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Energy Price Shocks and Inflationary Echoes in Nigeria: A Structural VAR Approach

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Abstract

This study assessed whether energy price shocks (in the form of crude oil price and automotive gas oil price) have inflationary or disinflationary effect, with particularly interest in headline inflation, for the monthly period from June 2015 to November 2025. In our methodological framework, we developed a structural vector autoregressive (SVAR) model of 6 variables with the ordering: Brent crude oil price (OLP), external reserves (ERS), exchange rate (ECH), automotive gas oil (AGO) price, food inflation (FCPI) and headline inflation (HCPI). The impulse response function (IRF) was applied to get an understanding of how HCPI response to OLP shock, ERS shock, ECH shock, AGO price shock, FCPI shock and own (HCPI) shock. We obtain empirical evidence of an unexpected rise in crude oil price inducing inflationary pressures. In terms of ECH, AGO price and FCPI shocks, the IRF suggests that exchange rate depreciation, AGO price hikes and increase in food prices lead to substantial inflation upswings. An application of FEVD analysis reveal that FCPI shock explains approximately 42 – 74% of headline inflation dynamics in Nigeria. Furthermore, OLP and AGO price shocks to headline price hikes, respectively. To ease and reverse the inflationary effects of FCPI, OLP and AGO price shocks, the study recommends aggressive and strategic collaborative combat operations in the North-East/Central region of Nigeria to improve security conditions and transition to renewable energy sources, facilitated by an advanced and developed financial sector.

Keywords: Energy Price Shocks, Oil Price, Automotive Gas Oil Price, Food Inflation, Headline Inflation

Introduction

Across economies, inflation remains a source of concern for policymakers. The impact of higher prices remains deleterious and reverberates across the Nigerian economy, making price movements a closely watched macroeconomic variable for policy authorities. Higher price levels can significantly inhibit economic activity and growth, as the macroeconomic uncertainty they create delays investment, with investors deferring projects due to shrinking profit margins. Higher inflation is a headwind for economic growth, as it squeezes consumption and reduces exports. The inhibitory effect of price increases also weighs heavily on the financial sector, as it is likely to subdue financial development and weaken the intermediary and resource-allocation roles of banks Yang et al. (2023)

The supply-leading hypothesis argues that financial development is essential for economic growth, as it efficiently allocates resources, reduces transaction costs and uncertainty, promotes trade, and increases access to financial services and institutions Yang et al. (2023). The potential for a well-developed financial system to deliver these benefits and leapfrog the economy to El Dorado can be hampered by upswings in inflation (Rousseau & Yilmazkuday, 2009; Boyd et al., 2001; Farahani et al., 2021). In an inflationary environment, financial intermediation becomes difficult as lenders shift from long-term lending to short-term objectives and reallocate capital to government securities. By raising uncertainty about interest rates, exchange rates, and prices, and by increasing currency

speculation, inflation increases the cost of hedging financial risks (Boyd et al., 2001; Farahani et al., 2021). The multifaceted upside risks of inflation make the achievement of price stability a critical macroeconomic objective.
Since 2015, headline inflation in Nigeria has risen sharply, reaching record levels, climbing from 9.17% in June 2015 to 18.72% in January 2017. Inflation eased to 11.02% in August 2019, rose to 11.24% the following month, and continued its upward trajectory to 18.17% in March 2021 (NBS, 2021). In a high-inflation environment, Nigeria eased into disinflationary territory as price pressures faded. Headline inflation weakened from 18.17% in March 2021 to 15.4% in November 2021 (NBS, 2022). Although price-level changes slowed between March 2021 and November 2021, upside risks to a price surge remained. Nigeria continued to face price upswings, with inflation soaring from 15.7% in February 2022 to a record high of 34.8% in December 2024 (NBS, 2025).

As with most diseases, the key to reining in inflation lies in carefully identifying the source(s) of inflationary pressures. The literature offers an avalanche of arguments that underpin the drivers of inflation – from the unconscionable growth in money supply (the monetarist view) to fiscal activities acting as the cause of inflation (the fiscal theory of the price level). The Dutch disease hypothesis, emphasised by the Corden and Neary (1982) model, posits that crude oil shocks can act as inflation drivers. According to López et al., (2025), crude oil and energy price shocks transmit to headline inflation through two channels. These processes occur through the spending effect and the resource movement effect. As noted by Corden and Neary (1982), oil price upswings generate extra revenues which finance public infrastructure and government safety nets, thus adding to aggregate demand. Additional aggregate demand is likely to cause inflation upswings, particularly in the non-tradables sector. The conjecture is that a boom in the oil sector due to rising oil prices leads to an exodus of labour from the service and manufacturing sectors to the resource sector, enticed by higher wages. Eventually, output in the manufacturing sector drops, thus lifting inflation (Mein, 2022). An alternative explanation for the link between oil prices and inflation was proposed by López et al., (2025. He further argued that crude oil or energy price shocks transmit to inflation through two channels: the direct channel and the indirect channel. The direct channel occurs through its impact on the production costs of firms, with variation in the cost structure induced by upswings or downswings in oil prices. Oil or energy price shocks influence domestic inflation indirectly through exchange rate variation, triggering inflation particularly in countries that are net importers of petroleum products (Sa'ad et al., 2023).

A cursory analysis of energy price movements reveals an upward trend in the price of automotive gas oil (AGO) in Nigeria. AGO price rose from ₦151.93 in June 2015 to ₦249.38 in February 2017, then declined to ₦184.8 per litre in September 2017. From 2022 to 2025, the AGO price broke past ₦500 per litre, rising from ₦539.31 per litre in March 2022 to a record high of ₦1,813.81 per litre in June 2025 (NBS, 2025). Although the price of AGO fell to ₦1,277.81 in September 2025, it resumed its upward trend, rising to ₦1,409.61 in November 2025 (NBS, 2025). Meanwhile, oil prices have also fluctuated, driven by exogenous factors and geopolitical events. Identifying and untangling the mechanisms by which energy price shocks trigger domestic inflationary pressures is critical for policymakers to devise a policy framework.

Empirical literature and past experience show that oil price shocks can push up prices through direct and indirect channels (Cao et al., 2025; Zhao et al., 2025; Ge & Sun, 2024; Aharon et al., 2023; Yang et al., 2023; Anyars & Adabor, 2023). The fact that prices soared following the energy crisis of the 1970s and the Russia-Ukraine war is a testament to the strong momentum oil price shocks have on inflation. The substantial decline in oil prices following the COVID-19 pandemic and the subsequent weakening of inflation provide evidence for these realities and clearly demonstrate the potential pass-through of oil price shocks to inflation. One channel through which oil shocks transmit to inflation is higher domestic energy prices. Past empirical studies have paid less attention to this and to how higher domestic energy prices feed through to food inflation and cascade into headline inflationary pressures. This study, recognising this gap, examines the inflationary impact of Brent crude oil shocks and automotive gas oil (diesel) shocks in Nigeria, applying the structural vector autoregressive (SVAR) model to monthly data from June 2015 to November 2025. The other sections of this paper proceed as outlined. Section 2 discusses the theoretical underpinnings of the study and prior research. Section 3 contains the methodological approach adopted. Section 4 presents the empirical results. Section 5 is reserved for the conclusion and policy recommendations.

Theoretical background

From a theoretical perspective, considerable literature has identified various factors as determinants of inflation. The earliest theoretical framework to identify the source(s) of general price variations is the quantity theory of money (QTM), attributed to Fisher and later restated by Friedman (1970). In explaining the dynamics of inflation, monetarists posit that upticks in domestic prices result from excessive growth in the money supply. From the monetarist perspective, inflation is driven by excess demand for money, which influences central banks to expand the money supply (Ge & Sun, 2024; Anyars & Adabor, 2023). This suggests a proportional relationship, in which an increase in the money supply raises inflation. Monetarists submit that inflation is a monetary event and that lowering inflation is attainable by mopping up excess liquidity; a policy direction known as contractionary monetary policy. Neo-Keynesian economists identified cost shocks, demand factors and the output gap as inflation triggers (Gordon, 1988; Ge & Sun, 2024). The famous fiscal theory of the price level (FTPL) offers an alternative lens through which inflation dynamics can be viewed. The FTPL argues that fiscal activities cause inflation and that inflation is a fiscal phenomenon, with the price level adjusting to bring government debt into equality with the present value of its future surpluses plus revenue from seigniorage. In this framework, fiscal policy assumes an active role in driving inflation, with monetary policy accommodating price upswings to ensure government solvency (a phenomenon termed fiscal dominance) (Surjaningsih et al., 2012).

Beyond these theoretical explanations, the recognition of oil prices as a source of inflation upswings is supported by the Dutch disease hypothesis, as articulated in the Corden and Neary (1982) model. The model explains how a boom in the natural resource sector triggers two effects that elevate prices: the spending effect and the resource-movement effect. Corden and Neary (1982) argue that a boom in the resource sector generates additional resource receipts and wealth, thereby increasing public and private expenditure. The increased demand drives up prices in the non-tradables sector – the spending effect. Subsequent to the boom, a migration of labour from the manufacturing and services sectors to the resource sector may occur due to higher wage offers in the latter sector. This will eventually lift inflation, as the manufacturing sector's production capacity and output are squeezed by the loss of labour – the resource-movement effect. These effects combine to fuel headline inflation (Mien, 2022).

Related Studies

There is a large body of empirical research examining how energy price shocks (crude oil price fluctuations and shocks, gasoline price shocks, among others) affect inflation. This literature relies on a plethora of estimation approaches to understand how oil prices impact inflation. Essentially, Kilian and Zhou (2025) use the Bayesian vector autoregressive (VAR) model to examine the inflationary impact of gasoline price shocks in the United States of America from April 1990 to June 2023. Although initially focused on the United States, the study is expanded to include the Euro area and the United Kingdom. They document that the response of headline inflation to gasoline price shocks is immediate but fades thereafter. Additionally, the core inflation response to gasoline price shocks is positive. According to their results, gasoline price shocks explain 69% and 9% of the variance in headline inflation and core inflation, respectively. Cao et al. (2025) assess the sensitivity of inflation to oil price shocks in G20 countries from 1990 to 2019. They demonstrate, using a dynamic simulated ARDL model, that oil price hikes transmit to higher inflation in the long run. Furthermore, they find that higher gold prices contribute to inflation in the G20 countries. For Lee and Kim (2025), the Markov-switching structural VAR model results show that the responsiveness of CPI to oil price shocks varies across low- and high-inflation regimes, noting that in a high-inflation environment, rising oil prices contribute to additional price spikes through expected inflation.

López et al. (2025) apply the Bayesian VAR framework to understand inflation dynamics in the Euro area and the role of gas price shocks. Their results indicate that higher gas prices lift headline inflation by 10% and 0.6 percentage points after a year. Zhao et al, (2025) employ the impulse response network as a methodological framework to study how oil price shocks transmit to inflation in five developed countries: the US, the UK, Germany, China, and Russia. They report a spike in CPI following oil price shocks, noting that national sub-price changes are pronounced within 1-2 months.

Ge and Sun (2024) estimate the asymmetric impact of oil price shocks on US inflation between January 1990 and June 2023. Using the quantile-on-quantile regression approach, they find that oil supply shocks reduce inflation, while demand shocks affect inflation asymmetrically. They note that a positive demand shock is inflationary, whereas negative demand shocks relieve inflationary pressures. Adolfsen et al. (2024) shed new light on the gas price changes and inflation nexus in the Euro area. Using the Bayesian VAR model, they demonstrate that gas price volatility lifts core inflation in the Euro area, and the effect is most pronounced in a tight labour market environment.

Aharon et al. (2023) tested the relationship between oil price shocks and inflation in the ASEAN5+3 countries using monthly data from 1987-2022. Using the structural vector autoregressive (SVAR) model and time-varying Granger causality, they produced evidence that both oil-specific demand and aggregate demand shocks spark inflation pressures in Japan, Malaysia, the Philippines, Thailand, and Singapore, and that inflation responds asymmetrically to oil price shocks. Yang et al. (2023) examined the inflationary impact of geopolitical risks and oil price shocks in the US, China, and 27 European countries, with data from January 2000 to July 2022. Results from the time-varying parameter structural vector autoregression with stochastic volatility model showed that inflation is driven by geopolitical risks in the long run in all three economies. They observed that oil demand shocks have a positive effect on inflation in the US and China, while a negative effect was observed in Europe.

Anyars and Adabor (2023) estimate the impact of oil price changes on inflation in Ghana between 2000Q1 and 2021Q1. The results from the nonlinear ARDL model reveal that an increase in oil prices triggers increases in food, energy, core, transport, and headline inflation. They report that a decrease in oil prices does not reduce inflation, but fuels core and headline inflation. Ha et al, (2023) applied the factor-augmented vector autoregression (FAVAR) model to country-specific data for 55 countries from 1970 to 2022, focusing on the drivers of global inflation. The findings revealed that oil price shocks drive inflation variance in 70% of the countries studied, with inflation increasing by 0.3 percentage points within a quarter and 1.2 percentage points after two years. Belloumi et al. (2023) analyse how oil prices influence inflation and economic output in Saudi Arabia. The linear and nonlinear ARDL models were applied to data from 1980 to 2021, and the results reveal that oil price hikes induce inflation, whereas decreases in oil prices lower inflation in both the short and long run. Tausif et al. (2023) used the VAR model with sign restrictions to identify how oil price shocks affect economic activity and inflation in Saudi Arabia. Their results highlight that higher oil prices are beneficial for economic growth but pose inflationary risks by fueling price spikes.

Neri et al. (2023) further support the sensitivity of inflation to energy price shocks, as results from VAR and dynamic factor models show that energy price shocks account for about 60% of the variance of inflation in the Euro area and 20 to 50% of the variance of core inflation. Diab and Karaki (2023) report a similar effect of gasoline price shocks. Their findings, based on a structural VAR, indicate that a positive gasoline price shock lifts food inflation. Disaggregated results for food items reveal that higher gasoline prices trigger upward price increases in animal feed and fertilisers. In Nigeria, Sa'ad et al (2023), who employed the nonlinear ARDL model, report that higher oil prices lower inflation. Surprisingly, they demonstrate that falling oil prices upswing headline inflation. Mien (2022), who employed dynamic OLS and autoregressive distributed lag (ARDL) models on data for five oil-producing countries in the Central African Economic and Monetary Community (CEMAC) from 1995-2019, established that the Brent oil price significantly stokes inflation. Li and Guo (2022) used the multiple-threshold nonlinear ARDL model to explore the asymmetric oil price pass-through to inflation in the BRICS countries. Their results suggest an asymmetric pass-through effect in China, with inflation increasing when oil prices fall. In Russia, they found that supply shocks restrain inflation.

Methodology

Data: This study untangles how headline inflation responds to shocks emanating from energy prices, namely, crude oil price (OLP) and automotive gas oil (AGO) price. The choice of AGO price over premium motor spirit (PMS) price stems from the AGO market been fully deregulated, making the transmission of oil price swings smooth. This study, according to availability of data, employed monthly series for Nigeria from June 2015 to November 2025. These monthly series comprise of data for Brent crude oil price (OLP), external reserves (ERS), official nominal exchange rate (ECH), automotive gas oil (AGO) price, food inflation (FCPI) and headline inflation (HCPI). The Brent crude oil price in US dollar per barrel was obtained from the World Bank Commodity Price Data (The Pink Sheet). The data for external reserves (in US dollar), official exchange rate (ECH), food inflation (FCPI) and headline inflation (HCPI) were extracted from the Central Bank of Nigeria (CBN) official website. The automotive gas oil price in naira was obtained from the National Bureau of Statistics (NBS) AGO price watch statistics. All the variables, except food inflation and headline inflation, were changed into natural logarithms to reduce variability.

SVAR model formulation

To analyse the response of headline inflation to energy price shocks, this study builds a six-variable structural VAR (SVAR) model consisting of Brent crude oil price (OLP), external reserves (ERS), exchange rate (ECH), automotive gas oil price (AGO), food inflation (FCPI) and headline inflation (HCPI). The SVAR provides a better framework for analysing the impact of crude oil and energy price shocks, as it allows us to disentangle variations in headline inflation and analyse how each distinct shock affects inflation. The model trumps the unrestricted VAR model by using contemporaneous variables as regressors and allowing restrictions to be placed on the contemporaneous relationships based on economic theory (Aharon et al., 2023).

The six variables considered in this study are captured in equation (1).

$$Y_t = [OLP_t, ERS_t, ECH_t, AGO_t, FCPI_t, HCPI_t] \quad (1)$$

To trace out the transmission mechanism of energy price movements and its impact on inflation, we propose a SVAR model of pth order expressed as follows:

$$A_0 G_t = \alpha_0 + \sum_{i=1}^{P} A_i \, G_{t-i} + \varepsilon_t \quad (2)$$

Where G_t is (6×1) vector of relevant variables as follows: $G_t = [lnOLP_t, lnERS_t, lnECH_t, lnAGO_t, FCPI_t, HCPI_t]$; A_i denote a (6×6) matrix of autoregressive coefficients; A_0 is a (6×6) matrix that informs on the contemporaneous relationship between the relevant variables of the model and ε_t represents the (6×1) structural shocks which are Brent crude oil price shock (ε_t^{lnolp}), external reserves shock (ε_t^{lners}), exchange rate shock (ε_t^{lnech}), automotive gas oil price shock (ε_t^{lnago}), food inflation shock (ε_t^{fcpi}), and headline inflation shock (ε_t^{hcpi}).

Unless Equation (2) can be transformed to a reduced-form VAR, estimating Eqn. (2) using the least squares (OLS) method will produce biased and inconsistent estimates.
By pre-multiplying both sides of Eqn. (2) by A_0^{-1}, we can express the SVAR model in reduced form as follows:

$$A_0^{-1} A_0 G_t = A_0^{-1} \alpha_0 + \sum_{i=1}^{P} A_0^{-1} A_i G_{t-i} + A_0^{-1} \varepsilon_t \quad (3)$$

This gives the reduced-form VAR captured using the equation below:

$$Y_t = \theta_0 + \sum_{i=1}^{P} \lambda_i \, Y_{t-i} + \mu_t \quad (4)$$

Where: $\theta_0 = A_0^{-1} \alpha_0$, $\lambda_i = A_0^{-1} A_i$ and $\mu_t = A_0^{-1} \varepsilon_t$.
μ_t denotes the reduced-form errors ($\mu_t^{lnolp}, \mu_t^{lners}$, μ_t^{lnech}, μ_t^{lnago}, μ_t^{fcpi} and μ_t^{hcpi}), which are linear combinations of structural shocks (ε_t).

Unit root
Since we employ time-series methods for this investigation and recognise the drawbacks of ignoring the stationarity properties of the relevant factors when estimating a model, this study followed the standard practice of checking the data for a unit root. To do this, we followed the procedures proposed by Dickey and Fuller (1979) and Phillips and Perron (1988), adopting the Augmented Dickey-Fuller and Phillips-Perron (PP) tests to assess stationarity. The sensitivity of the ADF test to lags prompted the use of the PP test as a confirmatory test.

Lag Selection
The estimation of the VAR model requires a definite number of lag(s), p, as specified in Eqn. 4. It is therefore important to determine the lag order appropriate for the model. This was achieved through a lag selection test.

Cointegration test
With all the variables found to be I(1), the study proceeded to examining long-run relationship between the variables. The confirmation of this, or otherwise, is done by conducting a cointegration test for which the system-based reduced rank approach proposed by Johansen (1991, 1995) was employed.
The Johansen (1991, 1995) method suggests two likelihood ratio tests, namely the trace statistic (λ_{trace}) and maximum eigenvalue (λ_{max}) statistic. These statistics are computed using the equations below:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{h} \log\left(1 - \hat{\lambda}_i\right) \quad (5)$$

$$\lambda_{max}(r, r+1) = -T log\left(1 - \hat{\lambda}_{r+1}\right) \quad (6)$$

Where T is the sample size; h represent the number of endogenous variables; $\hat{\lambda}_i$ and $\hat{\lambda}_{r+1}$ denote the measured values of characteristic roots obtain from the long-run coefficient matrix.

Identification of the SVAR model and contemporaneous restrictions

The next step in our methodological framework is to estimate the structural matrix and this is achieved through the process of identification. The identification of the SVAR model requires imposing restrictions on matrix A_0. In the 6-variable model , k (k-1)/2 short-term restrictions on matrix A_0 are imposed, which translates into 15 restrictions, to achieve identification The identifying restrictions placed on matrix A_0 draws from economic theory. The zero elements in matrix A_0 signify no contemporaneous impact of shocks to variable α_j on the response variable α_i. In Equation 7, the nonzero restrictions α_{ij} $(i = 1,2, \dots 6; j = 1,2, \dots, 6)$ indicate that variable α_j has immediate impact on variable α_i in the same period.

Matrix A_0 has 6 rows corresponding to 6 equations: the OLP, ERS, ECH, AGO, FCPI and HCPI equations. In the first row which features the OLP equation, the study assumes that structural shocks in ERS, ECH, AGO, FCPI and HCPI do not affect oil price within the same month or in the lag periods ($\alpha_{12} = \alpha_{13} = \alpha_{14} = \alpha_{15} = \alpha_{16} = 0$); however, unexpected deviation in oil prices are attributable to own shocks. In reality, unexpected oil price upswings are usually influenced by imbalances between oil demand and oil supply. ERS, occupying the second row, is affected by OLP ($\alpha_{21} \neq 0$) and its own lag. In the third row, ECH is contemporaneously affected by OLP, ERS and its own lag. The restrictions that $\alpha_{31} \neq 0$ and $\alpha_{32} \neq 0$ placed on the ECH equation is based on exchange rate being a fast-moving price. Exchange rate is influenced, among other things, by Nigeria's external reserves position which in turn rises with uptick in oil prices, provided there is no dip in oil output.

AGOP equation reflects that changes in AGO price are due to shocks originating from other endogenous variables. The study assumes that changes in AGO price is affected contemporaneously by OLP, ERS, ECH and itself ($\alpha_{41} \neq 0; \alpha_{42} \neq 0; \alpha_{43} \neq 0$). The study based these restrictions on several economic realities and theories. The deregulation of the AGO market has smoothened the transmission channel through which oil price vagaries pass-through to AGO price. Before the Dangote refinery came on stream, petroleum products (particularly AGO) were imported, making exchange rate exposure a cost in AGO pricing. The influence of exchange rate variation as a cost in AGO pricing has not dissipated with the onboarding of Dangote refinery, as crude oil feedstocks are imported and subject to exchange rate variabilities. Importantly, exchange rate remains a key component in the so-called naira-for-crude arrangement between Dangote Refinery and the Nigerian Government.

Fifth, FCPI is contemporaneously influenced by OLP, ERS, ECH, AGO and itself. AGO affects FCPI through transport and manufacturing costs, as most manufacturing plants and food haulage trucks run on AGO (diesel). Thus, AGO has a direct impact on food inflation through the food supply chain. The ECH effect manifests through the channels of imported fuel and food costs, as Nigeria relies heavily on imports of both food and crude oil feedstock. ERS's role in stabilising ECH is crucial for food inflation, as strong reserves provide a buffer against exchange rate shocks, thereby mitigating the inflationary pressures induced by exchange rate depreciation (Iliyasu & Sanusi, 2024; Akidi & Ikue, 2024; Tumala et al., 2023). Lastly, the HCPI equation suggests that HCPI is the most endogenous variable in the system, with structural shocks in OLP, ERS, ECH, AGO and FCPI assumed to have contemporaneous impact on HCPI. In particular, under this ordering and set of restrictions, all five shocks are assumed to potentially feed into headline inflation.

These restrictions placed on the contemporaneous matrix are captured using Equation . 7:

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$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ \alpha_{21} & 1 & 0 & 0 & 0 & 0 \\ \alpha_{31} & \alpha_{32} & 1 & 0 & 0 & 0 \\ \alpha_{41} & \alpha_{42} & \alpha_{43} & 1 & 0 & 0 \\ \alpha_{51} & \alpha_{52} & \alpha_{53} & \alpha_{54} & 1 & 0 \\ \alpha_{61} & \alpha_{62} & \alpha_{63} & \alpha_{64} & \alpha_{65} & 1 \end{bmatrix} \begin{bmatrix} \mu_t^{lnOLP} \\ \mu_t^{lnERS} \\ \mu_t^{lnECH} \\ \mu_t^{lnAGO} \\ \mu_t^{FCPI} \\ \mu_t^{HCPI} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} \end{bmatrix} \begin{bmatrix} \varepsilon_t^{lnOLP} \\ \varepsilon_t^{lnERS} \\ \varepsilon_t^{lnECH} \\ \varepsilon_t^{lnAGO} \\ \varepsilon_t^{FCPI} \\ \varepsilon_t^{HCPI} \end{bmatrix} \quad (7)$$

Results

Table 1: Summary statistics

	FCPI	HCPI	OLP	ERS	ECH	AGO
Mean	20.4084	18.0896	66.8374	36186.62	570.8197	549.0425
Median	18.405	16.475	66.43	36299.33	381	229.205
Maximum	40.87	34.8	120.08	47438.22	1670.78	1813.81
Minimum	10	9.17	23.34	23689.87	196.92	145.57
Std. Dev.	7.9506	6.9197	18.5351	5598.944	461.958	500.3809
Skewness	1.1330	0.9057	0.2415	-0.1251	1.4744	1.1072
Kurtosis	3.6029	2.9277	3.0685	2.4473	3.4877	2.7414
Jarque-Bera	28.8668	17.2562	1.2498	1.9320	46.9047	26.0977
Prob.	0.0000	0.0001	0.5353	0.3806	0.0000	0.0000
Obs.	126	126	126	126	126	126

Note: FCPI = food inflation; HCPI = headline inflation; OLP = Brent crude oil price; ERS = external reserves; ECH = exchange rate; AGO = automotive gas oil price

Table 1 presents the descriptive statistics of the relevant factors. We unpacked from Table 1 that headline inflation was highly elevated during the period considered (that is June 2015 to November 2025), as headline inflation averaging 18.0896% rose from 9.17% to 34.8% over the 126 months period. Food inflation was more severe, as food price increase broke pass 40% to 40.87% from the lowest food price jump of 10% during the period. It is interesting to note that, Table 1 shows an average uptick in food inflation of 20.40%. The inflationary environment suggested by these statistics emphasize an urgent response by policy authorities to rein in inflation as the continuous surge in general price and food price can further exacerbate the macroeconomic uncertainty and instability in the country, deflate productivity and output expansion, push more Nigerians into poverty as the local naira loses value, and facilitate dollarization of the economy as people hedge against the free-falling naira, among other cascading negative consequences of price surge.

Brent crude oil prices fluctuated significantly from June 2015 to November 2025, rising from an earlier low of USD 23.34 per barrel to a peak of USD 120.08 per barrel. On average, a barrel of crude oil was priced at USD 66.8374. Gross external reserves averaged USD 36,186.62 million, with the mean value falling between USD 23,689.87 million and USD 47,438.22 million. Over the 126 months, the exchange rate averaged ₦570.8197/US $1, appreciating to a high of ₦196.92/US $1. During the period, we observed that the naira depreciated to ₦1,670.78/US $1, on the heels of the exchange-rate floatation reform policy and other structural problems bedevilling the country. Automotive gas oil (otherwise diesel) price averaged ₦549.0425 per litre, with the price of AGO rising from ₦145.57 to ₦1,813.81 per litre during the investigation period. The estimated results disclose that FCPI, HCPI, log OLP, log ECH and log AGO are skewed positively, while log ERS is skewed negatively. The analysis of variables' standard deviation shows that ERS, ECH, AGO and OLP have high dispersion. Within the cohorts of variables analysed, ERS, AGO and ECH exhibit pronounced variability. The kurtosis statistics of the selected variables reveal that FCPI and log ECH have pointed peaks. Finally, we confirm from the Jarque-Bera test that the distributions of FCPI, HCPI, log ECH and log AGO are not normal.

Table 2: Stationarity Result

	ADF		PP	
Variables	**Levels**	**1st Diff.**	**Levels**	**1st Diff.**
$lnolp_t$	-2.1200	-8.8419***	-2.1298	-8.0487***
$lners_t$	-1.7336	-5.4920***	-1.7452	-9.4928***
$lnech_t$	-0.1887	-5.4269***	0.0740	-9.0127***
$lnago_t$	-0.2786	-7.8332***	-0.0657	-7.7932***
$fcpi_t$	-1.8208	-6.1906***	-1.6573	-6.1303***
$hcpi_t$	-1.6154	-6.4868***	-1.6142	-6.4502***

Note: ***$(p < 0.01)$, **$(p < 0.05)$ and *$(p < 0.1)$; 1st Diff. = first difference

Table 3 shows the results of the tests conducted to check if the series are stationary. The ADF test reveals that the null hypothesis of unit root was not rejected for the level series of FCPI, HCPI and log forms of OLP, ERS, ECH, and AGO, indicating that all the series are nonstationary in their original form. However, the series (FCPI, HCPI and the log converted series of OLP, ERS, ECH and AGO) exhibit stationarity after first differencing, indicating that change in the series are stable. These findings are also supported and validated by the standard PP test. The PP test revealed that all the series have unit root problems at level. Although we cannot find any of the variables considered exhibiting stationary characteristics at level, we did find that the changes in the series are of stationary sequence.

Lag selection

Table 3 present the results of lag selection test. As provided in Table 3, the FPE, AIC and HQ selection criteria indicate two-months lag as the optimal lag for the model. Thus, the study estimated the VAR model using a two-months lag. Additionally, the reduced form VAR of two-months lag was checked for stability, and the results fit the stability conditions. Specifically, the study found that all the roots lie inside the circle (see Fig. 1) and none of the modulus is unity (see Table 5).

Table 3: Lag length result

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-527.737	NA	0.0003	9.0463	9.1872	9.1035
1	414.8507	1773.342	7.26E-11	-6.3195	-5.3333*	-5.9190
2	478.2295	112.7926	4.59e-11*	-6.7835*	-4.9520	-6.0399*
3	505.8303	46.3132	5.35E-11	-6.6411	-3.9644	-5.5543
4	539.546	53.1452	5.68E-11	-6.6024	-3.0804	-5.1724
5	561.627	32.5600	7.47E-11	-6.3665	-1.9992	-4.5932
6	579.9922	25.2132	1.06E-10	-6.0676	-0.8550	-3.9511
7	625.0298	57.2512*	9.88E-11	-6.2208	-0.1629	-3.7611
8	666.2895	48.2527	1.01E-10	-6.3099	0.5932	-3.5070

Table 4 summarises the cointegration test results. In Table 5, the original hypothesis of no cointegration $(r = 0)$ against the aalternative of a cointegration series (r greater than 0) is tested based on the trace (lambda sub t r a. c e) and the maximum eigenvalueλ_{max}) statistics. According to the trace and Max-Eigen results, the null of none is rejected as both statistics indicate the existence of at least 1 cointegrating vector among the variables considered, suggesting that all the variables of interest are cointegrated to the same order, I(1).

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Table 4: Cointegration

	Trace test		
Null hypothesis	Statistics	5% CV	Prob.
$r = 0$*	107.7324	95.7536	0.0058
$r \leq 1$	62.3350	69.8188	0.1708
$r \leq 2$	32.2746	47.8561	0.5970
$r \leq 3$	16.5609	29.7970	0.6722
$r \leq 4$	7.4388	15.4947	0.5272
$r \leq 5$	1.2288	3.8414	0.2676
	Max-Eigen test		
Null hypothesis	Statistics	5% CV	Prob.
$r = 0$*	45.3973	40.0775	0.0115
$r \leq 1$	30.0604	33.8768	0.1336
$r \leq 2$	15.7137	27.5843	0.6899
$r \leq 3$	9.1221	21.1316	0.8225
$r \leq 4$	6.2100	14.2646	0.5864
$r \leq 5$	1.2288	3.8414	0.2676

Note: *($p < 0.05$)

Table 5: VAR residual diagnostics result

Modulus	0.9746	0.9532	0.9515	0.9515	0.8956	0.6084
	0.6084	0.4982	0.4982	0.3064	0.1321	0.1321

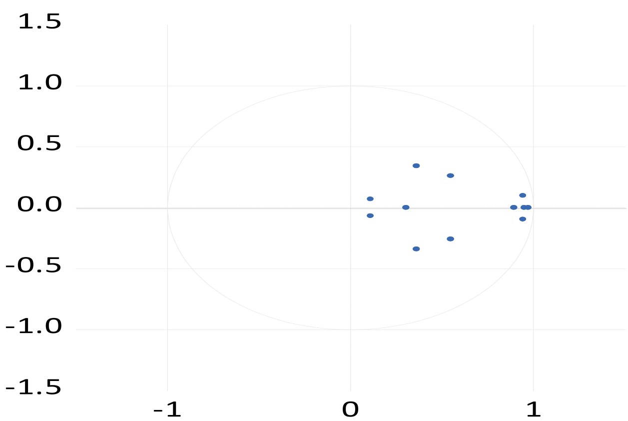

Fig. 1: Stability test

Table 6: SVAR estimates

	Endogenous Variables					
Variables	**OLP**	**ERS**	**ECH**	**AGO**	**FCPI**	**HCPI**
OLP	1					
ERS	-0.0433	1				
	(0.0337)					
ECH	0.0853	-0.1296	1			
	(0.0612)	(0.1620)				
AGO	-0.0939	0.1851	-0.1098	1		
	(0.0578)	(0.1522)	(0.0841)			
FCPI	-0.5438	-3.4358	-2.0055	-0.0696	1	
	(1.0974)	(2.8766)	(1.5915)	(1.6869)		
HCPI	-0.7109*	2.0374**	-0.4167	-0.3647	-0.6201***	1
	(0.3778)	(0.9951)	(0.5509)	(0.5802)	(0.0308)	

Note: Reported in parentheses are standard errors from MLE; ***($p < 0.01$), **($p < 0.05$) and *($p < 0.1$)

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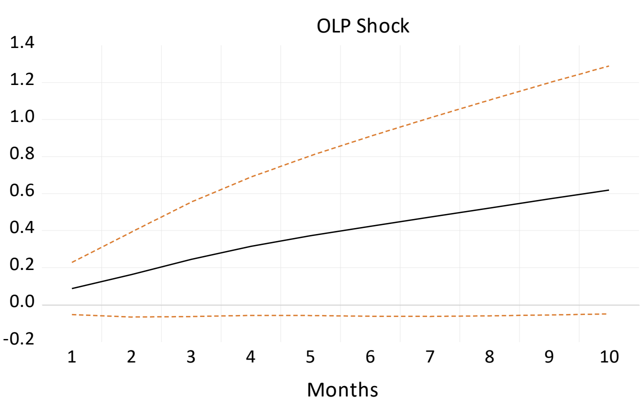
Table 6 reports the short-run contemporaneous relationship for the 6-variable SVAR model based on the ordering: crude oil price (OLP), external reserves (ERS) , exchange rate (ECH), automotive gas oil (AGO) price, food inflation (FCPI) and headline inflation (HCPI). As shown in Table 6, the study arrived at the following contemporaneous elasticities for the food inflation equation: -0.5438 for OLP, -3.4358 for ERS, -2.0055 for ECH, -0.0696 for AGO. As exhibited in Table 6, the contemporaneous effects of OLP, ECH and AGO price appear with the wrong theoretical signs and their impact on food prices are statistically insignificant. The negative sign of ERS matches theoretical expectation as results show that rise in external reserves triggers a decline in food inflation pressures, howbeit insignificantly. Regarding the interest variable of headline inflation (HCPI), we calculate contemporaneous elasticities of -0.7109 for OLP, 2.0374 for ERS, -0.4167 for ECH, -0.3647 for AGO price and -0.6201 for FCPI.

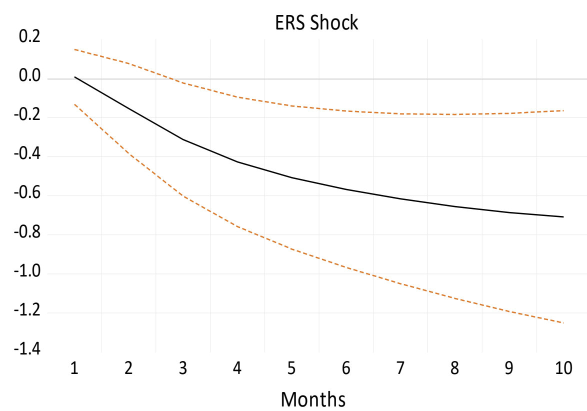
The oil price estimate value of -0.7109 indicate that oil price hike does not lift headline inflation, but cause inflationary pressures to taper down. The disinflationary effect of oil price surge is insignificant. The immediate effect of exchange rate depreciation and surge in AGO price on HCPI is negative, suggesting that hike in AGO price and exchange rate depreciation do not trigger inflationary pressures in the short-run. Though their contemporaneous effects do not match theoretical expectations, the headline inflation easing effects of AGO and ECH are statistically insignificant. As presented in Table 6, HCPI is a decreasing function of FCPI in the short-term. This signifies that, food inflation contributes significantly to easing headline inflation upticks in the short-term. The result exhibited in Table 6 lead us to conclude that food inflation is a headline inflation reducer as 1% hike in food prices causes 0.6201% decrease in HCPI. Our result which notably show that FCPI exert negative contemporaneous impact on HCPI in the short-term negates theoretical conscription and may be rationalized by the stickiness in downward adjustment in headline inflation when food prices eases and the high responsiveness of headline inflation to food price hike. This finding corroborates the results of Bello and Sanusi (2023) which show that food price has minimal inflationary effect on headline inflation.

Table 6 shows that rise in ERS transmit significant headline inflationary pressures. Table 6 evidence 2.0374% uptick in HCPI caused by 1% rise in ERS. This result presents a puzzling paradox as it is expected that a rise in ERS has disinflationary effect. Some explanations may be offered for this contradictory finding. First, the rising external reserves due to oil price surge increases naira liquidity, which causes money supply growth. This could push up prices, particularly when the injected liquidity from oil revenue is not fully sterilized. Second, the rise in ERS in Nigeria are driven mostly by crude oil sale, external borrowing and foreign portfolio investment rather than export. These compositions of external reserves do not improve domestic productive capacity, or translate into real output growth capable of having disinflationary effect. Third, the rise in external reserves may be driven by oil price hike which directly drive up AGO price and other petroleum product prices, thus lifting headline inflation.

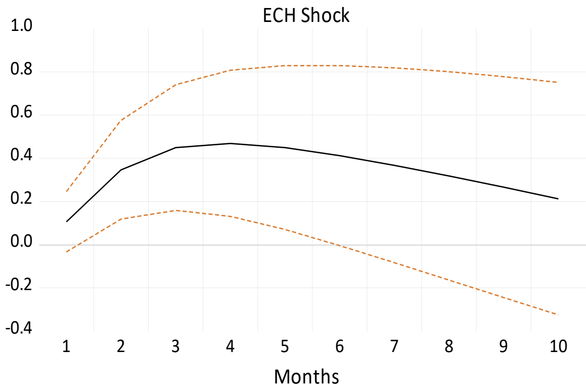
Impulse response function (IRF) analysis



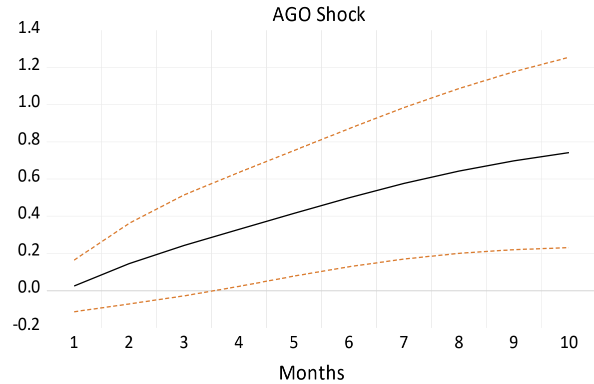
(a) HCPI response to oil price shock



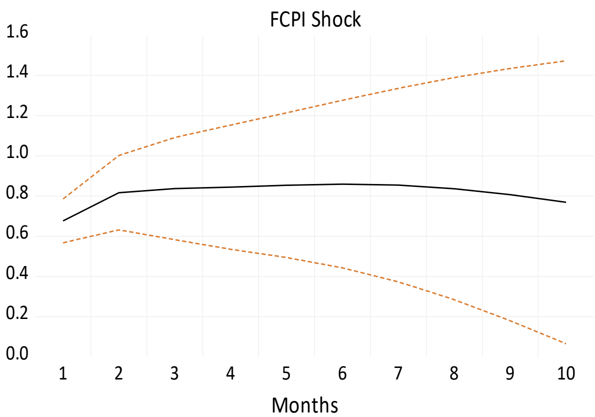
(b) HCPI response to ERS shock



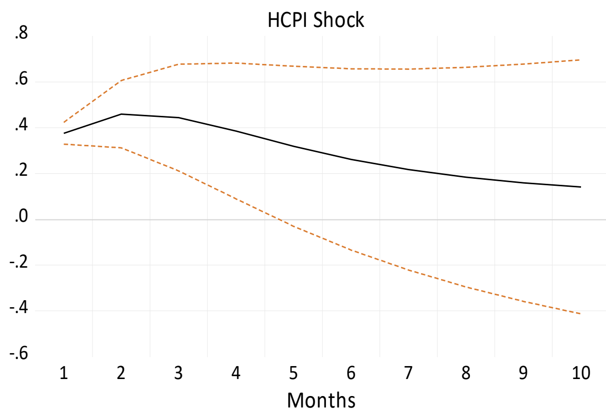
(c) HCPI response to ECH shock



(d) HCPI response to AGO price shock



(e) HCPI response FCPI shock



(f) HCPI response to HCPI shock

Fig. 2 a – f: IRF curves. OLP, ERS, ECH, AGO, FCPI and HCPI are Brent crude oil prices, external reserves, exchange rate, automotive gas oil prices, food inflation and headline inflation, respectively.

The study applied the use the IRF analysis to describe how headline inflation respond when oil price shocks (ε_t^{lnolp}), external reserves shocks (ε_t^{lners}), exchange rate shocks (ε_t^{lnech}), automotive gas oil price shocks (ε_t^{lnago}), food inflation shocks (ε_t^{fcpi}) and own shocks (ε_t^{hcpi}) occurs. In this case, a positive shock is used to convey an increase in Brent crude oil prices, rise in external reserves, depreciation of the naira, surge in AGO price, and increased food inflation.

Not surprising, an upsurge in Brent crude oil price triggers inflationary pressures in Nigeria in the short and medium term, which is captured by the positive response of headline inflation to upward oil price swings in Panel A of Fig. 2. Consistent with economic theory, a surge in oil prices generally increase the cost of production of petroleum products, like AGO, leading to an uptick in petroleum product prices. The increase in petroleum product prices transmit inflationary pressures through increase in energy prices and food prices, as cost of transporting manufactured and agrarian products rises. The deregulation of the AGO market and removal of fuel subsidy has made these transmission process smoother, as surge in oil prices translate much faster into inflation upswings. This result supports the findings of Cao et al. (2025), Zhao et al. (2025) and Aharon et al. 2023). Panel B of Fig. 2 show the response of headline inflation to impulse from external reserves. Panel B show that positive shocks to ERS have negative and significant impact on headline inflation and this runs from the first to tenth month without losing significance. As interpreted from Panel B of Fig. 2, one standard deviation increase in ERS causes a decline in the pace at which general prices increases in Nigeria. An increase in ERS signals stronger buffers to defend the naira and with the exchange rate considered a forward-looking asset, an increase in ERS eases price pressure and speculation, improve dollar supply and may lead to an appreciation of the naira. Following these, the cost of import of petroleum product decreases, together with domestic purchase of refinery feedstocks through the naira-for-crude arrangement. Price of petroleum products (like AGO) and energy costs are expected to fall, easing inflationary pressures in the country.

From Panel C of Fig. 2, a positive ECH shock (depreciation of the naira) manifests a positive impact on headline inflation, persisting for the initial four months and gradually declining afterwards. Nevertheless, the inflationary effect of exchange rate depreciation (positive ECH shocks) remains positive and significant at 5% level. This effect gives credence to the exchange rate pass-through to inflation phenomenon in Nigeria, with upswings in exchange rate (depreciation of the naira) fuelling price surge. The results pertaining to automotive gas oil price shocks indicate that positive AGO shocks (surge in AGO price) exert inflationary effect in the short and medium term. Our findings indicate that an upswing in AGO price elicit relatively immediate surge in headline inflation within the period and the effect is significant and persist for the ten months forecast period. Our result is consistent with those of Kilian and Zhou (2025), López et al. (2025) and Adolfsen et al. (2024). This finding is not surprising as AGO price constitute energy price and most manufacturing plants and haulage trucks for commodity distribution runs on automotive gas oil (AGO). Thus, an uptick in AGO prices is likely to push general prices higher, fuelling inflation. In response to food inflation shocks, we observe disinflationary trend from the seventh to the tenth month. Notwithstanding, the inflationary effect of food inflation shocks remains positive and highly significant. With a positive HCPI shock, HCPI is positive for the entire 10 months, but disinflationary from the third to tenth month. Statistically, the positive impact of own shocks on HCPI is significant, alluding to the role inflation expectations plays in headline inflation dynamics in Nigeria.

Forecast error variance decomposition (FEVD)

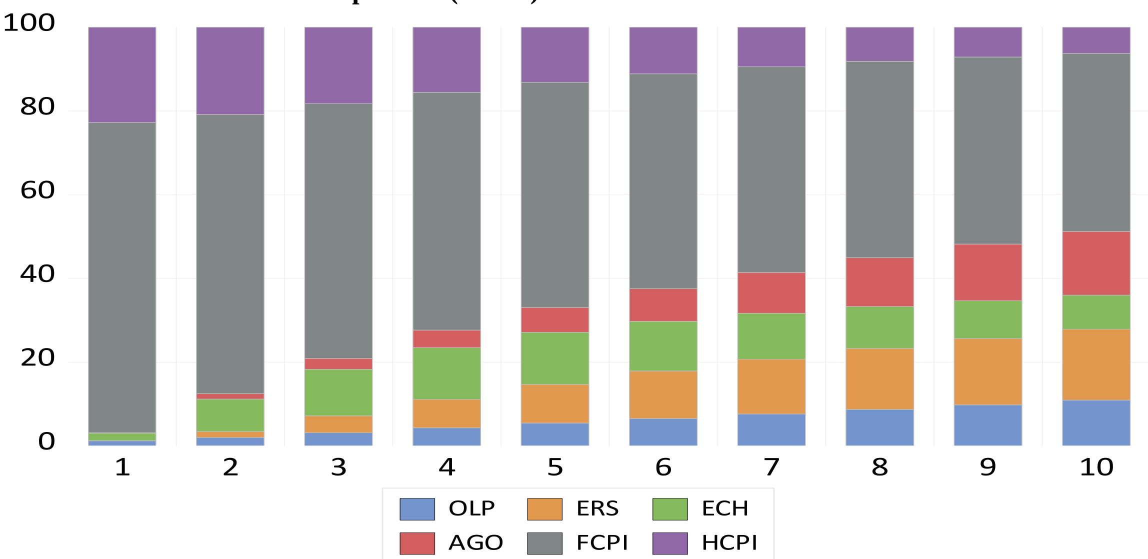


Fig. 3: FEVD plot of HCPI

Table 7: FEVD of headline inflation

Endogenous Variable	Month	Shocks $lnOLP$	$lnERS$	$lnECH$	$lnAGOP$	$FCPI$	$HCPI$
	1	1.2267	0.0108	1.8078	0.0908	74.0770	22.7866
	2	2.0144	1.4057	7.7799	1.2613	66.6904	20.8479
	3	3.1307	4.0443	11.0921	2.6590	60.7966	18.2770
	4	4.3244	6.7918	12.3611	4.2012	56.7354	15.5859
Headline CPI	5	5.4700	9.2379	12.4271	5.9304	53.7846	13.1497
	6	6.5561	11.3202	11.8545	7.8120	51.3433	11.1136
	7	7.6168	13.0844	10.9838	9.7591	49.0808	9.4748
	8	8.6872	14.5859	10.0088	11.6828	46.8619	8.1732
	9	9.7877	15.8630	9.0351	13.5182	44.6553	7.1403
	10	10.9245	16.9395	8.1195	15.2263	42.4728	6.3171

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Next, we turn our attention to untangling the contributions of OLP shock (ε_t^{lnolp}), ERS shock (ε_t^{lners}), ECH shock (ε_t^{lnech}), AGO price shock (ε_t^{lnago}), FCPI shock (ε_t^{fcpi}) and own shock (ε_t^{hcpi}) to fluctuations in headline inflation in the short-term (1 – 6 months) and medium term (7 – 10 months). Table 7 exhibit the contributions of these shocks to headline inflation variation and these were observed using the forecast error variance decomposition (FEVD) analysis. According to Table 7, FCPI largely explains headline inflation in the first month, with food inflation shock contributing approximately 74.08% to general price changes. The decomposed results point to FCPI being the major driver of headline inflation in the first month. In the month of reference, we observe that OLP shock (ε_t^{lnolp}), ERS shock (ε_t^{lners}), ECH shock (ε_t^{lnech}) and AGO price shock (ε_t^{lnago}) contributed relative little to inflationary pressures, as the proportion of their contributions to the uptick in general commodity prices were approximately 1.23% (for OLP), 0.01% (for ERS), 1.81% (for ECH) and 0.09% (for AGO price).

Our findings reveal that own shocks largely explain approximately 22.79% of the fluctuations in general prices, providing understanding that inflation expectation also fuels upsurge of general prices. The proportion of headline inflation explained by FCPI decreased in the short-term. Table 7 reveals that the proportion of variations in headline inflation due to food inflation shocks decreased from 66.6904% in the second month to 51.3433% in the sixth month. Table 7 show that variation in headline inflation induce by OLP shocks rose from 2.0144% in the second month to 6.5561% in the sixth month. An exchange rate shock causes 1.8078 – 12.4271% changes in headline inflation in the short term (1 – 6 months). Turning to AGO price shocks, we observe an increase in the variance in headline inflation induce by shocks in AGO price. The variations in headline inflation due to AGO shocks increased from 0.0908% in the first month to approximately 7.8120% in the sixth month. Similarly, external reserves shocks account for 0.0108 – 11.3202% of changes in headline inflation in the short term (1 – 6 months). The results suggests that food inflation assumes greater influence in explaining the variations in Nigeria's headline inflation in the short term, followed closely by inflation expectations or shocks from itself.

In the medium term (7 – 10 months), the effect caused by food inflation shocks remain pronounce, dropping to below 50% from period 7. We observe that variation in headline inflation induce by FCPI shocks fell from 49.0808% in period 7 to 42.4728% in period 10. The FEVD exhibited in Table 7 confirm an increase in the contribution of oil price shocks to headline inflation dynamics, as oil price shocks is responsible for approximately 7.62 – 10.92% of headline inflation behaviour in the medium term. External reserves shocks have an increasing effect on headline inflation in the medium term, with the contribution to HCPI variations increasing from approximately 13.08% in period 7 to 16.94% in period 10. Table 7 reveals declining sensitivity of HCPI to ECH shocks, as the variation in HCPI explained by ECH shocks declined from 10.98% in period 7 to approximately 8.12% in period 10. We observe increased headline inflationary vulnerabilities in Nigeria to ECH shocks as ECH shocks account for approximately 9.75 – 15.23% of medium-term variances. Lastly, the medium term HCPI variations explained by itself decline from 9.47% in period 7 to 6.32% in period 10. In the forecast window, we summarily conclude that food inflation contributes the most to HCPI variations, with external reserves shocks and automotive gas oil price shocks as second and third contributors to HCPI dynamics in Nigeria.

Conclusion

This study examined the impact of energy price shocks on headline inflation in Nigeria, using monthly data from June 2015 to November 2025. The study in identifying the contributors or drivers of headline inflation in Nigeria used the structural vector autoregressive (SVAR) model. With the impulse response function, we trace the response of headline inflation to shocks to Brent crude oil price, external reserves, exchange rate, automotive gas oil and food inflation. The FEVD analysis was used to understanding the contributions of shocks to Brent crude oil price, external reserves, exchange rate, automotive gas oil and food inflation to headline inflation variances in Nigeria. The study found that unanticipated positive shocks to Brent crude oil price leads to headline inflation upswings. Empirical results show that positive shocks to AGO price drives up headline inflation. Through the FEVD, we observed that food inflation contributes 42 – 74% of the variations in headline inflation. In reducing the effect of energy shocks to headline inflation, the study recommends that policy makers should address the security issues in the North-East/Central region through aggressive and collaborative combat operations and also improve financing development to aid the transition from nonrenewable to renewable energy sources.

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