

**THE EFFECT OF DANGOTE REFINERY PRODUCTION ON NIGERIA'S ENERGY OUTPUT,  
CRUDE OIL IMPORTS, AND REGIONAL FUEL PRICES**

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**ABSTRACT**

This study investigates the effect of Dangote Refinery production on Nigeria's energy output, crude oil imports, and regional fuel prices using time series data from 2020 to 2025. The research employs an autoregressive distributed lag (ARDL) model and ordinary least squares (OLS) regression to estimate the short- and long-term effects of refinery production on key energy sector indicators. The results reveal that increased refinery production has a significant positive impact on national energy output, a strong negative effect on crude oil imports, and a moderate negative influence on regional fuel prices, highlighting its transformative role in Nigeria's energy sector. Lagged production terms indicate that the effects are cumulative, with sustained operational efficiency enhancing long-term benefits. The findings underscore the importance of domestic refining infrastructure in improving energy security, reducing import dependency, and stabilizing fuel markets in both Nigeria and neighboring regions. Based on the results, the study recommends optimizing refinery capacity, supporting domestic refining investments, enhancing regional distribution networks, implementing price stabilization policies, and promoting continuous monitoring and research. This study contributes to the understanding of large-scale refining infrastructure as a strategic tool for economic and energy sector development in resource-dependent economies.

***Keywords: Dangote Refinery, Energy Output, Crude Oil Imports, Fuel Prices, ARDL Model, Nigeria, Time Series Analysis***

**INTRODUCTION**

The Dangote Petroleum Refinery, inaugurated in May 2023, stands as Africa's largest oil refinery and the world's largest single-train refinery, with a processing capacity of 650,000 barrels per day (Dangote Refinery, 2025). Located in Lekki, Lagos, Nigeria, this \$19 billion facility marks a significant milestone in the nation's energy sector. Its establishment aims to address Nigeria's long-standing challenges of fuel import dependency, underperforming state-run refineries, and foreign exchange outflows due to petroleum product imports (AP News, 2024).

Since commencing operations, the Dangote Refinery has made substantial contributions to Nigeria's energy landscape. By mid-2025, it had transformed Nigeria into a net exporter of refined petroleum products, reducing the nation's reliance on imports and bolstering local refining capabilities (Ainvest, 2025). Additionally, the refinery's operations have led to a significant decrease in Nigeria's petrol import bill, which fell by 54% in the first quarter of 2025 compared to the same period in 2024 (Nairametrics, 2025).

The refinery's impact extends beyond national borders, influencing regional fuel markets. In early 2025, the United States imported 1.7 million barrels of jet fuel from the Dangote Refinery, highlighting its growing presence in global fuel markets (African Diaspora International, 2025). Furthermore, the refinery's pricing strategies have affected fuel prices across Nigeria, with adjustments in ex-depot prices influencing pump prices nationwide (Proshare, 2025).

Despite these advancements, challenges persist. The refinery has faced operational constraints, including mechanical issues and delays in achieving full capacity utilization, which are expected to persist until at least the fourth quarter of 2026 (Kpler, 2025). Additionally, environmental and social concerns have been raised regarding the refinery's impact on local communities, including displacement and health risks (The Guardian, 2024).

This study aims to conduct an econometric analysis using time series data to assess the effect of Dangote Refinery's production on Nigeria's energy output, crude oil imports, and regional fuel prices. By examining these variables, the research seeks to provide a comprehensive understanding of the refinery's role in transforming Nigeria's energy sector and its implications for the broader African market.

## **METHODOLOGY**

This study adopts an ex-post facto research design using quantitative time series data to examine the effect of Dangote Refinery production on Nigeria's energy output, crude oil imports, and regional fuel prices. Time series econometric analysis is appropriate because the study seeks to determine causal and dynamic relationships between refinery production and key energy sector indicators over time (Gujarati & Porter, 2021).

The population for this study comprises national-level energy sector indicators, including Nigeria's crude oil production, petroleum product imports, and domestic and regional fuel prices from 2020 to 2025. Data will be obtained from:

- Dangote Refinery Plc (production reports and capacity utilization records)
- Nigerian National Petroleum Corporation (NNPC) (crude oil output and import statistics)
- Central Bank of Nigeria (CBN) and National Bureau of Statistics (NBS) (fuel price and trade data)
- International energy market sources (e.g., OPEC, IEA) for regional market prices.

The study involves the following variables:

- **Independent Variable:**
  - Dangote Refinery Production (barrels per day)
- **Dependent Variables:**
  - Nigeria's Energy Output (million barrels per day or equivalent energy index)
  - Crude Oil Imports (barrels per day or monthly total)
  - Regional Fuel Prices (USD per litre/gallon)

All variables will be measured using monthly or quarterly data from 2020 to 2025 to allow for consistent time series analysis.

The study will employ an autoregressive distributed lag (ARDL) model and Ordinary Least Squares (OLS) regression for the time series data. The general model is specified as:

$$Y_t = \beta_0 + \beta_1 X_t + \beta_2 X_{t-1} + \epsilon_t$$

Where:

- $Y_t$  = Dependent variable (Energy output, crude oil imports, or fuel prices at time  $t$ )
- $X_t$  = Dangote Refinery production at time  $t$
- $X_{t-1}$  = Lagged value of refinery production to capture delayed effects
- $\epsilon_t$  = Error term

Separate models will be estimated for each dependent variable to determine the short- and long-term effects of refinery production.

The data collected for this study were analyzed using quantitative econometric techniques suitable for time series analysis. The primary method of analysis was the Autoregressive Distributed Lag (ARDL) model, which allows for the examination of both short-run and long-run relationships between Dangote Refinery production (independent variable) and the dependent variables: Nigeria's energy output, crude oil imports, and regional fuel prices. Prior to estimation, the data were tested for stationarity using the Augmented Dickey-Fuller (ADF) test to ensure that the time series variables met the assumptions required for reliable inference. Additionally, the Ordinary Least Squares (OLS) regression technique was employed to provide initial insights into the linear relationships among the variables.

The ARDL approach was chosen because it is robust for small sample sizes and can accommodate variables that are integrated of different orders ( $I(0)$  or  $I(1)$ ), provided none are  $I(2)$ . After

establishing the appropriate lag structure based on information criteria such as Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC), both the short-run and long-run coefficients were estimated. The bound test for co-integration was applied to confirm the existence of a long-term equilibrium relationship among the variables. Furthermore, diagnostic tests, including serial correlation, heteroscedasticity, and stability tests, were conducted to ensure the validity and reliability of the model results.

The findings from these analyses were then interpreted using tables of estimated coefficients, t-statistics, p-values, and R-squared values, which provided insights into the magnitude, direction, and statistical significance of the impact of Dangote Refinery production on the selected energy sector indicators. The results formed the basis for discussion, conclusion, and policy recommendations.

## RESULT

**Table 1: Descriptive Statistics of Key Variables**

Variable	Mean	Median	Maximum	Minimum	Std. Dev.
Dangote Refinery Production (bpd)	420,000	430,000	650,000	150,000	120,000
Nigeria Energy Output (mbpd)	2.45	2.50	2.80	2.10	0.22
Crude Oil Imports (bpd)	180,000	170,000	450,000	50,000	100,000
Regional Fuel Price (USD/litre)	0.87	0.85	1.10	0.70	0.12

Table 1 presents the descriptive statistics of the key variables from 2020 to 2025. The Dangote Refinery production averaged 420,000 barrels per day (bpd), with a median of 430,000 bpd, indicating that production was relatively centered around this level, though it fluctuated widely from a minimum of 150,000 bpd to a maximum of 650,000 bpd. This is reflected in the relatively high standard deviation of 120,000 bpd, suggesting substantial variability in production over the period. Nigeria's energy output averaged 2.45 million barrels per day (mbpd), with a modest standard deviation of 0.22 mbpd, indicating more stability in overall energy production compared to refinery output. The crude oil imports averaged 180,000 bpd, but with a high standard deviation of 100,000 bpd, reflecting significant fluctuations likely due to changes in domestic refining capacity and demand. Regional fuel prices averaged 0.87 USD per litre, ranging from 0.70 to 1.10 USD, with a standard deviation of 0.12 USD, suggesting moderate variability in pricing. Overall, these statistics indicate that while energy output remained relatively stable, both refinery production and crude oil imports experienced considerable variation, which could influence domestic supply and regional pricing dynamics.

**Table 2: Unit Root Test (ADF Test)**

Variable	ADF Statistic	Critical Value (5%)	Order of Integration	Decision
Dangote Refinery Production	-4.21	-3.50	I(1)	Stationary at first difference
Nigeria Energy Output	-2.11	-3.50	I(1)	Non-stationary at level, stationary at first difference
Crude Oil Imports	-3.75	-3.50	I(0)	Stationary at level
Regional Fuel Price	-2.95	-3.50	I(1)	Stationary at first difference

Table 2 reports the results of the Augmented Dickey-Fuller (ADF) unit root tests conducted to examine the stationarity of the variables. The results show that Dangote Refinery production is non-stationary at level but becomes stationary after first differencing, indicating it is integrated of order one, I(1). Similarly, Nigeria's energy output and regional fuel prices are non-stationary at level but

stationary at first difference, also I(1). In contrast, crude oil imports are stationary at level (I(0)), meaning they do not require differencing before inclusion in the econometric model. These findings justify the use of the ARDL approach, which allows for a mix of I(0) and I(1) variables in analyzing both short- and long-run relationships. Ensuring stationarity is critical for avoiding spurious regression results and for producing reliable coefficient estimates in the subsequent econometric analysis.

**Table 3: ARDL Regression Results – Effect of Dangote Refinery Production on Nigeria Energy Output**

Dependent Variable: **Nigeria Energy Output (mbpd)**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C (Constant)	1.75	0.32	5.47	0.000
Dangote Refinery Production (bpd)	0.0021	0.0005	4.20	0.001
Lagged Dangote Production (bpd)	0.0015	0.0004	3.75	0.002
R-squared	0.81			
Adjusted R-squared	0.79			
F-statistic	35.62			0.000
Durbin-Watson stat	2.05			

Table 3 presents the ARDL regression results examining the effect of Dangote Refinery production on Nigeria's energy output. The model demonstrates strong explanatory power, with an R-squared of 0.81 and an adjusted R-squared of 0.79, indicating that about 79–81% of the variation in energy output is explained by current and lagged refinery production. The F-statistic of 35.62 ( $p < 0.001$ ) confirms that the model is statistically significant overall.

The coefficient for current Dangote Refinery production is 0.0021 ( $t = 4.20$ ,  $p = 0.001$ ), indicating a positive and statistically significant effect on energy output. This implies that an increase of 1,000 barrels per day in refinery production increases Nigeria's energy output by approximately 2.1 barrels per day, holding other factors constant. Similarly, the lagged production coefficient of 0.0015 ( $t = 3.75$ ,  $p = 0.002$ ) also has a positive effect, though slightly smaller than the immediate impact, suggesting that past refinery output contributes to sustaining energy production in subsequent periods.

The Durbin-Watson statistic of 2.05 suggests minimal autocorrelation in the residuals, confirming the reliability of the estimates. Overall, the results indicate that increased production at the Dangote Refinery positively affects national energy output in both the short and medium term. This finding supports the views of Eze et al. (2021), who argued that domestic refining expansion enhances national energy availability by supplementing crude oil processing capacity and reducing pressure on other energy infrastructure.

**Table 4: ARDL Regression Results – Effect on Crude Oil Imports**

Dependent Variable: **Crude Oil Imports (bpd)**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C (Constant)	320,000	25,000	12.80	0.000
Dangote Refinery Production (bpd)	-0.71	0.10	-7.10	0.000
Lagged Dangote Production (bpd)	-0.42	0.08	-5.25	0.001
R-squared	0.88			
Adjusted R-squared	0.86			
F-statistic	45.31			0.000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Durbin-Watson stat	2.12			

Table 4 presents the ARDL regression results examining the effect of Dangote Refinery production on Nigeria's crude oil imports. The model shows a high goodness-of-fit, with an R-squared of 0.88 and an adjusted R-squared of 0.86, indicating that approximately 86–88% of the variations in crude oil imports are explained by current and lagged Dangote Refinery production. The F-statistic of 45.31 ( $p < 0.001$ ) confirms that the overall model is statistically significant.

The results reveal a negative and significant relationship between Dangote Refinery production and crude oil imports. Specifically, the coefficient for current production is  $-0.71$  ( $t = -7.10$ ,  $p < 0.001$ ), suggesting that for every additional barrel per day produced by the refinery, crude oil imports decrease by 0.71 barrels per day, holding other factors constant. This indicates that higher domestic refining capacity reduces reliance on imported crude oil. Similarly, the lagged production coefficient of  $-0.42$  ( $t = -5.25$ ,  $p = 0.001$ ) shows that past refinery output also contributes to a reduction in crude oil imports, although the effect is slightly smaller than the immediate impact.

The Durbin-Watson statistic of 2.12 suggests that there is no serious autocorrelation in the residuals, indicating that the estimates are reliable. Overall, the findings confirm that the Dangote Refinery has a significant short- and medium-term effect on reducing Nigeria's dependence on imported crude oil, aligning with expectations that increased domestic refining capacity strengthens energy self-sufficiency. This result is consistent with the observations of Adegbite and Okafor (2022), who noted that expanding domestic refinery operations in Nigeria reduces the need for crude oil imports and stabilizes local supply chains.

**Table 5: ARDL Regression Results – Effect on Regional Fuel Prices**

Dependent Variable: **Regional Fuel Price (USD/litre)**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C (Constant)	0.95	0.08	11.88	0.000
Dangote Refinery Production (bpd)	-0.0003	0.0001	-3.00	0.005
Lagged Dangote Production (bpd)	-0.0002	0.0001	-2.50	0.015
R-squared	0.65			
Adjusted R-squared	0.62			
F-statistic	18.20			0.000
Durbin-Watson stat	1.98			

Table 5 presents the ARDL regression results examining the effect of Dangote Refinery production on regional fuel prices. The model shows moderate explanatory power, with an R-squared of 0.65 and an adjusted R-squared of 0.62, indicating that approximately 62–65% of the variation in regional fuel prices is explained by current and lagged refinery production. The F-statistic of 18.20 ( $p < 0.001$ ) confirms that the overall model is statistically significant.

The coefficient for current Dangote Refinery production is  $-0.0003$  ( $t = -3.00$ ,  $p = 0.005$ ), suggesting a negative and statistically significant relationship with regional fuel prices. This implies that an increase of 1,000 barrels per day in refinery production leads to a decrease in fuel prices by approximately 0.3 USD cents per litre, holding another factors constant. The lagged production coefficient of  $-0.0002$  ( $t = -2.50$ ,  $p = 0.015$ ) also shows a negative effect, though slightly smaller, indicating that past production continues to exert a downward influence on fuel prices over time.

The Durbin-Watson statistic of 1.98 suggests minimal autocorrelation in the residuals, confirming the reliability of the estimates. Overall, the findings indicate that the Dangote Refinery contributes to reducing regional fuel prices both immediately and in subsequent periods, aligning with previous

studies such as Okechukwu and Akinyemi (2021), who observed that increased domestic refining capacity tends to stabilize and lower fuel costs in West African markets.

### **Discussion of Findings**

The findings of this study indicate that Dangote Refinery production has a significant and positive effect on Nigeria's energy output, demonstrating that increased domestic refining capacity directly contributes to greater national energy availability. This result supports the view that large-scale, technologically advanced refineries are critical for enhancing energy security and industrial capacity in resource-dependent economies. The significance of the lagged production term suggests that the refinery's impact on energy output is not only immediate but also cumulative over time, reflecting the gradual integration of refined products into domestic supply chains. This outcome aligns with observations by Dangote Refinery (2025) and Ainvest (2025), who highlight that the refinery has strengthened Nigeria's ability to meet domestic energy needs, reduced pressure on aging state-owned refineries, and positioned the country as a net exporter of refined petroleum products.

In parallel, the study reveals a strong negative relationship between Dangote Refinery production and crude oil imports, indicating that higher domestic production substantially reduces Nigeria's reliance on imported petroleum products. The negative coefficients for both contemporaneous and lagged production emphasize that the effects of refinery operations extend beyond immediate periods, contributing to sustained reductions in import volumes over time. This finding corroborates reports by Nairametrics (2025) that Nigeria's petrol import bill fell by over 50% in early 2025 following increased refinery output, demonstrating the tangible economic benefits of domestic refining. Scholars in the energy economics literature have similarly noted that investment in local refining infrastructure can mitigate foreign exchange outflows and buffer national economies from global oil price volatility (Ainvest, 2025; Proshare, 2025). Hence, the Dangote Refinery appears to fulfill a dual role: meeting domestic consumption needs while promoting fiscal stability through reduced import dependency.

The analysis further shows that Dangote Refinery production exerts a moderate negative effect on regional fuel prices, suggesting that the increased availability of refined products contributes to market stabilization and, in some instances, price moderation. The lagged effect highlights that these benefits are realized progressively as production stabilizes and distribution channels adjust. This observation is consistent with the reports of Proshare (2025) and African Diaspora International (2025), which note that refinery pricing strategies have influenced pump prices nationwide and affected regional fuel markets. From a scholarly perspective, this result aligns with market theory, which predicts that higher domestic supply of a key commodity tends to exert downward pressure on prices, thereby mitigating the effects of external shocks (Dangote Refinery, 2025). The finding underscores the refinery's strategic role not only in national energy security but also in contributing to regional energy market integration.

The results suggest that the Dangote Refinery has a transformative impact on Nigeria's energy sector and the broader African fuel market. By simultaneously increasing energy output, reducing crude oil imports, and stabilizing fuel prices, the refinery exemplifies the potential of private sector-led infrastructure to drive structural change in resource-based economies. In comparison with prior studies, these findings reinforce the argument that modern refineries can play a pivotal role in enhancing energy efficiency, reducing import dependence, and stabilizing regional markets (Ainvest, 2025; Dangote Refinery, 2025; Nairametrics, 2025). Moreover, the cumulative effects observed through lagged variables highlight the importance of sustained operational efficiency and capacity utilization in achieving long-term economic and energy sector benefits.

### **CONCLUSION**

This study examined the effect of Dangote Refinery production on Nigeria's energy output, crude oil imports, and regional fuel prices using time series data. The findings reveal that increased refinery

production has a significant positive impact on national energy output, a strong negative effect on crude oil imports, and a moderate negative effect on regional fuel prices. These results indicate that the Dangote Refinery has substantially enhanced Nigeria's energy security, reduced import dependency, and contributed to price stabilization in both domestic and regional markets. In line with previous studies (Dangote Refinery, 2025; Ainvest, 2025; Nairametrics, 2025), the refinery exemplifies the critical role of large-scale, technologically advanced domestic refining in transforming resource-based economies. Furthermore, the significance of lagged production terms underscores the cumulative and sustained impact of refinery operations on economic and energy sector outcomes.

### **RECOMMENDATIONS**

1. Policy-makers and Dangote Refinery management should ensure that the refinery operates at full capacity consistently, as sustained production maximizes energy output and import reduction benefits.
2. The government should encourage private and public investment in additional refineries or expansions to further reduce dependency on imported refined petroleum products and enhance national energy security.
3. To maximize the impact on regional fuel prices, there should be investment in transportation and storage infrastructure, ensuring efficient delivery of refined products to both domestic and neighboring African markets.
4. Regulatory bodies should collaborate with refinery operators to develop pricing frameworks that mitigate volatility, ensuring that fuel price reductions benefit consumers without undermining refinery sustainability.
5. Stakeholders should invest in and periodic econometric assessments to evaluate refinery performance, import reductions, and market impacts. This will provide evidence for policy adjustments and strategic decision-making.

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