetric in the long-run but

symmetric in the short-run. However, variables like oil pump price and climate change though individually possess asymmetric relationships in the long run but not within acceptable level (5 or 10%) of statistical significance.

5. Conclusion and Recommendations

After analyzing the decomposed impact of oil price and climate change on food prices in a dynamic model that takes account of the previous periods' effects, the study found that decreases in oil prices and rainfall are found to have mixed effects. While negative change on oil price impacts positively on food prices in

the long-run, negative shocks to climate change increase price of food commodities in the short-run, showing that there are asymmetric effects of oil prices and climate change on food prices in Nigeria. Thus, the study concludes that between 1995 and 2002, increase in oil price and decrease in rainfall in Nigeria were associated with increase and decrease in food prices, respectively. This is consistent with the findings reported by Ichoku et al. (2023), Olasunkanmi and Oladele (2018) and Abdlaziz et al. (2016) but contradicts the findings suggested by Hamid and Alireza (2018). The finding is plausible and interesting considering that Nigeria is rich in oil while the majority of its citizens earn a living in the agricultural sector. Moreover, the policy implication of this finding is that given changes in the climate and international oil price influence food prices in Nigeria, there is the need to procure and maintain some buffer/storage of food in times of oil boom to smoothen consumption of food during oil glut.

The policy recommendation of the study therefore requires that, in the short run, policies geared towards mitigating the effects of climate variability on the agricultural sector, such as investment in small-scale irrigation technologies, and drought resistant crops be implemented to prevent climate-induced food inflation in the country. And for the long-run, policies geared towards improving agricultural productivity to match the growing demand for food, while emphasizing value addition should be targeted to help stabilize food prices. Also, to ensure self-sufficiency in the supply of food in Nigeria, significant portion of the proceeds from crude oil should be injected in agricultural activities and other essential facilities like post-harvest storage facilities, micro agriculture financing and boosting leasing activities in the agriculture sector, among others.

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