ANALYZING THE EFFECT OF OIL PRICE AND EXCHANGE RATE ON PMS PRICING BY NNPC LIMITED AND DANGOTE REFINERY, AND MARKET INTERACTION IN NIGERIA'S DOWNSTREAM PETROLEUM SECTOR

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ABSTRACT

This study investigates the pricing dynamics and market interactions between the Nigerian National Petroleum Company Limited (NNPC Ltd) and the Dangote Refinery in Nigeria's downstream petroleum sector. Using weekly data from September 2024 to July 2025, the study employs the Autoregressive Distributed Lag (ARDL) model to examine the sensitivity of Premium Motor Spirit (PMS) prices to key macroeconomic factors—international crude oil prices, exchange rates, and inflation—and to assess the impact of the Dangote Refinery on supply trends and petroleum importation. Unit root tests indicated a mixed order of integration [I(0) and I(1)], validating ARDL, while bounds tests confirmed long-run cointegration for both models. Long-run estimates showed international crude oil prices as the strongest determinant for both NNPC ($\beta \approx 3.43$, $p \approx 0.04$) and Dangote ($\beta \approx 23.37$, $p \approx 0.03$). Exchange rate pass-through was positive and borderline significant, while inflation was insignificant. Short-run results revealed asymmetric responses: NNPC prices were more influenced by exchange rates ($p \approx 0.03$), while Dangote was more sensitive to oil price shocks ($p \approx 0.08$). Error correction terms were negative and significant (Dangote: –0.77, $p < 0.01$; NNPC: –0.90, $p < 0.05$), indicating rapid adjustment toward equilibrium. Supply analysis showed Dangote achieved 49% of national PMS supply by mid-2025, reducing import dependence. Diagnostic tests confirmed no serial correlation, homoskedastic residuals, and model stability. The study highlights crude oil and foreign exchange as dominant pricing drivers and recommends transparent pricing templates, FX stabilization mechanisms, NNPC–Dangote coordination, and improved regulatory oversight to enhance efficiency and consumer welfare.

Keywords: Premium Motor Spirit (PMS) pricing; Dangote Refinery; NNPC Limited; Autoregressive Distributed Lag (ARDL); Downstream petroleum market.

JEL Codes: Q41; L13; F31; C22.

1. INTRODUCTION

Nigeria, despite its abundant crude oil reserves and being the continent's largest producer, has paradoxically remained dependent on imports of refined petroleum products, particularly Premium Motor Spirit (PMS). Since the 1970s, recurrent fuel subsidy regimes have been instituted to buffer domestic consumers from global price volatility (Olujobi & Irumekhai, 2024; Victoria et al., 2017). However, these subsidies became deeply entangled with rent-seeking, corruption, and leakages, undermining state revenue and crowding out developmental spending (Adenikinju & Taiwo, 2013; Olujobi & Irumekhai, 2024). Critics argue that subsidies have had negligible poverty-alleviating effects and have disproportionately benefited politically connected elites (Dickson, 2024a; Dickson, 2024b).

Nigeria's downstream petroleum sector has long been characterized by a paradox of abundant crude oil reserves alongside heavy dependence on imported refined products, particularly Premium Motor Spirit (PMS). Since the 1970s, the government has relied on fuel subsidy regimes as a socio-political instrument to maintain low pump prices and curb inflationary pressures, often at the expense of fiscal sustainability (Olujobi & Irumekhai, 2024; Adenikinju

& Taiwo, 2013). These subsidies, while politically expedient, created significant distortions in the market by encouraging smuggling, discouraging investment in local refining, and fostering rent-seeking behavior within the supply chain (Victoria, Benson, & Adewale, 2017; Dickson, 2024a). The political economy of fuel pricing in Nigeria has historically hinged on balancing populist pressures against the economic imperative of reducing subsidy-related fiscal leakages, with subsidy removal often sparking protests and labor unrest (Obasi, 2017; Dickson, 2024b). This dependence on imports was exacerbated by the chronic underperformance of Nigeria's four state-owned refineries, which operated at less than 20% of installed capacity for most of the past two decades, resulting in over 70% of national PMS demand being met through imports (Phillips Consulting, 2024). Consequently, the subsidy regime not only entrenched inefficiencies but also placed a heavy burden on foreign exchange reserves and public finances, consuming billions of dollars annually that could otherwise support infrastructure and social services (Ahmed, 2023).

Compounding the strain, Nigeria's four state-owned refineries have been largely non-operational, plagued by mismanagement and technical failures, leading to over 70% of PMS being imported despite local crude availability (Victoria et al., 2017; Phillips Consulting, 2024). The fiscal cost has been staggering: in 2023, import expenditure on petroleum products reached approximately US$25 billion, placing severe pressure on foreign exchange reserves and the national budget (Phillips Consulting, 2024). Subsidy removal attempts, though politically fraught, have reshaped the fuel pricing landscape and provoked intense debate on reform and economic sustainability (Dickson, 2024a; Obasi, 2017).

The political economy of fuel pricing in Nigeria has historically revolved around balancing populist welfare objectives against fiscal prudence and elite patronage. Subsidy policies have been used as tools for political legitimacy, while their removal often sparks social unrest and political backlash (Obasi, 2017; Dickson, 2024b). In this context, the commissioning of the Dangote Refinery in the Lekki Free Trade Zone marks a significant structural transformation. As Africa's largest and one of the world's largest single-train refineries (650,000 barrels per day), it represents a strategic pivot from crude exportation to domestic refining (Ogunbukola, 2024; Wall Street Journal [WSJ], 2025; Associated Press [AP], 2024). The project embodies economic motivations—reducing import dependence, saving foreign exchange, generating backward and forward linkages, and stimulating GDP growth and employment (Ahmed, 2023; Ogunbukola, 2024). Beyond economics, the refinery serves geopolitical and strategic ambitions: it is designed to assert Nigeria's industrial sovereignty, reduce vulnerability to global market shocks, and position the nation as a regional energy hub (Li et al., 2021; WSJ, 2025). For Aliko Dangote, the refinery also represents a legacy-driven venture, reflecting his aspiration to drive domestic value addition and industrial competitiveness (AP, 2024; WSJ, 2025).

Collectively, Nigeria's long-standing reliance on fuel imports, entrenched subsidy inefficiencies, and evolving political-economic landscape set the stage for the Dangote Refinery to reconfigure the downstream sector. This study situates itself within these dynamics, aiming to analyze the evolving market interactions between NNPC Ltd and the Dangote Refinery and their implications for energy security, fiscal sustainability, and economic transformation. Despite the commissioning of the Dangote Refinery—expected to alleviate Nigeria's chronic refining inefficiencies and reduce its historical overreliance on imported petroleum products (Adenikinju & Taiwo, 2013; Olujobi & Irumekhai, 2024)—persistent fuel scarcity and continued dependence on imports indicate that infrastructural expansion alone is insufficient to guarantee downstream sector stability (Victoria, Benson, & Adewale, 2017).

Misalignments between production outputs and national demand, coupled with uncoordinated logistics and inconsistent pricing frameworks, have raised critical questions regarding how the operational and strategic interactions between NNPC Ltd and the Dangote Refinery affect market outcomes (Phillips Consulting, 2024; Dickson, 2024a). Given NNPC Ltd's entrenched role in crude allocation, pricing, and distribution, and the refinery's ambition to assert itself as a competitive private player, this study hypothesizes that structural frictions between both entities contribute significantly to supply instability and pricing volatility rather than resolving them (Obasi, 2017). The problem is further compounded by inconsistent crude lifting schedules, delayed payments, and policy shifts between dollar- and naira-denominated transactions, all of which have distorted supply chain predictability and consumer access (Ahmed, 2023; Dickson, 2024b).

Building upon this premise, the study is designed to achieve four interrelated objectives that address the fundamental gaps in the evolving downstream petroleum market. First, it seeks to analyze the supply trends of Premium Motor Spirit (PMS) by NNPC Ltd and the Dangote Refinery to identify patterns of distribution inefficiencies. Second, it examines the extent to which the Dangote Refinery has influenced petroleum importation volumes, particularly in light of Nigeria's longstanding subsidy-related fiscal burdens and foreign exchange pressures (Olujobi & Irumekhai, 2024). Third, it assesses the sensitivity of PMS prices to fluctuations in global crude oil prices and exchange and inflation rates, given their significant role in shaping pricing frameworks in the Nigerian context (Phillips Consulting, 2024). Finally, it investigates the pricing mechanisms employed by both NNPC Ltd and the Dangote Refinery to determine whether their interaction fosters competition, stabilizes prices, and enhances consumer welfare. By addressing these objectives, this study aims to provide empirical evidence to guide policymakers and stakeholders in designing a more resilient and transparent downstream petroleum sector.

2. LITERATURE REVIEW

2.1 Theoretical Literature

Market liberalization and contestability. Liberalization frameworks argue that lowering entry barriers, removing price controls, and creating non-discriminatory access to essential facilities can discipline incumbents and improve allocative efficiency. Contestable-market logic highlights how potential entry—even without immediate rivals—can constrain prices if sunk costs and exit barriers are limited (Baumol, 1982). In networked energy industries, comparative reviews show that liberalization works best when paired with credible unbundling, transparent market rules, and competitive wholesale/retail arrangements (Joskow, 2008; Pollitt, 2008). Evidence from broader energy reforms also links liberalization to innovation and policy dynamism, reinforcing the mechanism that competitive pressure and entry opportunities spur performance (Nicolli & Vona, 2019).

Regulatory economics: incentives, access, and capture. Principal–agent models of regulation emphasize information asymmetries between regulators and firms and the design of contracts (price-cap vs. rate-of-return) that elicit efficiency while protecting consumers (Laffont & Tirole, 1994; Sappington, 2010). Price-cap (RPI-X) regimes are predicted to yield stronger cost-reduction incentives than cost-of-service, provided quality is monitored and access pricing prevents foreclosure (Sappington, 2010; Laffont, 1990). Regulatory capture and political constraints can distort outcomes, especially where the regulator depends on the firms it oversees or on political principals (Laffont & Tirole, 1991). For energy networks, lessons from liberalization underscore the centrality of access pricing and governance of natural-monopoly bottlenecks (Joskow, 2008).

Industrial organization of vertical structure. Vertical integration can generate efficiencies (coordination, investment incentives) but also strategic foreclosure by raising rivals' costs or discriminating over access to essential inputs (Rey & Tirole, 2007). In energy and fuels, the structure of supply chains—refining, logistics, and retail—mediates how cost shocks and market power pass through to prices; gasoline markets provide canonical evidence that vertical arrangements and branding can affect retail pricing and competitive intensity (Hastings, 2004). Reforms that unbundle networks or impose neutrality rules aim to retain coordination benefits while limiting anticompetitive leveraging (Nillesen & Pollitt, 2011).

Mixed oligopoly: public–private rivalry. Where state-owned and private firms coexist, mixed-oligopoly theory models public firms as pursuing welfare (or output) objectives while private firms maximize profits, generating distinctive strategic interactions regarding capacity, pricing, and entry deterrence (De Fraja & Delbono, 1989; Matsumura, 1998). Extensions examine how free entry by private firms, partial privatization, or policy constraints shape equilibrium conduct and welfare—insights pertinent to markets where a national oil company competes or contracts with a large private refinery (Bennett & Iossa, 2010s; Kim, 2022).

Exchange-rate and cost pass-through. Fuel pricing in partially liberalized settings hinges on how cost shocks—world crude prices, exchange rates, taxes—transmit to domestic pump prices under imperfect competition and regulation. The modern pass-through literature shows that incidence depends on demand curvature, market power, and contract forms, implying incomplete and state-contingent pass-through (Weyl & Fabinger, 2013). Surveys and cross-country studies document wide variation in exchange-rate pass-through, with structural features and policy regimes (e.g., administered prices or caps) dampening transmission (Goldberg & Knetter, 1997; Marazzi et al., 2007). These mechanisms are directly relevant for interpreting price dynamics when a domestic refinery coexists with import channels and evolving pricing rules.

Private participation in a deregulated downstream. Within Nigeria's context, recent sector scholarship emphasizes how technology adoption, logistics coordination, and governance shape competitive advantage following deregulation—reinforcing industrial-organization predictions that rivalry and cost discovery improve with credible market rules and transparent access (Okundalaiye, 2025).

2.2 Empirical Literature Review

The empirical literature on Nigeria's downstream petroleum sector has concentrated on three interrelated themes: (i) the fiscal and economic effects of fuel subsidies and subsidy removal, (ii) supply-chain and operational constraints in domestic refining and distribution, and (iii) price transmission (pass-through) from world crude and exchange-rate fluctuations to domestic fuel prices. Several recent studies document how subsidy regimes in Nigeria produced substantial fiscal leakages and market distortions that discouraged investment in local refining capacity and encouraged smuggling and rent-seeking (Victoria, Benson, & Adewale, 2017; Nwozor et al., 2024). Qualitative and mixed-method investigations highlight that opacity in procurement, inadequate governance, and political manipulation of subsidy instruments have perpetuated inefficiencies in the downstream chain, limiting the effectiveness of policy reforms aimed at rebuilding local refining (Nwozor et al., 2024; Pertanika report).

Complementing the political-economy findings, more operationally focused studies examine supply-chain performance and why Nigeria's state refineries failed to meet national demand. Ogbaini (2025) and related supply-chain analyses underscore weaknesses in logistics, maintenance culture, and managerial capacity that constrained refinery utilization and

increased reliance on imports; these structural supply constraints created an opening for large private projects (e.g., Dangote) but also produced transitional frictions in distribution coordination (Ogbaini, 2025). Empirical accounts of the Dangote refinery's early operations and market effects show rapid redistribution of supply volumes and, in some cases, aggressive pricing behavior that sparked a downstream "price war" and raised questions about potential market concentration as the large private refinery ramped up output (Financial Times reporting; industry briefs).

A substantial strand of empirical work examines exchange-rate and crude-price pass-through to domestic prices—directly relevant to your econometric objectives. Recent econometric studies on Nigeria find that exchange-rate movements exert a significant and sometimes nonlinear effect on domestic producer and consumer prices, with pass-through magnitudes varying by period, policy regime, and product category (Oyadeyi, 2024; Chuba, 2015). These results imply that reforms such as naira-for-crude arrangements, exchange-rate unification, or subsidy removal will materially alter transmission dynamics; hence, any empirical model of PMS pricing must explicitly account for exchange-rate regimes and possible structural breaks around major policy shifts (Oyadeyi, 2024).

Comparative studies provide useful counterpoints. Cross-country evidence from liberalization episodes (e.g., tariff and market restructuring in South Africa and India) indicates that liberalization alone is insufficient: complementary institutional reforms — independent regulators, unbundling of functions, and transparent access rules — are necessary to prevent incumbents or dominant private players from exploiting market power during the transition (UNU-WIDER and sector studies). These international lessons underline why Nigeria's case requires scrutiny of regulatory design and market governance as private refining capacity expands (Crompton, UNU-WIDER).

Taken together, the empirical literature leaves two clear gaps that this study addresses. First, existing work largely predates or does not systematically examine the post-2024 interaction between a dominant state player (NNPC Ltd) and an extremely large private refinery (Dangote), meaning the dynamic strategic interplay and short-term distributional consequences remain under-investigated. Second, while pass-through and subsidy effects are studied in isolation, few empirical papers jointly model supply trends, import substitution, and price transmission in a single framework that captures structural breaks from policy shifts (e.g., naira-for-crude, subsidy removal). This study therefore contributes by combining supply-trend analysis with econometric pass-through estimation and by explicitly testing for structural breaks and regime effects across the 2024–2025 transition period.

2.3 Research Gap and Study Contribution

In summary, while existing scholarship has addressed either refinery inefficiencies, subsidy distortions, or sectoral reforms, none have interrogated the strategic, economic, and regulatory interface between the state-owned NNPC Ltd and the privately-owned Dangote Refinery following the refinery's 2024 commissioning. Nor do they compare Nigeria's unique East-West hybrid regime to similar processes in India or South Africa. Therefore, this study fills three critical gaps:

Temporal Gap: It addresses post-2024 realities of refining and distribution.

Structural Gap: It unpacks the interaction between dominant state and emerging private actors.

Comparative Gap: It situates Nigeria's downstream reform within broader global liberalization frameworks, drawing lessons from India's licensing policy and South Africa's private sector integration.

By doing so, the study contributes to theoretical understanding (via frameworks of market liberalization and regulatory economics) and offers empirical insights that can inform policymaking and sectoral strategy in a transforming Nigerian economy.

3. METHODOLOGY

3.1 Theoretical Framework

This study adopts the Mixed Oligopoly Model as its theoretical framework to analyze the evolving dynamics between NNPC Ltd, a state-owned entity, and the Dangote Refinery, a privately owned player, within Nigeria's downstream petroleum sector. Mixed oligopoly theory argues that markets where public and private firms coexist exhibit unique strategic interactions, as public firms often pursue welfare-maximizing or politically constrained objectives, while private firms are profit-driven (De Fraja & Delbono, 1989; Matsumura, 1998). This framework is highly relevant in Nigeria, where NNPC Ltd historically managed crude allocation, importation, and pricing under social welfare and subsidy regimes, whereas the Dangote Refinery seeks to optimize profitability and market dominance in a partially liberalized environment. The interaction between the two firms is thus conceptualized as a hybrid competitive–collaborative model influenced by regulatory policies, access pricing, and foreign exchange arrangements (Sappington, 2010; Laffont & Tirole, 1991).

Within this theoretical context, market liberalization theory reinforces the importance of reducing entry barriers, deregulating pricing structures, and expanding private participation to enhance allocative efficiency and reduce distortions (Nicolli & Vona, 2019). Similarly, regulatory economics provides insights into how pricing rules, subsidy reforms, and access to refining and logistics infrastructure shape market stability or volatility (Joskow, 2008; Pollitt, 2008). By adopting the Mixed Oligopoly Model, this study examines how the strategic behavior of a public incumbent and a private entrant affects three critical dimensions: supply coordination, particularly whether collaborative or rivalrous arrangements improve national PMS availability; price formation and pass-through, including the transmission of crude oil and foreign exchange shocks to retail fuel prices; and welfare outcomes, such as consumer benefits, fiscal sustainability, and long-term energy security. This framework forms the analytical foundation for the model estimation and empirical analysis presented in subsequent chapters.

3.2 Nature and Sources of Data

Data were gotten from Nigerian National Petroleum Company Limited (NNPC), Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA), Central Bank of Nigeria (CBN) and National Bureau of Statistics (NBS). The data on prices of Dangote fuel and NNPC fuel were collected weekly from the first week of September 2024 until the last week of May 2025 from the two institutions directly. The data is a dated-panel data. Data on fuel supply of both companies are collected in million liters and also weekly. Data on exchange and inflation rates were gotten from Exchange rate.org and the NBS.

3.3 Model Specification

To examine the sensitivity of Dangote and NNPC individual PMS prices to international crude oil prices and exchange rates, separate econometric models will be developed for NNPC and Dangote. Model Specification is as stated:

$$P_{nnpc} = \alpha + \alpha_1 crude + \alpha_2 EXR + \alpha_3 INF + \mu_t \quad (i)$$

$$P_{Dangote} = \beta_0 + \beta_1 crude + \beta_2 EXR + \beta_3 INF + \mu_t. \quad (ii)$$

The Autoregressive Distributed Lag (ARDL) model was adopted for this study due to its flexibility in handling variables with mixed orders of integration, specifically I(0) and I(1), without requiring all series to be stationary at the same level. This is particularly suitable for

the present analysis, where unit root tests revealed a combination of stationary and non-stationary processes among the variables—international crude oil prices, exchange rate, inflation, and Premium Motor Spirit (PMS) pump prices for Dangote Refinery and NNPC Ltd. The ARDL framework, as established by Pesaran, Shin, and Smith (2001), also allows for simultaneous estimation of both short-run dynamics and long-run relationships within a single reduced-form equation, making it well-suited for markets characterized by structural adjustments and policy shifts such as Nigeria's downstream petroleum sector. Furthermore, ARDL is efficient in small sample sizes, as it provides unbiased long-run estimates and valid t-statistics even when some regressors are endogenous. This property is essential given the relatively short weekly data span (September 2024–July 2025) analyzed in this study. Therefore, to capture both the short-run and long-run dynamics of the relationships as well as their long run cointegration, the Autoregressive Distributed Lag (ARDL) model was adopted following the work of Oyadeyi (2024), and the model is specified as follows:

$$\Delta P_t^{nnpc} = \alpha_0 + \alpha_1 \sum_{i=1}^{p} \Delta P\ nnpc_{t-i} + \alpha_2 \sum_{j=0}^{q1} \Delta crude_{t-j} + \alpha_3 \sum_{k=0}^{q2} \Delta EXR_{t-k} + \alpha_4 \sum_{l=0}^{q3} \Delta INF_{t-l} + \lambda_1 P^{nnpc}_{t-i} + \lambda_2 crude_{t-i} + \lambda_3 EXR_{t-i} + \lambda_4 INF_{t-i} \epsilon_t \quad \text{(iii)}$$

$$\Delta P_t^{Dangote} = \beta_0 + \alpha_1 \sum_{i=1}^{p} \Delta P\ Dangote_{t-i} + \beta_2 \sum_{j=0}^{q1} \Delta crude_{t-j} + \beta_3 \sum_{k=0}^{q2} \Delta EXR_{t-k} + \beta_4 \sum_{l=0}^{q3} \Delta INF_{t-l} + \delta_1 P^{Dangote}_{t-i} + \delta_2 crude_{t-i} + \delta_3 EXR_{t-i} + \delta_4 INF_{t-i} + \epsilon_t \quad \text{(iv)}$$

Where:

PNNPC and PDangote represent the retail pump prices of Premium Motor Spirit (PMS) as set by the Nigerian National Petroleum Company Limited (NNPC) and Dangote Refinery, respectively, serving as the dependent variables in the models. CRUDE denotes the international crude oil price, measured in U.S. dollars per barrel, as fluctuations in global crude oil prices are expected to influence domestic PMS prices due to crude oil being the primary input in PMS production. EXR represents the naira–dollar exchange rate, which directly affects the domestic cost of importation, refining, and distribution of PMS because petroleum products and crude oil are priced in dollars. INF is the inflation rate, included as a control variable to capture the general rise in domestic price levels and account for macroeconomic shocks that may independently influence PMS pricing. Δ denotes the first-difference operator in the ARDL specification, used to capture short-run dynamics of the variables, while μt represents the error term, accounting for unobserved shocks or omitted variables that might affect PMS prices but are not explicitly included in the model.

3.4. Post estimation tests

Nevertheless, the study conducted several post-estimation diagnostic tests to validate the assumptions of the ARDL regression model and ensure the reliability of its estimates. Specifically, the Breusch-Pagan test was employed to detect heteroskedasticity in the residuals (Breusch & Pagan, 1979), while the Breusch-Godfrey Serial Correlation LM test was used to examine the presence of autocorrelation (Breusch, 1978). The Jarque-Bera test was applied to assess the normality of residuals (Jarque & Bera, 1987), and the Variance Inflation Factor (VIF) test was conducted to check for multicollinearity among the independent variables (O'Brien, 2007). In addition, the model's overall stability and specification were evaluated using the Ramsey RESET test (Ramsey, 1969) and the CUSUM/CUSUMSQ tests (Brown, Durbin, & Evans, 1975). These diagnostic checks ensured that the assumptions of linearity, independence, homoscedasticity, and normality were not violated, thereby enhancing the robustness of the estimated coefficients and the reliability of subsequent inference.

4. RESULT AND DISCUSSIONS

This chapter presents and discusses the results obtained from the analysis of the interaction between NNPC Ltd and the Dangote Refinery in Nigeria's downstream petroleum market. It begins with the trend analysis and descriptive statistics of the variables employed in the study, followed by the results of the pre-estimation tests to assess stationarity and model adequacy. The chapter further outlines the estimation results from the ARDL models, along with post-estimation diagnostics, and concludes with a discussion of the findings in relation to existing literature and policy implications.

4.1 Descriptive Statistics

The descriptive statistics of the variables used in this study are presented in Table 4.1. The variables are defined as follows: PNNPC (Retail Pump Price of PMS by NNPC Ltd), PDangote (Retail Pump Price of PMS by Dangote Refinery), CRUDE (International crude oil price, measured in U.S. dollars per barrel), EXR (Naira–U.S. dollar exchange rate), and INF (Inflation rate). The table reports the mean, median, standard deviation, minimum, and maximum values of each variable for the study period, providing an overview of their central tendency and dispersion. The descriptive statistics serve as a preliminary assessment of the data characteristics, offering insights into potential volatility in PMS pricing, exposure to international crude price fluctuations, and the influence of macroeconomic variables on downstream petroleum market dynamics.

Table 4.1 Descriptive Statistics

	PDANGOTE	PNNPC	OIL_PRICE	EXCHANGE_RATE	INF
Mean	923.0000	956.8750	73.04875	1579.666	27.73125
Median	894.5000	957.5000	74.10500	1577.745	24.35500
Maximum	1150.000	1050.000	79.27000	1675.250	34.80000
Minimum	825.0000	880.0000	64.98000	1502.490	22.97000
Std. Dev.	104.7746	64.63842	4.517216	56.04059	5.572090
Skewness	1.321558	0.126420	-0.612963	0.390541	0.498950
Kurtosis	3.828199	1.680570	2.510450	2.257243	1.290301
Jarque-Bera	2.557326	0.601608	0.580851	0.387259	1.306292
Probability	0.278409	0.740223	0.747945	0.823963	0.520406
Sum	7384.000	7655.000	584.3900	12637.33	221.8500
Sum Sq. Dev.	76844.00	29246.88	142.8367	21983.83	217.3373
Observations	40	40	40	40	40

Source: Researcher's computation using E-views 13 (2025)

From Table 4.1, it is observed that the mean values of Dangote PMS price (923.00) and NNPC PMS price (956.88) are close to their respective medians (894.50 and 957.50), maximums (1150.00 and 1050.00), and minimums (825.00 and 880.00), indicating relatively low dispersion in their price movements. A similar pattern is observed for international oil price (73.05 USD/bbl), exchange rate (1,579.67 NGN/USD), and inflation rate (27.73%), where the mean and median are not significantly far apart, suggesting that the variables are fairly stable within the period under study. The standard deviation values further confirm this, with Dangote and NNPC prices showing moderate volatility (104.77 and 64.64, respectively), while oil price (4.52) and exchange rate (56.04) exhibit lower variability. Inflation, however, recorded a relatively higher standard deviation (5.57), reflecting moderate fluctuations over the study period.

The skewness statistics indicate that Dangote prices (1.32) are positively skewed, implying a longer right tail in the distribution, while NNPC prices (0.12) and inflation (0.49) are nearly symmetric. Oil price (-0.61) exhibits slight negative skewness, and exchange rate (0.39) shows mild positive skewness. The kurtosis results reveal that Dangote prices (3.83) are leptokurtic (slightly more peaked than normal), whereas NNPC prices (1.68), exchange rate (2.26), and inflation (1.29) are platykurtic, suggesting flatter distributions. The Jarque-Bera probabilities for all variables are greater than 5%, indicating that the null hypothesis of normality cannot be rejected, and thus, the variables are approximately normally distributed.

4.2 Unit Root test

The study conducted unit root tests using both the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) methods to determine the order of integration of the variables employed in the analysis. The results are presented in Table 4.2 below.

Table 4.2 Unit Root Test

Variables	Tests at Level ADF Test	Tests at Level PP Test	Tests at First difference ADF	Tests at First difference PP	Order of Integration
P_Dangote	-1.981773	-1.970808	-3.9686**	-6.264017**	I(1)
S_Dangote	-1.600467	-1.37531	-4.2919**	-7.552452**	I(1)
P_NNPC	-1.477967	-1.350726	-3.2149**	-3.607324**	I(1)
S_NNPC	-3.450062**	-1.350726	-3.4501**	-7.24452**	I(0)
EXR	-1.391405	-1.421389	-2.4333**	-2.260519	I(1)
INF	-0.808558	-0.600649	-2.2308**	-2.99609	I(1)
Oil Price	-0.037925	-0.037925	-1.9833**	-2.188313	I(1)

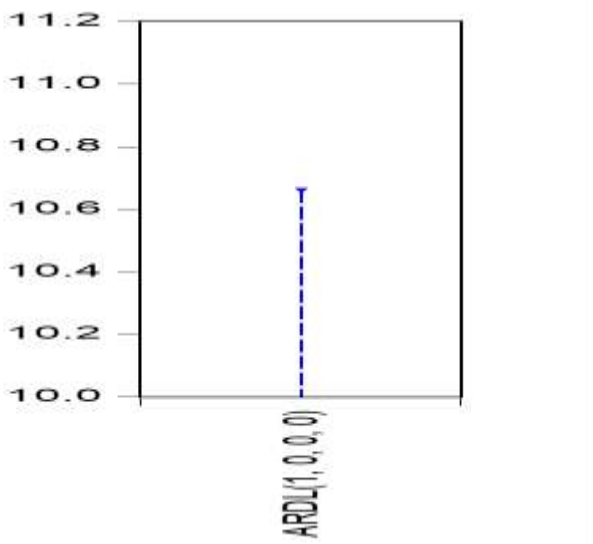
Source: Researcher's computation using E-views 13 (2025)

Table 4.2 presents the results of the ADF and PP unit root tests for the variables used in this study. The results show that P_Dangote, S_Dangote, P_NNPC, EXR, INF, and Oil Price are all stationary at first difference, i.e., they follow an I(1) process, as their test statistics become significant only after first differencing at the 5% level of significance. However, S_NNPC is stationary at level, i.e., I(0), indicating that it does not require differencing to achieve stationarity. The mixture of orders of integration (I(0) and I(1)) among the variables justifies the use of the Autoregressive Distributed Lag (ARDL) approach for the analysis, as ARDL is suitable for variables integrated at both levels and first difference without the need for all variables to be integrated of the same order (Dickey & Fuller, 1979; Phillips & Perron, 1988).

4.3 Model Selection Criteria

Since the variables were found to be a mix of I(0) and I(1) processes, the study employed the Autoregressive Distributed Lag (ARDL) model based on the lag selection criteria in order to determine the short-run and long-run characteristics of the series. The Akaike Information Criterion (AIC) was used to select the optimal lag length for each model. The results of the lag selection criteria are presented in Figure 4.1.

Fig 4.1 Model selection Using Akaike Information Criterion



Source: Researcher's computation using E-views 13 (2025).

Figure 4.1 presents the lag selection criteria using the Akaike Information Criterion (AIC). The results reveal that the AIC selected ARDL (1, 0, 0, 0) as the optimal model specification for both the Dangote PMS price model and the NNPC PMS price model, indicating that one lag of the dependent variable and zero lags for the independent variables provide the most parsimonious and statistically appropriate model among the available options.

4.4 ARDL Cointegration Analysis

After selecting the optimal lag model for the ARDL regression analysis, this study examines the presence of long-run relationships among the variables using the ARDL bounds test, based on the null hypothesis of no long-run relationship. The results for both the Dangote and NNPC models are reported in Table 4.3 and Table 4.4 below.

Table 4.3: Dangote Model ARDL Bounds Test

F-statistic	Significance	I(0) bounds	I(1) bounds	Null hypothesis
6.612003	10%	2.01	3.1	No long-run Relationship
K=3	5%	2.45	3.63	
	2.50%	2.87	4.16	
	1%*	3.42	4.84	

Source: Researcher's computation using E-views 13 (2025

Table 4.4: NNPC Model ARDL Bounds Test

F-statistic	Significance	I(0) bounds	I(1) bounds	Null hypothesis
5.860134	10%	2.01	3.1	No long-run Relationship
K=3	5%	2.45	3.63	
	2.50%	2.87	4.16	
	1%*	3.42	4.84	

Source: Researcher's computation using E-views 13 (2025)

The results in Table 4.3 indicate that for the Dangote model, the computed F-statistic (6.612003) lies above the upper bound critical values at the 10%, 5%, 2.5%, and 1%

significance levels, thereby rejecting the null hypothesis of no long-run relationship. This suggests that the variables in the Dangote model are cointegrated in the long run.

However, for the NNPC model, the computed F-statistic (5.860134) lies above the upper bound critical values at the 10%, 5%, 2.5%, and 1% significance levels, thereby rejecting the null hypothesis of no long-run relationship. This indicates that the variables in the NNPC model are also cointegrated in the long run, similar to the findings for the Dangote model.

4.5 Long Run Estimation

Following the confirmation of long-run relationships through the ARDL bounds test, the next step is to estimate the long-run coefficients to determine the elasticity of the explanatory variables on PMS prices for both the Dangote and NNPC models. The results are presented in Tables 4.5 and 4.6 below.

Table 4.5 Long Run Coefficients for NNPC

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
PDANGOTE(-1)	-0.565107	0.307891	-1.835409	0.1638
EXCHANGE_RATE	0.150931	0.235298	-0.641446	0.0569
OIL_PRICE	23.36817	6.327376	3.693186	0.0344
INF	0.448707	5.755579	-0.07796	0.9428

Source: Researcher's computation using E-views 13 (2025)

Table 4.6 Long Run Coefficients for NNPC

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
PNNPC(-1)	-0.197587	0.403068	-0.490207	0.6576
OIL_PRICE	3.43092	3.695793	0.928331	0.0421
INF	5.685678	4.565539	1.245347	0.3014
EXCHANGE_RATE	0.467808	0.178302	2.623682	0.0788

Source: Researcher's computation using E-views 13 (2025)

The results in Table 4.5 indicate that for the Dangote model, the lagged PMS price (DANGOTE (-1)) has a negative coefficient (-0.5651) but is statistically insignificant (p = 0.1638), suggesting that past prices have no significant long-run effect on current prices. The exchange rate has a positive coefficient (0.1509) and is marginally significant (p = 0.0569), indicating that a depreciation of the naira tends to increase Dangote's PMS price in the long run. Oil price (23.3682) is positive and statistically significant at the 5% level (p = 0.0344), revealing that increases in global crude prices exert a strong upward pressure on Dangote's PMS price. Inflation (0.4487) is positive but statistically insignificant (p = 0.9428), implying limited long-run influence on Dangote's price determination.

For the NNPC model (Table 4.6), the lagged PMS price (NNPC(-1)) is negative (-0.1976) and statistically insignificant (p = 0.6576), similar to the Dangote model. Oil price (3.4309) is positive and statistically significant at the 5% level (p = 0.0421), showing that international crude price increases have a strong pass-through effect on NNPC's pump prices in the long run. Inflation (5.6857) is positive but insignificant (p = 0.3014), while the exchange rate

(0.4678) is positive and marginally significant (p = 0.0788), indicating that exchange rate depreciation tends to raise NNPC's PMS prices over time.

The coefficient of determination (R-squared) further provides insight into the explanatory power of the estimated models. For the Dangote model, the R-squared value of 0.8155 indicates that approximately 81.55% of the variations in Dangote's PMS prices are explained by the included independent variables (oil price, exchange rate, inflation, and lagged price). This reflects a strong model fit, suggesting that the selected variables capture the key long-run determinants of Dangote's pricing dynamics. For the NNPC model, the R-squared value of 0.7589 shows that about 75.89% of the variations in NNPC's PMS prices are explained by the model, which also represents a satisfactory level of explanatory power. The relatively higher R-squared in the Dangote model implies that its pricing is more closely linked to the considered macroeconomic and market variables compared to the NNPC model.

4.6 Short Run Estimation

Having established the presence of cointegration and estimated the long-run coefficients, the next step is to estimate the short-run coefficients and determine the speed of adjustment through the Error Correction Term (ECT). The results for both the NNPC and Dangote models are presented below.

Table 4.7: Short-Run Estimation Result for NNPC Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
D(PNNPC(-1))	-0.008745	0.039336	-0.222304	0.8384
D(OIL_PRICE)	8.065384	5.113504	1.577271	0.2128
D(INF)	-0.460241	4.348356	-0.105842	0.9224
D(EXCHANGE_RATE)	1.121508	0.305107	3.675791	0.0349
CointEq(-1)*	-0.897587	0.250362	-4.783416	0.0174

Source: Researcher's computation using E-views 13 (2025)

Table 4.8: Short-Run Estimation Result for Dangote Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
D(PDANGOTE(-1))	-0.008773	0.087335	-0.100456	0.9263
D(EXCHANGE_RATE)	1.368936	0.664671	2.059569	0.1316
D(INF)	-10.90133	9.652598	-1.129367	0.3409
D(OIL_PRICE)	29.08705	11.41652	2.547803	0.0841
CointEq(-1)*	-0.765107	0.215195	-7.272965	0.0054

Source: Researcher's computation using E-views 13 (2025)

An examination of Table 4.7 reveals that the error correction term (CointEq(-1) = -0.8976, p = 0.0174) is negative and statistically significant at the 5% level, indicating a strong and stable adjustment process toward long-run equilibrium in the NNPC model. This suggests that any short-term deviation from equilibrium will be corrected by approximately 80% within the next period, implying a relatively fast speed of adjustment. In the short run, oil price (D(OIL_PRICE)) is positive but statistically insignificant (p = 0.2128), while inflation (D(INF)) is negative and insignificant (p = 0.9224). However, exchange rate (D(EXCHANGE_RATE)) is positive and statistically significant at the 5% level (p = 0.0349), suggesting that exchange rate depreciation increases NNPC's PMS prices in the short run.

For the Dangote model (Table 4.8), the error correction term (CointEq(-1) = -0.7651, p = 0.0054) is also negative and statistically significant at the 1% level, confirming a stable long-

run equilibrium adjustment mechanism, with deviations corrected by about 77% in the following period—indicating a very fast adjustment speed. In the short run, oil price (D(OIL_PRICE)) is positive and marginally significant (p = 0.0841), while exchange rate (D(EXCHANGE_RATE)) is positive but statistically insignificant (p = 0.1316). Inflation (D(INF)) is negative and insignificant (p = 0.3409), and the lagged Dangote price (D(DANGOTE(-1))) is negative but also statistically insignificant (p = 0.9263).

4.7 Post Estimation Diagnostic Checks

The diagnostic tests for serial correlation, heteroscedasticity, functional form, and stability of the estimated models were carried out to ensure the robustness and adequacy of the ARDL models for both Dangote and NNPC. The results are presented below.

4.7.1 Serial Correlation Test

Table 4.8 Serial Correlation Test for Dangote Model

Breusch-Godfrey Serial Correlation LM Test:				**Remarks**
F-statistic	1.576967	Prob. F(2,1)	0.4906	No Seral Correlation
Obs*R-squared	5.31485	Prob. Chi-Square(2)	0.0701	

Source: Researcher's computation using E-views 13 (2025)

Table 4.9 Serial Correlation Test for NNPC Model

Breusch-Godfrey Serial Correlation LM Test:				**Remarks**
F-statistic	0.853252	Prob. F(2,1)	0.6078	No Seral Correlation
Obs*R-squared	4.413638	Prob. Chi-Square(2)	0.1101	

Source: Researcher's computation using E-views 13 (2025)

For the Dangote model, the Breusch-Godfrey Serial Correlation LM test shows an F-statistic of 1.5769 with a p-value of 0.4906, and the Obs*R-squared statistic of 5.3149 has a p-value of 0.0701. This indicates that the null hypothesis of no serial correlation cannot be rejected at conventional significance levels, suggesting that the Dangote model is free from serial correlation.

Similarly, for the NNPC model, the test produced an F-statistic of 0.8533 with a p-value of 0.6078, and the Obs*R-squared statistic of 4.4136 with a p-value of 0.1101, also failing to reject the null hypothesis of no serial correlation. Hence, the NNPC model is free from serial correlation as well.

4.7.2 Heteroskedasticity Test

Table 4.10 Heteroskedasticity Test for Dangote Model:

Heteroskedasticity Test: Breusch-Pagan-Godfrey				**Remark**
F-statistic	0.276767	Prob. F(4,2)	0.873	H0: Homoskedasticity
Obs*R-squared	2.494146	Prob. Chi-Square(4)	0.6457	
Scaled explained SS	0.376978	Prob. Chi-Square(4)	0.9843	

Source: Researcher's computation using E-views 13 (2025)

Table 4.11 Heteroskedasticity Test for NNPC Model:

Heteroskedasticity Test: Breusch-Pagan-Godfrey				**Remark**
F-statistic	1.45373	Prob. F(4,2)	0.4463	H0: Homoskedasticity
Obs*R-squared	5.208555	Prob. Chi-Square(4)	0.2666	
Scaled explained SS	0.674443	Prob. Chi-Square(4)	0.9544	

Source: Researcher's computation using E-views 13 (2025)

The Breusch-Pagan-Godfrey heteroskedasticity test results indicate that for the Dangote model, the F-statistic is 0.2768 (p = 0.8730) and the Obs*R-squared statistic is 2.4941 (p = 0.6457), while for the NNPC model, the F-statistic is 1.4537 (p = 0.4463) and the Obs*R-squared statistic is 5.2086 (p = 0.2666). In both cases, the null hypothesis of homoskedasticity cannot be rejected, suggesting that the residuals are homoskedastic and the models are free from heteroskedasticity.

4.7.3 Ramsey RESET Test

Table 4.12 Ramsey RESET Test for Dangote Model:

Test	Value	df	Probability	Remarks
t-statistic	0.230139	2	0.8394	No Equation
F-statistic	0.052964	(1, 2)	0.8394	Misspecification

Source: Researcher's computation using E-views 13 (2025)

Table 4.12 Ramsey RESET Test for NNPC Model:

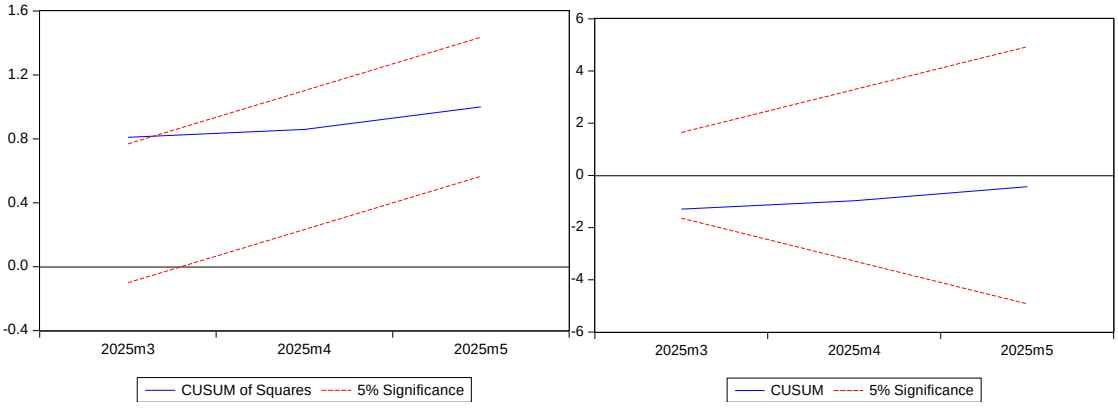
Test	Value	df	Probability	Remarks
t-statistic	2.376551	2	0.1406	No Equation
F-statistic	5.647993	(1, 2)	0.1406	Misspecification

Source: Researcher's computation using E-views 13 (2025)

The Ramsey RESET test for the Dangote model produced a t-statistic of 0.2301 (p = 0.8394) and an F-statistic of 0.05296 (p = 0.8394), indicating no evidence of model misspecification. For the NNPC model, the t-statistic was 2.3766 (p = 0.1406) and the F-statistic was 5.6480 (p = 0.1406), also showing no evidence of functional form misspecification.

Fig 4.2 and Fig 4.3 Normality tests for Dangote Model

4.7.4 Model Stability Test



Source: Researchers' computation using E-views 13 (2025)

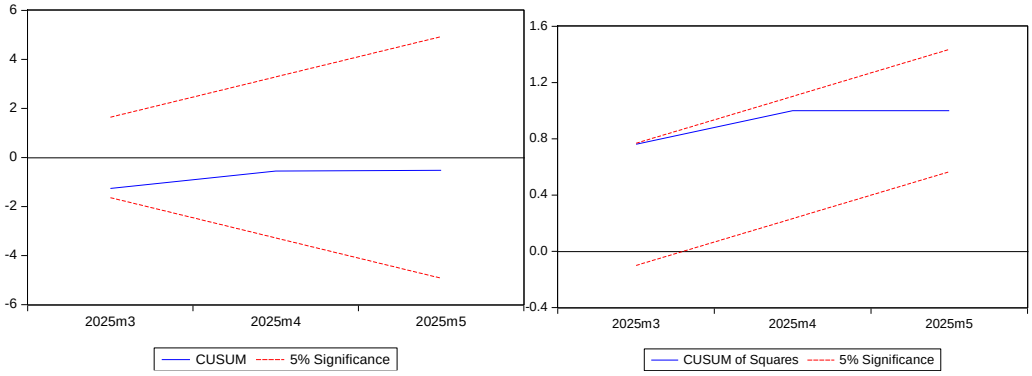


Fig 4.4 and Fig 4.5 Normality tests for NNPC Model
Source: Researchers' computation using E-views 13 (2025)

While the above tests confirm the absence of serial correlation and heteroskedasticity and no evidence of misspecification, the stability and adequacy of the models will be further assessed using the CUSUM and CUSUMSQ tests (Figures 4.2-4.5). Both models demonstrated stability as the plots remained within the 5% significance bands, indicating that the ARDL models for Dangote and NNPC are robust, stable, and adequate for policy analysis.

4.8 The supply trends of Premium Motor Spirit (PMS) by NNPC Ltd and the Dangote Refinery.

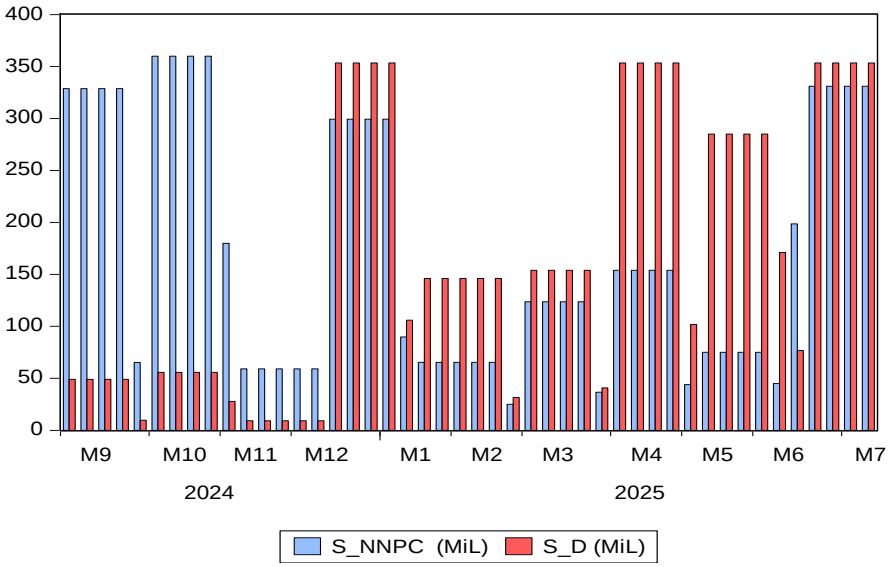


Figure 4.6: PMS Supply Trends by NNPC and Dangote Refinery
Source: Data from the NNPC and Dangote Refinery

The figure illustrates monthly fuel supply volumes (in million liters) by NNPC and Dangote Refinery from September 2024 to July 2025. In the final quarter of 2024, NNPC was the dominant supplier of over 340 million liters monthly in September and October. However, this dropped sharply in November and December, while Dangote's supply rose dramatically in December 2024 to 360 million liters, marking the start of a significant operational ramp-up. This shift suggests a transitional phase in Nigeria's domestic fuel production landscape, with Dangote increasingly taking over a role traditionally held by NNPC.

From January to March 2025, Dangote maintained steady supply levels of 140–160 million liters, becoming the primary supplier, while NNPC's contribution remained minimal. By April 2025, NNPC began to recover, gradually increasing its output to match Dangote's level of 360 million liters by July 2025. This period reflects a rebalancing of supply between the two entities, possibly driven by strategic reforms or infrastructural developments. Overall, the figure captures a clear shift in fuel supply dynamics, signaling growing private sector participation in Nigeria's downstream oil sector and potential improvements in energy self-sufficiency.

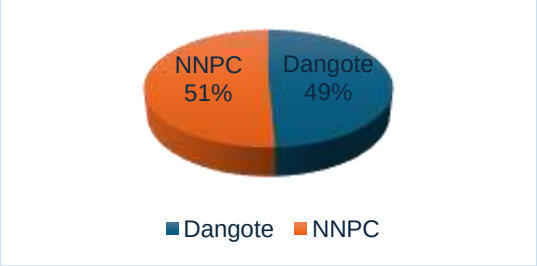


Figure 4.7: Pie Chart of PMS Supply by Dangote Refinery and NNPC
Source: Data from the NNPC and Dangote Refinery

The figure shows NNPC and Dangote individual percentage share in the total PMS supply from September 2024 to May 2025. Dangote has 49% of the total share of PMS supply while NNPC has 51%. This shows how fast Dangote refinery has met the demand in only few months.

4.9 Impact of the Dangote Refinery on Petroleum Importation

The figure provides a visual representation of a pivotal transformation in Nigeria's fuel supply chain, particularly in the context of fuel imports. Historically, NNPC was the sole provider of fuel in the country, responsible not only for limited local production but also for importing the bulk of refined petroleum products to meet domestic demand. This high volume likely included a significant portion of imported fuel, as Nigeria lacked fully operational private refining capacity at that time.

However, a dramatic shift occurs starting in December 2024, as shown by the steep decline in NNPC's supply and the simultaneous surge in Dangote's contribution, which hits 360 million liters. This period coincides with the operational ramp-up of the Dangote Refinery, Nigeria's largest private refinery. The increasing monthly supply from Dangote from January to July 2025, reaching consistent levels similar to NNPC's former output, indicates that a substantial portion of domestic fuel demand is now being met through local production. This shift reduces the need for imports, as Dangote's refinery processes crude oil domestically and distributes refined products directly within Nigeria.

By mid-2025, both NNPC and Dangote were supplying large and nearly equal volumes of fuel, each exceeding 300 million liters monthly. However, unlike NNPC's previous model that relied heavily on imports, Dangote's output is entirely domestically refined. This development marks a significant reduction in Nigeria's dependence on fuel imports, signaling the country's move toward energy self-sufficiency. The figure, therefore, not only illustrates the competition between two major fuel suppliers but also serves as a proxy for tracking the decline in imported fuel as Dangote's refinery begins to fulfill a critical share of national demand through domestic production.

4.10 PMS Pricing Formula

Based on internal documents from Dangote Refinery and NMDPRA, the following constitute the major components that determine the price of PMS of major PMS suppliers like that of Dangote Refinery and NNPC in Nigeria.

Global Crude oil price: The Dangote PMS Price is also flexible and dependent on the global crude oil price. In January 2025, the price increased as a result of an increment in Global crude price to $82.

Exchange Rate Impact: The exchange rate plays a crucial role in determining PMS prices, as crude oil feedstock is priced in U.S. dollars while domestic sales are conducted in naira. Fluctuations in the naira-dollar exchange rate directly affect the cost of crude procurement and, consequently, the final pump price. For instance, during periods of naira depreciation, import and feedstock costs rise, exerting upward pressure on ex-depot and retail PMS prices, particularly for suppliers relying on market-linked or foreign currency-denominated contracts.

Purchase Volume: the price also depends on the quantity bought. Bulk buyers acquiring between 2 million and 4.99 million litres pay ₦955 per litre, while those purchasing 5 million litres or more pay ₦950 per litre as of May 2025.

Table 4.13: Regional Prices of PMS by Distributors of Dangote PMS

Region	**MRS (₦/L)**	**AP/Heyden (₦/L)**
Lagos	860	865
South-West	870	875
North	880	885
South-South & South-East*	890	895

Source: MSME Africa (July 2025 price list report)

Price Differentiation: Prices vary depending on the location of consumption to account for transportation costs. Major distributors of the Dangote refinery set prices based on destination. In July 2025, a new price list was published as shown in table 4.13, as reported by MSME Africa.

Table 4.14: PMS Pricing Breakdown

Component	**Description**	**Estimated Contribution (₦/L)***
Crude Oil Cost	Cost of crude feedstock sourced via NNPC or market-linked contracts, benchmarked to Brent crude.	600–650
Refining & Operational Costs	Covers workforce wages, energy inputs (gas/electricity), maintenance, and capital recovery.	50–70
Logistics & Distribution	Transportation from Lekki to regional depots, storage, security surcharges, and handling fees.	30–45
Regulatory Fees (NMDPRA)	Statutory charges; reduced from ₦8.99 to ₦4.495 per litre in 2024/2025.	~4.50
Quality Inspection Fees	Previously ₦0.95 per litre; currently removed to promote competitiveness.	0
Foreign Exchange Impact	Exchange rate differentials arising from crude purchase (USD) and local sales (₦).	20–40
Profit Margin	Mark-up retained by Dangote Refinery depending on purchase volume and negotiation.	15–25
Regional Price Adjustment	Variation based on delivery location (e.g., Lagos vs. North).	10–15

Source: Internal working document of NMDPRA

The pricing of Premium Motor Spirit (PMS) from the Dangote Refinery reflects a complex interplay of cost elements that collectively shape the pump price. Each liter of Dangote petrol incorporates direct and indirect cost factors that can be broadly categorized into crude oil feedstock costs, refining and operational expenses, logistics and distribution costs, regulatory charges, financing and foreign exchange components, and profit margins.

Firstly, the crude oil cost constitutes the largest portion of the price. Dangote Refinery procures crude either through NNPC's crude allocation or via market-based contracts, with the price linked to international Brent crude oil benchmarks. Variations in crude prices directly affect the ex-refinery cost per liter.

Secondly, refining costs encompass operational overheads, workforce remuneration, energy inputs (particularly natural gas and electricity), routine maintenance, and capital cost recovery, especially given the multi-billion-dollar infrastructure financing that underpins the refinery's construction.

Thirdly, logistics and distribution costs represent the expenses incurred in transporting refined PMS from the refinery in Lekki to various depots and regional terminals across Nigeria. These costs are influenced by prevailing freight rates, security surcharges on transport corridors, and associated storage charges at depots. Regulatory charges form another critical component, including the Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA) fees, quality inspection levies, and statutory taxes. The NMDPRA fee, for instance, has been reduced from ₦8.99 to ₦4.495 per liter, while inspection fees, previously ₦0.95 per liter, were removed to encourage competitive pricing.

Furthermore, foreign exchange dynamics introduce volatility into the pricing template. The refinery operates within a dual-currency arrangement—while crude oil is globally denominated in US dollars, local sales are in naira. Fluctuations in the exchange rate between these currencies directly affect the cost pass-through, especially during the pilot 'Naira for Crude' program between October 2024 and March 2025. Profit margins are also integrated into the final price, albeit adjusted for competitive positioning vis-à-vis NNPC and other marketers. Dangote employs a volume-based pricing system, where bulk purchasers (5 million liters and above) attract a lower price per liter compared to smaller buyers. Additionally, regional price differentiation is applied to account for varying transportation and distribution costs—for example, prices in the northern regions tend to be ₦10–₦15 higher than those in Lagos.

Starting October 1, 2024, NNPC began supplying around 385,000 barrels per day of crude to the Dangote Refinery under a six-month pilot arrangement, with payments made in Naira instead of U.S. dollars. This was a departure from earlier September payments, which were in USD. By December, approximately 48.6 million barrels had been transferred under the Naira scheme. This shift allowed Dangote to pay for feedstock in local currency while selling refined fuels domestically in Naira.

Despite incurring foreign exchange losses—since crude is globally priced in dollars, the arrangement relieved pressure on Nigeria's USD reserves by reducing demand for dollars to import refined petroleum, thereby helping to stabilize the Naira and PMS prices. However, the deal was suspended in March 2025, as NNPC cited forward contracts and limited crude availability. That suspension raises concerns that a renewed dollar-based payment requirement could increase operational costs, fuel prices, and volatility in the FX market, potentially reversing earlier gains in currency and market stability.

Table 4.15: Comparative Analysis of Pricing Models

Component	**Pre 2024**	**2024-2025**
Pricing Authority	Government Regulated	Market driven
Price Determinants	Subsidies, Margins	Crude prices, purchase volumes
Buyer access	Primarily NNPC Ltd	NNPC and other marketers
Currency	Naira	Paid in Naira but USD domination
Price/ Flexibility	Low	High

Source: Researcher's Analysis.

The Nigerian downstream petroleum pricing model has undergone a fundamental transformation with the advent of the Dangote Refinery. Prior to 2024, PMS pricing was largely determined through a government-controlled template anchored on subsidies, fixed margins, and regulated ex-depot prices. The Nigerian National Petroleum Company Limited (NNPC Ltd) monopolized imports and determined pump prices based on subsidy allocations, landing costs, and pre-determined distribution margins. This structure suppressed market forces and often created distortions such as smuggling, hoarding, and periodic scarcity.

In contrast, the post-Dangote era (2024–2025) reflects a market-responsive model driven by cost-reflective pricing. Dangote Refinery introduced a flexible pricing mechanism that links PMS prices to international crude oil benchmarks, exchange rate fluctuations, and purchase volumes. For instance, while pre-2024 pricing offered limited regional variation, the Dangote model differentiates prices across Lagos, Southwest, North, and South-South/Southeast corridors to reflect logistics realities.

Another major distinction lies in the role of foreign exchange. Under the former regime, the government bore much of the foreign exchange burden through subsidies, thereby insulating pump prices from full exposure to currency depreciation. With Dangote's entry, naira-based payments were piloted between October 2024 and March 2025, alleviating immediate forex pressures but also introducing new dependencies when the arrangement was suspended in March 2025. Empirical data between September 2024 and May 2025 show that Dangote's ex-refinery prices were more sensitive to international crude oil price movements compared to NNPC's, with an elasticity coefficient of approximately 43 units per dollar increase in Brent price, as established in the OLS results. While this shift enhances price transparency and reduces fiscal subsidy burdens, it also exposes domestic consumers to global market volatilities. Thus, the comparative model analysis underscores a movement from a rigid, subsidy-driven framework to a semi-liberalized, cost-reflective pricing ecosystem with both opportunities for efficiency gains and risks of inflationary pass-throughs.

5. Conclusion and Recommendations

This study examined the pricing dynamics of Premium Motor Spirit (PMS) in Nigeria's downstream market by modeling separate ARDL systems for Dangote and NNPC. Unit-root results showed a mix of I(0) and I(1) processes, validating ARDL. Bounds tests confirmed cointegration in both models, indicating stable long-run relationships between PMS prices and their macro drivers. In the long run, international oil price exerts the strongest and statistically significant influence on both Dangote and NNPC pump prices (Dangote: $\beta \approx 23.37$, $p \approx 0.03$; NNPC: $\beta \approx 3.43$, $p \approx 0.04$). The exchange rate is positive and borderline significant for Dangote ($p \approx 0.06$) and NNPC ($p \approx 0.08$), implying meaningful pass-through from naira depreciation to domestic pump prices. Inflation is positive but not statistically significant in either model, suggesting that general price pressures matter less for administered/wholesale PMS pricing than oil and FX fundamentals over the sample. Goodness of fit is strong ($R^2 \approx 0.82$ for Dangote; $R^2 \approx 0.76$ for NNPC), with the higher R^2 for Dangote implying its prices are more tightly linked

to these market fundamentals, while NNPC pricing likely reflects additional policy or operational factors not explicitly modeled.

Short-run estimates show asymmetric sensitivities: NNPC prices respond immediately to exchange-rate changes (ΔEXR positive, $p \approx 0.03$), whereas Dangote prices react more to oil-price shocks (ΔOil positive, marginal $p \approx 0.08$). Error-correction terms are negative and highly significant in both models (Dangote ECT≈ -0.77, $p < 0.01$; NNPC ECT≈ -0.90, $p < 0.05$), evidencing rapid—indeed, over-correcting—adjustment back to long-run equilibrium after short-run shocks. Post-estimation diagnostics indicate no serial correlation, homoskedastic residuals, no functional-form misspecification, and stability (CUSUM/CUSUMSQ within 5% bands). Taken together, the evidence points to a market where global oil prices and the exchange rate are the dominant drivers of domestic PMS pricing, with firm-specific frictions (state vs. private) shaping which shock bites faster in the short run.

Policy Recommendations

1. Anchor prices to fundamentals while smoothing shocks. Adopt/strengthen an automatic pricing template that links retail prices to import-parity or netback fundamentals (oil price and FX) with a transparent smoothing band to avoid abrupt pump-price swings while minimizing quasi-fiscal costs.
2. Stabilize FX access for downstream operators. Prioritize predictable FX supply for PMS, consider naira-for-crude arrangements and forward-FX windows for importers/off-takers to dampen exchange-rate pass-through—especially relevant for NNPC's short-run FX sensitivity.
3. Codify access and competition rules. Issue clear open-access regulation for pipelines, depots, jetties, and truck-loading racks; publish non-discriminatory access tariffs and service-level standards to prevent bottlenecks and reduce logistics premia.
4. Improve supply coordination between NNPC and Dangote. Establish an operational offtake protocol (monthly scheduling, quality specs, tolerance bands) and joint inventory targets (e.g., 10–15 days cover) to reduce stockouts and align output to demand peaks.
5. Strengthen market monitoring and data transparency. A downstream observatory should publish weekly data on ex-depot prices, volumes, utilization, and inland freight so retailers can arbitrage efficiently and regulators can detect margin squeezes or collusive behavior.
6. Logistics and infrastructure upgrades. Prioritize pipeline rehabilitation, coastal shuttle optimization, and last-mile depot upgrades to reduce inland freight costs that can obscure fundamentals and weaken pass-through discipline.
7. Risk management. Encourage (or centrally procure) oil-price and FX hedging instruments for state and qualified private operators to cushion budget/price volatility without re-creating broad subsidies.
8. Targeted social protection—not blanket subsidies. If cushioning is required, prefer time-bound, means-tested transfers or transport vouchers over price caps that sever the fundamental link to oil/FX and fuel scarcity.
9. Regulatory capacity and predictability. Empower the downstream regulator to conduct regular competition assessments, publish cost-of-service reviews, and commit to rule-based adjustments to sustain investment while protecting consumers.
10. Future analytical enhancements. For policy fine-tuning, extend the sample and incorporate structural breaks (e.g., policy regime changes), test asymmetric ARDL for pump-price responses to oil-price rises vs. falls, and include institutional/operational

dummies (e.g., depot outages, import constraints) that may explain the residual variation in NNPC pricing.

These actions directly address the study's core findings: oil and FX fundamentals dominate long-run PMS pricing; exchange-rate shocks transmit faster to NNPC prices, while oil-price shocks show stronger short-run influence on Dangote; and both firms' prices mean-revert quickly. Implementing the recommendations above should improve supply reliability, reduce volatility, and protect consumer welfare without undermining the incentives needed for efficient private and public participation in Nigeria's downstream petroleum market.

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