Does Petroleum Products Pricing Stimulate Economic Growth in Nigeria? An Empirical Investigation Applying ARDL Approach

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ABSTRACT

The rising prices of petroleum products and energy in Nigeria, coupled with a surge in poverty and a decline in living standards, necessitate an investigation into how the pricing of petroleum products has impacted Nigeria's economic growth from 1990 – 2022. To achieve the purpose of the study, data on growth rate of gross domestic product, premium motor spirit price, automotive gas oil price, household kerosene price, compressed natural gas price and crude oil price were sourced from the World Bank and Petroleum Product Pricing and Regulatory Agency (PPPRA) and analysed by employing the Autoregressive Distributed lag (ARDL) method. Our results and findings revealed that: Prices of Premium Motor Spirit, automotive gas oil, dual purpose kerosene and crude oil were all negatively and marginally related to economic growth in the long run. Only price of compressed natural gas was positively but marginally related to economic growth. This implies that petroleum products prices had retarding effect on economic growth in Nigeria in the long run. In the short run, premium motor spirit and automotive gas oil had mixed effect on economic growth while price of household kerosene and price of crude oil were positively related to economic growth but price of compressed natural gas were negatively related to economic growth. Petroleum products prices proxied by prices of Premium Motor Spirit, Automotive Gas Oil, Household Kerosene, Compressed Natural Gas and Crude oil had less impact on economic growth in the long but had serious implications on economic growth in the short run in Nigeria over the period of the study. Based on this conclusion, the study recommended Increase investment in compressed natural gas, proper utilization of crude oil revenue and strengthening existing policies in the oil and gas sector as possible measures towards improving economic growth in Nigeria.

Key words: Economic growth, Premium motor spirit price, automotive gas oil price, Household kerosene price, compressed natural gas price and crude oil price

INTRODUCTION

The petroleum and energy industry constitutes a significant portion of both developed and undeveloped economies. The importance of it differs in different nations depending on whether the nation is a net importer or exporter of it. Due to the substantial significance of petroleum and energy in contemporary economic activities, an increasing number of nations have developed national policies in recent years regarding energy and petroleum products. The petroleum and energy industry has seen substantial government intervention in terms of pricing and competition, with involvement from both federal and state authorities. In Nigeria, the government has implemented a systematic and comprehensive approach to intervention, which includes policies aimed at promoting production and policies aimed at regulating output to maintain stable pricing for petroleum products. It is comprehensible, given that the industry accounts for more than 90% of the nation's foreign currency profits and between 55% and 70% of its government income (Odior& Okoh, 2023).

The reduction in world oil prices in the early 1980s resulted in an economic crisis, namely an oil glut in the global market which caused a decrease in oil prices and thus reduced the government's oil income. Subsequently, the Nigerian government has aimed to implement suitable pricing for petroleum products to prevent hoarding, artificial scarcity, smuggling, diversion, inadequate investment, and product adulteration of this vital commodity.

In light of the economic challenges stemming from inadequate pricing and limited competition in the sector, it became necessary to explore effective solutions to alleviate the existing difficulties in the industry. The quest for a solution led to the need of deregulating the industry, which involves gradually eliminating government subsidies. This would enable the establishment of fair pricing and competition (Olawuni & Oyeladun, 2024). The elimination of subsidies provided by state-owned businesses (SOEs), which is a crucial part of a larger reform process in the public enterprise sector, is one of the specified conditions of the Structural Adjustment Programme (SAP) that was implemented in 1986 (FRN, 1986, 1988). The research suggests that deregulation would benefit the petroleum products industry by allowing for more flexibility in pricing and competition. This will lead to increased profit maximisation and the growth of the petroleum products market.

Adebisi, Alenoghena, and Charles (2023) assert that petroleum products, i.e. crude oil, petrol, diesel, and natural gas, play a crucial role as indispensable energy sources that propel global economic activity. The price of petroleum products is influenced by several variables, i.e. supply and demand dynamics, geopolitical tensions, production costs, and government regulations. The volatility in pricing of petroleum products has substantial ramifications for macroeconomic performance, particularly in terms of economic growth.

Building with the previous statement, Raymond (2020) confirmed that increased petroleum prices may enhance government income, so generating extra cash for investment in infrastructure projects, social initiatives, and economic stimulus measures. This has the potential to increase economic activity and make a substantial contribution to the growth of the Gross Domestic Product (GDP). Net exporters of petroleum products, i.e. Nigeria, might see a boost in export revenues and a favourable impact on GDP growth when oil prices rise. This has the potential to bolster economic growth, stimulate investment, and foster the development of employment opportunities in companies that focus on exporting goods and services. In contrast, elevated fuel expenses might diminish the amount of money available for families to spend, resulting in a decline in consumer expenditure on non-essential products and services. The decrease in consumption might hinder economic expansion, especially in industries that depend on consumer demand. Moreover, the escalation in petroleum prices might augment the expenses associated with production for enterprises, resulting in elevated prices for commodities and services. In the event that enterprises are unable to transfer these cost escalations to consumers, it is possible that profit margins may contract, resulting in less investment and production, which might have an adverse effect on GDP growth. In addition, whereas elevated oil prices might enhance the export revenues of nations that rely on oil exports, they can also escalate the expenses associated with importing petroleum goods. If the rate at which import costs increase exceeds the rate at which export revenues rise, it may have a negative impact on the trade balance and lead to a decrease in net exports, which in turn hampers overall GDP development.

In congruent with statistical data from the National Bureau of Statistics (2023), the price of Premium Motor Spirit (PMS) grew from N11 in 1994 to N25 in 1998. By June 2000, the price of PMS further soared to N30 in 2004. The value increased to N87 in 2012, N150 in 2017, N165 in 2020, N195 in 2022, and N626 in 2023. The price of Automotive Gas Oil (AGO) showed a consistent upward trend, increasing from N9 in 1995 to N21 in 2000, N60 in 2005, N115 in 2010, N164.26 in 2015, N224.3 in 2020, and N817.86 in 2022. Despite the increasing cost of petroleum goods, economic expansion has not consistently followed the same pattern, since it continues to vary throughout the years. The GDP saw a negative growth rate of -0.07% in 1995. It then grew to 5.02% in 2000, 6.44% in 2005, and 8.01% in 2010. However, it decreased to 1.62% in 2016 and 1.79% in 2020. It barely improved to 3.25% in 2022, in congruent with the National Bureau of Statistics in 2023. Considering the unpredictable and exclusive nature of economic expansion in

Nigeria over the years, it is crucial to analyse the impact of petroleum product price on the national economy from 1990 to 2022. We will proceed with our investigation by examining pertinent literature about the subject.

ii. Literature Review

The investigation into the nexus between energy consumption and economic growth began in the 1970s with the influential research conducted by Kraft and Kraft (1978). They found evidence of a one-way causal nexus, where economic growth, as measured by Gross National Product (GNP), led to increased energy consumption in the United States from 1947 to 1974. Subsequently, many academics have conducted further examinations to ascertain the correlation between energy consumption and economic expansion (Yildrim & Aslan 2012). Studies without qualitative differentiation have proposed and presented four hypotheses that might be tested to elucidate the direction of the link between energy and economic expansion. The energy-growth literature proposes four hypotheses on the cause-and-effect link between energy and economic expansion. These hypotheses are known as the Growth Hypothesis, the Conservation Hypothesis, the Feedback Hypothesis, and the Neutrality Hypothesis. Each of these ideas has substantial policy ramifications (Ouedraogo, 2013; Ozturk, 2010; Yildirim & Aslan, 2012; Ekeocha, Penzin & Ogbuabor, 2020).

*Growth Hypothesis:*The Growth Hypothesis posits that energy consumption has a direct impact on economic growth, while accounting for the effects of capital and labour. The concept posited a one-way causal nexus, with energy use leading to economic expansion. Energy policies targeting energy conservation will have a detrimental impact on economic expansion.

*Conservation Hypothesis:*The Conservation Hypothesis posits that economic growth is the driving force behind the expansion of the energy sector and suggests an economy that relies less on energy. The empirical validity of this theory is confirmed by the one-way causation that exists from economic growth to energy consumption. Therefore, energy conservation strategies, i.e. allocating resources to enhance energy efficiency and implementing demand control rules, are not expected to have any negative effects on the increase of production.

*Feedback Hypothesis:*In congruent with the Feedback Hypothesis, there is a two-way causal nexus between energy consumption and economic expansion, which means that the two go hand in hand. Here, efforts to curb energy use via conservation policies might have the unintended consequence of slowing economic expansion, which would in turn have an impact on energy consumption levels.

Neutrality Hypothesis: Energy usage does not impact economic expansion, in congruent with the Neutrality Hypothesis. It states that energy use and economic expansion are not directly related. If there is no correlation between energy use and GDP growth, then this theory holds. In such a scenario, efforts to reduce energy use via conservation regulations will not contribute to economic expansion. There is no correlation between energy production and GDP growth, says the Neutrality Hypothesis. The fact that energy consumption does not seem to have any impact on GDP growth lends credence to the Neutrality Hypothesis. In congruent with Ouedraogo (2013), Ozturk (2010), Yildirim & Aslan (2012), and Ekeocha, Penzin & Ogbuabor (2020), policies that encourage more energy use and access will not contribute to economic expansion in this scenario.

Despite having access to a variety of energy sources, less developed nations have failed to see faster economic expansion. For example, as of 2024, Nigeria's average power output was below 4000 Megawatts, despite the nation's abundant resources of crude oil, natural gas, solar, and hydropower. With a population of nearly 200 million, this electricity production is clearly not enough. Despite having a lot of natural gas and crude oil on hand, the nation nevertheless has to import petroleum products. Because of this, the price of petroleum goods is unpredictable, putting them out of reach for most consumers and small businesses. Regardless, we should look at how the price of petroleum products has impacted economic expansion.

There has been a lot of empirical investigation on the impact of petroleum product prices on economic performance, and the findings have been varied. To illustrate the point, Nwaoha et al. (2018) discovered that premium motor spirit and dual-purpose kerosene prices substantially and negatively impact GDP, whereas the price of automobile petrol oil has a negligible and negatively impactive effect on economic growth. In addition, Omotosho (2019) discovered that the macroeconomic variables of Nigeria are substantially and persistently affected by fluctuations in oil prices. Also, the petroleum industry in Nigeria has an inverse link with currency and inflation rates, but a strong and positive long-term association with GDP and unemployment (Onakoya and Agunbiade, 2020). In addition, Olawale and Luqman (2020) discovered that premium motor spirit pricing increased the likelihood of inflation, but they could not find any direct nexus between changes in the price of petroleum motor spirit and changes in inflation in Nigeria. The authors Kabiru and Rabiu (2021) have discovered that the Nigerian currency rate and inflation rate are highly correlated with the price of petroleum items. Finally, Ukangwa et al. (2022) found that premium motor spirit and dual-purpose kerosene prices correlate insignificantly with inflation, but had a substantial influence on Real Gross Domestic Product prices. Unemployment also has a substantial upshot on the pricing of premium motor spirit, dual-purpose kerosene, automobile petrol oil and a host of other petroleum products.

Using data from 1985 to 2020, Sule-Iko et al. (2023) examined how fluctuations in the global price of crude oil affected the real GDP of Nigeria. Weutilised the auto-distributed-lag approach. International oil prices had a favourable effect on Nigeria's real GDP in the near term, in congruent with the authors. There is a substantial and beneficial connection in the long term. Although oil price volatility has no long run impact on the Nigerian economy, it does have a favourable short-term impact.

Mukhtar, Abubakar, Ibrahim, Hassan and Ibrahim (2022) examined the link between natural gas consumption and economic expansion in Nigeria, both in the short and long term, accounting for breaks. This research made use of a break-based ARDL model. Both the short run and long run results showed a positive nexus between natural gas use and growth, with the latter showing statistical significance. When looking at the nexus between growth and natural gas consumption, there is evidence of both short run and long run bidirectional causation. The results suggest that natural gas plays a role in Nigeria's economic growth, so any energy policy that encourages more use of this fuel could boost the nation's GDP. In the short run, Nigerian officials could implement measures to reduce energy consumption in response to climate change. More gas storage facilities and pipeline construction, exploration of alternative energy sources, and more knowledge and education about natural gas's usage in Nigeria are all things the study suggests doing to boost natural gas use.

Abner, Izuchukwu, Eneoli, and Udo (2021)utilised a multivariate framework spanning 2000Q1–2018Q4, the ARDL bounds test method, the Error Correction Model (ECM), and the Clemente-Montanes-Reyes unit root to examine the correlation between energy consumption and economic growth in Nigeria. Results showed that electricity consumption, liquefied natural gas, and petroleum all have bidirectional nexus with one another. Increasing energy consumption boosts economic growth by adding value to products and services, but reducing it by one unit increases petroleum consumption due to distribution failure, an estimated billing system, and an over-reliance on generating sets as alternative energy sources. A discrepancy between energy demand and supply is to blame for the lack of a causal link. Among other things, the report suggested reevaluating the price structure, the billing system, and the policies that aim to promote and guarantee responsive and efficient energy distribution and maintenance in order to boost economic expansion and value creation.

Ighosewe, Akan, and Agbogun (2021)utilised a resource-dependence technique to look at the 35-year research period (1984-2018) of crude oil fluctuations and how they affected the Nigerian economy. applying the Auto-Regressive Distributed Lag Model, the following variables were considered: Oil Price per Barrel Fluctuation (FOBP), Diesel Pump Price Fluctuations (PPPF), Petrol Pump Price Fluctuations (DPPF), Kerosene Pump Price Fluctuation (KPPF), and Real GDP. The findings showed that the Nigerian economy benefited greatly from just the Fluctuation in Oil Price per Barrel (FOBP) in the short term. Both the Oil Price per Barrel (FOBP) and the Kerosene Pump Price Fluctuation (KPPF) have positive effects on

the Nigerian economy over the long run. Therefore, the research found that private and governmental organisations should stay out of the top rank's oversight of the surplus crude account if the Nigerian economy wants to achieve remarkable performance. Moreover, the Federal government needs to make an effort to bring the Nigerian economy into the industrial age.

Mathew and Sunday (2020) looked at the distributional features of petroleum product prices and how they affected Nigerian households. We utilised information from the 2010 Nigerian Living Standard Measurement Survey, which surveyed 53,663 homes. Weutilised quintile analysis. Subsidies for petroleum products do not have "the same distributional welfare benefits" on Nigerian households, in congruent with the research.

In their reevaluation of the 1999Q1–2016Q4 energy consumption–economic growth connection in Nigeria, Patterson, Dinci, and Jonathan (2020)utilised different model parameters. The research relied on an ARDL-ECM specification that assumes a linear connection instead of a nonlinear one, and a nonlinear (or asymmetric) ARDL model. In essence, the analysis indicated that energy consumption's impact as a growth driver was consistently small, indicating that more work remains before energy's anticipated upshot becomes apparent in Nigeria's economy. In congruent with the granger causality tests, there is a one-way causation between energy consumption and economic expansion. This means that with a reliable and better energy supply, Nigeria may achieve high levels of sustainable growth. The study's authors drew the conclusion that Nigeria's and other Sub-Saharan African economies' structural similarities should serve as a wake-up call to their respective governments and policymakers, urging them to swiftly develop and enact policies to solve their energy crises.

In 2020, Athanasios, Michael, and Symeoni-Eleni revisited the topic of the peripheral European Union's long-run link between energy costs and economic expansion. The work estimated a Vector-Error Correction Model applying the Engle-Granger approach. Researchers alsoutilised Variance Decomposition Analysis to try to pin down how much of an impact energy prices had on GDP growth. For the real GDP and residential electricity price cases, the research offered evidence on the conservation hypothesis; for the real output and industrial electricity price cases, it offered evidence on the growth hypothesis. Industrial electricity price and crude oil price "Granger cause" home electricity prices which showed the greatest amount of effect on the residential power sector. In terms of total energy use and residential power pricing, the analysis discovered evidence supporting the feedback theory. Finally, shocks from other variables seem to have a transient influence on the degree of economic growth, which is substantially endogenous in the short-run and proxied by real GDP.

Using the Engle-Granger technique to estimate yearly data applying the VECM, Dagoumas, Polemis, and Soursou (2020) conducted an investigation of the correlation between energy costs and growth in Europe from 1990 to 2018. The research established a direct correlation between crude oil prices, industrial electricity prices, and home power prices. The findings also indicated that the growth rates of European economies will be unaffected by a rise in power costs.

Oil price shocks and Nigeria's current fuel subsidy system was the subject of Omotosho's (2019) macroeconomic study. He accomplished this by creating and testing a New-Keynesian DSGE model that takes into consideration the impact of changes in the price of oil on petrol prices at the pump. Up to the fourth year, the result reveal that oil price shocks account for over 22% of the fluctuations in production, demonstrating their substantial and long-lasting effects. A negative oil price shock reduces aggregate GDP, raises non-oil GDP, enhances headline inflation, and depreciates the currency rate, in congruent with our benchmark model (i.e., with fuel subsidies). In contrast, the model devoid of fuel subsidies produces findings that show headline inflation falling and the currency rate depreciating more in the near term, with a reduced contractionary impact on aggregate GDP from a negative oil price shock. Removing fuel subsidies increases macroeconomic instability and has non-trivial consequences for how monetary policy reacts to an oil price shock, in congruent with counterfactual simulations. This report warns that in order to overhaul gasoline subsidies successfully, we must also develop long-term adjustment mechanisms and

implement tailored safety nets.

Ogbonna and Orlu (2017) evaluated the effects of fluctuations in petroleum prices on the Nigerian economy from 1970 to 2013 applying the error correction approach. Considered variables are Premium Motor Spirit (PMS) price, lending interest rate (LIR), labour employment (LEMP), and gross domestic investment (GDI). The NBS annual report (2013) and the CBN Statistical Bulletin provided the datautilised in the study. The research found that the Nigerian economy was small yet negatively affected by PMS Price volatility. Accordingly, the research concluded that the government of Nigeria needs to loosen its grip on the pricing of PMS. Once again, we need to promote private sector involvement in the crude oil downstream sector.

From 1970 to 2011, Ismail and Adegbemi (2013) looked at how changes in oil prices affected actual growth in Nigerian production. The results showed that oil price shocks do not have a direct upshot on production, exchange rate, or inflation in the near term, in congruent with the results obtained applying the dynamic VAR analytical framework. Output increase in the long term is positively and substantially correlated with the research. The generalised impulse responses confirmed both the direct and indirect links between the oil price shock and growth.

From 1980 to 2010, Nwosa and Ajibola (2013) looked at how the price of petrol affected different parts of Nigeria's economy. Agriculture, manufacturing, transportation, communication, wholesale/retail, and the building/construction industries were the primary foci of the research. Agricultural and manufacturing sectors are the only ones that feel the short run effects of a rise in petrol prices, in congruent with the research, while the building and construction industry is the only one that feels the long run effects.

Using the General Method of Moments (GMM) model, Molly, Richard, and Edwin (2022) examined the outcome of petrol use on economic expansion in Kenya from 2008 to 2020. Petrol use has an effect on GDP growth in Kenya, in congruent with the research. In order to counteract the impact of the gas consumption coefficient and have a positive influence on economic growth rate, the government should think about the gas supply and the kind of subsidies available.

Momodu et al. (2022) utilized ARDL to study the result of fluctuating crude oil prices on the performance of Nigerian macroeconomics. They utilised data from 1980 to 2020. There is a positive and statistically substantial nexus between oil prices and Nigeria's macroeconomic performance. Unemployment was substantially and negatively impacted by the oil price. The impact of oil prices on foreign exchange reserves was substantial and favourable.

The authors Siyakudumisa, Kin, and Yiseyon-Sunday (2022) utilised the auto-regressive distributed lag (ARDL) bounds test method to empirically examine the link between energy prices and economic performance in South Africa from 1994 to 2019. The results showed that crude oil prices have a strong positive relationship with economic growth over the long and short run, whereas power costs have a markedly negative effect on both. There was no nexus between rising energy costs and GDP expansion in South Africa, in congruent with the Granger causality study. Nonetheless, it demonstrated a one-way causal nexus between economic growth, labour productivity, and gross fixed capital creation. The government should act to reduce the effect of power costs on economic expansion in South Africa, in tandem with the recommendations.

The review of past studies on the topic of interest shows that a lot of works have been done on the issue at stake. For instance, Ighosewe, Akan and Agbogun (2021) examined the effect of crude oil fluctuation on the Nigeria’s economy while Abner, Izuchukwu, Eneoli and Udo (2021) studied the impact of energy consumption on economic growth in Nigeria. The work by Mukhtar et al (2022) dwelled on the impact of natural gas consumption on economic growth in Nigeria while Ogbonna and Orlu (2017) investigated the effect of fluctuations in petroleum prices on the Nigeria’s economy among others. These evidences show that none of the previous studies investigated holistically all the components of the key petroleum products prices available and used in Nigeria such as: premium motor spirit price, household kerosene price,

compressed natural gas price, and automotive gas oil price and other ally products prices such as crude oil price and natural gas price. In a bid to fill the gap, this study was carried out in Nigeria and empirically analyzed the effects of petroleum product pricing on Nigeria's economic growth.

METHODOLOGY

This study's model is base on Kraft and Kraft's (1978) energy growth theory, which concluded that there was a one-way causality between the growth of the United States' Gross National Product (GNP) and energy consumption from 1947 to 1974. The analytical framework is premise on Kabiru and Rabiu's (2021) work, with some modifications made to accommodate the study's specific variables and their intended use. So, this is how the revised model is defined:

$$RGDPR = f(\beta_0, PMS^{\beta 1}, HHK^{\beta 2}, CNG^{\beta 3}, AGO^{\beta 4}, COP^{\beta 5}) \quad 1$$

For ease of estimation, equation 1 is transform into linear form thus:

$$RGDPR_t = \beta_0 + \beta_1 \ln PMS_t + \beta_2 \ln HHK_t + \beta_3 \ln CNG_t + \beta_4 \ln AGO_t + \beta_5 \ln COP_t + U_t \quad 2$$

Where: *Ln*=Natural logarithms;β_0 = intercept; $RGDPR_t$ = growth rate of Real Gross Domestic Product; PMS_t= Premium motor spirit price, HHK_t= Household kerosene price, CNG_t= Compressed natural gas price, AGO_t = Automotive gas oil price, COP_t = Price of crude oil, $\beta_1 - \beta_5$= Coefficients of independent variables in economic growth model, U_i= error term. Sources for the time series data on the aforementioned variables include the following: the Central Bank of Nigeria (CBN) Statistical Bulletin, the National Bureau of Statistics (NBS), the Petroleum Products Pricing Regulatory Agency (PPPRA), the Nigerian National Petroleum Company Ltd (NNPCl), and the World Bank's World Development Indicators (WDI). This data set has thirty-three (33) years of observations, beginning in 1990 and ending in 2022.

Estimating the association between the price of petroleum products and economic expansion in Nigeria required the use of the ARDL method since the variables had heterogeneous order of integration.

$$\begin{aligned}\Delta(RGDPR_t) = {} & \beta_0 + \sum_{t=1}^{p} \beta_{1i} \Delta(RGDPR_{t-1}) + \sum_{t=1}^{q} \beta_{2i} \Delta(lnPMS_{t-1}) + \sum_{t=1}^{q} \beta_{3i} \Delta(lnHHK_{t-1}) \\ & + \sum_{t=1}^{P} \beta_{4i} \Delta(lnCNG_{t-1}) + \sum_{t=1}^{P} \beta_{5i} \Delta(lnAGO_{t-1}) + \sum_{t=1}^{P} \beta_{6i} \Delta(lnCOP_{t-1}) + \chi_{1i} \Delta(RGDPR_{t-1}) \\ & + \chi_{2i} \Delta(lnPMS_{t-1}) + \chi_{3i} \Delta(lnHHK_{t-1}) + \chi_{4i} \Delta(lnCNG_{t-1}) + \chi_{5i} \Delta(lnAGO_{t-1}) \\ & + \chi_{6i} \Delta(lnCOP_{t-1}) + \varepsilon_{1i}(3)\end{aligned}$$

Where,Δ = the difference operator and indicates the optimum lag;t = time lag; β_0, = constant variable and $\beta_1 - \beta_6$, = long-run dynamic coefficients of the model $\chi_1 - \chi_6$ = short-run dynamic coefficients of the model; ε_{1i} = serially uncorrelated stochastic term with zero mean and constant variance. Now that we know how the variables interact over the long term, we can estimate the following equations to predict Nigeria's GDP growth:

$$RGDPR_t = \beta_0 + \beta_1 InPMS_{t-1} + \beta_2 InAGO_{t-1} + \beta_3 InHHK_{t-1} + \beta_4 InCNG_{t-1} + \beta_5 InCOP_{t-1} + \mu_t - 4$$

Weutilised the Akaike Information Criterion (AIC) to determine the ARDL model's lag length, which was two (2) for the dependent variable and four (4) for the independent variables. We developed the ARDL error correction model in order to determine the short-run dynamics:

$$\Delta(RGDPR_t) = \sum_{i=1}^{n} \beta_0 \Delta(RGDPR_{t-1}) + \sum_{i=1}^{n} \beta_1 \Delta 1n(PMS_{t-1}) + \sum_{i=1}^{n} \beta_2 \Delta 1n(AGO_{t-1}) + \sum_{t=1}^{n} \beta_3 \Delta 1n(HHK_{t-1}) + \sum_{t=1}^{n} \beta_4 \Delta 1n(CNG_{t-1}) + \sum_{t=1}^{n} \beta_5 \Delta 1n(COP_{t-1}) + \sum_{t=1}^{n} ECM_{t-1} + U_t \quad 5$$

RESULTS

Considering the mean, minimum, and maximum values likewise the standard deviation values of premium motor spirit (PMS) and real gross domestic product growth rate (RGDPR) across the period, the descriptive statistical results displayed in Table 1 suggest that there was less volatility in these variables. Nevertheless, after looking at the average, minimum, and maximum values likewise the standard deviation values, it was clear that the prices of crude oil (COP), automobile gas oil (AGO), kerosene (HHK), and compressed natural gas (CNG) varied greatly over the period. We can deduct from the probability values that the prices of premium motor spirit, crude oil, and real GDP growth all follow a normal distribution around their mean values, but the prices of kerosene, compressed natural gas, and automotive gas oil do not. To sum up, the study's time frame allowed us to infer that petroleum product prices were quite volatile.

Table 1. Summary statistics result

Statistic	RGDPR (%)	COP ($/barrel)	PMS (N/litre)	AGO (N/litre	HHK (N/litre)	CNG (N/kg)
Mean	4.29	49.65	0.81	170.33	109.69	137.56
Median	4.23	41.47	65.00	60.00	50.00	75.00
Maximum	15.33	109.45	195.00	2140.00	809.00	816.00
Minimum	-2.04	12.28	0.60	0.50	0.40	0.50
Std. Dev.	3.96	31.74	60.02	385.32	176.52	202.77
Skewness	0.47	0.57	0.50	4.36	2.45	2.20
Kurtosis	3.39	1.99	1.86	22.28	9.04	7.23
Jarque-Bera	1.40	3.14	3.18	615.24	83.21	51.19
Probability	0.50	0.21	0.20	0.00	0.00	0.00
Sum	141.52	1638.29	2336.55	5620.96	3619.90	4539.50
Sum Sq. Dev.	501.47	32243.90	115283.1	4751192.	997075.1	1315646.
Observations	33	33	33	33	33	33

Source: Researcher's Computation

From 1990 to 2005, real GDP and petroleum product prices grew at a sluggish pace, as seen in Figure 1. With the exception of the dramatic increase in the price of petrol for automobiles from 2013 to 2015, the variables under study rose gradually beginning in 2006. Petroleum product prices have been rising since 2015. On the other hand, actual GDP growth has been declining. The elimination of subsidies for

petroleum products and subsequent deregulation of the petroleum downstream industry have driven up the price of petroleum goods, which in turn has raised the cost of living in Nigeria.

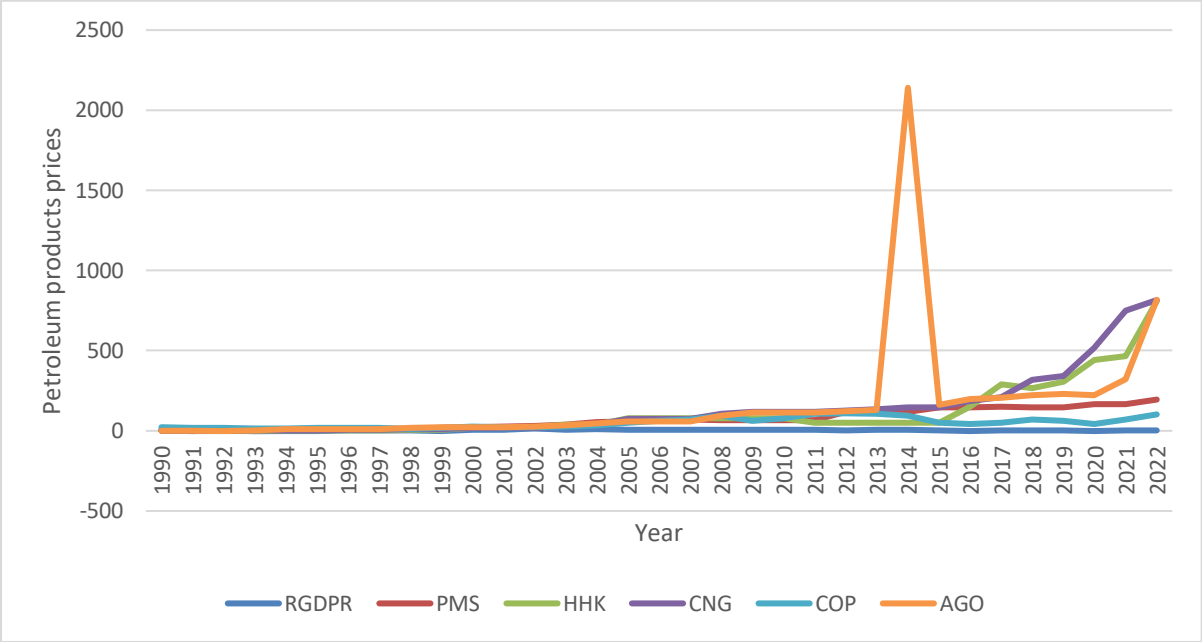

Figure 1: Trend in Growth rate of GDP, premium motor spirit price, Household kerosene price, compressed natural gas price, crude oil price and automotive gas oil price in Nigeria 1990 - 2022

In congruent with Tables 2 and the results of the test for unit roots, the real growth of gross domestic product (RGDPR) and the price of premium motor spirit (PMS) were both stationary at level i(0). This indicates that these variables did not vary or were stationary at the zero order. Therefore, for real GDP growth and premium motor spirit, the existence of unit roots cannot be considered as a null hypothesis. The prices of kerosene, crude oil, compressed natural gas, automated gas oil and compressed natural gas all remained stable at initial difference i (1). This means that after checking for differences between the variables, we rejected the null hypothesis that unit roots were present. Together, the results of the Philip-Perron unit roots test show that the variables are not all of the same stationarity order. This change prompted researchers to examine the impact of petroleum product prices on Nigeria's GDP growth applying the ARDL approach.

Table 2: Unit Roots Test Result applying Philip-Perron Procedure

Variable	Philip-Perron Statistic	1% critical level	5% critical level	Probability	Inference
RGDPR	-3.81	-3.65	-2.96	0.00	Stationary@ I(0)
Log(PMS)	-4.40	-3.65	-2.96	0.00	Stationary@ I(0)
Log(AGO)	-8.43	-3.66	-2.96	0.00	Stationary@ i(1)
Log(HHK)	-6.07	-3.66	-2.96	0.00	Stationary@ i(1)
Log(CNG)	-6.56	-3.66	-2.96	0.00	Stationary@ i(1)
Log(COP)	-4.98	-3.66	-2.96	0.00	Stationary@ i(1)

Source: Researcher's Computation

This work generated a model of economic growth and then tested it for cointegration/ long-run nexus applying the ARDL bound test. With an F-statistic of 5.454202, which is higher than both the lower and upper limit at the 5% critical threshold, there is a long-run nexus between real growth of gross domestic product (RGDPR) and petroleum product prices, as seen in Table 3. So, we may say that there is a level link, contrary to the null hypothesis.

Table 3: ARDL Bound Test Result for Real Economic growth (RGDPR) Model

F-Bounds Test		Null Hypothesis: No levels nexus		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	5.454202	10%	2.08	3
K	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15
Actual Sample Size	29		Finite Sample: n=35	
		10%	2.331	3.417
		5%	2.804	4.013
		1%	3.9	5.419

Source: Researcher's Computation (E-view 12)

Estimation of the Real Gross Domestic Product (RGDPR) model

Table 4 shows that there is a negative and negligible nexus between the growth rate of real gross domestic product and the prices of premium motor spirit, automated petrol oil, dual purpose kerosene and crude oil. This suggests that over the time frame of this research, prices of these goods and services had a dampening effect on economic expansion in Nigeria, while price reductions had the opposite effect. The data also shows that there is a positive, although minor, correlation between economic growth and the price of compressed natural gas. This indicates that over the time frame of this research, there was a positive correlation between changes in the price of compressed natural gas and economic growth in Nigeria, and a negative correlation between changes in this variable with GDP growth.

Since none of the explanatory factors were statistically substantial, it follows that petroleum product prices less effect on Nigeria's GDP development throughout the research period. Problems have arisen in several areas of the petroleum subsector, including production, refining, distribution, and stakeholder management. Lessening the advantages of petroleum in Nigeria, the refineries have collapsed and host communities are constantly attacking and stealing oil. Despite having a huge crude oil reserve, Nigeria still has to import petroleum products. A combination of factors, including instability in oil-producing areas and theft of crude, has prevented the nation from meeting its OPEC-mandated output target of 2 million barrels per day. All of these things have changed the dynamics of oil production and the benefits enjoyed by nations who have abundant oil reserves.

Table 4: Long run Result for Real Economic growth (RGDPR) Model -ARDL(2, 4, 2, 3, 4, 4)

Variable	Coefficient	t-Statistic	Prob.
LOG(PMS)	-27.44504	-0.090985	0.9319
LOG(AGO)	-346.4596	-0.095270	0.9287
LOG(HHK)	-414.3085	-0.094719	0.9291
LOG(CNG)	823.4223	0.095299	0.9287
LOG(COP)	-441.9519	-0.097040	0.9274
C	1721.161	0.097850	0.9268

Source: Researcher's Computation (E-view 12)

In congruent with Table 5, the premium motor spirit (PMS) price has a negative and statistically substantial association with the real GDP growth rate at level and lag 1, but a positive nexus at lags 2 and 3, with a statistically substantial link at lag 3. In the near term, this means that the price of PMS might either slow down or speed up economic expansion. A rise in the price of PMS, if refined locally, might boost investment and economic expansion, whereas a decrease in the price could encourage investment via lower manufacturing costs. Regrettably, although producing crude oil, a key ingredient in PMS, Nigeria imports the finished product for domestic use.

When the real GDP growth rate is at level, the price of automated petrol oil (AGO) has a negative coefficient; however, when the real GDP growth rate is at lag 1, the price of AGO has a positive and statistically significant coefficient. This variable's level and lag 1 significance levels show that AGO substantially affects Nigeria's GDP growth.

At level, the link between dual-purpose kerosene (HHK) and economic expansion is negative and negligible; however, at lags 1 and 2, the association is positive and statistically significant. Despite a mixed impact, the data demonstrates that, at least in the short run, the price of household kerosene contributes to economic expansion (growth) in Nigeria. There was a negative and statistically significant nexus between the price of compressed natural gas and economic growth at lags 1, 2, and 3, but no such nexus at level. That means that, for the time being in this research, the price of compressed natural gas substantially slowed economic expansion (growth) in Nigeria. The outcome shows a positive and statistically substantial relationship between the economic and crude oil prices. This means that crude oil price increases help the Nigerian economy in the short run.

Thesignificant and negative sign of the error correction term (ECT) suggest that the prices of petroleum products (PMS, AGO, HHK, CNG, COP) quickly respond to changes in Nigeria's long runeconomic expansion (growth) within the time frame of this research. In congruent with the goodness-of-fit finding, fluctuations in the price of petroleum products in Nigeria over the research period explain almost all (97%) of the systematic variance in economic growth.

Table 5:ECM Result for Real Economic growth (RGDPR) Model - ARDL(2, 4, 2, 3, 4, 4)

Variable	Coefficient	t-statistic	Probability
D(RGDPR(-1))	-0.451990	-6.634307	0.0027
DLOG(PMS)	-13.70752	-9.232933	0.0008

DLOG(PMS(-1))	-7.160004	-3.869352	0.0180
DLOG(PMS(-2))	2.756333	1.420813	0.2284
DLOG(PMS(-3))	12.63119	7.899812	0.0014
DLOG(AGO)	-2.339734	-3.460686	0.0258
DLOG(AGO(-1))	2.614217	6.430579	0.0030
DLOG(HHK)	-0.300050	-0.321143	0.7642
DLOG(HHK(-1))	3.610921	5.134591	0.0068
DLOG(HHK(-2))	3.548869	4.313644	0.0125
DLOG(CNG)	-1.437711	-1.205389	0.2945
DLOG(CNG(-1))	-15.43933	-8.569157	0.0010
DLOG(CNG(-2))	-16.92235	-9.066547	0.0008
DLOG(CNG(-3))	-10.59189	-8.962409	0.0009
DLOG(COP)	5.046622	4.621171	0.0099
DLOG(COP(-1))	10.10589	7.760036	0.0015
DLOG(COP(-2))	9.571914	7.861177	0.0014
DLOG(COP(-3))	4.350500	3.600895	0.0227
CointEq(-1)*	-0.024785	-9.769776	0.0006
R^2 = 0.97; R^2-adjusted = 0.91; Durbin Watson Statistic = 2.28			

Source: Researcher's Computation (E-view 12)

In congruent with Table 6, which displays the results of the diagnostic tests conducted on the economic growth model, the error terms are likely to follow a normal distribution. This is supported by the Jarque-Bera statistic, which has a probability value of 0.96 and is greater than the expected level of significance at the 5% level. Due to the low likelihood of serial correlation (0.31) and the high Breuch Godfrey test or Lagrange Multiplier (LM) F-statistic of 2.2, we may conclude that the residuals do not exhibit serial correlation. We did not find heteroscedasticity in our model in congruent with the Bresch-Pagan-Godfrey heteroskedasticity test (F= 1.05). Reason being, with a probability value of 0.55, we kept the null hypothesis of homoscedasticity. The Ramsey Regression Equation Specification Error Test (RESET) also confirmed the model's accurate specification with an F-statistic of 1.28 and a probability value of 0.34. As a consequence, the model could not have been defined wrongly, ruling out the possibility of missing variables. Once again, there is no incorrect functional form for the model. Our study and predictions were both supported by the model's sufficient fit and performance as a consequence of these findings.

Table 6: Model Diagnostic Test Result for Economic growth (RGDPR) Model

Diagnostic Test	F-ratio	Probability	Inference
Normality	0.08	0.96	Accept H_0
Serial Correlation	2.22	0.31	Accept H_0
Heteroskedasticity	1.05	0.55	Accept H_0
Ramsey RESET	1.28	0.34	Accept H_0

Source: Researcher's Computation (E-view 12)

Using the Recursive Residual, Cumulative Sum (CUSUM), and CUSUM of Squares graphs, we compared the short-run dynamics of the economic growth model to the long-run coefficients to ensure that the residual was stable. Figures 2 (a), 2(b), and 2(c) show that all three lines—the Recursive Residual, CUSUM, and CUSUM of Squares—stayed below the crucial restriction of 5%. This suggests that the long-run coefficients of petroleum product prices on Nigeria's real GDP growth rate are stable, since neither the Recursive Residual nor the CUSUM or CUSUM of Squares plots go over the 5% critical lines. Confirmation of parameter stability proves that the model accurately predicted the upshot of petroleum product prices on economic expansion in Nigeria.

Model Stability Test Result

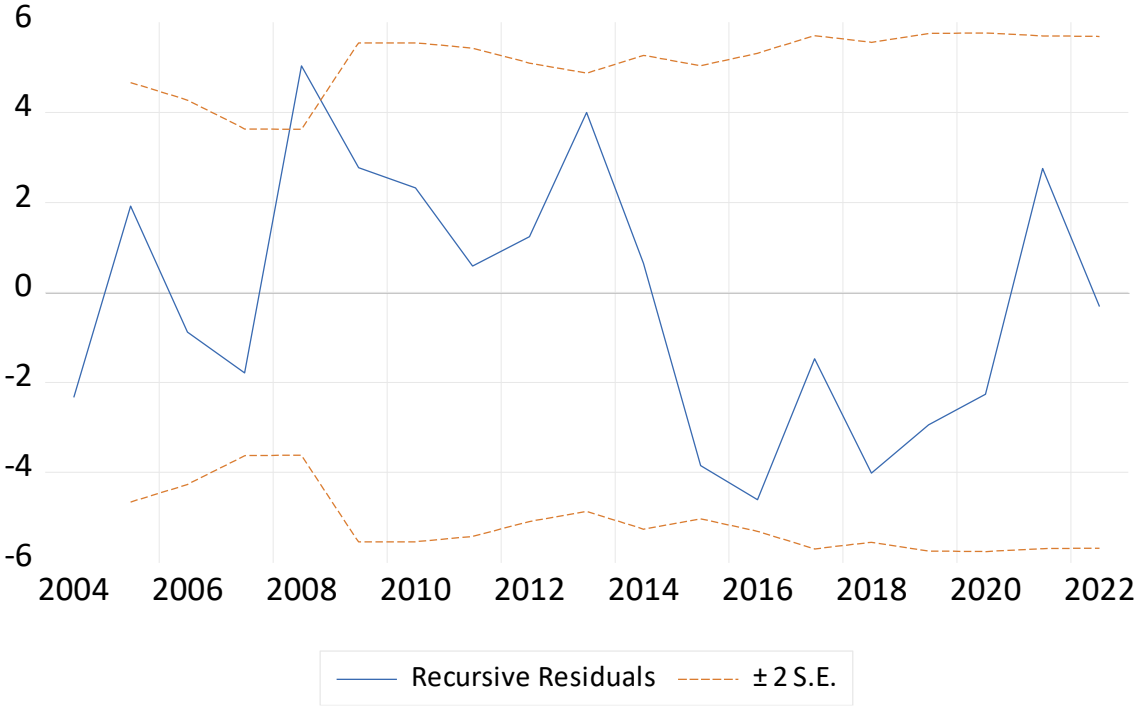

Figure 2(a): Recursive Residuals Test graph

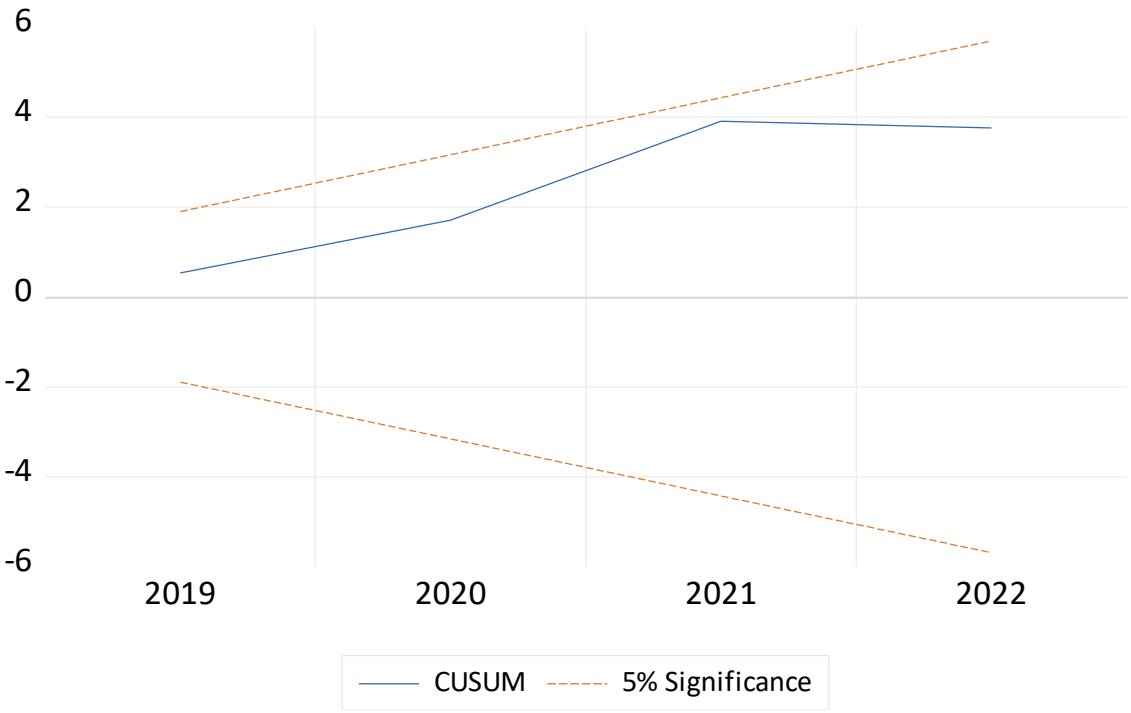

Figure 2(b): CUSUM graph

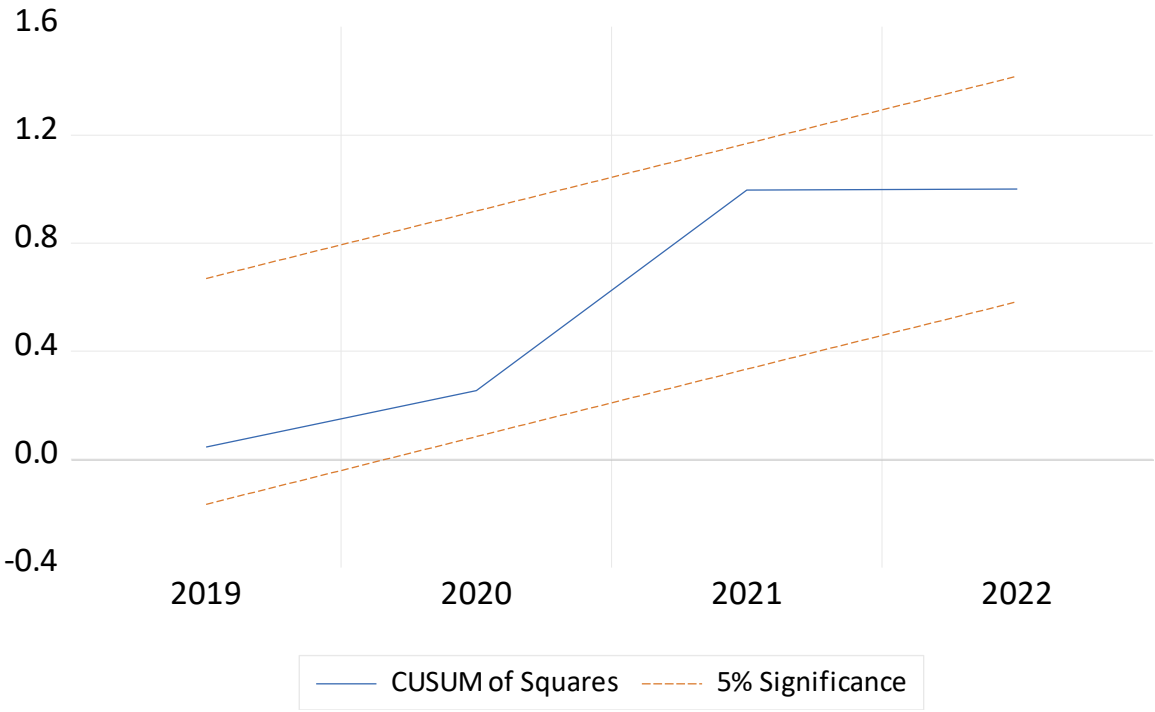

Figure 2(c): CUSUM of Square graph

Source: Researcher's Computation (E-view 12)

DISCUSSIONS OF FINDINGS

There is a negative and insignificant long-run nexus between the price of premium Motor Spirit and economic growth, but there is a positive and negative short-run nexus with substantial implications for economic growth. Consistent with previous research showing a negative correlation between the price of premium motor spirit and GDP growth in Nigeria, this negative coefficient is in agreement with the findings of Nwoaha et al. (2018), Orlu (2017), and Ogbonna and Orlu (2017). A substantial portion of the energy for transportation, home power generation, and even certain industrial power production comes from Premium Motor Spirit (PMS). When the price of PMS goes up, the manufacturing cost goes up as well, since the raw ingredients and transportation needed to make it go up are more expensive for most homes and businesses. This slows down the economy and makes productive activity harder.

There is a negative but insignificant long-term correlation between the price of automobile petrol oil (AGO) and economic growth. However, in the near term, it has a significant influence on economic growth while having varied results. Since diesel, or automobile petrol oil, is a key ingredient in many industrial power plants, this negative upshot is in line with previous research by Nwoaha et al. (2018) that indicated an inverse nexus between AGO prices and GDP growth. A rise in the price of AGO has a multiplicative effect on manufacturing costs, which in turn dampens economic activity.

While the price of household kerosene (HHK) had a small but favourable effect on economic expansion in the near term, it had a far larger negative effect in the long run. Although the beneficial upshot differed from the results of Nwaoha et al. (2018), the fact that kerosene retards growth is consistent with their previous studies. Some individuals and the state might lose out on financial resources that come from forest resources if the price of kerosene goes up. This is because deforestation could become worse. Constraints on forest usage for energy generation have the potential to exacerbate pollution and the greenhouse impact.

The long run influence of the price of compressed natural gas on economic growth was positive and minor, but the short run effect was negative and considerable. This finding is consistent with previous research by

Molly Richard and Edwin (2022) that indicated a negative and considerable nexus between the price of CNG and economic growth in the short run. Both residential and commercial energy needs rely heavily on compressed natural gas. An increase in the product's price may dampen economic growth since it might drive up manufacturing costs and consumer prices.

Results showed that although crude oil prices had a negative and negligible influence on long runeconomic expansion (growth), they had a favourable (positive) and statistically significant effect on short run growth. Previous research by Musa et al. (2019), Siyakudumisa, Kim & Yiseyon-Sunday (2022), Momodu et al. (2022), and Sule-Iko et al. (2023) has also shown a positive and statistically significant nexus between the price of crude oil and economic growth. The expansion of Nigeria's economy is reliant on the nation's abundant supply of crude oil, which has been the nation's principal export and source of foreign currency since its independence. Since Nigeria's GDP and growth are sensitive to fluctuations in the price of crude oil, this development has created a substantial threat to the nation's economy.

CONCLUDING REMARKS AND RECOMMENDATIONS

This study investigated the impact of petroleum products pricing on the Nigeria's economic growth over the period 1990 - 2022 by employing the Autoregressive Distributed lag (ARDL) method. Our results and findings revealed that: long run relationships exist between petroleum products pricing and economic growth in Nigeria over the period of the study. Prices of Premium Motor Spirit, automotive gas oil, dual purpose kerosene and crude oil were all negatively and marginally related to economic growth in the long run. Only price of compressed natural gas was positively but marginally related to economic growth. This implies that petroleum products prices had retarding effect on economic growth in Nigeria in the long run. In the short run, premium motor spirit and automotive gas oil had mixed effect on economic growth while price of dual purpose kerosene and price of crude oil were positively related to economic growth but price of compressed natural gas were negatively related to economic growth. Petroleum products prices proxied by prices of Premium Motor Spirit, Automotive Gas Oil, Household Kerosene, Compressed Natural Gas and Crude oil had less impact on economic growth in the long but had serious implications on economic growth in the short run in Nigeria over the period of the study. Based on this conclusion, the study recommended Increase investment in compressed natural gas, proper utilization of crude oil revenue and strengthening existing policies in the oil and gas sector as possible measures towards improving economic growth in Nigeria.

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