
# Does agricultural price volatility influenced by oil price affect food security? Evidence from Nigeria

**Eche Nwachukwu Austine[1], Bernard Ojonugwa Anthony[2] & Dambo Hussaini[3]**

[1] Department of Economics, Air Force Institute of Technology, Kaduna, Nigeria, Email: enaustine@afit.edu.ng
[2] Department of Economics, Kampala International University, Uganda, Email: bernard.ojonugwa@kiu.ac.ug
[3] Department of Economics, Air Force Institute of Technology, Kaduna, Nigeria, Email: useiy2009@gmail.com

## Abstract

The study examined how agricultural price volatility influenced by oil price affect food security in Nigeria. Quarterly time series data spanning from Q1 2023 to Q4 2024 was employed in the study and were sourced from the National Bureau of Statistics (NBS) and the Food and Agriculture Organization (FAO). The variables used include; crude oil prices, petroleum motor spirit (PMS) prices, and agricultural price volatility, proxied by the domestic food price volatility index, with local rice price as a primary indicator. Descriptive statistics and the Augmented Dickey–Fuller test for unit root were applied. Also, Johansen co-integration test was used to examine the long-run relationships. A Vector Autoregressive (VAR) model was used to analyze short-run dynamics amongst oil prices, agricultural prices, and food security. Where cointegration is detected, a Vector Error Correction Model (VECM) was applied, capturing both short- and long-term relationships. The VECM regression results revealed that agricultural price volatility, driven by oil price fluctuations, impacts food security in Nigeria. The significant ecm implies a long-run equilibrium connection, while short-run adjustments inform the inverse effects of oil price changes through PMS price and agricultural price volatility. The impulse response analysis shows the interrelation between crude oil prices (COP), petroleum motor spirit (PMS), agricultural prices (AGP), and food security (FOS). The results revealed that shocks to crude oil prices significantly influence PMS prices, which in turn affect agricultural prices and ultimately food security. Base on the finding, the study recommends that the Federal Government should implement an integrated policy that would guarantee PMS price relieve specifically for agricultural production regions, ensuring that farmers have access to cost effective fuel for logistics needs, farm irrigation, and tractor operation. This approach would diminish the transmission of PMS price volatility to food production and distribution, thereby stimulating food security.

**Keywords:** Fuel subsidy, Oil price volatility, Agricultural productivity, PMS, Energy diversification GEL Code: Q11, E31, Q18

## Introduction

In recent times, agricultural price volatility in Nigeria has become a major concern due to its impact on food security, particularly in a country where agriculture contributes about 23% of the GDP and employs over 36% of the labour force (World Bank, 2023). As a major oil-producing nation, Nigeria's economy is heavily dependent on crude oil exports, which expose the agricultural sector to global oil price fluctuations. These fluctuations influence agricultural input costs, transportation, and production, contributing to agricultural price volatility and, in turn, affecting food security.

The dependence of Nigeria on oil incomes creates a strong connection between global oil prices and domestic economic settings, including food production and distribution costs. Nigerian National Petroleum Corporation (2022) noted that return from crude oil sales accounts for over 60% of the country's revenue and foreign exchange earnings by approximately 90%. Therefore, Nigeria tends to experience increased fuel price, cost of transportation, agricultural inputs, and fertilizers, which are significant to farmers, when global oil price rises. In this regard, Food and Agriculture Organization (FAO) (2023) held that approximately 30% rise in farm inputs can be attributed to period of high oil prices on the international oil market has a significant influence on smallholder farmers capacity to produce at scale.

The influence of oil price volatility on agricultural prices is intricate. On the supply side, farmers have to deal with growing input prices, which incidentally might impact agricultural production and, ultimately, the cost of food availability in the local markets. FAO (2023) pointed out that the production of maize and rice in Nigeria fell by 17% in 2022 due to higher costs of fertilizer, brough about by higher oil prices globally. On the demand side also, high cost of food make it difficult for consumer to purchase enough food household consumption, thereby worsening food insecurity. Similarly, higher food prices, occasioned by high oil prices have a trickledown effect on other sectors of the economy that shares close link to agriculture. For instance, transportation cost is significantly influenced by oil prices, incidentally, higher transportation cost in turn can facilitate a reduction in access to market for both farmers and consumers.

A study by Olaniyi and Olayemi (2022) revealed that in Nigeria a 10% rise in oil prices results to 5% increase in food prices. This particularly affects rural populace disproportionately, with already high cost of transportation due to deficit infrastructure. This situation limits rural farmers from making more profit from their farm produce, which in turn lowers their capacity to scale up production, and ultimately reduced production. Consumers also must pay higher prices to purchase food items as they become more and more limited in supply. This situation creates a vicious cycle of poverty.

According to World Food Programme (2023) Nigeria's food security situation has declined. This is alluded to the significant percentage of about 25 million people estimated to face food insecurity in year 2023 as a result of a combination of factors that ranges from rising food costs, banditry, and economic shocks. The volatility of agricultural prices, which is influenced in part by changes in oil prices is a important consideration in determining the result of food security. Nonetheless, this volatility exacerbates the susceptibility of food system, making it severe for households to have access to consistent affordable and nutritious food, which is a vital factor of food security as expressed by the Food and Agriculture Organization (FAO, 2018). Given these, the interconnectedness between oil price volatility and agricultural price changes poses a significant amount of challenge to Nigeria's food security. Consequently, this study aims to examine the impact of agricultural price volatility influenced by the price of petroleum motor spirit on food security in Nigeria. The study spanned the period of first quarter of 2023 to the fourth quarter of 2024.

## Literature Review

### Theoretical Framework

The theoretical framework that establishes how agricultural price volatility stimulated by oil price fluctuations influences food security in Nigeria is anchored on the Price Transmission Theory. This theory illustrates how price changes in one market (such as oil) are transmitted to another connected market (such as agriculture). Changes in input costs (such as fuel or fertilisers) usually have a direct influence on agricultural production costs, which are then reflected in the food prices. This movement is known as price transmission. This theory is rooted in the study of market interconnectedness and became established in the work of Gardner (1975) and was further developed by Meyer and Cramon-Taubadel (2004). These scholars examined how price volatility in one sector or region is transmitted to other sectors or environments. In the agricultural market, the theory facilitates the understanding of the degree to which external shocks, such as oil price volatility, influence the cost of agricultural inputs, which are transferred to consumers in the form of higher agricultural product prices.

According to Meyer and Cramon-Taubadel (2004), price transmission is classified into two forms: First is, symmetric price transmission – this is when price fluctuations, whether they are growing or lowering are passed on in the same amount. The second classification is asymmetric price transmission – when price rises affect producers or consumers more frequently than price declines because they are more swiftly and completely disseminated.

In Nigeria's context, the high sensitivity of the agricultural sector to oil price shock is because production cost and transportation costs are significantly impacted by PMS prices. Akpan et al. (2021), noted that oil price shocks result in a direct change in agricultural input prices, which are swiftly transmitted to the agricultural market. For instance, the cost of transportation and fertilizer surged during the period of the oil price rise, leading to higher food prices. Conversely, price reduction is not immediately and fully passed on to the consumers when there is a reduction in oil prices, stressing the presence of asymmetric price transmission in Nigeria's agricultural market. The empirical debate on price transmission has focused on both the speed and magnitude of price changes as they move through agricultural markets. Studies such as those by Meyer and von Cramon-Taubadel (2004) and Akpan et al. (2021) emphasized that in developing countries, due to market inefficiencies, poor competition and inadequate infrastructures, asymmetric price transmission is more common. In Nigeria, the report of National Bureau of Statistics (NBS) (2023) showed that asymmetric price transmission is often responsible for the high transportation costs and monopolistic practices in the distribution of agricultural inputs, where price rise is more swiftly transmitted than price decrease, placing a greater burden on the end users.

**Empirical Review**

There are empirical studies that showed that in certain contexts, oil price shocks can result to positive influence on agricultural prices and then food security. Some of these studies generally focused on cases where farmers earn higher revenues or oil revenue enable government to increase investment in agriculture following oil price rise. A study by Adeyemi and Obafemi (2021) found that oil price booms positively influenced rural income through higher agricultural prices. The study illustrated that during the oil price boom, Nigeria government where able to fund rural development programs that enhanced market access for farmers. Arising from this, there was improvement in food availability in the urban areas, contributing to enhances food security. This positive influence was specifically noted between 2010 and 2014 that characterized periods of high global oil prices. Similarly, in an earlier study by Lawal et al. (2020), they found that in oil exporting countries like Nigeria, there's a positive relationship between price increases and agricultural output. The study came to conclusion that oil price rise facilitates enhanced government revenue, allowing for more investment in agricultural investment such as infrastructures and subsidies. These investments enhance the productivity of agriculture, resulting to improved food security. The experience has not been so different in Nigeria, where the government has utilized excess crude oil income to facilitate fertilizer subsidies, reducing input costs for farmers and stimulating food production in the short run.

Some studies, incidentally, draw attention to the detrimental effect of oil price shocks on food security and agricultural prices, generally, contending that rising oil price facilitates high agricultural production costs, transportation costs, and agricultural inputs. This in turn drive up food prices and exacerbates food insecurity, particularly for vulnerable populations. a study on the impact of oil price volatility on food security in Nigeria shows a strong negative relationship between oil price spikes and food availability by Olaniyi and Olayemi (2022), revealed that increasing oil prices upsurge the cost of inputs such as fertilizers and fuel for agricultural equipment, which drives up food prices. The findings of this study underlined that Nigeria's reliance on fuel importation exacerbates food insecurity, and currency rate volatility worsens the inflation of food prices. Another study by Yin and Zhou (2020), on the price transmission effect of oil price volatility on global food prices, with a particular interest in developing economies, found that higher agriculture production costs arise from oil price increases, and are transmitted to consumers. Consequently, the study's outcome demonstrated that during spike in oil prices, food costs in countries like Nigeria become extremely unstable, compromising food insecurity, especially for the urban populace that largely rely on food brought from the market. Similarly, an earlier study by Baffes (2015), on oil prices and global agricultural markets, found that in sub-Saharan Africa, a 10 per cent rise in oil prices leads to a 5 per cent rise in food prices. The study demonstrated that fluctuations in oil prices stimulate the upsurge in fertilizer and transportation costs, which in turn affects the price of food. The implication is that low-income households are disproportionately impacted by these growing costs, which exacerbates food insecurity, especially for essentials like rice and maize.

Despite compounding evidence of positive and negative empirical findings, various studies still exist that found mixed and neutral outcomes. In a general sense, these studies demonstrate that impact varies depending on several variables which include market conditions, government policy responses, and the particular kind of agricultural commodity. Nevertheless, a study analyzing oil price shock and its effects on Nigeria's agricultural sector by (Akpan et al. 2021) had a mixed outcome. The study demonstrated that while rising oil prices result in higher production costs, the impact differs depending on the agricultural subsectors. For instance, compared to more input-intensive crops like rice, crops like cassava that depend less on mechanization and chemical inputs are less impacted by changes in the price of oil. The impact of instabilities in oil prices on food security was also narrowed during some times by the government's action in the form of input subsidies for specific crops. A study by Akinleye and Sanusi (2020) showed that the oil price shock on food security in Nigeria was contingent upon government responses. Their study demonstrated that government policy response would determine how the oil price shock affected food security in Nigeria. Also, their study suggested that the Nigerian government was frequently able to stabilize food prices via targeted subsidies and intervention programs at times when the price of oil was down. However, their study also noted that these measures were not enough to stop food prices from increasing during prolonged periods of increasing oil prices, which exacerbated food insecurity. While some households witnessed improvement in their food security, others observed a decline in their food access as a result of this. This study contributes to the literature by considering the quarterly data on domestic food price volatility and oil price volatility. Implicitly, this study aims to examine the trend of oil prices (crude oil and petroleum motor spirit (PMS)) and domestic food price volatility on food security.

## Methodology

### Data

The study used quarterly time series data, which are secondary data types spanning between the first quarter of 2023 to the fourth quarter of 2024. Quarterly data on crude oil prices, approved petroleum motor spirit (PMS) prices and agricultural prices indicator (proxied by average domestic food price volatility index) were obtained from the National Bureau of Statistics (NBS). The food price of local rice per 1kg was used as an indicator for the average domestic food price volatility index in this study. The price of local rice per kilogram serves as an effective indicator for measuring agricultural price volatility in Nigeria due to its centrality in household diets, sensitivity to market fluctuations, and strong correlation with broader economic and policy changes. To achieve an inclusive assessment of food security, food price volatility index was measured using the price of local rice. Also, also, shocks in the price of fuel significantly influence the price of rice in the Nigerian market. To measure food security in this study, aggregate food price index was obtained from the (FAO). In economic sense, a rise in the aggregate food price index signifies rising food costs, which undermines household purchasing power and worsen access to nutritious food by low-income households. Essentially, higher food prices in Nigeria market are associated with greater food insecurity, especially in rural regions, according to studies by (Ogunleye & Ayeni, 2021). The Aggregate Food Price Index emerged as a strong measure of food security in Nigeria because it accounts for factors including household purchasing power, supply chain dynamics, inflationary pressures, and food affordability.

**VAR Model Specification**

This study adopted a modified version of the model that Baffes (2015) developed to investigate the connection between changes in the price of agricultural commodities and variations in the price of oil. This model provides a comprehensive path that captures price transmission mechanism, which facilitate the understanding of the effect of oil price shocks on food security. Furthermore, the model adoption is also rooted in its ability to explore how volatility in one variable (say, oil price) impact other variable (say, agricultural prices and food security) overtime. The moderated VAR model can be expressed as follows:

$$Y_t = A_1Y_{t-1} + A_2Y_{t-2} + \cdots + A_pY_{t-p} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{eq(1)}$$

Where:

$Y_t$ is a vector of endogenous variables at time t, including:

$COP_t$: Crude oil price

PMSt: Price of Petroleum Motor Spirit

$AGP_t$: Agricultural prices

$FOS_t$: Food security

$A_1$, $A_2$…, Ap represent slope of coefficients to be estimated, highlighting the impact of lagged values of the variables on their current values. $\varepsilon_t$ is a vector of error terms (shocks) that captures the unexplained variation in the variables. The endogenous variables in the model are: Oil Price (OP): Representing global oil price movements, which is the primary source of volatility in Nigeria. Agricultural Prices (AP): Representing the domestic prices of key agricultural products in Nigeria, which are hypothesized to be influenced by oil prices. Food Security (FS): Measured through indicators such as the food price index. Food security is determined by availability, access, utilization, and stability of food. The Food Price Index (FPI) is a strong measure of food security in Nigeria because the cost of food is a key determinant of affordability, especially for low-income households, which spend a significant portion of their income on food. High food prices reduce access to adequate nutrition, leading to increased food insecurity. Food price fluctuates due to government policies, PMS price volatility, which can disrupt the food supply. The VAR framework is particularly useful because: It treats all variables as endogenous, which aligns with the study's objective of analyzing the reciprocal effects between oil prices, agricultural prices, and food security. The model captures the lagged effects of oil price shocks, enabling the study to assess how past oil price changes influence current agricultural prices and food security.

The VAR model may be specified as:

$$\Delta yt = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma \Delta y_{t-1} + \varepsilon t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{eq}(2)$$

This equation represents the Vector Error Correction Model (VECM), which is a reparametrized form of the Vector Autoregressive (VAR) model for non-stationary time series that are cointegrated. This formulation is crucial because, when the variables in a VAR model are integrated of the same order (I(1)) and cointegrated, a VECM is used to capture both the short-term dynamics and the long-term equilibrium relationships between the variables. As such, $\Delta y_t$ is the **first difference** of the vector of variables at time t (e.g., changes in oil prices, agricultural prices, or food security indicator). $y_{t-1}$ is the **lagged level** of the variables, representing the long-term equilibrium relationship. Π captures the **long-run relationships** (cointegration) among the variables. $\Gamma_i$ captures the **short-term dynamics** between the variables through their lagged differences. $\varepsilon_t$ is the error term (shocks). The **cointegration term ($\Pi y_{t-1}$)** explains the deviation from the long-term equilibrium, while the **short-run dynamics ($\Gamma_i \Delta y_{t-i}$)** capture how quickly the system adjusts back to equilibrium.

$$\Pi = \sum_{i=1}^{p} A_i - I, \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{eq}(3)$$

This matrix (Π) contains information about the **cointegrating relationships** between the variables. If the variables are cointegrated, the rank of Π will be greater than zero, meaning that the variables share a long-term relationship.

$$\Gamma_i = -\sum_{j=i+1}^{p} A_j \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{eq}(4)$$

The Gamma ($\Gamma_i$) matrices account for the **short-run adjustments** between the variables based on their past differences. This part of the model shows how the variables interact in the short term to restore equilibrium after any shock or disturbance. The economic implications for modelling the VECM in this study are because oil prices, agricultural prices, and food security may have long-run relationships (e.g., oil price volatility could affect agricultural prices and, in turn, household food security over time). The VECM allows the modelling of these **long-term impacts and short-term fluctuations** simultaneously. Consequently, if the variables (oil prices, agricultural prices, and food security indicator) are non-stationary but cointegrated, the VECM form of the VAR model becomes appropriate.

## Result and Discussion

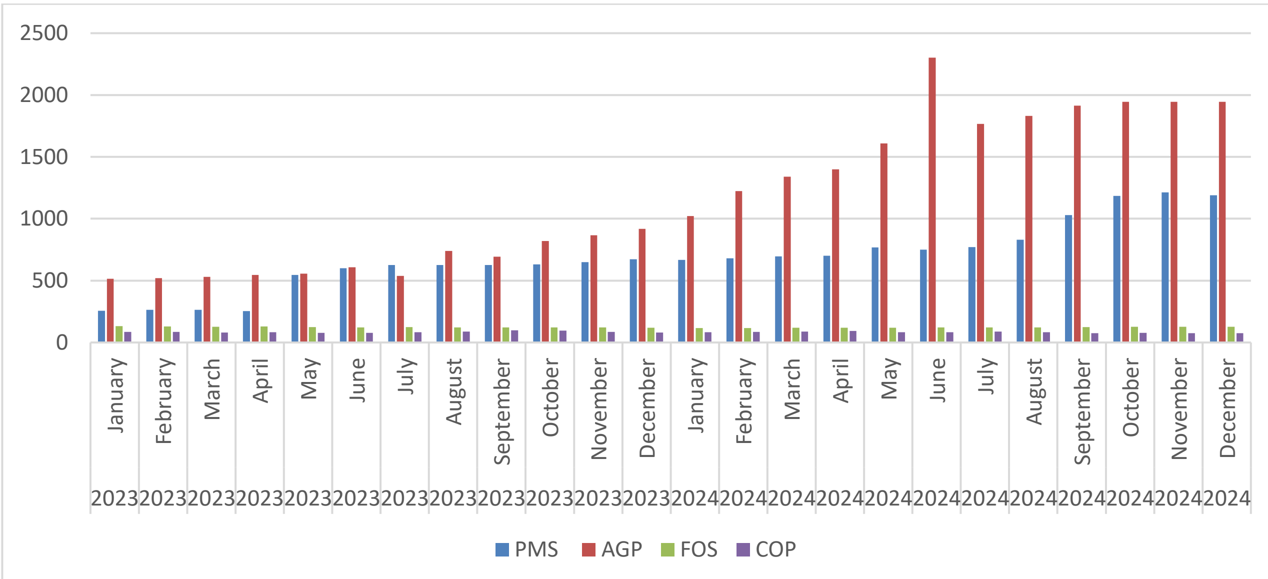



Figure 1: Trend and Properties of Oil Price, Agricultural Price, and Food Security
Source: Authors' computation, using eviews 10, 2025

The chart illustrates a clear linkage between oil price volatility, agricultural price volatility, and food security in Nigeria. The data suggests that fluctuations in global oil prices (COP) lead to changes in domestic fuel prices (PMS), which in turn affect agricultural prices (AGP) and, ultimately, food security (FOS). If the AGP line rises in response to increases in PMS, it indicates that oil price volatility contributes to agricultural price volatility. This is likely due to the increased fuel costs for farming machinery, transportation, and distribution. Similarly, if the FOS line declines as AGP rises, it suggests that agricultural price volatility, driven by oil price fluctuations, is adversely affecting food security. Higher food prices can lead to reduced food access and affordability, particularly for low-income households. This finding emphasized the need for policies aimed at stabilizing fuel prices, improving agricultural efficiency, and enhancing food distribution systems to mitigate the impact of oil price volatility on food security.

**Table 1: Descriptive Statistics**

| | AGP | COP | FOS | PMS |
|---|---|---|---|---|
| Mean | 1170.545 | 83.67833 | 123.2375 | 687.5625 |
| Median | 969.8600 | 83.26000 | 121.7500 | 670.0800 |
| Maximum | 2302.260 | 98.16000 | 131.4000 | 1214.170 |
| Minimum | 514.8300 | 74.72000 | 117.4000 | 254.0600 |

| | | | | |
|---|---|---|---|---|
| Std. Dev. | 595.6528 | 6.229930 | 4.065958 | 272.5259 |
| Skewness | 0.388646 | 0.532594 | 0.473498 | 0.268056 |
| Kurtosis | 1.650972 | 2.742810 | 2.133111 | 2.880311 |
| | | | | |
| Jarque-Bera | 2.424060 | 1.200771 | 1.648300 | 0.301741 |
| Probability | 0.297593 | 0.548600 | 0.438608 | 0.859959 |
| | | | | |
| Sum | 28093.07 | 2008.280 | 2957.700 | 16501.50 |
| Sum Sq. Dev. | 8160451. | 892.6765 | 380.2363 | 1708218. |
| Observations | 24 | 24 | 24 | 24 |

**Source: Authors computation, using eviews 10, 2025**

In Table 1, the mean AGP is 1170.545, with a median of 969.8600, indicating that agricultural prices are generally high but with significant variability (standard deviation of 595.6528). The wide range between the minimum (514.8300) and maximum (2302.260) values suggests substantial volatility in agricultural prices. The mean COP is 83.67833, with a median of 83.26000, showing relatively stable crude oil prices. However, the standard deviation of 6.229930 indicates some fluctuations, which can impact domestic fuel prices. The mean FOS is 123.2375, with a median of 121.7500, reflecting moderate levels of food security. The low standard deviation (4.065958) suggests that food security levels are relatively stable, though the range between minimum (117.4000) and maximum (131.4000) values indicates some variability. The mean PMS is 687.5625, with a median of 670.0800, indicating relatively high fuel prices. The high standard deviation (272.5259) and the range between minimum (254.0600) and maximum (1214.170) values highlight significant volatility in fuel prices.

All variables exhibit positive skewness, indicating that the distributions are skewed to the right. The kurtosis values are below 3 for AGP and FOS, suggesting lighter tails compared to a normal distribution, while COP and PMS have kurtosis values closer to 3, indicating a more normal distribution. The probabilities associated with the Jarque-Bera test are all above 0.05, indicating that the null hypothesis of normality cannot be rejected for any of the variables. This suggests that the data for AGP, COP, FOS, and PMS are normally distributed. Overall, the statistical summary reveals significant volatility in agricultural and fuel prices, which can be attributed to fluctuations in crude oil prices.

**Table 2: Stationarity Test**

| Variable | **t-Statistic** | **Critical Values (5%)** | **Prob*** | **Order of Integration** | **Remark** |
|---|---|---|---|---|---|
| FOS | -3.550438 | -3.004861 | 0.0161 | 1(1) | Stationary |
| COP | -3.773441 | -3.012363 | 0.0103 | 1(1) | Stationary |
| PMS | -3.225784 | -3.012363 | 0.0326 | 1(1) | Stationary |

| | | | | | |
|---|---|---|---|---|---|
| AGP | -6.397775 | -3.004861 | 0.0000 | 1(1) | Stationary |

**Source: Authors' computation, using eviews 10, 2025**

In Table 2, stationarity test results showed that the study's variables—FOS, COP, PMS, and AGP—are stationary in the first difference I(I). To achieve accurate econometric modelling and analysis, stability is critical, facilitating an extensive examination of the relationship among oil price shocks, agricultural price shocks, and food security in Nigeria. Therefore, since all variables are found to be stationary I(I), it indicates that, while the initial series may show trends or non-stationarity, the first difference is stable based on I(I), which states that all variables are stationary at the first difference. This is a prerequisite to conducting robust econometrics analysis and cointegration analysis that require stationary data. The stationary variables—FOS, COP, PMS, and AGP—guarantee that subsequent econometric models, such as the Vector Error Correction Model (VECM) will yield consistent and effective outcomes. To understand the outcome of dynamic relationship existing between oil prices, agricultural prices and food security, this is particularly important.

**Table 3: Johansen Cointegration Test**

| Unrestricted Cointegration Rank Test (Trace) | | | | |
|---|---|---|---|---|
| **Hypothesized** | | **Trace** | **0.05** | |
| **No. of CE(s)** | **Eigenvalue** | **Statistic** | **Critical Value** | **Prob.**** |
| None * | 0.767135 | 64.21477 | 47.85613 | 0.0007 |
| At most 1 * | 0.601417 | 33.61156 | 29.79707 | 0.0173 |
| At most 2 | 0.451382 | 14.29491 | 15.49471 | 0.0752 |
| At most 3 | 0.077212 | 1.687479 | 3.841466 | 0.1939 |
| Trace test indicates 2 cointegrating eqn(s) at the 0.05 level | | | | |

**Source: Authors computation, using eviews 10, 2025**

The Johansen cointegration test in Table 3, evaluates the long-run relationship between the study's variables in Nigeria— crude oil prices (COPt), petroleum motor spirit prices (PMSt), agricultural prices (AGPt), and food security (FOSt). The cointegration result for the trace test showed two cointegrating variables at 5 per cent level of significance. This implies that a stable long-run relationship runs among these variables. Therefore, since the trace statistic (64.21477) is greater than the critical value (47.85613) with a probability of 0.0007, the first hypothesis of (none) is rejected. This result demonstrates solid evidence of cointegration among the variables, revealing that shocks in the price of crude oil and fuel may have a lifelong impact on agricultural prices and consequently, food security.

Similarly, the trace test statistic (33.61156) for the second hypothesis (At most 1) is greater than the critical value (29.79707) with a probability of 0.0173 is rejected, buttressing the presence of a second long term equilibrium relationship amongst the variables that are cointegrated. However, the null hypotheses for at most 2 and 3 are rejected since the trace test statistic (14.29491 and 1.687479) is lesser than the critical values (15.49471 and 3.841466, respectively). This revealed that supplementary connections among the variable may not be statistically significant beyond the first two cointegrating relationships. The cointegration outcome highlights a consistent effect of agricultural price shocks on food security in Nigeria, as influenced by oil and fuel price volatility. Moreover, the existence of interdependency between fuel price, agricultural markets and food security informing the presence of two cointegrating variables implies that over time, despite the short-run disturbances, stabilization occurs.

**Table 4: Vector Error Correction Estimates**

| Error Correction: | D(COP) | D(PMS) | D(AGP) | D(FOS) |
|---|---|---|---|---|
| CointEq1 | -0.497948 | 5.784172 | -9.531230 | 0.186239 |
| | (0.20937) | (3.03711) | (9.57875) | (0.06683) |
| | [-2.37832] | [ 1.90450] | [-0.99504] | [ 2.78683] |
| | | | | |
| D(COP(-1)) | 0.406296 | 2.602350 | -9.495523 | -0.047712 |
| | (0.23599) | (3.42323) | (10.7965) | (0.07532) |
| | [ 1.72168] | [ 0.76020] | [-0.87950] | [-0.63342] |
| | | | | |
| D(COP(-2)) | 0.031263 | -9.551767 | 18.61898 | 0.017805 |
| | (0.25749) | (3.73516) | (11.7803) | (0.08219) |
| | [ 0.12142] | [-2.55726] | [ 1.58051] | [ 0.21664] |
| | | | | |
| D(PMS(-1)) | -0.005528 | 0.436919 | -0.202908 | 0.008092 |
| | (0.01743) | (0.25284) | (0.79744) | (0.00556) |
| | [-0.31714] | [ 1.72803] | [-0.25445] | [ 1.45457] |
| | | | | |
| D(PMS(-2)) | -0.005831 | -0.268227 | -0.793704 | 0.012909 |
| | (0.01712) | (0.24840) | (0.78343) | (0.00547) |
| | [-0.34053] | [-1.07981] | [-1.01311] | [ 2.36176] |
| | | | | |
| D(AGP(-1)) | 0.015994 | -0.185992 | -0.187875 | -0.002153 |
| | (0.00637) | (0.09242) | (0.29149) | (0.00203) |
| | [ 2.51034] | [-2.01240] | [-0.64453] | [-1.05866] |
| | | | | |
| D(AGP(-2)) | 0.008692 | -0.288261 | 0.043873 | -0.002557 |
| | (0.00656) | (0.09522) | (0.30032) | (0.00210) |
| | [ 1.32420] | [-3.02727] | [ 0.14609] | [-1.22042] |
| | | | | |
| D(FOS(-1)) | 0.143040 | 8.948567 | 45.98951 | -0.159709 |

| | | | | |
|---|---|---|---|---|
| | (0.71697) | (10.4003) | (32.8015) | (0.22885) |
| | [ 0.19951] | [ 0.86041] | [ 1.40205] | [-0.69788] |
| | | | | |
| **D(FOS(-2))** | 0.247151 | -17.05244 | -10.73861 | -0.034369 |
| | (0.71242) | (10.3343) | (32.5935) | (0.22740) |
| | [ 0.34692] | [-1.65008] | [-0.32947] | [-0.15114] |
| | | | | |
| **C** | -1.181666 | 63.60890 | 127.9931 | -0.711484 |
| | (1.68384) | (24.4257) | (77.0363) | (0.53746) |
| | [-0.70177] | [ 2.60418] | [ 1.66146] | [-1.32379] |
| R-squared | 0.574761 | 0.614368 | 0.452325 | 0.551823 |
| Adj. R-squared | 0.226838 | 0.298852 | 0.004227 | 0.185132 |
| Akaike AIC | 6.170882 | 11.52000 | 13.81728 | 3.886931 |
| Schwarz SC | 6.668273 | 12.01740 | 14.31468 | 4.384322 |

**Source: Authors computation, using eviews 10, 2025**

The Vector Error Correction Model (VECM) in Table 4, evaluated both the short-run and long-run relationship among the study variables — crude oil prices ($COP_t$), petroleum motor spirit prices ($PMS_t$), agricultural prices ($AGP_t$), and food security ($FOS_t$). The result showed that as expected the error correction term (CointEq1) for D(COP) is negative -0.4979 and statistically significant given that (t = -2.3783). This showed that a departure in equilibrium in the long term quickly correct itself at a speed of 49.8% per period signifying a solid adjustment mechanism. The results of Lawal et al. (2020) provides empirical support for this finding. Their study found that shocks in oil prices impacts government revenues, which in turn influence food security via agricultural investments. Similarly, Adeyemi and Obafemi (2021) finding equally provided additional empirical backing for this study's outcome. Their study outcome revealed how boom in oil price enabled government investment in rural development initiatives that facilitated market access and food availability. On the centrally, the significance of the adjusting coefficient for D(FOSt) (0.1862, t = 2.7868) showed that the response of food security to long-run distortions is slower than the response of the oil prices. Furthermore, agricultural prices and petroleum prices may not steadly adjust to deviations from equilibrium in the long-term since the coefficient for D(AGP) and D(PMS) are not statistically significant.

The coefficient of D(COP(-1)) and D(COP(-2)) revealed mixed impact, with no solid short-term implication. However, this study outcome is consistent with findings of Olaniyi and Olayemi (2022). They fund that over time food security is primarily affected by oil price shocks through upsurge in the price of agricultural input and transportation, rather than immediate short run influence. Likewise, Baffes (2015) also provided empirical support. Baffes's study outcome, showed oil price shocks exert slower effects on food prices via transmission trough fertilizer and transportation costs. Nevertheless, in the

PMS equation (-9.5517, t = -2.5572), the negative coefficient of D(COP(-2)) revealed that previous shocks in oil price significantly influence fuel prices, and indirectly impacting the price of transportation and agricultural products. This result supports the finding of Yin and Zhou (2020). Their study found that oil price upsurges are transmitted to food security through higher production and transportation costs. Similarly, Baffes (2015) finding equally revealed that in sub-Saharan African a 10 per cent upsurge in oil prices results to a 5 per cent rise in food prices dur to upsurge in the price of fuel and fertilizer.

D(PMS(-1)) and D(PMS(-2)) showed weak significance for food security, but D(PMS(-2)) is statistically significant (t = 2.3617), indicating that past fuel price changes have a delayed but meaningful effect on food security. This suggests that rising fuel prices may increase transportation costs for food over time. This aligns with Olaniyi and Olayemi (2022), who emphasized that Nigeria's dependency on oil imports and exchange rate volatility exacerbates food price inflation. D(AGP(-1)) is negative (-0.1859, t = -2.0124) and significant in the petroleum price equation, suggesting that past agricultural price changes may indirectly impact fuel costs, possibly due to government interventions such as subsidies or trade adjustments. The strong significance of D(AGP(-2)) in the PMS equation (-0.2882, t = -3.0272) showed the important role agricultural price shocks plays in shaping shocks in petroleum price, which might affect security via upsurge in the cost of agricultural production and transportation. Akpan et al. (2021) provided empirical support to this outcome. Akpan et al. study found that depending on government response via subsidies, the impact oil price shocks on agricultural production cost are mitigated sometimes. Similarly, Akinleye and Sanusi (2020) study also showed that in stabilizing food prices during oil price shocks, government intervention via policy response plays a role.

Finally, the R-squared values of 57.5% explained the variation in the dependent variable, arising from the independent variables. The model's result showed a possibility of omitted variables affecting food security due to the relatively low Adjusted R-squared values (0.0042). This aligns with Akinleye and Sanusi (2020) finding. They found that in Nigeria, oil price shocks alone do not fully explicate food security due to factors such as government policies and market conditions.

**Post Estimation Test**

**Table 5: Portmanteau Tests for Autocorrelations**

| Lags | Q-Stat | Prob.* | Adj Q-Stat | Prob.* | df |
|---|---|---|---|---|---|
| 1 | 8.942706 | --- | 9.389842 | --- | --- |
| 2 | 21.11032 | --- | 22.83825 | --- | --- |
| 3 | 39.39108 | 0.1748 | 44.16581 | 0.2268 | 28 |

**Source: Authors computation, using eviews 10, 2025**

In Table 5, the Portmanteau test for autocorrelations showed that at lag 3, the Q-statistic is 39.39108, with a p-value of 0.1748. Also, the adjusted Q-statistic is 44.16581, with a p-value of 0.2268. therefore, since the respective p-values are higher than 0.05 threshold, the null hypothesis of no serial correlation in the residual is uphold. This indicates the absence of significant autocorrelation in the residuals, suggesting a well-specified model that effectively captured the relationships among oil prices, agricultural prices, and food security in Nigeria economic setting. Furthermore, the zero-sum presence of autocorrelation indicates that the VECM is most appropriate in examining the impact of shocks in agricultural price —driven by oil price shocks—on food security. This strongly suggests that the models estimate regarding the interactions amongst the variables are not distorted by residual dependencies.

**Table 6: Serial Correlation LM Tests**

| Lag | LRE* stat | df | Prob. | Rao F-stat | df | Prob. |
|---|---|---|---|---|---|---|
| 1 | 12.54570 | 16 | 0.7056 | 0.707943 | (16, 12.9) | 0.7462 |
| 2 | 18.89799 | 16 | 0.2740 | 1.277760 | (16, 12.9) | 0.3326 |
| 3 | 23.52299 | 16 | 0.1005 | 1.823626 | (16, 12.9) | 0.1410 |

**Source: Authors computation, using eviews 10, 2025**

The result of the serial Correlation test presented in Table 7, showed that the null hypothesis cannot be rejected since all the p-values are greater than 0.05. This effectively revealed no significant serial correlation in the residuals. The zero-sum presence of serial correlation in the model indicates that the VECM is well specified and tenaciously captures the dynamics amongst the study's variables in Nigeria.

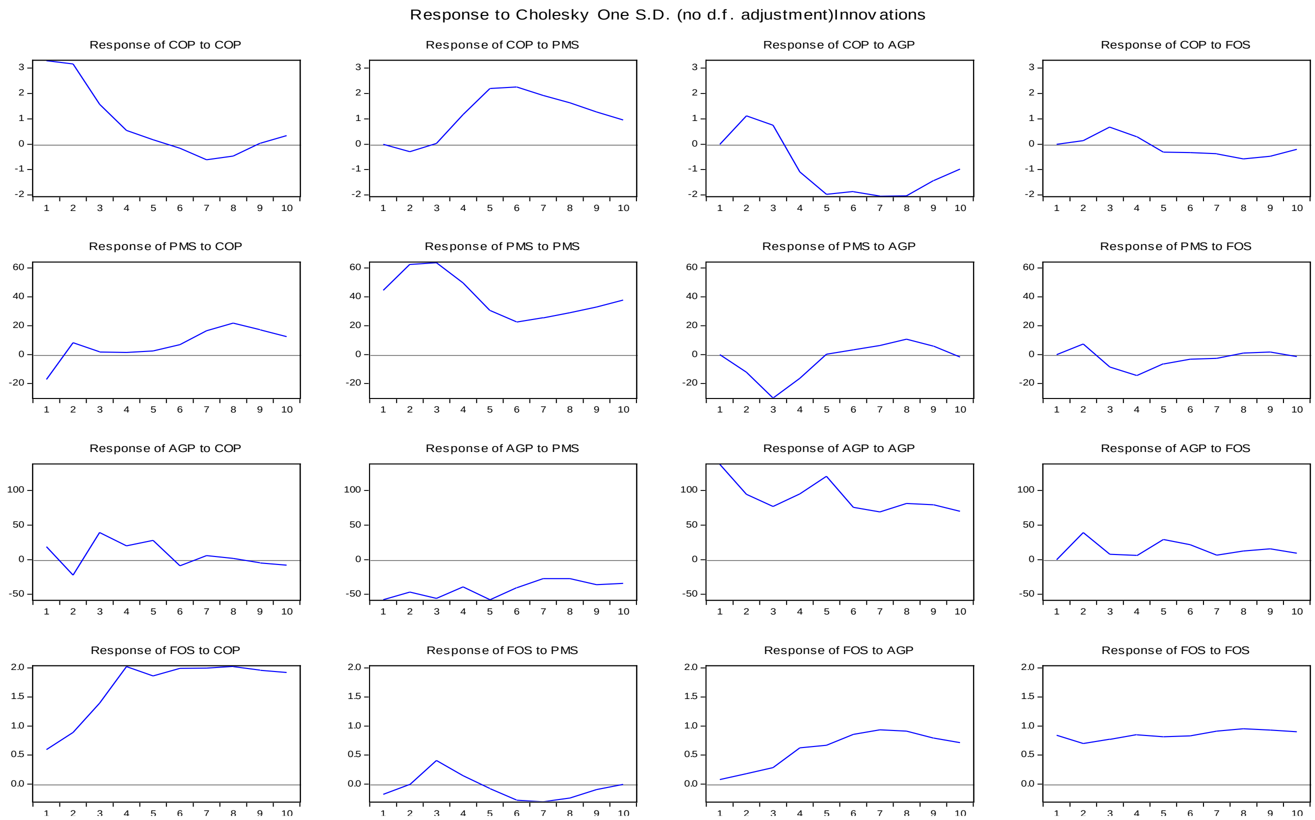
**Table 7: VEC Residual Normality Tests**

| Component | Jarque-Bera | df | Prob. |
|---|---|---|---|
| 1 | 1.837941 | 2 | 0.3989 |
| 2 | 5.000692 | 2 | 0.1821 |
| 3 | 9.397749 | 2 | 0.1391 |
| 4 | 4.045581 | 2 | 0.1323 |
| Joint | 20.28196 | 8 | 0.2093 |

**Source: Authors' computation, using eviews 10, 2025**

The null hypothesis ($H_0$) of the Normality Test states that the residuals are normally distributed. The Joint JB statistic for all components combined is 20.28196, with a p-value of 0.2093, which is less than 0.05, indicating that, overall, the residuals followed a normal distribution.

**Fig 2: Impulse Response**




**Source: Authors computation, using eviews 10, 2025**

The Impulse Response Function (IRF) graph showed how shocks to one variable affect other variables in the system over time. Each subplot represents the response of a variable (on the y-axis) to a one-standard deviation shock in another variable (on the x-axis) over a given time horizon. COP shocks have a significant initial impact on PMS (petroleum motor spirit) prices, likely due to the direct relationship between global oil prices and domestic fuel prices. COP shocks also influence agricultural prices (AGP) and food security (FOS), though the effects vary in magnitude and duration. The impulse response also reports that fuel price significantly influences production of agricultural produce and food prices since the PMS price shocks indicated a strong transmission effect on AGP. Furthermore, the response of FOS to PMS shocks signifies that upsurge in fuel prices may impact food security, through diminish food affordability.

Also, the AGP shocks creates instability in food security (FOS) in Nigeria, reflecting the change in agricultural prices to sensitivity of food availability and accessibility. However, the feedback loop from AGP to PMS or COP is negligible, signifying that agricultural price shocks do not significantly impact fuel price. Likewise, FOS shocks do not strongly impact other variables, indicating that rather than as a driver of economic volatility, food security is a result of an outcome variable facilitated by external shocks. The consequence of this finding lies in the fact that the strong response of PMS to COP shocks explicates Nigeria's dependence on oil prices for fuel costs. In the same trajectory, the connection between AGP and FOS indicates that the upsurge in agricultural prices dimmish food security, accentuating the need for an inclusive policy to stabilize food prices.

## Conclusion and Recommendation

The study examined how agricultural price volatility influenced by oil price affect food security in Nigeria. Quarterly time series data spanning from Q1 2023 to Q4 2024 was employed in the study and were sourced from the National Bureau of Statistics (NBS) and the Food and Agriculture Organization (FAO). The study utilized a vector Error Correction Model (VECM in the analysis of the data. The cointegration result for the trace test showed two cointegrating variables at 5 per cent level of significance. The VECM result showed that ecm-1 is negative and statistically significant, implying the existence of a long-run equilibrium relationship, while the adjustment in short-run signifies the inverse effects of oil price changes through fuel price and agricultural price shocks. The impulse response also reports that fuel price significantly influences production of agricultural produce and food prices since the PMS price shocks indicated a strong transmission effect on AGP. Furthermore, the response of FOS to PMS shocks signifies that upsurge in fuel prices may impact food security, through diminish food affordability. This finding stressed the susceptibility of food security to shocks in oil prices, demonstrating that upsurge in fuel prices contributes to rising agricultural production costs, resulting to upsurge in food costs and diminished food affordability.

In line with this finding, the following recommendations were advanced:

1) An inclusive targeted policy intervention for farmers that will cushion the effect of transmission of oil price to agricultural production is required to diminish the transmission of oil price volatility on food security.
2) Investment in alternative modern agricultural farming technologies, and irrigation systems, that can diminish over reliance on fuel-intensive agricultural practices is required to mitigate the influence of fuel price volatility on food security.
3) The federal government should intensify its effort in promoting the adoption of alternative energy sources such as renewable energy source in agricultural production and transportation can significantly diminish dependency on fossil fuel, and thereby insulating food security from oil price shocks.
4) The federal government should build food reserves that can help in stabilizing food prices in times of agricultural price shocks, ensuring steady food availability and affordability.

## References

1) Akpan, U. F., Oboh, V. U., & Ebong, F. S. (2021). Oil price shocks and agricultural productivity in Nigeria. *Journal of Energy and Economic Development*, 15(2), 46-61.

2) Food and Agriculture Organization (FAO). (2018). *Food Security Indicators*. Rome: FAO.
3) Food and Agriculture Organization (FAO). (2023). *Impact of rising fertilizer prices on global food production.* Retrieved from FAO website.
4) Nigerian Bureau of Statistics (NBS). (2021). *Agricultural price volatility in Nigeria*: A 5-year trend. NBS Report.
5) Nigerian National Petroleum Corporation (NNPC). (2022). *Oil and Gas Industry Annual Report.*
6) Olaniyi, O., & Olayemi, A. (2022). The impact of oil price on food prices in Nigeria. *Journal of Economic Policy Studies,* 9(1), 33-48.
7) World Bank. (2023). *Nigeria Economic Update*. Retrieved from World Bank website.
8) World Food Programme (WFP). (2023). *Nigeria food security outlook*: 2023-2024.
9) Barrett, C. B. (2022). The Resilience of Food Security in the Face of Economic and Environmental Shocks. *Journal of Global Food Policy,* 18(3), 219-235.
10) Food and Agriculture Organization (FAO). (2018). *Food Security Indicators*. Rome: FAO.
11) Ingram, J. (2023). Sustainable Food Systems and Food Security: A Pathway to Health and Nutrition. *Agricultural Systems*, 214, 103-117.
12) Maxwell, S., & Smith, M. (2021). Household Food Security: Concepts, Indicators, and Measurements. *Food Policy Journal*, 34(5), 78-88.
13) World Bank. (2020). World Development Report 2020: *Trading for Development in the Age of Global Value Chains*. Washington, DC: World Bank.
14) Akpan, U. F., Oboh, V. U., & Ebong, F. S. (2021). Oil price shocks and agricultural productivity in Nigeria. *Journal of Energy and Economic Development*, 15(2), 46-61.
15) Gardner, B. L. (1975). The farm-retail price spread in a competitive food industry. *American Journal of Agricultural Economics,* 57(3), 399-409.
16) Meyer, J., & von Cramon-Taubadel, S. (2004). Asymmetric price transmission: A survey. *Journal of Agricultural Economics*, 55(3), 581-611.
17) Nigerian Bureau of Statistics (NBS). (2021). *Agricultural price volatility in Nigeria*: A 5-year trend. NBS Report.
18) Adeyemi, S., & Obafemi, T. (2021). Oil price booms and agricultural development in Nigeria. *Journal of Agricultural Economics*, 67(3), 119-135.
19) Akpan, U. F., Oboh, V. U., & Ebong, F. S. (2021). Oil price shocks and agricultural productivity in Nigeria. *Journal of Energy and Economic Development*, 15(2), 46-61.
20) Akinleye, S. O., & Sanusi, R. A. (2020). Government interventions and food security in oil-dependent economies: Nigeria as a case study. *Journal of Development Policy and Practice,* 25(4), 133-150.
21) Baffes, J. (2015). The long-term impacts of oil price changes on agricultural commodity prices. *Energy Economics*, 51, 170-180.

22) Lawal, A. S., Akanbi, O. M., & Abdullahi, K. A. (2020). Government oil revenues and their impacts on agriculture in Nigeria. *Nigerian Journal of Economic and Social Studies*, 62(2), 98-110.

23) Meyer, J., & von Cramon-Taubadel, S. (2004). Asymmetric price transmission: A survey. *Journal of Agricultural Economics*, 55(3), 581-611.

24) Olaniyi, O., & Olayemi, A. (2022). The impact of oil price on food prices in Nigeria. *Journal of Economic Policy Studies,* 9(1), 33-48.

25) Yin, Y., & Zhou, L. (2020). Oil price volatility and food prices: The role of global supply chains. *International Journal of Agricultural Economics*, 7(4), 258-271.