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Critical Analysis of Petroleum Subsidies Implications on Nigeria's Economic Performance

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ABSTRACT
This work critically analyzes the influence of petroleum subsidies on Nigeria's economic performance between 2014 and 2023. The impact of fuel subsidies on key economic indicators, including government expenditure, inflation, gross domestic product (GDP), and consumer demand were evaluated using secondary data from the National Bureau of Statistics (NBS), Central Bank of Nigeria (CBN), and the Nigerian National Petroleum Corporation (NNPC). Quantitative methods, including price elasticity of demand, descriptive statistics, and regression analysis were utilized.The results indicate a complex relationship between subsidies and the Nigerian economy, with subsidies contributing to fiscal strain, inflation, and inefficiencies in fuel consumption, while having a minimal positive impact on economic growth. A negative correlation was found between petroleum subsidies and GDP, indicating that the resources allocated to subsidies would have been better utilized in other sectors to promote economic development. Furthermore, the analysis highlights that subsidy removal often leads to significant shifts in fuel prices and demand, creating both economic and social challenges. The study concludes by providing policy recommendations to mitigate the negative socio-economic effects of subsidy removal.

Keywords: Gross domestic product, Inflation rate, Crude oil price, Premium motor spirit, Price elasticity of demand

I. INTRODUCTION

Petroleum subsidies have consistently been a controversial policy tool employed by governments globally to stabilize premium motor spirit, automotive gas oiland dual purpose kerosene prices and enhance energy affordability for consumers. In Nigeria, a major oil-producing nation, these subsidies have substantially influenced the economic framework and consumer habits. A petroleum subsidy involves government intervention where the state covers a part of the petroleum product costs to maintain low consumer prices. This intervention may include direct financial aid, tax incentives, or other strategies aimed at lowering the retail price of premium motor spirit. The primary objective is to make premium motor spirit more accessible, especially in developing countries like Nigeria, where energy expenses can profoundly affect living costs and the broader economy(WorldBank,2020; Obasi,2020). The subsidies were designed to shield consumers from the high costs of petroleum products, leveraging Nigeria's oil wealth to foster economic stability and improve living standards (Adenikinju,2012).These subsidies were introduced to alleviate poverty and maintain social stability and to shield the population,especially low-income households, from the impact of fuel price fluctuations(Onyekwelu et al., 2020).The subsidies were seen as a means to shield consumers from global oil price volatility and to promote equitable access to energy resources(Raji ,2018).These subsidies that were introduced to make premium motor spirit more affordable also can create a variety of both positive and negative outcomes (Coady et al., 2019).Subsidies can influence both inflation and exchange rates. Specifically, the removal of subsidies often results in a significant rise in premium motor spirit prices, which in turn escalates the cost of goods and services overall, leading to inflationary pressures (Adamu, 2018; World Bank, 2019). Additionally, this can affect the exchange rate by increasing the demand for foreign currency required for imports (IMF, 2021).

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Subsidies have also strained the government's finances,diverting funds from essential services like healthcare and education(Ogunkola et al.,,2019).Economic distortions have arisen, with subsidies encouraging wasteful consumption and deterring investment in alternative energy sources(Ikein, 2009).Subsidy program distorted market signals, discouraging energy efficiency and innovation in renewable sectors, which hindered economic diversification and left the economy vulnerable to global oil price fluctuations (Eleri et al., 2019).Policy changes regarding subsidies frequently trigger public protests and social unrest. In Nigeria, efforts to eliminate or reduce subsidies have faced substantial opposition from the public and various interest groups, resulting in strikes and protests that can disrupt the economy (Ogbu, 2012; Nwaoha, 2021).However, these subsidies have been controversial due to their economic implications, including fostering inefficiencies and corruption. For instance, it is estimated that Nigeria spent over $8 billion on fuel subsidies in 2011 alone and critics have argued that these funds could be better utilized in other sectors such as education and healthcare(Nwafor et al., 2018). Over the years, the persistence of these subsidies has sparked extensive debate, particularly concerning their long-term sustainability and economic implications on consumers. Therefore, this work will analyze the impact of petroleum subsidies on the Nigeria's economic performance.

II. METHODOLOGY

This work adopted quantitative analysis approach.Secondary data (premium motor spirit prices(PMS),subsidy amount paid by the Federal government of Nigeria , sourced from Petroleum Products Pricing Regulatory Agency (PPPRA) and the Central Bank of Nigeria Statistical Bulletin for the period 2014 to 2023 were used.

The price elasticity of demand(PED) were evaluated from equation (1)

$$PED = \frac{(\%\ \text{Change in Quantity Demanded})}{(\%\ \text{Change in Price})} \quad (1)$$

The Gross domestic product(GDP) was estimated from equation (2)

$$GDP = a + b_1(PS) + ? \quad (2)$$

where,GDP = Gross Domestic Product ,PS = Petroleum Subsidy,a = Model Constantb = Coefficient of the independent variable,u = Error Term

Transforming the equation(2) in log form gives;

$$\log GDP = a + b_1(\log PS) + \mu \quad (3)$$

Regression analyses were employed for the relationship between PMS prices and various economic indicators such as GDP, petroleum subsidy, and overall inflation with the ex-post facto research design adopted.

III. RESULTS

3.1 Descriptive Analysis

The economic and energy indicators for over ten years from 2014 to 2023 showing the petroleum subsidy amount, crude oil price, Premium motor spirit price, Gross Domestic Product, and Inflation rate are presented in Table 1.

Table 1.Economic and Energy Related Indicators for Nigeria Over a Period of Ten Years (2014-2023)

Date (Year)	Petroleum Subsidy (NGN Billion)	Crude Oil Price (USD/barrel)	Premium Motor Spirit Price (NGN/liter)	GDP (NGN/billion)	Inflation Rate (%)	Quantity of petroleum Demanded (barrel/day)
2014	1,220	63.28	97	67,977.46	8.05	283,648
2015	654	37.80	87	69,780.69	9.55	306,289
2016	240	53.48	145	68,652.43	18.55	428,000
2017	154	65.11	150	69,205.69	15.37	315,723
2018	1,190	62.00	147.5	70,536.35	11.44	334,591
2019	508	68.56	145.3	72,094.09	11.98	345,911
2020	864	50.33	145.41	70,800.54	15.75	247798
2021	1,430	65.41	166.24	73,382.77	15.63	453,270
2022	4,390	82.50	206.19	75,768.95	21.34	415,094
2023	3,600	79.12	257	77,936.10	28.92	520,000

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3.1.1 Petroleum Subsidy (NGN Billion)

Table 1 shows that the petroleum subsidy amounts fluctuated significantly between 2014 and 2023. The subsidy amount was highest in 2022, reaching NGN 4,390 billion, followed by NGN 3,600 billion in 2023. The lowest subsidy amount was recorded in 2017, at NGN 154 billion. The sharp increase in subsidies from 2020 to 2022 is particularly notable and could be attributed to factors such as the global economic impact of the COVID-19 pandemic and the resulting fluctuations in oil prices.

3.1.2 Crude Oil Price (USD/barrel)

Crude oil prices have experienced considerable volatility during the period under review. The lowest crude oil price was recorded in 2015 at USD 37.80 per barrel, while the highest price was recorded in 2022 at USD 82.50 per barrel as shown in Table 1. The significant drop in oil prices in 2015 was likely due to global market dynamics, including oversupply and reduced demand, which had direct implications on Nigeria's revenue and subsidy payments.

3.1.3 Premium Motor Spirit Price (NGN/liter)

Premium motor spirit prices in Nigeria have steadily increased from NGN 97 per liter in 2014 to NGN 257 per liter in 2023 as presented in Table 1. The most substantial price hike occurred between 2015 and 2016, where the price increased from NGN 87 to NGN 145 per liter. This increase aligns with the government's decision to partially deregulate the downstream petroleum sector, leading to adjustments in pump prices to reflect market realities.

3.1.4 Gross Domestic Product (GDP) (NGN Billion)

Nigeria's GDP exhibited a relatively steady growth trend, increasing from NGN 67,977.46 billion in 2014 to NGN 77,936.10 billion in 2023 as presented in Table 1.Despite the recession in 2016, where the GDP declined to NGN 68,652.43 billion, the economy showed resilience, bouncing back in subsequent years. However, the slower GDP growth rate from 2020 onwards indicate the impact of both the pandemic and the fluctuating subsidy policies.

3.1.5 Inflation Rate (%)

Inflation in Nigeria fluctuated significantly from 2014 to 2023. The highest inflation rate was recorded in 2023 at 28.92%, while the lowest was in 2014 at 8.05%. The surge in inflation from 2020 onwards can be linked to several factors, including increased subsidy payments, higher premium motor spirit prices, and broader economic challenges.

3.2 Correlation and Regression Analysis

Correlation analysis was conducted to understand the relationships between petroleum subsidies and the other economic indicators (crude oil prices, PMS prices, GDP, and inflation rate).

3.2.1 Petroleum Subsidy and Crude Oil Price

A positive correlation was observed between petroleum subsidies and crude oil prices, suggesting that higher oil prices often lead to higher subsidy payments. This correlation is intuitive, as Nigeria imports refined petroleum products, and higher crude oil prices increase the cost of these imports, thus raising the subsidy burden on the government.

3.2.2Petroleum Subsidy and Premium motor spirit Price

There is a weak correlation between petroleum subsidies and petrol prices. This weak correlation indicates that despite rising subsidy amounts, premium motor spirit prices have been adjusted periodically, reflecting the government's attempts to balance between subsidy payments and deregulation efforts.

3.2.3 Petroleum Subsidy and GDP

The correlation between petroleum subsidies and GDP was negative, suggesting that higher subsidy payments are associated with slower economic growth. This relationship indicates that the financial resources allocated to subsidies could have been diverted from other productive sectors, thereby hampering economic growth.

3.2.4 Petroleum Subsidy and Inflation Rate

A strong positive correlation exists between petroleum subsidies and inflation rates. The increase in subsidy payments is closely linked to rising inflation, as the government's heavy spending on subsidies may contribute to macroeconomic instability, including higher inflation.

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The results of the regression analysis are shown in Table 2.

Table 2. Regression Analysis

	df	SS	MS	F	Significance F
Regression	4	14822636.9674	3705659.241	5.195521861	0.04993915
Residual	5		3566205.032	713241.0065	
Total	9	18388842			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%
Intercept	-31999.05212	13127.11236	-2.437630701	0.058825071	-65743.36871
CRUDE OIL PRICE (USD/BARREL)	68.65972856	44.99139417	1.526063591	0.187517044	-46.99433206
PMS PRICE (NGN/LITER)	-42.05067833	34.54265351	-1.217355184	0.277784058	-130.845396
INFLATION RATE (%)	192.8243644	176.9809395	1.089520515	0.325626768	-262.119624
GDP (NGN BILLION)	0.455214663	0.206763405	2.201621042	0.078932607	-0.07628759

From table 2 above, there is an indication that payment of subsidy have positive and significant
impact on Gross Domestic Product of Nigeria for the period 2014 to 2023 (coefficient of LogPS = -31.99, t-value = -2.4376, p-value 0.0588 > 0.05). R-Square which measures the goodness of fit of the model was 80.61%. This was properly adjusted to 65.09%. The F-statistic which measures the overall goodness of the model was statistically significant since the probability of the f-statistic was 0.05.

(i)**Negative Impact of Subsidy on GDP**: The coefficient of the variable representing petroleum subsidy (LogPS) was -31.99, indicating a negative relationship between the payment of subsidies and Nigeria's GDP for the period from 2014 to 2023. This suggests that for every unit increase in the subsidy, GDP decreases by 31.99 units. Therefore, subsidies have a negative impact on economic performance.

(ii) **Statistical Significance**: The t-value of -2.4376 shows that the variable (LogPS) has some level of statistical significance, but the p-value of 0.0588 is slightly above the conventional threshold of 0.05. This means that although the negative relationship between subsidies and GDP is notable, it is not statistically significant at the 5% level.

(iii)**Goodness of Fit (R-Square)**: The R-square value of 80.61% indicates that the model explains a large proportion (80.61%) of the variability in GDP, meaning that the independent variables used in the model are strong predictors of GDP. The adjusted R-square of 65.09% suggests that the model retains a good fit even when adjusted for the number of variables.

(iv)**Overall Significance of the Model**: The F-statistic is statistically significant, with a p-value of 0.05, implying that the overall regression model fits the data well. This suggests that the combined influence of the variables in the model, including subsidies, has a statistically significant impact on GDP.

3.2.5 Price Elasticity of Demand(PED)

The price elasticity of demand (PED) values for each year from 2015 to 2023 are presented in table 3.The PED values vary across the years, indicating different elasticities. A negative value suggests that the demand for petroleum moved in the opposite direction of price, while positive values indicate a direct relationship between price and quantity demanded.

Table 3. Data-set for the Changes in Price and Quantity Demanded.

Year	% Change in Quantity Demanded (%)	% Change in Price (%)	PED
2014	----	----	----
2015	7.98	-40.27	-0.20
2016	39.74	41.48	0.96
2017	-26.23	21.75	-1.21

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2018	5.98	-4.78	-1.25
2019	3.38	10.58	0.32
2020	-28.36	-26.59	1.07
2021	82.92	29.96	2.77
2022	-8.42	26.13	-0.32
2023	25.27	-4.10	-6.17

(i) **Inelastic to Elastic Transitions**

Table 3 shows that between 2015 and 2016, the PED values were near zero, reflecting relatively inelastic demand. A PED of -0.20 in 2015 indicates that despite a significant price drop (possibly due to subsidy adjustments or external market factors), the demand for petroleum did not respond proportionally. This suggests that petroleum demand in Nigeria during this period was relatively unresponsive to price changes. In contrast, by 2021, there was a significant PED value of 2.77, indicating highly elastic demand. During this period, even a moderate price increase led to a disproportionately large increase in demand, likely driven by market or policy shifts, such as subsidy adjustments or price deregulation.

(ii)**Subsidy Impact on Price Elasticity**

Table 3 shows a PED values of -1.21 and -1.25 in 2017 and 2018,where demand was highly responsive to price changes, but in the opposite direction. The negative elasticity shows that as prices rose (or subsidies were reduced), demand decreased significantly. This behavior was common when subsidies were adjusted, making petroleum more expensive for consumers, and thus reducing demand. The sharp PED drop in 2023 (-6.17) indicates that despite a price reduction, the demand increased sharply, a scenario that reflect market overreaction or sudden policy shifts like a significant subsidy reinstatement, leading to higher consumption due to lower prices.

(iii) Elastic Demand and Economic Efficiency

In 2021 with elastic demand as presented in Table 3, the large consumer response to price changes indicate that subsidies leads to inefficient consumption. Subsidized prices might encourage overconsumption, creating economic distortions where consumers use more petroleum than is economically optimal, contributing to fiscal strain on government budgets.

(iv) Negative Elasticities and Policy Implications

The negative PED values in some years suggest that price increases (likely from subsidy removal
or reduction) directly resulting to decreased consumption. This indicates the ability of the government to use subsidy adjustments as a tool to control petroleum consumption, reduce fiscal burdens, and promote energy efficiency. However, it also highlights the risk of social unrest or reduced economic activity as petroleum becomes less affordable for average consumers.

(v) Market Sensitivity Post-Subsidy Adjustments

The periods of high PED (2017, 2021) indicate that market sensitivity to price changes grows when subsidies are adjusted or removed. Subsidies typically create artificial price stability and when reduced, the market responds more dramatically. This highlights a critical issue in Nigeria's subsidy policy, while subsidies temporarily stabilize prices, they also create long-term vulnerabilities in market stability when removed.

IV. ONCLUSIONS

The analysis of petroleum subsidies and their implications on Nigeria's economic performance over the period 2014 to 2023 reveals a complex interplay between government policies, macroeconomic indicators, and energy consumption. While subsidies have helped to stabilize petrol prices and manage the cost of living for Nigerians, they have also introduced significant fiscal burdens on the economy. Subsidy regime has led to a distortion of market dynamics, encouraging inefficiencies in energy use, while failing to significantly promote long-term economic growth.The correlation and regression analyses demonstrate that higher subsidy payments are linked to slower economic growth and rising inflation rates. The price elasticity of demand analysis reveals that subsidy adjustments have caused significant fluctuations in petroleum demand, contributing to economic inefficiencies.Ultimately, while petroleum subsidies have provided some short-term economic benefits, they have undermined the long-term sustainability of Nigeria's economic performance. The subsidy regime has contributed to fiscal strain, discouraged investment in alternative energy, and

fostered an over-reliance on oil, which makes the economy vulnerable to global oil price shocks.

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