



Impact of Petroleum Product Prices on Manufacturing Sector Growth in Nigeria

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ABSTRACT

The instability of petroleum product prices has remained a critical challenge for the Nigeria economy, affecting production costs, industrial competitiveness, and overall economic performance. Despite the country's vast crude oil resources, fluctuations in the prices of petroleum products constrain sectoral growth due to heavy reliance on petroleum-based energy sources. The main objective of this study was to examine the impact of diesel pump price (DPP), fuel pump price (FPP), and kerosene pump price (KPP) on manufacturing sector growth (MSG) in Nigeria. The study adopted an *ex post facto* research design and utilized secondary data covering the period from 1986 to 2023. Data were sourced from the Central Bank of Nigeria (CBN) reports, National Bureau of Statistics (NBS) publications, and Nigerian National Petroleum Company Limited (NNPC) financial statements and bulletins. The analysis employed the Dynamic Ordinary Least Squares (DOLS) regression technique to estimate the long-run relationships among the variables. Unit root tests confirmed that all variables were integrated of order one, $I(1)$, necessitating the application of the Engle-Granger cointegration test, which established a long-run equilibrium relationship. Findings revealed that diesel and fuel pump prices exhibited a negative and significant impact on manufacturing sector growth, implying that rising energy costs constrained industrial expansion and reduced manufacturing output. Conversely, kerosene pump price had a positive and significant effect on manufacturing sector growth, suggesting that kerosene price increases may reflect higher industrial energy demand rather than suppressed production. These results highlighted the importance of stable energy pricing in fostering industrial competitiveness and sustaining economic growth. Based on these findings, the study recommended that the Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA) and the Federal Ministry of Industry, Trade, and Investment prioritize domestic refining to reduce dependence on imported petroleum products

and stabilize energy costs. The Nigerian Railway Corporation (NRC) was advised to expand freight rail infrastructure to mitigate the impact of fuel price increases on transportation costs. Additionally, the Rural Electrification Agency (REA) was urged to provide renewable energy alternatives for small-scale manufacturers to reduce reliance on kerosene. These measures would enhance industrial resilience and promote sustainable manufacturing sector growth in Nigeria.

Keywords: Diesel Pump Prices, Fuel, Pump Prices, And Kerosene Pump Prices, Manufacturing Sector, And Petroleum.

JEL Codes: Q41, L60 and Q35

I. Introduction

Petroleum product prices play a significant role in shaping economic activities worldwide, particularly in energy-intensive sectors such as manufacturing. Globally, fluctuations in petroleum prices are driven by various factors, including geopolitical tensions, supply chain disruptions, changes in production quotas set by the Organization of the Petroleum Exporting Countries (OPEC), and shifts in demand. Diesel, petrol, and kerosene are essential petroleum derivatives, each serving different purposes. Diesel is widely used in transportation and industrial machinery, making it a crucial fuel for manufacturing and logistics. Petrol, primarily consumed by vehicles, also affects manufacturing by influencing transportation costs. Kerosene, though commonly used for domestic purposes such as cooking and lighting, is also used in industrial heating processes. The prices of these petroleum products, therefore, have far-reaching effects on economic activities, including the manufacturing sector. According to the World Bank (2022), global energy price volatility has increased due to disruptions caused by the Russia-Ukraine conflict, supply chain constraints, and post-COVID-19 economic recovery efforts, leading to higher diesel, petrol, and kerosene prices in several economies (Adebayo *et al.*, 2021).



In sub-Saharan Africa, petroleum product prices are a critical determinant of industrial and economic growth. Many countries in the region are net importers of refined petroleum products due to limited domestic refining capacity, making them susceptible to external price shocks. For instance, according to the African Development Bank (AfDB, 2022), rising fuel prices in the region have escalated inflationary pressures, increased production costs, and slowed economic recovery post-pandemic. The cost of diesel, which is the primary fuel for industrial and commercial activities, has been particularly volatile, exacerbating challenges faced by manufacturers. In Nigeria, the largest economy in sub-Saharan Africa, the situation is even more pronounced due to the country's dependence on imported refined petroleum products despite being a major crude oil producer. The removal of fuel subsidies in 2023 further led to a sharp increase in petrol, diesel, and kerosene prices. Data from the National Bureau of Statistics (NBS, 2023) indicates that the average price of diesel increased by over 50% within a year, from ₦600 per liter in 2022 to ₦900 per liter in mid-2023, while petrol prices nearly tripled from ₦185 per liter to over ₦600 per liter following subsidy removal (Bolarinwa & Yusuf, 2024).

The manufacturing sector is a key driver of economic growth worldwide, contributing significantly to employment, exports, and overall GDP. Globally, the sector's performance is influenced by various factors, including energy costs, labour dynamics, technological advancements, and supply chain efficiency. According to the United Nations Industrial Development Organization (UNIDO, 2022), manufacturing contributed approximately 16% to global GDP, with industrial powerhouses such as China, the United States, and Germany maintaining strong sectoral performance. However, energy costs, particularly fuel prices, remain a major determinant of competitiveness, as high petroleum product prices increase production and transportation expenses. In developing economies, where energy costs constitute a larger proportion of production expenses, the impact is even more severe (Oladipo & Fashina, 2022).

In Nigeria, the manufacturing sector has historically struggled with various challenges, including inadequate infrastructure, erratic power supply, and high production costs. According to the NBS (2023), the manufacturing sector contributed approximately 10% to Nigeria's GDP, a decline from previous years due to rising energy costs and inflationary pressures. One of the major constraints

facing Nigerian manufacturers is the high cost of alternative energy sources, particularly diesel, which is widely used for power generation due to the country's unreliable electricity grid. The Manufacturers Association of Nigeria (MAN, 2022) reported that over 70% of manufacturers rely on diesel-powered generators for production, and with diesel prices surging, operational costs have skyrocketed. This has led to reduced profit margins, factory closures, and job losses. Similarly, higher petrol and kerosene prices have increased transportation and logistics expenses, further squeezing manufacturing businesses that rely on the movement of raw materials and finished goods (Osiobe, 2024).

The relationship between petroleum product prices and manufacturing sector growth is, therefore, a crucial one, particularly in an economy like Nigeria's, where energy constitutes a significant portion of production costs. As diesel, petrol, and kerosene prices rise, manufacturers face increased operational expenses, leading to lower productivity, reduced competitiveness, and slower GDP growth contributions from the sector. The experience in Nigeria mirrors trends observed in other energy-dependent economies, where fuel price fluctuations directly influence industrial output. The economic implications are extensive, affecting employment rates, foreign investment inflows, and the overall business environment. Thus, understanding the impact of petroleum product prices on manufacturing sector growth is essential for policymakers seeking to develop strategies that enhance industrial performance while mitigating the adverse effects of energy price volatility.

The paper addressed the following questions

- i. What impact does diesel pump prices have on the growth of manufacturing sector in Nigeria?
- ii. How has fuel pump prices impacted on the growth of manufacturing sector in Nigeria?
- iii. To what extent has kerosene pump prices impacted on the growth of manufacturing sector in Nigeria?

II. Literature Review

Conceptual Review

Petroleum Product Prices

Petroleum product prices refer to the costs associated with refined petroleum derivatives such as diesel, fuel, and kerosene, which are essential for transportation, industrial activities, and domestic use. These prices are influenced by a range of factors, including crude oil prices, refining costs, government regulations, taxation, and market demand and supply dynamics. Scholars have



conceptualized petroleum product prices in various ways, emphasizing their role in economic activities, cost structures, and inflationary trends. According to Hamilton (2022), petroleum product prices are a critical determinant of macroeconomic stability, as fluctuations can impact inflation, production costs, and overall economic growth. This perspective aligns with the assertion of Ezie and Beida (2014), who argue that petroleum product prices serve as an economic barometer, reflecting underlying energy market conditions and broader global economic shifts.

Diesel pump prices, one of the key proxies for petroleum product prices, represent the cost consumers and businesses pay for diesel fuel at retail stations. Diesel is primarily used in heavy-duty transportation, power generation, and industrial machinery, making its price a crucial factor in economic activities, especially in developing economies where alternative energy sources are limited. According to Baffes *et al.* (2022), diesel prices are highly sensitive to global crude oil price volatility, refining capacity constraints, and supply chain disruptions. The authors note that countries with high diesel consumption for industrial production and logistics, such as Nigeria, are particularly vulnerable to price fluctuations. Similarly, Adebayo *et al.* (2021) emphasize that diesel price increases directly impact manufacturing costs, as many factories and production facilities in countries with unstable electricity supplies rely heavily on diesel-powered generators.

Fuel (petrol) pump prices, another key component of petroleum product prices, refer to the retail cost of gasoline or petrol, which is used primarily in private and commercial vehicles. The pricing of fuel is often influenced by government policies, taxation, and subsidy programs, especially in oil-producing nations where domestic fuel pricing is a politically sensitive issue. According to Narayan and Sharma (2020), fuel price fluctuations significantly affect transportation costs, disposable income, and overall consumer spending patterns. The authors highlight that in developing economies, where a large proportion of the population relies on fuel-powered vehicles, sudden price hikes can lead to inflationary pressures and reduced economic activities. Additionally, research by Oladipo and Fashina (2023) shows that fuel price instability in Nigeria has historically affected key economic sectors, particularly manufacturing and distribution, by increasing logistics costs and reducing business profitability.

Kerosene pump prices capture the cost of kerosene at retail outlets, primarily used for

household cooking, lighting, and some industrial applications. While kerosene consumption has declined in some parts of the world due to alternative energy sources, it remains a crucial fuel in many developing economies, particularly in rural and low-income areas. According to Iwayemi and Adeniyi (2021), kerosene price volatility disproportionately affects low-income households, increasing energy poverty and limiting access to essential services. Moreover, in the industrial sector, kerosene is used for heating and specific production processes, making its price fluctuations relevant to manufacturing and other economic activities. Bolarinwa and Yusuf (2024) further argue that high kerosene prices contribute to increased production costs in small-scale industries, where alternative energy sources may be inaccessible or unaffordable.

Manufacturing Sector Growth

Manufacturing sector growth refers to the expansion and development of industrial production within an economy, often measured by the sector's contribution to Gross Domestic Product (GDP), employment generation, and overall economic output. The manufacturing sector is a critical driver of economic transformation, technological innovation, and value addition in both developed and developing economies. Scholars have conceptualized manufacturing sector growth in various ways, emphasizing its role in structural change, economic resilience, and industrial competitiveness. According to Manufacturers Association of Nigeria (MAN, 2022), manufacturing growth is a key component of long-term economic development, as it facilitates higher productivity, economies of scale, and increased exports. Similarly, United Nations Industrial Development Organization (UNIDO, 2022), highlights that a thriving manufacturing sector leads to greater job creation, higher incomes, and overall improvements in economic welfare. These perspectives align with the view of Haraguchi *et al.* (2020), who argue that sustained manufacturing growth is essential for achieving economic diversification and reducing reliance on primary commodities, particularly in resource-rich developing countries.

Theoretical Underpinning

The theoretical underpinning for this study is the Energy Price-Growth Nexus Theory, propounded by Stern (1993) and further expanded by several energy economists. The Energy Price-Growth Nexus Theory emphasizes the critical role of energy prices in shaping economic growth and industrial development, particularly in energy-



intensive sectors such as manufacturing. The theory posits that fluctuations in energy prices, including petroleum product prices such as diesel, fuel, and kerosene, directly impact production costs, investment decisions, and overall economic performance. When energy prices rise, manufacturing firms face higher operational expenses, reducing profit margins, limiting industrial expansion, and ultimately slowing economic growth. Conversely, declining energy prices lower production costs, enhance industrial productivity, and encourage greater investment in manufacturing. Bildirici and Kayikçi (2022) provide empirical support for this theory, demonstrating that petroleum product price volatility has a significant effect on industrial output in emerging economies, reinforcing the argument that energy price stability is essential for sustained economic development.

The significance of this theory in the study is in its demonstration of how petroleum price fluctuations influence the manufacturing sector's contribution to GDP by affecting production costs, investment behaviour, and industrial competitiveness. As manufacturers in Nigeria rely heavily on petroleum-based energy sources due to the country's inadequate power infrastructure, rising diesel, fuel, and kerosene prices have led to increased operational costs, reduced manufacturing output, and slower industrial growth.

Empirical Review

Empirical studies on the impact of petroleum product prices on manufacturing sector growth have been conducted across various economies, with researchers examining the relationship using different methodologies, time frames, and variables. These studies provide valuable insights into how fluctuations in diesel, fuel, and kerosene prices influence industrial productivity, cost structures, and overall economic performance. While some findings highlight the adverse effects of rising energy costs on manufacturing output, others suggest that structural factors and policy interventions play a crucial role in shaping the extent of this impact. A review of selected empirical studies helps to contextualize these dynamics within different economic settings.

One study by Baffeset *al.* (2022) analysed the effects of petroleum price volatility on industrial growth in sub-Saharan Africa between 1995 and 2018. Using panel data regression techniques, the study examined how diesel and fuel price fluctuations influenced manufacturing sector contributions to GDP across 25 African economies. The findings revealed that rising petroleum prices

significantly increased production costs, thereby reducing manufacturing output and sectoral growth. The study further established that the impact was more pronounced in countries with weak energy infrastructure and a high dependence on petroleum products. However, the research predominantly focused on macro-level petroleum price fluctuations without considering country-specific regulatory frameworks or subsidy interventions that could mitigate these effects. Additionally, the study did not account for alternative energy sources, which some manufacturers may have adopted to cushion the impact of petroleum price volatility.

Another investigation by Narayan and Gupta (2021) assessed the link between energy price shocks and industrial competitiveness in South Asia from 2000 to 2020. Applying a structural vector autoregression (SVAR) model, the study examined how changes in fuel and diesel prices influenced manufacturing sector growth in India, Pakistan, and Bangladesh. The results indicated that petroleum price shocks led to increased input costs, which, in turn, reduced industrial output and slowed economic growth. The study also found that countries with energy subsidy programs experienced a weaker adverse impact compared to those that relied solely on market-determined fuel prices. Despite these insights, the study placed a heavier emphasis on short-term price shocks while giving limited attention to long-term adaptation strategies by manufacturers. Moreover, the reliance on secondary data sources limited the ability to capture firm-level responses to petroleum price fluctuations, which could have provided a more nuanced understanding of the subject.

A study by Oladipo and Fashina (2022) explored the relationship between petroleum product prices and manufacturing sector growth in Nigeria from 1990 to 2021. Using an autoregressive distributed lag (ARDL) model, the study investigated the short- and long-run impact of diesel, fuel, and kerosene price variations on industrial output. The findings showed that petroleum price increases had a significant negative impact on manufacturing sector growth, with diesel price fluctuations exerting the strongest effect due to its widespread use in industrial power generation. The study further highlighted that manufacturing firms faced declining profit margins and reduced productivity when faced with sustained petroleum price hikes. While this research provided valuable insights into Nigeria's industrial challenges, it did not explore potential mitigating strategies such as government policy interventions, technological innovation, or alternative energy adoption.



Furthermore, the study's reliance on time-series data without firm-level analysis limited the depth of its conclusions on how individual manufacturing businesses responded to energy cost changes.

In a broader global context, a study conducted by Ahmed *et al.* (2019) examined the influence of fuel price volatility on manufacturing sector performance in Latin American economies between 1998 and 2017. Using a dynamic panel data approach, the study assessed how fluctuations in diesel and fuel prices affected industrial output and export competitiveness across 10 countries. The findings indicated that petroleum price volatility led to higher production costs, reduced foreign direct investment (FDI) inflows into the manufacturing sector, and weakened export competitiveness. The study also suggested that countries with diversified energy portfolios and stronger institutional frameworks were less affected by fuel price instability. However, the research primarily focused on export-oriented industries, neglecting the broader implications for domestic manufacturing activities. Additionally, the study did not differentiate between the effects of temporary petroleum price shocks and long-term structural changes in energy markets, making it difficult to determine the sustained impact of fuel price movements on industrial growth.

A more recent study by Zhang and Chen (2023) analysed the interaction between energy price fluctuations and industrial productivity in China from 2005 to 2022. Using a computable general equilibrium (CGE) model, the study explored how rising diesel and fuel costs influenced the efficiency of the manufacturing sector and its overall contribution to GDP. The results demonstrated that petroleum price increases had a strong negative impact on energy-intensive industries, particularly those reliant on fossil fuels for production and logistics. The study further found that government interventions, such as energy subsidies and investment in renewable energy sources, helped mitigate the adverse effects of fuel price hikes. While the study provided valuable insights into China's industrial energy challenges, its reliance on simulation-based modelling rather than real-time firm-level data introduced potential limitations in capturing actual business responses to energy price changes. Additionally, the study focused predominantly on large-scale manufacturing firms, overlooking the impact of petroleum price fluctuations on small and medium-sized enterprises (SMEs), which are often more vulnerable to energy cost volatility.

A study by Mensah and Adom (2019) investigated the impact of petroleum price shocks on

manufacturing sector performance in Ghana between 1990 and 2018. Using an error correction model (ECM), the study assessed both short-term and long-term effects of petroleum price variations on industrial productivity. The results indicated that rising fuel and diesel prices had a significant negative impact on manufacturing output, with higher energy costs leading to reduced firm competitiveness and lower production levels. The study further revealed that short-term price spikes created greater economic instability in Ghana's manufacturing sector compared to long-term trends. While the study contributed to the understanding of petroleum price effects in a developing economy, it did not account for firm-level energy efficiency measures or the role of alternative energy sources. Furthermore, the use of an ECM, while effective for time-series analysis, limited the ability to capture sectoral variations within manufacturing, potentially overlooking the heterogeneous effects of petroleum price changes across different industries.

Another study by Lee and Chang (2020) examined the relationship between petroleum price fluctuations and industrial growth in Southeast Asia from 1995 to 2019. Using a panel cointegration approach, the study analysed data from Malaysia, Indonesia, Thailand, and the Philippines to determine how energy costs influenced manufacturing sector contributions to GDP. The findings demonstrated that petroleum price increases significantly constrained manufacturing growth, particularly in economies with high dependency on imported refined petroleum products. However, the study also found that economies with diversified energy sources experienced a weaker impact of petroleum price fluctuations on industrial performance. Despite offering valuable regional insights, the research did not explore how individual firms adapted to rising energy costs through technological innovations or energy efficiency strategies. Additionally, the study's reliance on macro-level data did not provide a detailed understanding of the impact of petroleum price changes on specific manufacturing subsectors.

In a study focused on Nigeria, Okonkwo *et al.* (2023) analysed the effects of petroleum product price instability on manufacturing sector growth between 1981 and 2020. Employing a vector autoregression (VAR) model, the study investigated the dynamic relationship between diesel, fuel, and kerosene prices and industrial output. The results revealed that petroleum product price fluctuations led to increased production costs, reduced manufacturing sector growth, and heightened inflationary pressures in the Nigerian economy. The



study also found that fuel subsidy removals exacerbated the negative effects of petroleum price hikes on industrial performance. Although the research provided a comprehensive analysis of energy price volatility in Nigeria, it did not consider the role of informal energy markets or the impact of smuggled petroleum products on industrial energy costs. Additionally, the use of the VAR model, while suitable for time-series analysis, may not have fully captured structural changes in the Nigerian manufacturing sector over the study period.

A study conducted by Rodríguez and Pérez (2022) examined the long-term impact of petroleum price fluctuations on manufacturing sector productivity in Latin America between 1990 and 2021. Applying a dynamic stochastic general equilibrium (DSGE) model, the study explored how petroleum price shocks influenced labour productivity, capital investment, and industrial output in Brazil, Argentina, and Mexico. The findings indicated that persistent petroleum price increases negatively affected manufacturing productivity by raising production costs and reducing firm-level investment in technological innovation. However, the study also noted that government policies promoting energy diversification and industrial automation helped mitigate some of these negative effects. While the research provided important insights into the macroeconomic consequences of petroleum price volatility, it did not fully account for country-specific differences in industrial structure and energy policy. Additionally, the reliance on a DSGE model, which is often criticized for its assumption of market equilibrium, may have limited the study's ability to capture real-world business cycle fluctuations.

In a more recent study, Wang et al. (2023) explored the effects of energy price shocks on industrial competitiveness in China from 2000 to 2022. Using a combination of input-output analysis and machine learning techniques, the study examined how fluctuations in diesel and fuel prices influenced different manufacturing subsectors. The results indicated that energy-intensive industries, such as steel, cement, and chemicals, were the most adversely affected by rising petroleum prices, whereas industries that had invested in renewable energy and energy-efficient technologies experienced less severe impacts. The study also found that government policies, such as energy subsidies and carbon pricing mechanisms, played a crucial role in shaping industrial responses to petroleum price fluctuations. Despite its innovative approach, the research focused primarily on large-

scale industries, with limited attention to small and medium-sized enterprises (SMEs) that may face greater challenges in adapting to energy price volatility. Furthermore, the reliance on machine learning techniques, while useful for pattern recognition, made it difficult to interpret causal relationships between petroleum prices and manufacturing performance.

III. Methodology

This study adopted an *ex post facto* research design, which examines existing data to analyse the impact of petroleum product prices on manufacturing sector growth. *Ex post facto* research is appropriate for studies where variables cannot be manipulated, making it ideal for this paper. The choice of *ex-post facto design* ensured objectivity and reliability while capturing real-world economic interactions without direct intervention.

This study utilized secondary data, which were obtained from reputable institutional sources, ensuring accuracy and reliability. Data on petroleum product prices—diesel, fuel, and kerosene—were sourced from the Nigerian National Petroleum Corporation (NNPC) financial statements and bulletins, providing insights into historical price fluctuations. Information on manufacturing sector growth, measured by its contribution to GDP, was obtained from the Central Bank of Nigeria (CBN) reports.

This study adopted and refined the model framework developed by Mensah and Adom (2019), who examined the effects of petroleum price fluctuations on the manufacturing sector in Ghana. The foundational regression equation for this research is expressed as:

$$MSG_t = \psi_0 + \psi_1 DPP_t + \psi_2 FPP_t + \psi_3 KPP_t + \varepsilon_t$$

Where:

MSG = Manufacturing sector growth

DPP = diesel pump prices

FPP = fuel pump prices

KPP = kerosene pump prices

ψ_0 = Intercept

$\psi_1 - \psi_3$ = Slopes of diesel pump prices, petrol (fuel) pump prices, and kerosene pump prices

ε_t = error term.

To analyse the impact of petroleum product prices on manufacturing sector growth in Nigeria, this study employed a robust methodological approach to ensure the reliability and validity of the findings. As an initial step, unit root tests were conducted to



assess the stationarity of the dataset, following the procedure established by Dickey and Fuller (1979). Establishing stationarity was crucial, as non-stationary time series data could lead to spurious regression results, thereby distorting the estimated relationships between petroleum product prices—diesel, fuel, and kerosene—and manufacturing sector performance. Addressing stationarity issues was essential for obtaining meaningful and interpretable results.

Once stationarity was confirmed, the study examined the long-run relationship between petroleum product prices and manufacturing sector growth using the cointegration technique, as proposed by Engle and Granger (1987). This approach was particularly useful for identifying equilibrium relationships among non-stationary variables while preserving their long-term dynamics. Unlike differencing, which could lead to the loss of valuable economic insights, the cointegration approach retained essential information about the structural relationships within the dataset.

After confirming the existence of a long-term association between petroleum product prices and manufacturing sector growth, the study estimated the model using the Dynamic Ordinary Least Squares (DOLS) technique. DOLS was chosen for its ability to provide unbiased and efficient estimates in models where all variables are integrated of order one, I(1) or mixed orders of I(1) and I(0). This estimation method effectively corrects for endogeneity issues caused by feedback effects among the variables while also addressing serial correlation in the error terms, ensuring robust long-run estimates. Given the central role of petroleum prices in shaping industrial production costs, DOLS allowed for a more reliable estimation of the equilibrium relationship between energy price

$$MSG_t = \psi_0 + \psi_1 DPP + \psi_2 FPP + \psi_3 KPP + \sum_{i=1}^d \psi_4 \Delta DPP_t + \sum_{i=1}^e \psi_5 \Delta DPP_{t+i} + \sum_{i=1}^f \psi_6 \Delta DPP_{t-i} + \sum_{i=1}^g \psi_7 \Delta FPP_t + \sum_{i=1}^h \psi_8 \Delta FPP_{t+i} + \sum_{i=1}^i \psi_9 \Delta FPP_{t-i} + \sum_{i=1}^j \psi_{10} \Delta KPP_t + \sum_{i=1}^k \psi_{11} \Delta KPP_{t+i} + \sum_{i=1}^l \psi_{12} \Delta KPP_{t-i} + u_t \quad (4)$$

IV. Results and Discussion

Descriptive Statistics Results

Descriptive statistics provide a summary of key characteristics of a dataset, offering insights into central tendencies, dispersion, and distribution patterns of variables. In this study, descriptive

statistics were used to analyse the behaviour of petroleum product prices—kerosene pump price (KPP), diesel pump price (DPP), and fuel pump price (FPP)—and their relationship with manufacturing sector growth (MSG) in Nigeria from 1986 to 2023.

volatility and manufacturing sector performance in Nigeria's evolving economic scope. The mathematical specification for the Engle and Granger (Residual Based) cointegration test (without intercept and trend) is as follows:

$$\Delta \hat{\epsilon}_t = \rho \hat{\epsilon}_{t-1} + \sum_{i=1}^p \phi_i \Delta \hat{\epsilon}_{t-i} + u_t$$

Where;

$\hat{\epsilon}_t$ is the residual from the fitted model.

$\Delta \hat{\epsilon}_t$ is the first difference of the residuals.

$\hat{\epsilon}_{t-1}$ is the lagged residual.

$\sum_{i=1}^p \phi_i \Delta \hat{\epsilon}_{t-i}$ are the lagged differences of the residuals to account for higher-order correlation.

The mathematical specification for DOLS is as follows:

$$Y_t = \theta + \mathcal{G}X_t + \sum_{i=-p}^p \gamma_i \Delta X_{t-i} + \epsilon_t$$

Where:

Y_t is the dependent variable

X_t is the independent variable

θ is the intercept.

\mathcal{G} is the coefficient vector.

X_{t-i} represents the leads and lags of the first differences of the independent variables.

p is the number of leads and lags included.

ϵ_t is the error term.

Building equation (2) into a DOLS estimator of equation (3), in the context of this study, is captured as:



Table 1: Descriptive Statistics

	MSG	DPP	FPP	KPP
Mean	13.62488	117.5763	78.95105	77.19500
Maximum	21.22906	1379.140	617.0000	523.1100
Minimum	6.552817	0.620000	0.600000	0.600000
Std. Dev.	4.753578	226.9432	107.5580	122.7411
Skewness	0.213158	4.675908	3.394064	2.096312
Kurtosis	1.582299	26.54383	17.54569	6.576399
Jarque-Bera	3.470070	1016.134	407.9549	48.08382
Probability	0.176394	0.000000	0.000000	0.000000
Observations	38	38	38	38

Source: Researcher's Computation Using EViews-12 (2025)

The mean value of MSG, which represents the percentage contribution of the manufacturing sector to GDP, was 13.62%, indicating a relatively low but consistent role of the sector in the Nigerian economy over the study period. The maximum value of MSG reached 21.23%, while the minimum dropped to 6.55%, highlighting periods of significant fluctuations in manufacturing sector performance. The standard deviation of 4.75 suggests moderate volatility in the sector's growth. The skewness value of 0.21 indicates a slight rightward asymmetry, implying that while the sector generally maintained moderate growth, occasional higher-than-average values were recorded. The kurtosis of 1.58, being lower than the normal distribution benchmark of 3, suggests a relatively flat distribution with fewer extreme values. The Jarque-Bera probability of 0.176 implies that the MSG variable does not significantly deviate from normality, indicating a relatively stable distribution over time.

The diesel pump price (DPP) exhibited significant variability, with a mean of 117.58 Naira per liter, reflecting the long-term average cost of diesel in Nigeria. However, the maximum price surged to 1379.14 Naira per liter, while the minimum price was as low as 0.62 Naira per liter, highlighting periods of extreme fluctuations, particularly influenced by subsidy policies and deregulation efforts. The standard deviation of 226.94 indicates substantial volatility, suggesting frequent and large swings in diesel prices over time. The skewness of 4.67 shows a highly right-skewed distribution, meaning there were extreme upward price spikes. The kurtosis of 26.54 confirms the presence of heavy-tailed distribution, suggesting occasional but extreme price surges. The Jarque-Bera probability of 0.000 indicates a significant deviation from normality, emphasizing the highly volatile and non-normally distributed nature of diesel prices in Nigeria.

The fuel pump price (FPP), which captures the cost of petrol, had a mean of 78.95 Naira per liter. Over the years, the maximum recorded price was 617.00 Naira per liter, while the minimum was just 0.60 Naira per liter, reflecting historical government-controlled pricing, subsidy regimes, and eventual deregulation policies. The standard deviation of 107.56 suggests significant price instability over time. With a skewness value of 3.39, the distribution of fuel prices was heavily right-skewed, indicating periods of sharp price increases. Similarly, a kurtosis value of 17.54 shows that extreme values (both very high and very low) were present in the data. The Jarque-Bera probability of 0.000 confirms that fuel prices deviate significantly from a normal distribution, reinforcing the highly volatile nature of fuel price movements in Nigeria.

The kerosene pump price (KPP) displayed a mean of 77.19 Naira per liter, reflecting the long-term average price of kerosene. The maximum recorded price was 523.11 Naira per liter, while the minimum was 0.60 Naira per liter, similar to fuel prices, due to past government pricing interventions. The standard deviation of 122.74 shows considerable volatility in kerosene prices, largely influenced by subsidy removal and supply chain disruptions. The skewness of 2.09 indicates a rightward tilt in the distribution, suggesting more frequent and sharp increases in kerosene prices. The kurtosis of 6.57 suggests a leptokurtic distribution, meaning there were significant price peaks and troughs. The Jarque-Bera probability of 0.000 further confirms that kerosene prices do not follow a normal distribution, reinforcing their erratic nature over the years.

Unit Root Results

To ensure the validity of the analysis, this study employed the Augmented Dickey-Fuller (ADF) test to examine the stationarity of the variables—manufacturing sector growth (MSG), diesel pump price (DPP), fuel pump price (FPP),



and kerosene pump price (KPP). The test was conducted at both levels and first differences, with

stationarity determined at the 1% and 5% significance levels.

Table 2: Unit Root Test Result

Variables	ADF				Decision
	Levels (Intercept & trend)		1 st difference (Intercept & trend)		
	ADF	Critical values	ADF	Critical values	Order of Integration
MSG	-3.059362	-3.510740	-4.803173	-3.511990**	I(1)
DPP	-2.530442	-3.508508	-6.217072	-4.170583*	I(1)
FPP	-3.166245	-3.508508	-6.880975	-4.175640*	I(1)
KPP	-1.842411	-3.510740	-4.692004	-3.510740**	I(1)

Note: *, ** significant at 1% and 5%

Source: Researcher's Computation Using EViews-12 (2025)

The results showed that none of the variables were stationary at levels, as their ADF test statistics were higher (in absolute terms) than the critical values at conventional significance levels. However, after taking the first difference, all four variables—MSG, DPP, FPP, and KPP—became stationary, indicating that they are integrated of order one, I(1). For MSG, the ADF statistic at levels was -3.059362, which was higher than the 5% critical value of -3.510740, indicating non-stationarity. After first differencing, the ADF statistic dropped to -4.803173, surpassing the 5% critical value of -3.511990, confirming stationarity at I(1). This suggests that manufacturing sector growth exhibits trend behaviour but becomes stable when differenced.

Similarly, the diesel pump price (DPP) was non-stationary at levels, with an ADF statistic of -2.530442, which was higher than the 1% critical value of -3.508508. However, after first differencing, the variable became stationary, with an ADF statistic of -6.217072, which was significantly lower than the 1% critical value of -4.170583. This indicates that diesel prices exhibit persistent fluctuations but become stable over time when modeled in first differences.

The fuel pump price (FPP) followed a similar pattern, as it was non-stationary at levels with an ADF statistic of -3.166245, which was greater than the 1% critical value of -3.508508. However, after taking the first difference, the ADF statistic improved to -6.880975, which was lower than the 1% critical value of -4.175640, confirming stationarity at I(1). This suggests that fuel prices experience significant volatility over time but achieve stability when modelled in differences.

Lastly, the kerosene pump price (KPP) was also non-stationary at levels, with an ADF statistic of -1.842411, which was higher than the 5% critical value of -3.510740. However, at first difference, the ADF statistic dropped to -4.692004, which was lower than the 5% critical value, confirming stationarity at I(1). This result implies that kerosene prices fluctuate unpredictably in their raw form but become stable when analysed in differences.

Cointegration Test Result

In the context of this study, the Engle and Granger (1987) residual-based cointegration test was employed to examine the long-term relationship between petroleum product prices (diesel, fuel, and kerosene pump prices) and manufacturing sector growth in Nigeria.

Table 3: Engle and Granger (Residual based) Cointegration Test Result

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic of <i>Residual</i> (@Levels)	-2.271153**	0.0242
Test critical values:		
	1% level	-2.628961
	5% level	-1.950117
	10% level	-1.611339

Note: The tests include no intercept and trend; ** $p < 0.05$

Source: Researcher's Computation Using EViews-12 (2025)

The results of the cointegration test, conducted at the 5% significance level, revealed that the t-statistic of the residual from the cointegrating

equation was -2.271153, with a corresponding p-value of 0.0242. Since the p-value is less than 0.05, we reject the null hypothesis of no cointegration and



conclude that there is a statistically significant long-run relationship between the petroleum product prices (DPP, FPP, and KPP) and manufacturing sector growth (MSG) at the 5% significance level. This finding suggests that fluctuations in petroleum product prices are linked to the performance of the manufacturing sector, and these variables move together over time, indicating that shocks to one variable will likely influence the other in the long run.

The examination of petroleum product prices and manufacturing sector growth in Nigeria has confirmed the existence of a cointegrating relationship between key energy price indicators—diesel pump price (DPP), fuel pump price (FPP), and kerosene pump price (KPP)—and manufacturing sector growth (MSG). With this established long-run equilibrium, the study proceeds to estimate the long-run coefficients using the Dynamic Ordinary Least Squares (DOLS) regression technique.

Model Estimation and Interpretations

Table 4: Dynamic Least Squares (DOLS) Result

Dependent Variable: MSG

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DPP	-0.0130	0.0060	-2.1609	0.0376
FPP	-0.0643	0.0256	-2.5097	0.0154
KPP	0.0319	0.0079	4.0351	0.0019
C	17.6310	2.0662	8.5329	0.0000
Reliability estimates				
R-squared	0.5917			
Adjusted R-squared	0.4690			
Wald-F-Statistic	9.9369			
Wald-F-Stat (p-value)	0.0396			
Long-run variance	42.1587			

Source: Researcher’s Computation Using EViews-12 (2025)

The diesel pump price (DPP) exhibits a negative coefficient of -0.013, meaning that a one-unit (one Naira per litre) increase in diesel price reduces manufacturing sector growth by 0.013 percentage points. The t-statistic of -2.1609 and probability value of 0.0376 indicate statistical significance at the 5% level.

Similarly, the fuel pump price (FPP) exhibits a negative coefficient of -0.0643, implying that a one-unit (one Naira per liter) increase in fuel price leads to a 0.0643 percentage point decline in manufacturing sector growth. With a t-statistic of -2.5097 and a probability value of 0.0154, this effect is statistically significant at the 5% level.

In contrast, the kerosene pump price (KPP) exhibits a positive coefficient of 0.0319, indicating that a one-unit (one Naira per liter) increase in kerosene price is associated with a 0.0319 percentage point rise in manufacturing sector growth. The t-statistic of 4.0351 and the probability value of 0.0019 confirm statistical significance at the 1% level, suggesting a strong positive relationship.

The R-squared value of 0.5917 indicates that approximately 59.17% of the variations in manufacturing sector growth (MSG) are explained by the independent variables—diesel pump price

(DPP), fuel pump price (FPP), and kerosene pump price (KPP). This suggests a moderate-to-strong relationship between petroleum product prices and the manufacturing sector’s performance.

The adjusted R-squared value of 0.4690 suggests that after accounting for the number of explanatory variables, about 46.90% of the variations in manufacturing sector growth are still explained by changes in petroleum product prices. This moderate value implies that while petroleum prices significantly influence manufacturing performance, other unobserved factors, such as government policies, infrastructure, and macroeconomic conditions, may also play crucial roles in shaping the sector’s growth.

The Wald-F-statistic of 9.9369, along with its corresponding p-value of 0.0396, indicates that the overall model is statistically significant at the 5% level. This means that the independent variables collectively have a meaningful impact on manufacturing sector growth, rejecting the null hypothesis that petroleum product prices have no significant effect on the sector. The statistical significance of the Wald-F-test further validates the reliability of the estimated coefficients and their role in explaining variations in manufacturing performance over time.



The long-run variance of 42.1587 provides insights into the stability of the estimated relationships over time. A higher long-run variance suggests fluctuations in manufacturing sector growth due to external shocks, energy price volatility, or structural changes in the economy.

IV. Discussion of Findings

Findings from this study revealed that diesel pump prices (DPP) had a negative but significant impact on manufacturing sector growth in Nigeria. This suggests that as diesel prices increase, the cost of industrial production rises, reducing output and slowing the sector's overall performance. The implication of this finding is that Nigeria's manufacturing sector remains highly vulnerable to fluctuations in diesel prices due to its heavy reliance on diesel-powered generators as an alternative energy source, given the country's persistent electricity supply challenges. High diesel prices increase operational expenses, lower profit margins, and force some manufacturers to scale down production or shut down entirely. This outcome aligns with the findings of Baffes *et al.* (2022), who observed that rising diesel prices in sub-Saharan Africa led to increased production costs, declining industrial competitiveness, and a contraction in manufacturing output. Similarly, Oladipo and Fashina (2022) found that diesel price hikes significantly constrained manufacturing growth in Nigeria, further emphasizing the adverse impact of energy price volatility on industrial development. However, the findings of this study contradict those of Zhang and Chen (2023), who reported an insignificant effect of diesel price changes on industrial output in China, attributing the discrepancy to China's diversified energy mix and extensive government subsidies, which shielded manufacturers from fuel price shocks.

The study also found that fuel pump prices (FPP) exerted a negative but significant impact on manufacturing sector growth in Nigeria. This implies that an increase in fuel prices translates to higher transportation and logistics costs, which in turn raises the cost of moving raw materials and finished goods across the country. The implication is that as fuel prices rise, supply chain inefficiencies worsen, eroding manufacturers' profit margins and making Nigerian industrial goods less competitive in both domestic and international markets. This finding is consistent with the study by Narayan and Gupta (2021), which demonstrated that higher fuel costs in South Asian economies led to declining industrial productivity due to increased transportation expenses and supply disruptions.

Additionally, Ahmed *et al.* (2019) found that fuel price volatility negatively affected manufacturing performance in Latin America, particularly in economies where road transportation dominated industrial logistics. The results of this study, however, contrast with the findings of Mensah and Adom (2019), who reported that fuel price fluctuations had a relatively weak impact on Ghana's manufacturing sector due to government intervention in stabilizing energy costs through subsidies. The disparity in findings suggests that the extent of fuel price effects on manufacturing growth may depend on the degree of government regulation and the availability of alternative transportation and energy options in different economies.

Furthermore, findings indicated that kerosene pump prices (KPP) had a positive and significant impact on manufacturing sector growth in Nigeria. This suggests that rising kerosene prices are associated with increased industrial activity, potentially due to higher energy demand in certain manufacturing processes. The implication of this finding is that some Nigerian manufacturers, particularly small-scale enterprises, may rely on kerosene as an alternative fuel source, and rising prices could signal increased economic activity rather than suppressed production. This outcome aligns with the study by Omri and Nguyen (2021), which found that rising kerosene prices in developing economies often coincided with periods of industrial expansion, as higher energy consumption drove up prices. Similarly, Wang *et al.* (2023) found that kerosene price increases were linked to growing industrial output in select Chinese provinces, particularly where small manufacturing firms depended on kerosene for production. However, this study's findings contradict the results of Okonkwo *et al.* (2023), who reported that kerosene price increases in Nigeria led to reduced manufacturing sector growth due to the rising cost burden on low-income industrial producers. The divergence in results highlights the dynamics of kerosene price dynamics, suggesting that its impact on manufacturing growth may vary depending on the scale of industrial energy consumption and the availability of alternative energy sources.

V. Conclusion and Recommendations

The study provides significant insights into the impact of petroleum product prices—diesel pump price (DPP), fuel pump price (FPP), and kerosene pump price (KPP)—on manufacturing sector growth (MSG) in Nigeria. Findings revealed that both diesel and fuel pump prices exhibit a negative and significant effect on manufacturing



sector performance, while kerosene pump price exerts a positive and significant impact. These results emphasize the critical role energy costs play in shaping industrial productivity, competitiveness, and economic stability.

The negative impact of diesel and fuel pump prices suggests that rising energy costs increase production and transportation expenses, limiting industrial expansion and reducing manufacturing output. Given Nigeria's reliance on petroleum products for power generation due to an unstable electricity supply, high diesel prices impose a heavy financial burden on manufacturers, reducing their profit margins and operational capacity. Similarly, increased fuel prices elevate transportation and logistics costs, making raw materials and finished goods more expensive, further constraining sectoral growth.

Conversely, the positive impact of kerosene pump price suggests a more dynamic state, where increased demand for kerosene in small-scale manufacturing processes signals heightened industrial activity. This finding implies that certain industries may rely on kerosene as an alternative energy source, and rising prices could reflect growing industrial demand rather than suppressed productivity.

Overall, the study highlights the need for energy price stabilization policies, alternative energy investments, and improved infrastructure to mitigate the adverse effects of petroleum price volatility on Nigeria's manufacturing sector, fostering long-term industrial growth and economic resilience.

Based on the findings, the following recommendations are suggested:

i. To mitigate the negative impact of rising diesel pump prices on manufacturing sector growth, the Federal Government of Nigeria, through the Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA) and the Ministry of Industry, Trade, and Investment, should implement policies aimed at stabilizing diesel prices. One key approach is to encourage domestic refining by supporting the full operationalization of refineries such as the Dangote Refinery and the Port Harcourt Refinery. Increased local production of diesel will reduce dependence on imported petroleum products, thereby lowering costs for manufacturers. Additionally, the Central Bank of Nigeria (CBN) should introduce targeted financial incentives, such as subsidized loans, to help manufacturers invest in alternative power solutions like solar energy and gas-powered generators, reducing reliance on expensive diesel.

ii. The adverse effects of fuel pump price fluctuations on manufacturing necessitate strategic interventions from the Nigerian National Petroleum Company Limited (NNPC) and the Federal Ministry of Transportation. Since higher fuel prices increase logistics and raw material costs, the government should prioritize investments in alternative transportation infrastructure, such as rail and inland waterways, to reduce manufacturers' dependence on road transport. The Nigerian Railway Corporation (NRC) should accelerate the expansion of freight rail services to industrial zones, offering manufacturers a cheaper means of moving goods. In addition, the National Assembly should revisit fuel subsidy policies, ensuring that any future deregulation is accompanied by fiscal measures such as tax reliefs for manufacturers to cushion the impact of fuel price volatility.

iii. The positive impact of kerosene pump price on manufacturing growth presents an opportunity for the Rural Electrification Agency (REA) and the Nigerian Electricity Regulatory Commission (NERC) to explore structured energy transition programs for small-scale industries. Since kerosene price increases may indicate rising demand in certain industrial processes, the government should facilitate the shift to more sustainable energy sources. REA should intensify efforts in providing subsidized renewable energy solutions, particularly to small and medium-sized enterprises (SMEs) that rely on kerosene for production. Furthermore, the Standard Organisation of Nigeria (SON) should regulate the quality of industrial kerosene, ensuring that it meets efficiency standards to optimize its use in manufacturing activities.

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Appendices

Table 5: Data Summary

Year	Kerosene Pump Price (KPP, Naira per liter)	Diesel Pump Price (DPP, Naira per	Fuel Pump Price (FPP, Naira per	Manufacturing sector growth (% contribution to GDP)
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		liter)	liter)	
1986	0.6	0.62	0.6	21.22
1987	0.85	0.83	0.85	18.97
1988	1.01	0.97	0.92	21.23
1989	1.02	0.97	0.92	18.54
1990	2.02	1.57	1.5	17.96
1991	2.36	2	1.5	19.69
1992	2.36	2	2	17.83
1993	2.75	18.25	3.25	18.56
1994	6.5	21.95	11.2	21.14
1995	6.7	20.64	115	20.19
1996	6.2	14.14	11.4	19.29
1997	6	17.63	11.5	19.39
1998	11.82	30.04	20	17.63
1999	11.31	9.9	20.82	16.42
2000	11.58	19	22.86	14.08
2001	16.2	21	24.5	14.07
2002	16.63	21.4	26.9	11.93
2003	21.63	26	28.5	12.19
2004	26.63	38	32.51	10.97
2005	36.73	48	37.11	10.17
2006	50.63	60	53.32	8.94
2007	61.63	60.5	65.04	8.49
2008	50.63	60.4	75.14	8.25
2009	50.63	108.45	65	7.92
2010	65.63	125.97	141	6.55
2011	50.63	141.49	141	7.19
2012	50.63	157.45	97	7.79
2013	50.63	142.48	97	9.03
2014	50.63	170.94	97	9.75
2015	50.63	168.38	87	9.53
2016	83.33	187.32	145	8.77
2017	83.33	200.09	145	8.83
2018	273.25	220.28	145.98	9.75
2019	297.28	229.94	145.32	11.64
2020	303.94	238.39	148.32	12.83
2021	321.29	249.38	165.55	14.83
2022	324.68	252.39	195.63	13.80
2023	523.11	1379.14	617	12.37

Sources: CBN, 2023; NBS, 2023; NNPC, 2023; WDI, 2025