Effects of Fuel Subsidy Removal on Inflation rate in Nigeria

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Abstract

This study investigated the effects of fuel subsidy removal on inflation rate in Nigeria using monthly data from January 2020 to March 2024. The research employed the Autoregressive Distributed Lag (ARDL) model to analysed relationships between key economic variables, testing two primary hypotheses regarding fuel-related policy interventions on macroeconomic indicators through rigorous econometric testing and cointegration techniques. The investigation provided evidence rejecting both null hypotheses. For fuel price-inflation nexus, long-run ARDL results reveal a statistically significant positive relationship, at 1% significance level (coefficient: 0.002434, p-value: 0.0004), indicating a one-unit fuel price increase associates with 0.002434 unit inflation increase. Short-run dynamics demonstrate complex adjustment mechanisms, including initial negative effects at first lag (coefficient: -0.00022, p-value: 0.0032), suggesting immediate economic adjustments. The results have significant policy implications, suggesting need for gradual subsidy removal approach to manage both inflationary pressures and growth stimulation effectively. The study recommended that policymakers should design implementation strategies that harness the positive growth effects identified in the study while implementing complementary measures to mitigate the long-run inflationary consequences.

Keywords: ARDL Bound Test, Fuel Price, Fuel Subsidy Removal, Inflation.

1. Introduction

1.1 Background of the study

Nigeria, the largest economy in Africa, has been rassling with the contentious issue of fuel subsidies for decades. The government has been constantly subsidizing the prices of premium motor spirit (PMS), commonly known as petrol, to make it cheap and affordable for the populace. However, this policy has come at a considerable cost to the nation's economy, prompting calls from international organizations and economic experts to remove or phase-out the subsidy regime. The possible effects of subsidy removal on the inflation rate in Nigeria have been a subject of concentrated debate and research, given the comprehensive implications for the country's economic steadiness and the well-being of its citizens.

Fuel subsidies in Nigeria have a long and intricate history, dating back to the 1970s when the country witnessed an oil boom. The government introduced subsidies as a means of allocating the benefits of the country's oil treasure with the citizens by keeping fuel prices low (Nwafor, 2006). Over the years, successive administrations have sustained the subsidy regime, although with varying degrees of commitment and implementation. The rationale behind this policy has been to cushion the impact of high fuel prices on households and businesses, thereby mitigating the possible inflationary pressures (Adenikinju, 2009).

However, the subsidy regime has been troubled with challenges, including corruption, inadequacies, and a significant drain on the government's funds (Adebiyi, Adenuga and (Abeng, 2022). The Nigerian National Petroleum Corporation (NNPC), the state-owned oil company responsible for importing and allotting subsidized fuel, has consistently suffered substantial losses owed to the subsidy program (Akinwunmi, Oluwatomisin and Adedokun, 2021). These losses have been further worsened by the volatile nature of global oil prices, which have oscillated significantly over the past decades.

The substantial fiscal burden imposed by fuel subsidies has prompted international organizations, including the International Monetary Fund (IMF) and the World Bank, to advocate for their elimination (Sidiq and Rabiu, 2019). These organizations argue that subsidies are unsustainable, distort market signals, encourage inefficient consumption, and divert essential resources from critical sectors such as education, healthcare, and infrastructure. Despite these calls, past attempts by Nigerian governments to remove or reduce the subsidy have consistently faced significant public resistance and protests from labor unions and civil society organizations, primarily due to concerns about the potential inflationary impact and increased cost of living, given fuel's crucial role in transportation across the country (Nwafor et al., 2006; Sidiq and Rabiu, 2019).

The persistent fuel subsidy management has created a fiscal burden of approximately ₦4.39 trillion in 2022 alone, representing 2.39% of GDP (Adeniran et al., 2023). While fuel subsidy removal is economically necessary to reduce fiscal deficits and improve resource allocation, its implementation postures a significant threat to price stability in Nigeria's already fragile inflationary environment. The fundamental problem is the lack of empirical evidence on the magnitude and duration of inflationary pressures that would result from fuel subsidy removal in current economic context. This knowledge gap presents three critical challenges:

The persistent fuel subsidy management in Nigeria presents a critical research problem due to several challenges. Firstly, the nation's inflation rate remains well above target, reaching 28.92% in December 2023 (National Bureau of Statistics, 2024), and the precise quantitative impact of subsidy removal on exacerbating these cost-push pressures is undetermined. Secondly, the transmission mechanisms through which fuel price increases affect general price levels are not well understood, with existing empirical studies on the fuel subsidy-inflation nexus being limited and inconclusive, despite theoretical suggestions (Oriakhi and Iyoha, 2023; Babatunde et al., 2024; Adenuga and Oyewole, 2023). Thirdly, there is insufficient evidence on the heterogeneous sectoral and distributional effects of subsidy removal, particularly on vulnerable low-income households (Okafor et al., 2024). This problem is urgent given Nigeria's mounting fiscal pressures, with subsidies consuming about 40% of government revenue in 2023 (Fiscal Responsibility Commission, 2024). Lastly, the issue is compounded by a lack of effective social safety nets and compensatory measures, which could disproportionately burden the poor and worsen socioeconomic inequalities if not addressed (Adebiyi et al., 2022; Sidiq and Rabiu, 2019). It is against this backdrop that this paper examines how removing fuel subsidies impacts Nigeria's inflation rate using ARDL bounds test, analysing the immediate short-term relationship between fuel subsidy removal and inflation, determining the long-term equilibrium relationship between fuel prices, exchange rates, money supply and inflation, and assessing how quickly inflation adjusts back to its long-run equilibrium after subsidy removal. The research aims to provide comprehensive insights into both immediate and lasting economic effects of this significant policy change on Nigeria's price levels. The findings of this paper are significant as they can guide policymakers in designing effective implementation strategies to mitigate the negative consequences of subsidy removal while leveraging its potential benefits for economic growth and improved fiscal management.

2. Literature Review

2.1. Concept of Subsidy

Myers and Kent (2001) define a subsidy as a form of financial aid or support extended to an economic sector (or institution, business, or individual) generally with the aim of promoting economic growth and social policy. They argue that subsidies can take various forms including direct (cash grants, interest-free loans) and indirect (tax breaks, insurance, low-interest loans, depreciation write-offs, rent rebates).

Koplow (2009) expands on this concept stating that; subsidies are government actions that confer an advantage on consumers or producers in order to supplement their income or lower their costs. He categorizes subsidies into on-budget subsidies (direct payments to producers, consumers, or related bodies) and off-budget subsidies (implicit payments through tax exemptions or reductions).

Measurement of subsidies can be complex in nature, the OECD (2005) proposes the Producer Support Estimate (PSE) and Consumer Support Estimate (CSE) as comprehensive indicators of the annual monetary value of gross transfers from consumers and taxpayers to support agricultural producers and consumers respectively.

2.2 Fuel Subsidy

Kojima (2013) defines fuel subsidies as measures that keep domestic fuel prices below market-based reference prices. She noted that these can include direct financial transfers to oil companies, regulated prices set below market levels or tax exemptions. Also, the International Monetary Fund (IMF, 2013) differentiates between pre-tax and post-tax subsidies. Pre-tax subsidies arise when energy consumers pay less than the supply cost of energy while post-tax subsidies occur when energy consumers pay less than the supply cost plus an appropriate "Pigouvian" tax to reflect environmental damage and revenue considerations. Coady, Parry and Shang (2019) emphasize that fuel subsidies can be explicit or implicit. Explicit subsidies involve direct budget allocations while implicit subsidies occur when governments mandate state-owned enterprises to sell fuel below cost-recovery levels.

2.3 Fuel Price

The International Energy Agency (IEA, 2020) defines fuel prices as the cost of various types of fuel (gasoline, diesel, natural gas) to end-users. They also noted that these prices can vary significantly across countries due to differences in taxation, subsidies, and market structures. Adeleke et al. (2020) define fuel price in Nigeria as the government-regulated cost of petroleum products, particularly Premium Motor Spirit (PMS) or petrol, which is subject to frequent adjustments based on global oil prices and domestic economic factors. Nwoko et al. (2019) describes fuel price as the retail cost of refined petroleum products in Nigeria, which has historically been influenced by government subsidies and is a key driver of transportation costs and overall inflation in the country.

2.4 Theory of Inflation

Inflation is broadly defined as a sustained increase in the general price level of goods and services in an economy, it is a crucial macroeconomic indicator with far-reaching implications for economic stability and growth. The theoretical underpinnings of inflation have evolved significantly over time, with various schools of economic thought contributing to our understanding of its causes and consequences.

The Quantity Theory of Money pioneered by Irving Fisher, posits a direct relationship between the money supply and price levels (Fisher, 1911). This theory encapsulated in the equation MV = PT (where M is the money supply, V is the velocity of money, P is the price level, and T is the volume of transactions), suggests that an increase in money supply, ceteris paribus, leads to a proportional increase in the price level. While this theory provides a fundamental framework, it has been critiqued for its assumptions of constant velocity and full employment (Humphrey, 1974). Building on this, the Monetarist school, led by Milton Friedman emphasized the role of monetary policy in controlling inflation. Friedman famously stated that "inflation is always and everywhere a monetary phenomenon" (Friedman, 1970). This perspective highlights the importance of money supply (M2 in our model) as a key determinant of inflation. However, the New Keynesian approach introduces the concept of sticky prices and wages, suggesting that inflation can also be driven by demand-pull and cost-push factors in the short run (Mankiw and Reis, 2002). This perspective is particularly relevant when considering the impact of fuel subsidy removal as it can act as a cost-push factor in the Nigerian economy.

2.5 Cost-Push Inflation Theory

This theory suggests that an increase in production costs such as higher fuel prices resulting from subsidy removal, can lead to increased prices for goods and services as businesses pass on these higher costs to consumers (Mishkin, 2007). In the setting of fuel subsidies, their removal can contribute to cost-push inflationary pressures.

2.6 Demand-Pull Inflation Theory

According to this theory, an increase in aggregate demand for goods and services driven by factors such as rising consumer income or government spending, can lead to inflationary pressures (Mishkin, 2007). In the case of fuel subsidies, their removal can reduce disposable income for households potentially dampening consumer demand and mitigating demand-pull inflationary pressures.

2.5 Fuel Price

The theory of supply and demand is fundamental to understanding fuel prices. According to this theory, the price of fuel is determined by the interaction of supply and demand in the market (Mankiw, 2020). The theory of government intervention suggests that subsidies can artificially lower prices, possibly leading to overconsumption and market distortions (Stiglitz and Rosengard, 2015).

2.6 Theoretical link between fuel subsidy and inflation

Direct Inflationary Effects of Fuel Subsidy

The removal or reduction of fuel subsidies can potentially impact the inflation rate in an economy through direct and indirect channels. The direct impact arises from the increase in fuel prices, which directly affects the cost of transportation and energy-intensive goods and services (Nwafor et al., 2006). This can lead to an immediate rise in consumer prices for items with high transportation costs or reliance on energy inputs.

Adenikinju (2009) conducted a study on the impacts of fuel subsidy removal in Nigeria and found that it led to a significant increase in the general price level in the short term. Similarly, Bazilian and Onyeji (2012) noted that the partial removal of fuel subsidies in Nigeria in 2012 led to an immediate spike in inflation rates. The year-on-year inflation rate rose from 10.3% in December 2011 to 12.6% in January 2012 following the subsidy reduction. However, the magnitude and duration of these inflationary effects can vary. A study by Anwar (2016) on fuel subsidy removal in Indonesia found that while there was an initial spike in inflation, the effects were relatively short-lived, with inflation rates returning to normal levels within a few months.

Indirect Inflationary Effects of Fuel Subsidy

Fuel subsidy removal can indirectly trigger a broader inflationary spiral through its effects on production costs and consumer demand. As fuel prices increase, businesses may pass on higher transportation and energy costs to consumers, leading to a rise in the prices of various goods and services (Adebiyi and Adenuga, 2020). Additionally, higher fuel prices can reduce disposable income for households, potentially dampening consumer demand and economic growth, which can further contribute to inflationary pressures. Moreover, Siddig et al. (2014) argue that fuel subsidy removal can lead to cost-push inflation as businesses pass on increased energy costs to consumers. Their computable general equilibrium (CGE) model for Nigeria suggested that full subsidy removal could lead to price increases across various sectors of the economy.

Long-term Inflationary Effects

While most studies focus on the short-term inflationary impacts of fuel subsidy removal, some researchers have examined the long-term effects. Coady et al. (2010), in a cross-country study that included Nigeria, found that while subsidy removal often led to short-term inflation spikes, the long-term inflationary impacts were generally minimal if the policy was accompanied by appropriate fiscal and monetary measures. However, Nwachukwu and Chike (2011) argue that in Nigeria, the long-term inflationary effects of fuel subsidy removal could be more persistent due to structural inefficiencies in the economy and the heavy dependence on fuel for power generation and transportation.

2.7 Empirical Review

The empirical literature section reviews previous research studies and empirical analyses that have investigated the actual effects of fuel subsidy removal on inflation rates. It covers studies conducted in Nigeria as well as cross-country analyses. This section provides an overview of the methodologies used in testing their models, key findings, and implications from existing empirical research on the topic. It also helps situate the current study within the broader body of empirical evidence and identifies gaps or areas for further investigation.

The potential inflationary impact of fuel subsidy removal has been broadly studied by researchers and economists, both inside and outside the context of Nigeria and in other countries. Several studies have precisely focused on analysing the potential inflationary consequences of fuel subsidy removal in Nigeria, which employed various econometric techniques and data sources. These studies tender valuable insights into the degree and dynamics of the inflationary impact, as well as the potential justifying factors and sectoral effects.

Balogun (2025) examined the immediate consequences of gasoline subsidy removal in Nigeria, focusing on economic and social outcomes. Using monthly data from 2000 to 2024, the study found significant inflationary pressures, social unrest, and disproportionate impacts on low-income households, alongside modest fiscal gains. The study underscores the need for compensatory measures to mitigate short-term shocks. It also draws parallels with similar reforms in countries like Ghana and Indonesia, which triggered inflationary spirals and protests.

Njoku and Mmougbuo (2025) employed qualitative research using a descriptive design and secondary data, aimed to assess the impact of the 2023 fuel subsidy removal on low-income families in Nigeria. The findings revealed significant negative impacts, such as reduced household income, altered consumption patterns, and increased transportation costs, which in turn contributed to rising inflation rates. The study recommends a phase-out approach and the provision of palliative measures. Similarly, Adams and Jauro (2024) uses descriptive statistics and multiple regression models to establish that the removal of the fuel subsidy led to increased costs for food, transportation, and healthcare, which adversely affected low-income households.

Odey (2024) and Akorede (2024) argued that fuel subsidies lead to inefficiencies and corruption. They also noted that the removal of subsidies can lead to high inflationary pressures, increased poverty, and social unrest, but that these negative consequences can be mitigated by government transparency in spending the funds saved from the subsidy. Aniemeke (2024) examined the microeconomic and macroeconomic implications of fuel subsidy removal. The paper highlighted that the removal would likely lead to higher prices for goods and services due to increased transportation costs, contributing to inflation and a decline in living standards. The study also mentioned that the removal could free up resources for investment in other critical sectors.

Okonkwo et al. (2024) conducted a comprehensive study on the long-term effects of fuel subsidy removal in Nigeria using a dynamic stochastic general equilibrium (DSGE) model. They use quarterly data from 2000 to 2023, encompassing several episodes of partial and full subsidy removals. Their findings indicate that while fuel subsidy removal led to an initial spike in inflation with a peak increase of 2.5 percentage points in the first two quarters following removal, the inflationary pressure tended to stabilize within 18 months. Regarding economic growth, the study found a short-term contraction of GDP by 0.8% in the first year after removal of subsidy, but this was followed by a cumulative growth of 1.5% over the subsequent three years. The authors attribute this long-term positive effect to improved fiscal space and more efficient resource allocation.

Furthermore, the empirical literature on fuel subsidy removal in Nigeria highlights several key findings: Alexander (2024) found that fuel price shocks led to a substantial positive response in inflation, projecting acceleration for 9 months post-subsidy removal before deceleration. Eze and Okafor (2023) demonstrated that subsidy removal disproportionately affects lower-income households, increasing inflation for their consumed goods and significantly reducing their real consumption. Nnamani and Onyeka (2023) revealed that subsidy removal positively impacts government revenue and fiscal balance, though these gains can be offset by social protection spending. Ogunleye and Adebayo (2022) identified significant pass-through effects of fuel price increases on consumer prices across sectors, particularly transportation and food. Omotosho (2022) emphasized the amplifying role of inflation expectations in the inflationary impact of subsidy removal. Despite these insights, critical research gaps remain, including the need for more in-depth analysis of sectoral impacts beyond transportation, the specific role of inflation expectations, and detailed analysis of complementary policies and mitigating measures to address the multifaceted consequences of fuel subsidy removal.

3. Methodology

This study employs an Autoregressive Distributed Lag (ARDL) model to analyze the effects of fuel subsidy removal on inflation rates in Nigeria, chosen for its ability to capture both short-run and long-run relationships between variables. The analysis utilizes secondary monthly data spanning from January 2020 to March 2024, sourced from the CBN Statistical Bulletin, National Bureau of Statistics (NBS), and World Development Indicators (WDI). Key variables included in the models are Inflation Rate, Fuel Prices, Exchange Rate, Money Supply, and a dummy variable representing Fuel Subsidy Removal.

3.1 Method of Data Analysis

The framework adopted for this study is ARDL model which is in line with studies by Adeleke et al., (2021); Ogunmuyiwa et al., (2020); Eregha et al., (2019); and Nwoko et al., (2022). The paper employs an Autoregressive Distributed Lag (ARDL) model to analyze the effects of fuel subsidy removal on inflation rates in Nigeria, chosen for its ability to capture both short-run and long-run relationships between variables. The ARDL model is particularly suitable because it allows for the use of variables with different orders of integration, i.e., I(0) and I(1), as long as none are integrated of order I(2) or higher. This flexibility is a key strength of ARDL over other time series methods like the Vector Error Correction Model (VECM), which requires all variables to be integrated of the same order[16]. The analysis uses secondary monthly data from January 2020 to March 2024, sourced from the CBN Statistical Bulletin, National Bureau of Statistics (NBS), and World Development Indicators (WDI). The key variables are the Inflation Rate (INF), Fuel Prices (FP), Exchange Rate (EXR), Money Supply (M2), and a dummy variable for Fuel Subsidy Removal (FSR). The proxies for these variables are as follows: the Inflation Rate is proxied by the Consumer Price Index (CPI), Fuel Prices are proxied by the official pump price of Premium Motor Spirit (PMS), the Exchange Rate is proxied by the official Naira to USD exchange rate, and the Money Supply is proxied by the broad money supply (M2). The dummy variable for Fuel Subsidy Removal is coded as 0 before the removal and 1 after the removal.

3.2 Model Specification

The mathematical model could be symbolically expressed as:

INF = *f*(FP, EXR, M2, FSR) (1)

While the second objective would be express as:

These model adaptations reflect theoretical refinements designed to enhance the explanatory power of the econometric specifications while maintaining consistency with established empirical methodologies in the literature.

Thus, the econometric model can be written as:

$$INF_t = \beta_0 + \beta_1 FP_t + \beta_2 EXR_t + \beta_3 M2_t + \beta_4 FSR_t + \epsilon_t \quad (2)$$

The following paragraph describes the log-transformed econometric model used in the study, defining each of the variables and coefficients. The log-transformed econometric model (with the exception of the Exchange Rate and the dummy variable for Fuel Subsidy Removal, FSR) is specified as:

$$lnINF_t = \beta_0 + \beta_1 lnFP_{t-1} + \beta_2 EXR_{t-1} + \beta_3 lnM2_{t-1} + \beta_4 FSR_{t-1} + \epsilon_t \quad (3)$$

In this model, INF represents the Inflation Rate, FP stands for Fuel Prices, EXR is the Exchange Rate, and M2 is the Money Supply. FSR is a dummy variable used to represent the Fuel Subsidy Removal policy. The constant term is represented by β0, while the coefficients of the explanatory variables are given by β1 through β4. The error term is denoted by εt, and t-1 indicates a one-month lag at time *t*.

To facilitate efficient estimate and to directly aid in decreasing or solving the problem of heteroskedasticity and autocorrelation, we transformed the equations into the natural logarithm (Gujirati, 2004). A severely skewed variable can be transformed into a more typically distributed one using a logarithmic transformation.

3.3 Analytical Techniques

The Generalized ARDL (p, q) Model is Specified as:

$$Y_t = \gamma_{0i} + \sum_{i=1}^{p} \delta_i Y_{t-i} + \sum_{i=1}^{q} \beta_i X_{t-i} + \mu_{it} \quad (4)$$

Where **Y** is a vector and the variables in (**X**) are allowed to be purely I(0) or I(1) and cointegrated; β and δ are coefficients; γ is the constant; i=1,…,k; p, q are optimal lag orders; μ is a vector of error terms unobservable zero mean while noise vector process (serially uncorrelated or independent).

To specify the ARDL models utilizing the variables used for this study the model becomes:

$$\Delta INF_t = \alpha_0 + \sum_{i=1}^{p} \beta_{1i} \Delta INF_{t-i} + \sum_{i=0}^{q1} \beta_{2i} \Delta FP_{t-i} + \sum_{i=0}^{q2} \beta_{3i} \Delta EXR_{t-i} + \sum_{i=0}^{q3} \beta_{4i} \Delta M2_{t-i} + \beta_5 FSR_t + \theta_1 INF_{t-1} + \theta_2 FP_{t-1} + \theta_3 EXR_{t-1} + \theta_4 M2_{t-1} + \epsilon_t \quad (5)$$

ARDL Model with Lags:

$$lnINF_t = \beta_0 + \beta_1 lnINF_{t-1} + \beta_2 lnFP_t + \beta_3 lnFP_{t-1} + \beta_4 lnEXR_t + \beta_5 lnEXR_{t-1} + \beta_6 lnM2_t + \beta_7 lnM2_{t-1} + \beta_8 FSR_t + \epsilon_t \quad (6)$$

In both models:

Δ = First difference operator

α0, γ0 = Constant terms

β, δ = Short-run coefficients

θ, λ = Long-run coefficients

ε, μ = Error terms

p, q1, q2, q3, r, s1, s2, s3 = Optimal lag lengths

The ARDL Bounds Test

This test is used to check if long run relationship exists among the variables in the model (Banerjee and Carrion Silvestre, 2015) this will be carried out using the ARDL Bound technique.

$$\Delta INF_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta INF_{t-i} + \sum_{i=0}^{q1} \beta_{2i} \Delta FP_{t-i} + \sum_{i=0}^{q2} \beta_{3i} \Delta EXR_{t-i} + \sum_{i=0}^{q3} \beta_{4i} \Delta M2_{t-i} + \beta_5 FSR_t + \theta_0 INF_{t-1} + \theta_1 FP_{t-1} + \theta_2 EXR_{t-1} + \theta_3 M2_{t-1} + \epsilon_t \quad (7)$$

i. Decision Rule

$H_0: \theta_0 = \theta_1 = \theta_2 = \theta_3 = 0$ (there is no cointegration among the variables)

$H_1: \theta_0 \neq 0, \theta_1 \neq 0, \theta_2 \neq 0, \theta_3 \neq 0$ (there is cointegration among the variables)

ARDL Short-Run Equation:

$$\Delta INF_t = \alpha_0 + \sum_{i=1}^{p} \beta_{1i} \Delta INF_{t-i} + \sum_{i=0}^{q1} \beta_{2i} \Delta FP_{t-i} + \sum_{i=0}^{q2} \beta_{3i} \Delta EXR_{t-i} + \sum_{i=0}^{q3} \beta_{4i} \Delta M2_{t-i} + \beta_5 FSR_t + \epsilon_t \quad (8)$$

ARDL Long-Run Model

After discovering the evidence of cointegration, the long-run ARDL model would be estimated and is specified as:

$$\Delta INF_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta INF_{t-i} + \sum_{i=0}^{q1} \beta_{2i} \Delta FP_{t-i} + \sum_{i=0}^{q2} \beta_{3i} \Delta EXR_{t-i} + \sum_{i=0}^{q3} \beta_{4i} \Delta M2_{t-i} + \beta_5 FSR_t + \theta_0 INF_{t-1} + \theta_1 FP_{t-1} + \theta_2 EXR_{t-1} + \theta_3 M2_{t-1} + \epsilon_t \quad (9)$$

ARDL Error Correction Term Model

Sequel to the existence of long run relationship, the error correction model for the estimation of the short run relationships is specified as:

$$\Delta INF_t = \alpha_0 + \sum_{i=1}^{p} \beta_{1i} \Delta INF_{t-i} + \sum_{i=0}^{q1} \beta_{2i} \Delta FP_{t-i} + \sum_{i=0}^{q2} \beta_{3i} \Delta EXR_{t-i} + \sum_{i=0}^{q3} \beta_{4i} \Delta M2_{t-i} + \beta_5 FSR_t + \lambda ECT_{t-1} + \epsilon_t \quad (10)$$

The Error Correction Term (ECT) represents the residual of the long-run relationship, indicating the extent to which disequilibrium from a previous period is corrected in the current period. A negative coefficient signifies convergence towards long-run equilibrium, while a positive one indicates divergence. An ECT of 1 implies a 100% instantaneous adjustment, 0.5 suggests a 50% adjustment per period, and 0 means no adjustment, invalidating a long-run relationship. Ultimately, a negative and statistically significant ECT coefficient confirms that any short-term imbalance between explained and explanatory variables will converge back to the long-run equilibrium.

4. Results and Discussion

Unit Root Test

Table 1: Unit Root Tests Result

Variables	ADF Test Statistics			
	Constant		Trend	
	Level	First difference	Level	First Difference
ΔINF_RATE	2.303 (0.176)	7.775 (0.000) [A]	2.441 (0.354)	7.749 (0.000) [A]
ΔFUEL_PRICE	3.010 (0.041) [B]	7.303 (0.000) [A]	3.956 (0.017) [B]	8.277 (0.000) [A]
ΔEXC_RATE	0.677 (1.000)	6.256 (0.000) [A]	4.907 (0.145)	7.093 (0.000) [A]
ΔM2	3.803 (1.000)	6.014 (0.000) [A]	4.671 (1.000)	6.137 (0.000) [A]

Sources: Author's computation using e-views version 12 (2024)

Notes: [A, B & C] Significant at the 1%, 5% and 10%.

Δ = Difference Operator

The Augmented Dickey-Fuller (ADF) test results on monthly data spanning January 2020 to March 2024 provide convincing support for its use over the Phillips-Perron (PP) test in this analysis. The ADF test reveals a crucial distinction in the integration order of variables particularly identifying fuel price (ΔFUEL_PRICE) as stationary at level, I(0), with a test statistic of -3.9658 and p-value of 0.0174. This finding is particularly relevant given the study's focus on fuel subsidy removal and its economic impacts. Other variables, including inflation rate (ΔINF_RATE), exchange rate (ΔEXC_RATE), and money supply (ΔM2) are found to be integrated of order one I(1), becoming stationary after first differencing as indicated by their significant p-values below 0.05. This validates the use of the ARDL econometric technique, which requires variables to be either I(0) or I(1), but not I(2).

Regression Analysis:

Table 2: Cointegration Bounds Tests

F-Bounds Test **Null Hypothesis: No levels relationship**

Test Statistic	Value	Signif.	Lower Bounds	Upper Bounds
F-statistic	7.956	10%	2.45	3.52
		5%	2.86	4.01

	1%	3.74	5.06

Sources: Author's computation using e-views version 12 (2024)

The ARDL bounds test results show an F-statistic of 7.9562 which exceeds all upper bound critical values at the 10% (3.52), 5% (4.01), and 1% (5.06) significance levels. This provides strong evidence of cointegration among the variables, confirming the existence of a long-run equilibrium relationship between inflation rate, fuel price, exchange rate, money supply, and the fuel subsidy removal dummy. The error correction term coefficient of -0.21645 with a p-value of 0.0000 further validates this long-run relationship and indicates that approximately 21.6% of any disequilibrium is corrected in each period as the system moves back toward its long-run equilibrium.

Table 4: Short-run ARDL Result

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	1.384	0.207	6.677	0.000[A]
D(INF_RATE1(-1))	0.487	0.119	4.065	0.000[A]
D(INF_RATE1(-2))	0.136	0.143	0.953	0.347
D(INF_RATE1(-3))	0.528	0.133	3.957	0.000[A]
D(FUEL_PRICE)	6.940	5.570	1.245	0.221
D(FUEL_PRICE(-1))	-0.000	6.920	-3.177	0.003[A]
D(EXC_RATE)	0.000	5.090	4.196	0.000[A]
D(EXC_RATE(-1))	0.000	7.290	4.833	0.000[A]
CointEq(-1)	-0.216	0.032	-6.678	0.000[A]

R-squared	0.841	Adjusted R-squared	0.807
S.E. of regression	0.028	Sum squared resid	0.029
Log likelihood	103.991		
F-statistic	24.502	Prob(F-statistic)	0.000
Durbin-Watson stat	2.160		

Sources: Author's computation using eviews version 12 (2024)

Note: [A], [B] and [C] Denotes 1%,5% and 10% significance level respectively

The short-run ARDL model reveals that Nigerian inflation is significantly influenced by its recent past values. While fuel price increases show a counterintuitive negative effect on inflation in the very short term, possibly due to immediate demand reduction, currency depreciation (exchange rate) contemporaneously and with a lag leads to higher short-run inflation. The highly significant negative error correction term confirms a long-run cointegrating relationship, indicating that approximately 21.65% of any disequilibrium in the inflation rate is corrected within one period, demonstrating a relatively fast adjustment speed towards long-run equilibrium. With an R-squared of 0.841215 and a significant F-statistic, the model strongly explains short-run inflation variations, and the Durbin-Watson statistic suggests no significant autocorrelation, providing a comprehensive understanding of the complex interplay between inflation, fuel prices, and exchange rates in Nigeria.

Table 5: Long-run ARDL Result
Levels Equation
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FUEL_PRICE	0.002	0.001	3.914	0.000[A]
EXC_RATE	-0.001	0.001	-1.950	0.058[C]
LOGM2	-0.354	0.237	-1.495	0.144
DUMMY_FSR	0.091	0.078	1.172	0.250

EC = INF_RATE1 - (0.0024FUEL_PRICE -0.0011EXC_RATE -0.3544LOGM2 + 0.0914DUMMY_FSR)

Sources: Author's computation using eviews version 12 (2024)
Note: [A], [B] and [C] Denotes 1%,5% and 10% significance level respectively

The levels equation of the ARDL model reveals that in the long run, fuel price exhibits a significant positive relationship with inflation, indicating that a one-unit increase in fuel price is associated with a 0.002434 unit increase in the inflation rate. Conversely, the exchange rate shows a marginally significant negative relationship, suggesting that currency depreciation might be associated with lower inflation in the long run, a somewhat counterintuitive finding that could reflect complex economic dynamics or policy responses in Nigeria. The direct long-run effects of money supply and the dummy variable for fuel subsidy removal are not statistically significant at conventional levels, implying their long-term impact on inflation is less clear in this model, though the error correction term confirms the presence of a long-run equilibrium relationship guiding short-run adjustments.

Post-Estimation Tests

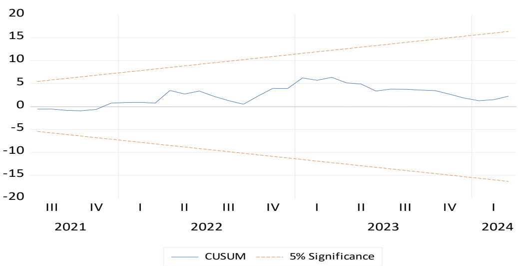
Table 6: Post-Estimation Tests

Test Statistic	**ObsR-squared**	**Prob. Chi-Square(2)**
Serial Correlation LM Test	1.210	0.546
Heteroscedasticity Tests:		
Breusch-Pagan Godfrey	14.199	0.288
ARCH	3.357	0.066
Glejser	14.990	0.242
Normality Test (Jarque-Bera)	2.599	0.272

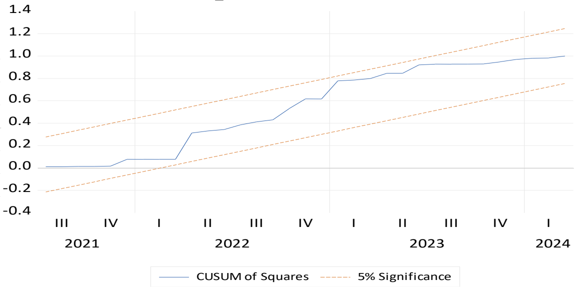
Sources: Author's computation using e-views version 12 (2024)

The econometric model estimates demonstrate good statistical properties, as evidenced by various diagnostic tests: the Breusch-Godfrey LM test, Breusch-Pagan-Godfrey test, ARCH heteroskedasticity test, and Glejser heteroskedasticity test all indicate no evidence against the assumption of no serial correlation and homoskedasticity (constant error variance) in the residuals at the 5% significance level. Furthermore, the Jarque-Bera test confirms the normal distribution of the residuals, collectively validating the adequacy of the model and the appropriateness of inferences drawn from its estimates.

CUSUM Tests



CUSUM Squared Test



Finally, the CUSUM and CUSUM Squared tests affirmed the model's structural stability, with no significant evidence of parameter instability or structural breaks, thus collectively validating the model's adequacy and the reliability of its inferences.

Discussions and policy Implications

The analysis reveals a significant long-term positive relationship between fuel prices and inflation in Nigeria, confirming the long-term inflationary consequences of fuel price adjustments and the transmission mechanisms through which energy costs affect general price levels. This finding aligns with the results of Okonkwo, et ta., (2024), who showed an initial inflationary spike following subsidy removal. The conclusions of this study are further supported by a number of other authors: Balogun (2025) found that the immediate consequences of the subsidy removal led to significant inflationary pressures and social unrest; Adams and Jauro (2024) concluded that the policy resulted in increased costs for food, transportation, and healthcare, all of which contribute to higher inflation; Njoku and Mmougbuo (2025) noted that the removal had a significant negative impact on households, causing a rise in inflation rates due to increased transportation costs; and Aniemeke (2024) highlighted that the upward adjustment of fuel prices contributes to higher costs for goods and services, ultimately leading to inflation and a decline in living standards.

The finding of a short-run negative effect at the first lag suggests that initial price increases may cause temporary deflationary pressures as consumers adjust their spending, but this is quickly followed by the long-term inflationary spiral. This supports a decisive approach to fuel subsidy removal, capitalizing on immediate positive economic growth by redirecting savings into high-multiplier investments like infrastructure, education, and healthcare. Simultaneously, robust social safety net programs, such as direct cash transfers and subsidized public transportation, should be established to mitigate inflationary pressures on vulnerable households. The central bank should therefore monitor fuel price trends for effective monetary policy, and improvements in transportation infrastructure could help reduce the inflationary impact.

5. Conclusion and Recommendations

The short-run analysis reveals that fuel prices and inflation have a negative effect at the first lag, demonstrating complex adjustment mechanisms where initial price increases trigger deflationary pressures before subsequent inflationary adjustments. The long-run estimation, however, establishes a statistically significant positive relationship between fuel prices and inflation, confirming the long-term inflationary consequences of fuel price adjustments and the transmission mechanisms through which energy costs affect general price levels.

The study recommends a decisive approach to fuel subsidy removal, capitalizing on immediate positive economic growth by redirecting savings into high-multiplier investments like infrastructure, education, and healthcare. Simultaneously, robust social safety net programs, such as direct cash transfers and subsidized public transportation, should be established to mitigate inflationary pressures on vulnerable households. Other recommendations include diversifying revenue sources, improving fiscal management, leveraging dynamic monetary policy, enhancing exchange rate management, and developing a dynamic inflation management strategy that accounts for both the short-run and long-run effects of subsidy removal.

Future research should focus on a more in-depth analysis of sectoral impacts beyond transportation, the specific role of inflation expectations, and a detailed analysis of complementary policies and mitigating measures to address the complex consequences of fuel subsidy removal.

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