Monetary Policy, Fuel Prices, and Inflation Persistence in Nigeria: Structural Drivers and Policy Trade-offs

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Abstract

This study analyses the structural and policy drivers of inflation in Nigeria, focusing on post-covid, post-subsidy removal period and the 2023 shift to a flexible exchange rate regime. Using a Structural Vector Autoregressive (SVAR) model with quarterly data from 2000 to 2024, we analyze interactions among refined fuel prices (PMS), inflation, the Monetary Policy Rate (MPR), and the Bureau de Change (BDC) exchange rate. Impulse response results show that PMS shocks have a modest, short-lived effect on inflation, while inflation remains significantly self-driven and persistent. MPR shocks strongly affect the BDC rate and gradually affect PMS, suggesting effective policy transmission through the exchange rate channel but a little impact on inflation. The Central Bank's response to inflation shocks is weak and temporary, reflecting a fragile inflation-targeting regime. Forecast error variance decomposition reveals MPR as the most influential policy tool for exchange rate and fuel price movements, but with minimal influence on inflation. Inflation is driven mainly by its shocks, pointing to underlying structural factors such as food supply disruptions, insecurity, and infrastructure deficits as key inflationary pressures.

Keywords : Inflation, Energy Price, Monetary Policy

JEL classification : Q43, E31, E43

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1. Introduction

Energy price shocks arise from both demand and supply factors (Kilian, 2009), but this study focuses on shocks from prices of refined fuel imported to Nigeria and monetary policy outcomes, given Nigeria's distinctive position as an energy resource-importer. Nigeria, like certain economies, faces inflationary pressures from rising energy costs, posing a challenge to monetary policy (Shazad, Orsi and Sharma, 2024). Developments in both international and domestic fronts greatly impact countries' economic policy environment, including monetary policy decisions. The supply shocks during the COVID-19 pandemic, the Russian-Ukraine war, and geopolitical hostilities in the Middle East have had far-reaching implications for commodity markets posing multi-faceted risks to energy security. Commodities are key inputs for the critical sectors of economies (Qian, Zhang and Li, 2023). Thus, higher energy costs increases cost of production with the passthrough to general prices, necessitating monetary authorities' responses. The global crises have also worsened energy price volatility, affecting inflation, exchange rates and trade balances (Sokhanvar and Bouri, 2023; Basher, Haug and Sadorsky, 2016; Lizardo and Mollick, 2010).

Monetary authorities are confronted with the policy challenge of making optimal choices amongst competing objectives, the effectiveness of which depends on prevailing shocks. Most oil-rich African countries remain heavily reliant on imported refined oils. For instance, Nigeria's heavy reliance on fuel imports limits economic gains from high crude prices (Tajudeen, 2017). The removal of subsidies on major household and firm-dependent fuels and exchange rate liberalization mid-2023 represent a fundamental shift in the nation's economic landscape, intensifying inflationary pressures, and underscoring the need to understand monetary policy responses. Multitude of studies have analyzed the link between oil price shocks and monetary policy variables (see, Tang, Wu & Zhang, 2010; Filis and Chatziantoniou, 2014; Sokhanvar and Bouri, 2023; Bigerna, 2023; and Yu, Fu and Xu, 2024). However, these studies have considered global oil prices from the perspective of oil-exporting countries. This is same for Nigeria, where in most studies on the effect of energy price shocks on monetary policy premise their analysis on the country's crude oil exporting position (e.g., see Otoakhia, 2020; Abeng and Hilili, 2017; Ugwu and Emma-Ebere, 2018, Ama, 2019; and Okunoye, & Hammed, 2020;). These studies are great strides towards the propagation of the research area. However, our study fills the gap in literature by analysing the transmission of energy price shocks from the importation of refined oil, which constitutes a large share of Nigeria's imports. Such research, which captures Nigeria's net fuel importing position remains scarce. The study elucidates on monetary policy outcomes given Nigeria's unique role as a fast growing consumer of imported fuel. Moreso, the interrelationship

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between Nigeria's energy market and the recent inflationary and exchange rate pressures renders this study topical.

2. Related Literature

Research on monetary policy has expanded due to concerns over food and energy price shocks, particularly in commodity-exporting countries. Studies on the oil price-macroeconomy nexus have evolved from theories like the "Dutch Disease" and "resource curse" (Lane and Tornell, 1995) to political economy factors such as governance and institutional weaknesses (Robinson, Torvik and Verdier, 2006; Udo and Egwaikhide, 2012). Recent research explores moderating factors of these phenomena (Xiang and Shi, 2024; Liu & Lan, 2024). Oil price shocks disproportionately impact inflation in economies with pre-existing inflationary pressures. Developing nations, including Nigeria, face rising inflation and currency risks due to external debt (Bulus et al., 2023). However, most studies on Nigeria fail to distinguish commodity imports from refined oil imports (Otoakhia, 2020; Abeng and Hilili, 2017). Comparative studies show mixed results on the short- and long-term effects of oil price shocks on GDP and inflation (Gershon, Ezenwa and Osabohien, 2019; Shahrazi, Ghaderi and Sanginabadi, 2022; Zhao et al., 2016). While oil price increases typically hurt net-importing economies by worsening terms of trade and currency depreciation (Jibril et al., 2020), some findings suggest positive effects (Wesser-Jnr. and Lin, 2018). Additionally, exchange rate responses to oil price volatility vary across countries (Korley and Giouvres, 2022). Despite extensive literature on oil price shocks, Nigeria remains under-researched regarding the impact of refined oil price fluctuations on monetary policy. This study fills the gap by analyzing the effects of refined oil price shocks on monetary policy through the import-price channel using a Structural Vector Autoregressive Model.

3. Materials and Methods

3.1 Theoretical framework

This study attempts to investigate how structural shocks from the price of refined oil, proxied by Premium Motor Spirit (PMS), impact inflation, monetary policy and the exchange rate. It draws theoretical backing from modern macroeconomic shock transmission mechanism as well as the cost push theory of inflation. By macroeconomic shock transmission mechanism, external price shocks such as those from refined fuel imports to Nigeria can significantly affect inflation and the broader macroeconomy. Furthermore, the theoretical disposition to the cost-push inflation paradigm lies in the fact that an increase in the price of imported raw materials may lead to cost-push inflation. In this context, this theory aligns with monetary transmission theory where higher energy input feeds into general price levels, prompting monetary policy responses. The highlighted linkages constitute the foundations upon which the analysis is premised.

3.2 Data

The data covers the period from January 2000 to February 2024. We present a summary of the data and variables' definitions in Table 1.

Table 1: Data Summary

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Variable	Proxy	Description	Source
Energy price (₦)	pms	Premium Motor Spirit (refined oil in Nigeria)	NBS
Inflation rate (%)	inf	Price level of commodities in Nigeria	NBS
Monetary Policy Rate (%)	mpr	CBN anchor rate in the economy	CBN
Exchange rate (₦/US$)	bdc	Bureau de Change market exchange rate	CBN

Source: Authors compilation

All the variables considered in this study are pms price, inflation monetary policy rate and the exchange rate are monthly data extracted from the Central Bank of Nigeria Statistical Bulletin and National Bureau of Statistics.

3.3 Model Specification

This study examines refined oil price shocks from an import perspective, using PMS as a proxy . Using SVAR model, this paper highlights monetary policy responses to imported oil price shocks, in line with the context that rising oil prices increase costs and inflation, prompting the Central Bank of Nigeria (CBN) to adjust its policy rate (i.e., the MPR). The SVAR model, superior to VAR and VECM, allows for theory-consistent short- and long-run restrictions (Sen & Kaya, 2015). It also enhances shock identification, empirical fit via variance decomposition and impulse response functions (Van-Aarle et al., 2003). Given Nigeria's reliance on imported refined oil, price shocks affect inflation, influencing the MPR and exchange rate. Following Sims (1980), our VAR model captures these interdependencies as presented in equation (1).

$$AZ_t = \gamma_0 + \sum_{i=1}^{p} \gamma_i Z_{t-i} + u_t \quad (1)$$

From equation(1), Z_t is a $K\ by 1$ matrix, the dimensional vector of the endogenous variable for model one, A is $K\ by\ K$ matrix of parameters of endogenous variables, γ_0 is a $K\ by 1$-dimensional vector of constant and γ_i are $K\ by\ K$ dimensional autoregressive coefficient matrices of parameters of the lagged value of variables of Z_t and u_t is the K by1 dimensional vector of the stochastic error term normally distributed with white noise properties N $(0,\sigma^2)$. Finally, p is the optimal lag length used in the model. The structural form of the above equation will be as follows:

$$A\mu_t = B\epsilon_t \quad (2)$$

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ \theta_{21} & 1 & 0 & 0 \\ \theta_{31} & \theta_{32} & 1 & 0 \\ \theta_{41} & \theta_{42} & \theta_{43} & 1 \end{bmatrix} \begin{bmatrix} \mu_{pms} \\ \mu_{inf} \\ \mu_{mpr} \\ \mu_{bdc} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & b_{11} \\ 0 & b_{21} & 0 & 0 \\ 0 & 0 & b_{31} & 0 \\ 0 & 0 & 0 & b_{41} \end{bmatrix} \begin{bmatrix} \epsilon_{pms} \\ \epsilon_{inf} \\ \epsilon_{mpr} \\ \epsilon_{bdc} \end{bmatrix} \quad (3)$$

The structural shock matrix is represented by equations 2 and 3. Each element in the matrix indicates the presence of a contemporaneous relationship between the refined oil price shock and other variable shocks in the model presentation, and it stands for the shocks related to refined oil

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prices, inflation, monetary policy, and exchange rates, respectively. However, the study emphasizes how other variables react to the shock of higher refined oil prices.

3.4 Theoretical Justification

The VAR framework is ordered as follows: $pms - inf - mpr - bdc$. The PMS, which is ordered first, is based on the cost-push inflation framework, and is derived from the New Keynesian Models which suggests that increases in the prices of inputs can cause an increase in the overall price level. The justification for the positioning of Inflation as the second variable draws from the from the modern view to the Philips curve where supply side shocks like fuel prices can influence inflation dynamics. The third variable, i.e., the Monetary Policy Rate is justified based on the monetary policy rule, i.e., the Taylor Rule, which states that monetary policy reacts to the disequilibrium of inflation from its target. Exchange rate is ordered as the last variable based on the Nigerian-specific context that the parallel market exchange rate is a residual indicator reflecting market reactions to both inflationary pressures and policy making.

4. Results and Discussions

Unit root test

The unit root table shows the unit root test of $I(0), and\ I(1),$ based on the Augmented Dickey Fuller test.

Table 2 : Augmented Dickey Fuller Test

Variables	I(0)	I(1)
pms	-0.59	-6.39
prob	0.97	0.01
inf	-3.49	-6.7
prob	0.07	0.01
mpr	-0.91	-4.66
prob	0.95	0.01
bdc	3.46	2.47
prob	0.99	0.01

Source : authors computation

Table 2 shows that inf , pms, mpr, and bdc are stationary at first difference. This implies that all the variables are in their difference form in the analysis. From our analysis, the estimated coefficients of the structural VAR are as follows:

$$\begin{bmatrix} variables & pms & inf & mpr & bdc \\ pms & 1 & 0 & 0 & 0 \\ inf & -0.05 & 1 & 0 & 0 \\ mpr & -0.04 & 0 & 1 & 0 \\ bdc & -0.49 & 0 & -5.86 & 1 \end{bmatrix} \quad (4)$$

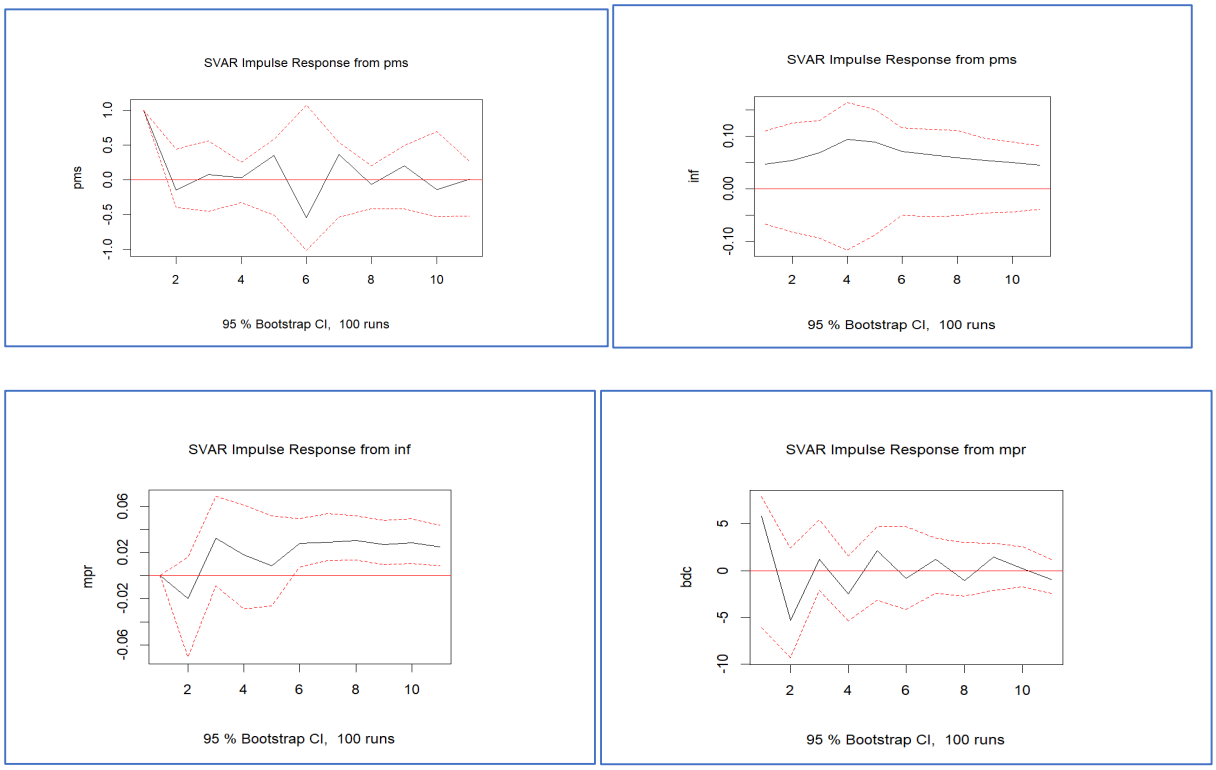
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The SVAR results show (pms) are exogenous and drive inflation, mpr and parallel exchange rate, reflecting cost-push inflation and parallel foreign exchange market pressure. Inflation responds directly to pms shock but does not immediately influence interest rates or exchange rates, indicating a lag in policy response. The mpr is slightly accommodative to fuel shocks but effectively shocks the parallel exchange rate, while the FX market reacts more strongly to pms and mpr than to inflation.

4.1 Impulse and response function

Impulse Response Functions (IRFs) show how economic variables respond over time to shocks. In our SVAR model, various interactions are highlighted between fuel prices (pms), inflation (inf), the monetary policy rate (mpr), and the Bureau de Change exchange rate (bdc).

Figure 1: IRFs



Source: Authors' computation

The impulse response analysis reveals key dynamics in Nigeria's macroeconomic environment. A shock to pms prices leads to a moderate but persistent increase in pms itself, stabilizing over 6–8 periods without overshooting. This actually suggests internal price stickiness. When pms prices rise, inf also increases, though modestly, with the effect peaking after 2–3 periods. This confirms a moderate pms pass-through to inf, this shows that other variables might be causing the excessive spike on inf. In response to inf shocks, mpr increases slightly, peaking around the third period before returning toward baseline, indicating a reactive but temporary policy stance.

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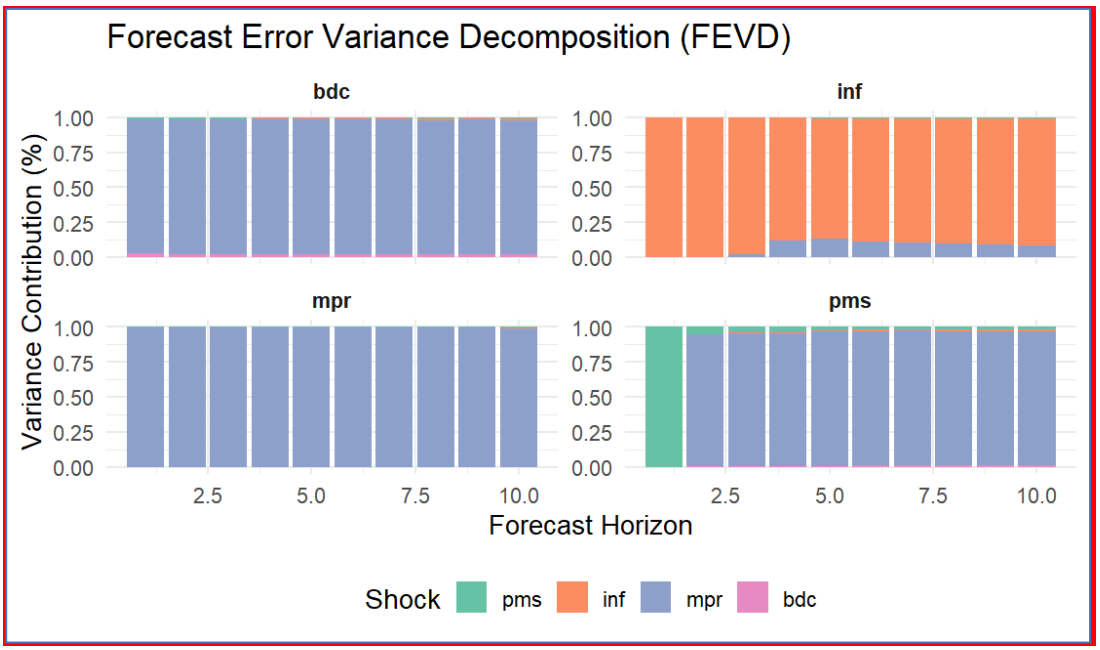
Additionally, a shock to the *mpr* initially causes a significant appreciation of the naira, seen in the sharp drop in the *bdc*.

In conclusion, *pms* modestly affect *inf*; the Central Bank responds to *inf* with *mpr* hikes; and tight monetary policy briefly supports *bdc*. Yet, these effects are not long-lasting, highlighting the temporary nature of policy transmission and suggesting that inflation control and exchange rate stability may require broader structural measures beyond fuel price or rate adjustments alone.

4.2 Forecast error variance decomposition

Forecast Error Variance Decomposition (FEVD) in VAR and SVAR models quantifies how much of a variable's forecast variability is due to its own shocks versus those from other variables, helping to assess their relative influence.

Figure 2: FEVD



Source: Authors' computation

The FEVD shows that *mpr* is the most influential and independent variable, driving both *bdc* and *pms*, and not really influenced by other shocks. The *bdc* is almost entirely explained by *mpr*, indicating strong monetary policy transmission through the *bdc* channel. It is noteworthy that *pms* is increasingly influenced by *mpr* over time, while inf is mostly driven by its own shocks, with only minor influence from *mpr* and virtually none from *pms*.

This suggests that *mpr* is effective for managing *bdc* but has limited impact on *inf*. On the other hand, *Inf* appears largely autonomous, and the Central Bank does not react strongly to *inf* shocks, indicating a weak inflation-targeting stance. *Pms* also have little effect on inf, implying limited inflationary risk from *pms* shocks, which means other variables affects inf rather than *pms*. This

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analysis shows that Nigeria's policy transmission is stronger through the exchange rate than through direct inflation control.

5 Conclusion and Policy Recommendations

The findings reveal that Nigeria's monetary policy, particularly through the monetary policy rate (mpr), plays a dominant role in influencing the parallel forex market and fuel prices proxied by pms, but has very low impact on inflation. The analysis of impulse responses and forecast error variance decomposition shows that mpr effectively and strongly drives bdc and gradually influences pms, while inflation is seen to be self-driven and unaffected by either mpr or pms shocks. In conclusion the subsidy removal might not have driven inflation, instead other structural issues might have increased inflation.

Given these dynamics, there is a need for more proactive and responsive monetary policy targeting inflation directly. Therefore, strengthening the inflation-targeting regime would help align interest rate decisions with price stability goals. However, since inflation is largely autonomous and not significantly affected by pms or mpr , it is clear that structural issues in Nigeria such as food supply disruptions, insecurity, and infrastructural bottlenecks are likely increasing price pressures. Addressing these through coordinated fiscal and structural reforms is important.

Moreover, the strong link between mpr and bdc indicates that monetary policy is effective in stabilizing the parallel exchange rate, and efforts should focus on maintaining policy credibility and consistency to sustain investor confidence. Ultimately, broader policy coordination beyond monetary tools is essential to achieve lasting inflation control and macroeconomic stability in Nigeria.

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