

PETROLEUM PUMP PRICE AND CONSUMER PRICE INDEX IN NIGERIA: A CASE FOR OR AGAINST TOTAL SUBSIDY REMOVAL – PANEL DYNAMIC ANALYSIS

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This study investigated the impact of petroleum pump price (PPP) on consumer price index (CPI) in Nigeria between 2000 and 2019, in order to have empirical support for or against total removal of subsidy on PPP. Three pump prices: prices of petrol, diesel and kerosene, were used to represent PPP. The economy was sub-divided into four: manufacturing; transportation; food; and domestic activities. Monthly Data were collected from both the NBS and CBN bulletins of different series. CPI was made the dependent variable and PPP, the independent variable. After the usual stationarity test, CPI was stationary at level while others were stationary at first difference. This informed the study to employ panel pooled mean/ARDL cointegration technique, which separated the impact into short and long run periods. Findings in the short run revealed that, the price of petrol had significant direct impact on consumer price in the short run. While these prices had no significant impact in the long run period, the price of kerosene indicated a significant inverse impact on consumer price in the short run but positive in the long-run. Results of cross-section short run coefficient revealed that prices of petrol and diesel had significant positive effect on manufacturing sector of the economy. The study, therefore suggests that, the government should remove subsidy totally on petrol and kerosene prices and reinvest the surplus into the economy, mostly in revamping the refineries. Also, Prices of alternative products to kerosene should remain stable to further reduce domestic use of kerosene in the economy.

Keywords: Consumer Price index, Petroleum pump price, Petrol subsidy, Market oil

JEL Classification: C13, C22, C33, E31, G43

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1. Introduction

Petroleum pump price plays a critical role in economic growth of any economy, whether developed or developing. Changes in petroleum pump price arise from changes in the price of crude oil in the international markets and these are passed on to consumers in form of change in prices of the final petroleum products.

When international prices of crude oil increases, government will pay more on petroleum subsidy which will reduce government spending on developmental project as well as reduce foreign reserve. Otherwise if government increases petroleum pump price, it is widely believed that inflation will step in and which will mean that consumers use more of their income to pay for oil-derived products, and their spending on other goods and services declines.

Nigeria is the 7th largest country in the world in terms of population size. It is estimated that Nigerian population stood at about 198 million and it is usually referred to as the Giant of Africa. Apart from the abundant human resources, Nigeria is also blessed with abundant natural resources which include coal, tin, large arable lands, iron ore, gold, crude oil and many others. Upon all these resources, Nigeria is still struggling to develop which is characterized by high unemployment rate, low per capita income, high level of poverty, inflation and many others.

In the 1950s, before the discovery of oil, agriculture has been the spine of the Nigerian economy which has been responsible for about 72 percent of the total national output against the 1.1% from mining and crude oil. Agriculture still continued to dominate export in Nigeria after independence when over 70% of outputs exported are basically agricultural products. In fact, about 95% of Nigerian food needs were locally produced (Ajakaiye, 2001)

It is worthy to note that during this period, the regional economy flourished and recorded tremendous growth and development. The revenue from agriculture in those days was used to build tremendous infrastructures such as the first set of Federal Universities, such as the Ahmadu Bello University Zaria, the then University of Ile Ife, University of Lagos and University of Nigeria Nsukka. The Cocoa house, the National Stadium Lagos, Liberty Stadium and others were not all built with foreign grant or loans but through proceeds from cocoa, rubber, groundnut, cotton etc.

After the discovery of oil in commercial quantity in 1956, the Nigerian economy changed drastically and started relying solely on crude oil export, it began to take a larger percentage of our national output leading to fall in output of agricultural output.

Between the 1960s and when Nigeria became a member of the organization of Petroleum Exporting countries as its 11th member in 1971, the total contribution of oil in the national output that stood at less than 2%, rose to about 70%. The level of foreign exchange gotten after the joining of the cartel kept increasing; For instance, Statistics showed that crude oil was sold between 45 cents and 65 cents per barrel before 1971 but this changed drastically as it rose to over \$3 per barrel and by the year 2008, a barrel had become over \$145 per barrel at some time before it started declining to less than \$30 per barrel in 2015/16.

The inability of the local refineries to produce locally consumed petroleum products have resulted into importation of refined products from abroad at very exuberant prices. The Nigerian government, over the years has been forced to pay subsidy running to trillions of naira which ought to have been used for the development of infrastructures.

Petroleum prices coupled with widespread corruption of leaders in the economy who have been unable to plan appropriately for the future and their inability to appropriately use the revenue generated yester-years to develop the infrastructures of today as well as excessive borrowings and looting have led to increasing level of inflation as a result of increase in price levels of commodities and over reliance on importation of basic needs of the economy such as food items that can be produced locally.

The failure to plan during the economic boom experienced from rising petroleum prices in the late 70s to early 80s coupled with massive corruption resulted in borrowing for building of infrastructures at higher cost. These and many other factors have led to excess money in circulation chasing few commodities.

Increasing cost of importation of refined crude oil which ordinarily is supposed to be refined locally but for the dilapidated state of our four local refineries have affected the development of infrastructures over the years. This is because the bulk of revenue generated from exportation of crude oil which is supposed to have been used for developmental projects were redirected to paying subsidy on petroleum products so as to reduce the pump price of petroleum products.

Despite the increase in the expenses incurred on subsidizing petroleum products in recent years, most especially the dual-purpose kerosene (DPK) which is majorly consumed by the masses and which is supposed to be sold at pump rate of #50 per litre, consumers still buy it at rates ranging from #150 to #250 per litre.

The subsidy regime has been faced with massive corruption and most times subsidy was paid on empty vessels all in the pretense that refined oil has been imported and at the end, the masses are at the receiving end. It has led to too much money in circulation chasing few goods and resulting to two digits' inflation rates over the years. There is this general intuition

that prices of petroleum product determine the prices of goods and services in the society (Orgunbodede, Ilesanmi & Olurankinsa, 2010).

It has been discovered that before the discovery of oil in commercial quantity when the mainstay of the economy was agriculture, the economy prospered with prices of commodities including pump prices of petroleum product relatively low and stable even without any need to subsidize petroleum products and inflation rates were put at a very stable single digit. Infrastructures were developed without borrowings or grants.

As a result of the mono economic nature of the Nigerian economy, Petroleum is the major source of revenue and that is the main reason why the government makes high expectation from it in its budget. In fact, it is used as a basis of benchmark in the budget and also its prices have become one of the determining factors of prices of goods and services in the society as well as a major determinant of inflation rate. However, there are some factors that are likely to determine these assertions.

Against the background, the study set out to investigate the impact of petroleum pump price on consumer price index in Nigeria using the panel dynamic analysis with special consideration on looking at a case for or against total subsidy removal. Specifically, the study examined the short run and the long run impact of petroleum pump price on consumer price index in Nigeria and further investigates the speed of adjustment this petroleum pump price would have in adjusting the consumer price disequilibrium back to equilibrium.

The research was restricted to the influence of petroleum pump prices on consumer price in Nigeria considering other variables that may directly or indirectly affect price and as such a justification to the payment of subsidy by government or its total removal. Petroleum pump price is restricted to only the prices of PMS, AGO and DPK.

Organization-wise, the study featured section one, which showcased the introduction of the study and stylized facts. In section two, the related literature to the study was reviewed and section three addressed the model adapted and the technique employed for analysis. Section four presented the results of analysis and the interpretation and implications. Finally, section five concluded our research and outlined recommendations.

2. Literature Review

Petroleum products are complex mixtures that are derived from crude oil, they are processed in oil refineries, and petroleum products are majorly converted to products which are used as

fuel. Petroleum products differ from petrol chemicals because petrochemical products are well defined pure chemical compounds.

Petroleum by-products. Over 6,000 items are made from petroleum waste include: fertilizer, flooring (floorcovering), perfume, insecticide, petroleum jelly, soap, vitamins and some essential amino acids. Out of all petroleum waste by-products, some are hazardous to health like toluene; it is a clear, colorless liquid with a distinctive smell. However, effects such as in coordination, cognitive impairment, and vision and hearing loss may become permanent with repeated exposure, especially at high levels associated with intentional solvent abuse. High levels of toluene exposure during pregnancy, such as those associated with solvent abuse, may lead to developmental effects, such as retardation of mental abilities and growth in children. Other health effects of potential concern may include immune, kidney, liver, and reproductive effects (Isaac, 2017).

The pricing of petroleum products has over the years been a contentious issue and has dominated public discourse, policy makers and policy contestants for years in Nigeria. Contestants are concerned on subsidy removal and deregulation of the sector. In the middle of these discussions is the pricing i.e. the cost of petroleum products to consumers and producers in the country. Yet, most Nigerians are not aware of the main determinants of petroleum prices as well as with the pricing mechanism. Globally, the petroleum industry is oligopolistic in nature because very few multinational companies with huge financial resources dominate the industry and that is the main reason why in many countries of the world, the pricing of petroleum products is regulated in one form or the other in order to protect consumers against oligopolistic and monopolistic exploitations.

The pricing of petroleum pump product is also regulated because of the nature of the product, the roles it plays in the economy as well as in the lives of all its citizens and also to avoid fluctuations and ensure uniformity in the prices of petroleum products across the country.

As usual, consumer price is the price at which the consumers buy goods on the market. Change in consumer price measures inflation, which is the persistence increase in general price level of goods and services which could be as a result of increase in money supply leading to fall in the value of money. Basically, when the volume of money in circulation is more than the available goods and services, prices being bound to go up and however regarded as inflation. Shortfall of supply due to bad harvest, war or natural disaster could also lead to scarcity and then increase in general price level (Stephen, 2015).

Two major theories exist as regards the origin of petroleum: a Western theory suggests that its origin is biogenic resulting from biological matter and stored in sedimentary basins while a Russian Ukrainian school proposes that it is abiogenic with the deep origin in the Earth's crust (Regnier, 2007). The first theory implies a finite source of petroleum whereas the

second theory suggests an almost unlimited one. Evidence for the organic origin of petroleum seems to be overwhelming since petroleum oil is found in sedimentary rocks, not in igneous rocks which contains cholesterol, porphyrins and nitrogen. Hence the chemical composition of the petroleum is similar to the composition of organic material.

However, as early as in 1877, D.I. Mendeleev, the Russian chemist who proposed the modern version of the periodic table, wrote that the petroleum deposits of the World are likely to be controlled more by tectonics than by the age of sedimentary rock Mendeleev proposed the metal carbide theory. In this model metal carbides deep within the Earth react with water at high temperatures to form acetylene which subsequently condenses to form heavier hydrocarbon (Isaac, 2017). The Fischer–Tropsch process is probably the second well known example of the possibility of formation of synthetic lubrication oil and synthetic fuel, typically from coal, natural gas, or biomass. The Fischer–Tropsch process involves a series of chemical reactions that produce a variety of hydrocarbons, in particular alkanes. The carbon cycle, i.e. carbon exchange among the biosphere, atmosphere and other spheres of the Earth, also need to be considered. The volume and rate of carbon exchange is not well defined and it is a matter of continuous debate (Walther & Otto, 2015).

Some of the few theories that have been used to explain inflation worldwide includes Demand – pull inflation; Cost – push inflation; Structural inflation and imported inflation. Demand pull inflation is a type of inflation where by the aggregate demand for goods in an economy exceeds supply i.e. too many people chasing few goods and this leads to increase in general price level. It is also referred to as surplus demand (Jhingan, 2010). Cost-Push Theories of Inflation arises from the supply side. It is basically caused by the rising cost of production leading to high cost of goods and services. It is also referred to as 'market power inflation'. Structural inflation is a type of inflation that is associated with the process of economic development. It is believed that economic development in a developing country is associated with disequilibrium and this leads to inflation which is neither caused by cost push or demand-pull inflation but by the sectorial change in demand. Imported inflation is associated with countries like Nigeria that rely solely on imported goods and services. Imported inflation arises from dumping of goods in the importing country, such goods can be in form of inputs or final output. The high cost of importing such goods into the local economy leads to rise in inflation (Gbanador, 2007).

Empirical studies on Petroleum prices by previous researchers focused on oil price elasticity of demand and macroeconomic variables. Raymond, (2010) in his research work titled 'The Relationship among Petroleum Prices' considered the relationship between the spot prices of gas, petrol, diesel and heating oil in a multivariate framework as well as examining if the prices of these products are predicated on the theory of derived demand. His findings showed

that the prices of petroleum products are strongly co-integrated. The researcher further stressed that in the long run oil price is found to be weekly exogenous and states the possible reasons for his findings.

Arinze (2011) in his paper titled 'The impact of oil price on the Nigerian economy' states among his findings that petroleum pump price has been increased 18 times between 1978 – 2007 and this have resulted in the increase in inflation according to his findings. He suggested in his findings that the economy should be diversified to cushion the effect of petroleum price increase on inflation.

Macro-economic variables like money supply, fiscal deficit, and exchange rate was added into the model in the Eregha, Mesagan, and Olawale (2015) paper titled Petroleum Products Prices and Inflationary Dynamics in Nigeria. In their study they didn't determine the relationship between the pump prices and inflation but shows the correlation co-efficient between the old and new prices of PMS in Nigeria. Akinleye and Ekpo (2013) in their paper titled "Oil price shocks and macroeconomic performance in Nigeria", examined the implications of oil price shocks on macroeconomic performance in Nigeria. Their study reveals that both positive and negative oil price shocks influence government expenditure in the long run and not in the short run. The study also revealed that only positive oil price shocks have stronger short and long run effects on real gross domestic product, which influences inflationary pressure and domestic currency depreciation in the process as importation increases. The study reveals that crude oil price shocks are capable of impeding economic growth only in the long run while raising general price levels marginally in the short run leading to exchange rate depreciation and high importation.

Labys (2006) in his paper titled Globalization, Oil Price Volatility, and the U.S. Economy posits that higher oil prices can lead to higher inflation, lower corporate profits, higher unemployment and reduced national economic growth. Higher price volatility can lead to a reduction in investment, leading in turn to a long-term reduction in supply, higher prices, and even reduced macroeconomic activity. Bobai (2012) analysed in his paper titled "the relationship between petroleum prices and inflation in Nigeria". He researched on the impact of PMS, AGO and DPK on inflation rate in the Nigerian economy from 1990 to 2011. His findings showed that there exists a positive relationship between PMS, AGO and inflation but a negative relationship exists between DPK and Inflation. He further found in his study that PMS have the highest impact on Inflation than AGO. It is clearly indicated in his study that an increase in pump prices contributes significantly to the rate of inflation in Nigeria.

Nwosu (2009) researched into the impact of fuel price on inflation. In his paper "Import of Fuel Prices on Inflation: Evidences from Nigeria". He employed the variance Autoregressive analysis to assess the contribution of fuel price on inflation using quarterly data between 1995 to 2008. His findings showed a positive relationship between fuel price and inflation

and therefore advocated that the policy of subsidizing fuel price should continue in Nigeria so as to help cushion the economy from the adverse effects of oil-price shock.

Isaac (2017) investigated the impact of change in petroleum products prices on inflation in Nigeria, using annual data between 1980 and 2016. He regarded inflation rate as the dependent variable and automotive gas oil (AGO) and bonny light crude oil (BLCO) among others, stood as independent variables in his model. Employing Autoregressive Distributed Lag technique, he found out that, the prices of petroleum pump product have significant positive impact on the inflation rate, and that AGO and BLCO show positive correlation with inflation in Nigeria.

Nwaoha et al. (2018) examined the movement of petroleum pump price and standard of living in Nigeria using secondary data from 1981 to 2016. Employing Ordinary Least Squares technique for the analysis, they found out that, the prices of petrol, kerosene and diesel have statistically significant impact on the standard of living which was proxied with producer price index and inflation rate.

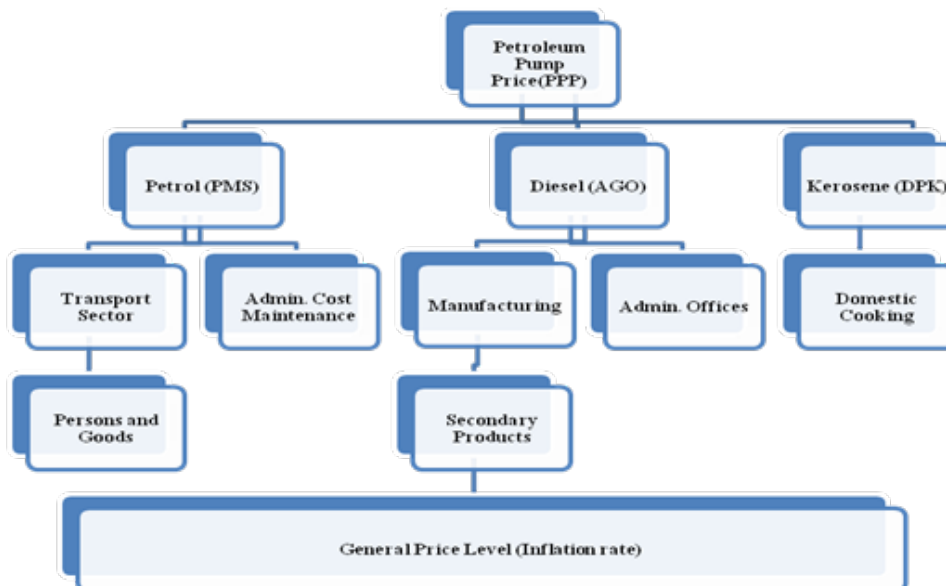
The research adopted the theory of demand-pull inflation, cost push as well as imported inflation in order to further solve the general intuition that an increase in petroleum pump price will lead to inflation and form an opinion for or against total subsidy removal. The reason for adopting the demand-pull theory is because at some point when petroleum products that are meant for local consumption were smuggled to neighboring countries such as Niger, Benin republic and Cameroun to be sold at higher prices having enjoyed subsidy from the Nigerian government, it creates an artificial scarcity of the product leading demand exceeding supply of the product most especially during festive periods, thereby leading to a rise in pump prices.

The rising cost of petroleum pump price will also lead to increase in production cost of final products of other commodities and wages of labour, this is also referred to as market power inflation or the Cost push inflation.

The over reliance on imported refined petroleum products which is supposed to be refined in the country too is another reason why the theory of imported inflation will be adopted.

The pump price transmission mechanism in Nigeria in figure 1 shows the relationship between the changes in Petroleum pump prices as it affects general price level (consumer prices). There exist different channels in which petroleum prices affects inflation. Amongst these channels are through the three major petroleum products i.e. Petrol (PMS), Diesel (AGO) and Kerosene (DPK) as illustrated in figure 1.

2.1 Transmission mechanism of petroleum pump price in Nigeria



Source: Author's own Composition adapted from PPPRA (2012)

Figure 1. Transmission mechanism

Petrol i.e. PMS is basically used for fueling most commercial and private vehicles used for transportation of people and goods as well as private generating sets used as alternate to electricity too are powered with petrol.; this transmits into general price level.

Diesel (AGO) are mostly used in the manufacturing sectors to power machineries and also for haulage of both raw materials and secondary products to and fro the companies to the final consumers, the prices of diesel consumed is included into the cost of the final goods, hence contributes to the general price level.

Kerosene (DPK) is majorly used for domestic cooking in Nigeria and this also contributes to the general price level.

2.2 Research gap

The impact of petroleum pump price on consumer price index considering the impact of some transmission mechanism such as the cost of domestic activities, Manufacturing/Industrial Costs, transportation, food items have not been researched on previously, hence the researcher will fill the general intuition that total subsidy removal will lead to inflation or otherwise.

There is paucity of research in the economic literature as regards the impact of PPP on consumer price index in Nigeria. The few studies available have one major fault or the other from problems of spurious analysis to small data usage, to mention a few. Also, none of the previous studies have used panel data technique to analyze its data by disaggregating the economy into sector in order to examine the impact of petroleum pump price on each sector. This study is set to fill this gap in the literature.

This work is at variance with existing works as it attempted to disaggregate petroleum price into PMS, AGO and DPK as well as solve the intuition that total removal of subsidy on pump price will cause inflation. This will be the contribution of the researchers to knowledge.

The researcher will also go a step further than Eregha, Masagan and Olawale (2015) that examined petroleum products' prices and inflationary dynamics in Nigeria. In their data presentation of prices, quarterly data was used between 1994 and 2012, but in this study, monthly time series data was employed between January 2015 and October 2019. This will in the long run be more reliable due to the volume of data collected.

Amongst the recommendations of the previous researcher is that the removal of subsidy should not be implemented to prevent hike in the prices of basic household commodities in the economy. This assertion is only an a priori assertions and an intuition which the current research work is in to unravel by proving the level of significance of removal of subsidy.

3. Methodology and Model Specification

This study simply employed monthly time series data from 2000-2019. The model was analyzed using the panel pooled mean group/autoregressive Distribution lag model to diagnose the dynamic effect of petroleum pump price on price level. Since the data set was panel and contained time series, the data were tested for trend and subsequently analyzed after removing the trend. The choice of dynamism was due to the fact that most economic variables do not have impact until after a period of time. Petroleum pump price was not left out of this case.

To determine the influence of petroleum pump price proxied by prices of premium motor spirit (Ppetrol), Dual Purpose Kerosene (Pkerosene) and Automatic Gas Oil (Pdiesel) on sector consumer prices in Manufacturing (Manu), Transportation (Trans), Domestic activities (Domact), Food items (Food) in Nigeria, the study adapted the work of Bobai (2012).

$$\text{CPI} = f(\text{Ppetrol}, \text{Pdiesel}, \text{Pkerosene}) \quad (1)$$

Where:

CPI = Consumer price index of sectors

f = Function

Ppetrol = Pump price of petrol

Pkerosene = Pump price of kerosene

Pdiesel = Pump price of diesel

Equation 1 was transformed to a mathematical model as shown in equation 2

$$\text{CPI} = \beta_0 + \beta_1 \text{Ppetrol} + \beta_2 \text{Pdiesel} + \beta_3 \text{Pkerosene} \quad (2)$$

Since there are some other variables that could affect CPI but not captured in the model should be enlisted, but because of parsimony, they were all implicitly included in the disturbance variable μ , thus, forming an econometric equation as in equation 3.

$$\text{CPI} = \beta_0 + \beta_1 \text{Ppetrol} + \beta_2 \text{Pdiesel} + \beta_3 \text{Pkerosene} + \mu \quad (3)$$

Where:

β_0 is constant

$\beta_1 - \beta_3$ are the parameters/coefficients of the variables for estimation.

μ denotes the error term which represents all other variables that affect CPI that are not included in the model. The CPI consisted of a panel of four sectors used in the study.

$$\log \text{CPI} = \beta_0 + \beta_1 \log \text{Ppetrol} + \beta_2 \log \text{Pdiesel} + \beta_3 \log \text{Pkerosene} + \mu \quad (4)$$

Equation 4 gave the logged values of equation 3 in order to remove trend and make variables equal.

After the estimation, the slope coefficients are expected to be positive, implying that, when there is an increase in the prices of diesel, kerosene, petrol, producers and other users of these products will transfer it onto consumers in form of high prices, though it depends on its elasticity. Hence, high PPP will result to high CPI.

The unit root tests have become a popular path to ascertaining the properties of macroeconomic time series variables because it exhibits non stationary behavior, capable of invalidating the quality of empirical inferences drawn from such estimates if appropriate measures are not taken. Therefore, the study employed Levin Lin & Chu t, Im, Pesaran and Shin W-stat, Augmented Dickey-Fuller (ADF) and the Phillip-Perron (PP) tests of stationarity in the panel variables.

Secondary data sources have been used to collect information about the petroleum pump prices, and Inflation rate. Secondary data sources include National Bureau of Statistics (NBS) 2020 World development indicators (WDI), Central Bank of Nigeria (CBN), Petroleum Product Pricing Regulatory Agency (PPPRA), Nigeria National Petroleum Corporation (NNPC) reports and websites.

The choice of secondary data is derived from the fact that data cannot be obtained through primary sources since they have to be collected over a long period of time. The data set are monthly time series from January 2000 to December 2019. This period was chosen as it was the period between the era of massive disparity between the approved petroleum pump prices and the actual selling price despite the subsidy regime of the federal government and a period when there was a kind of uniform price across the country coupled with partial removal of fuel subsidy.

4. Result and Discussion

The descriptive statistics is presented in table 4.1 below with 240 observations. It shows that PKEROSENE has the highest mean of 131.9, followed by CPI, PDIESEL and PPETROL with mean of 120.9, 113.9 and 79.9. The mean of the distribution is all high because their logarithm is not taken. The distribution also shows that all the variable shows a kurtosis less than 3 (Platykurtic or platykurtotic distribution) meaning that the distribution is flat relative to the normal.

The Jarque-Bera shows the normality distribution of the data. The probability as reported is the probability that the Jarque-Bera statistic exceeds, in absolute terms, the observe value under the null hypothesis. The probability shows that all variables are not normally distributed as they are all less than 0.05, hence the null hypothesis is rejected.

The standard deviation shows the rate of disparity from the mean, the standard deviation follows the same pattern as the mean as shown on Table 4.1 where PKEROSENE has the highest standard deviation of 94.4 followed by CPI, PDIESEL and PPETROL with mean of 70, 59 and 42 respectively. Skewness is a measure of asymmetry of the distribution of the series

around its mean. The positivity of all the skewness figures of the variables simply implies that the distribution has a long right tail. It is also understandable that the variables are not logged so their volatility are not increased, thereby causing their skewness to be positive.

Table 4.1. Descriptive Statistics

	CPI	PDIESEL	PKEROSENE	PPETROL
Mean	120.8762	113.8729	131.9056	79.93996
Median	102.3855	110.9500	104.9200	65.00000
Maximum	288.9957	249.4000	433.8000	190.9000
Minimum	32.81360	20.30000	16.16000	20.00000
Std. Dev.	70.22544	59.60115	94.39813	42.22343
Skewness	0.736930	0.306695	0.792124	0.501711
Kurtosis	2.504010	2.477222	2.593950	2.389863
Jarque-Bera	24.18271	6.495439	26.74718	13.79125
Probability	0.000006	0.038863	0.000002	0.001012
Sum	29010.30	27329.49	31657.35	19185.59
Sum Sq. Dev.	1178655.	848998.9	2129731.	426093.6
Observations	240	240	240	240

Source: Author's Extract from EViews 9.

Correlation analysis is important since it shows that the regressors do not have perfect or exact linear representations of one another in order to avoid multicollinearity. This is presented in Table 4.2

Table 4.2. Result of Correlation Matrix

	CPI	PDIESEL	PKEROSENE	PPETROL
CPI	1			
PDIESEL	0.9618	1		
PKEROSENE	0.9756	0.9632	1	
PPETROL	0.9476	0.9588	0.9489	1

Source: Author's Extract from EViews 9 analysis.

The four unit root test statistics used are Levin, Lin & Chu t^* , Im, Pesaran and Shin W-stat., ADF - Fisher Chi-square and PP - Fisher Chi-square. The Panel unit root tests results are presented in Tables 4.3a and 4.3b. All the four statistics show that CPI, Ppetrol, Pdieisel and Pkerosene are not stationary at 1% and 5% level of significant as their probabilities are greater than 0.05 at level.

Table 4.3a. Result of Panel Unit Root at Level

Method	CPI		Ppetrol		Pdiesel		Pkerosene	
	Stat	Prob	Stat	Prob	Stat	Prob	Stat	Prob
Levin, Lin & Chu t*	12.5610	1.0000	-0.45920	0.3230	1.42004	0.9222	2.87710	0.9980
Im, Pesaran and Shin W-stat	12.9583	1.0000	1.82352	0.9659	3.40447	0.9997	4.56120	1.0000
ADF - Fisher Chi-square	8.7E-06	1.0000	1.34941	0.9949	0.35344	1.0000	0.10706	1.0000
PP - Fisher Chi-square	2.3E-06	1.0000	2.32348	0.9695	0.26516	1.0000	0.38395	1.0000

Source: Author's Extract from EViews 9 analysis.

At first difference, all the four statistics shows that CPI, Ppetrol, Pdiesel and Pkerosene are stationary at 1% level of significant as their probabilities are less than 0.01. This is presented on Table 4.3b.

Table 4.3.b. Result of Panel Unit Root at 1st Difference

Method	CPI		Ppetrol		Pdiesel		Pkerosene	
	Stat	Prob	Stat	Prob	Stat	Prob	Stat	Prob
Levin, Lin & Chu t*	-2.566	0.005***	-12.520	0.000***	-19.782	0.000***	-4.463	0.000***
Im, Pesaran and Shin W-stat	-8.232	0.000***	-18.838	0.000***	-18.586	0.000***	-19.456	0.000***
ADF - Fisher Chi-square	90.471	0.000***	280.795	0.000***	276.01	0.000***	292.47	0.000***
PP - Fisher Chi-square	401.329	0.000***	239.193	0.000***	439.05	0.000***	73.683	0.000***

*** denotes significance at 1% level

Source: Author's Extract from EViews 9 analysis.

Table 4.4 presents the order of 10 model selection criteria using the Akaike Information Criteria from the top twenty models. It is clear from the model that ARDL (2, 3, 3, 3) is chosen as the best model lag because it has the lowest figure of 3.984 among the model selected, therefore we employ this model.

Table 4.4. Result of Model Selection Order

Model	AIC	ARDL Specification
1	3.984	(2, 3, 3, 3)
2	3.987	(3, 3, 3, 3)
3	3.987	(4, 3, 3, 3)
4	3.991	(2, 1, 1, 1)
5	3.992	(2, 4, 4, 4)
6	3.994	(3, 1, 1, 1)
7	3.994	(3, 4, 4, 4)
8	3.995	(4, 4, 4, 4)
9	3.995	(4, 1, 1, 1)
10	4.002	(2, 2, 2, 2)

Source: Author's Extract from EViews 9 analysis.

The study skipped cointegration tests on the assumption of long-run homogeneity.

Table 4.5 showcases the result of short-run effect and ECM of PPP and CPI at the average pool in all four sectors of the economy. In the short-run the Ppetrol multipliers show a significant impact on CPI in all three periods employed. All the periods show a positive impact on CPI except on first lag (Ppetrol (-1)) which shows an unexpected negative impact. Going by the expected positive signs at present and 2-lag periods, a unit increase in Ppetrol, on the average, will lead to approximately 1.0 unit (present periods) and 2.7 unit (2-lag periods) increase in CPI.

Table 4.5. Result of Pooled Mean Group/ ARDL (2, 3, 3, 3) - Short Run Coefficients

	Coefficient	Standard Error	t-Statistics	Prob
COINTEQ01	-0.006992	0.000604	-11.57942	0.0000
D(CPI(-1))	-0.032229	0.151975	-0.212066	0.8321
D(PPETROL)	0.009995	0.002201	4.541635	0.0000
D(PPETROL(-1))	-0.011867	0.001682	-7.055510	0.0000
D(PPETROL(-2))	0.027186	0.011062	2.457543	0.0142
D(PDIESEL)	0.001852	0.006770	0.273558	0.7845
D(PDIESEL(-1))	-0.007618	0.010460	-0.728303	0.4666
D(PDIESEL(-2))	0.000355	0.012613	0.028183	0.9775
D(PKEROSENE)	-0.014731	0.001349	-10.91851	0.0000
D(PKEROSENE(-1))	-0.014201	0.001282	-11.07325	0.0000
D(PKEROSENE(-2))	-0.011667	0.000897	-12.99993	0.0000
C	0.592267	0.109997	5.384390	0.0000
Mean dependent var	1.078286	S.D. dependent var		2.166085
S.E. of regression	1.953384	Akaike info criterion		3.930167
Sum squared resid	3468.480	Schwarz criterion		4.188723
Log likelihood	-1835.480	Hannan-Quinn criter.		4.028630

Source: Author's Extract from EViews 9 analysis.

The effect of Pdieisel on CPI shows an insignificant impact as the probabilities of all three periods selected are above 5% (78%, 46.7% and 97.8%) still on Table 4.4, it shows that Pkerosene has significant negative impact on CPI. Based on this result, a unit increase in Pkerosene, on the average, beads to a decrease in the CPI by 1.5, 1.4 and 1.2 units in present

1-lag and 2-lag periods. The probabilities (0.0000, 0.0000, 0.0000) show that Pkerosene is significant at 1% level of significance. On the same Table 4.5, the result shows that the coefficient of Ppetrol and Pdiesel show a positive short run impact on CPI in the current period while the coefficient of Pkerosene shows a negative short run impact on CPI in the current period and previous periods. This is understandable owing to the fact that, both Ppetrol and Pdiesel directly affect productive activities thereby increasing cost of operations and consequently affecting the general price level across board, while kerosene is only consumed by the household and therefore doesn't affect the cost of operation or general price level.

Table 4.6 showcases the long run impact of PPP on CPI with the underlying assumption that there exists cointegrating association in the model. In the long run, the Ppetrol and Pdiesel show an unexpected negative impact on CPI while Pkerosene shows a positive impact on CPI. However, the impact of Ppetrol and Pdiesel is not significant as their probabilities (51.3% and 37.8%) show more than 5%. Pkerosene shows a significant and expected positive impact on CPI. This means that a unit increase in Pkerosene, on the average, leads to 2.28 units increase in CPI. The impact is statistically significant at 1% as its probability (0.0049) shows. The ECM coefficient (-0.006992) in Table 4.4 shows the correct negative sign, though very low figure. This means that about 0.7% of the disequilibrium in the model is corrected in each period (each month) and also the coefficient is significant at 1% as the probability (0.0000) shows.

Table 4.6. Result of Long Run Equation

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
PPETROL	-0.514542	0.786469	-0.654242	0.5131
PDIESEL	-0.557797	0.632825	-0.881438	0.3783
PKEROSENE	2.275316	0.806840	2.820032	0.0049

Source: Author's Extract from own computations from Eview 9 analysis

Table 4.7(a) Presents the results for the manufacturing sector (Manu) of the Nigerian economy. In the Manu sector, Ppetrol and Pdisel have significant impact on CPI in the short run and the impact is direct and expected, except in 1-lag period which happens to be inversely related with CPI, which is against the a priori expectation of the study. Pkerosene in all the periods shows a negative relationship and significant at 1% level, meaning that a 1-unit increase in Pkerosene, on the average will lead to 0.013 and 0.012-unit decrease in CPI. The sectional ECM coefficient (-0.006) shows that there is a very low speed of adjustment of CPI by the Ppetrol, Pdiesel and Pkerosene. However, the coefficient is statistically significant at 1%.

Table 4.7a. Result of Short Run Coefficient of Manu

Variable	Coefficient	Std. Error	t-Statistic	Prob.
COINTEQ01	-0.005726	8.93E-06	-641.0291	0.0000
D(CPI(-1))	-0.365915	0.003646	-100.3675	0.0000
D(PPETROL)	0.016277	0.000579	28.12295	0.0001
D(PPETROL(-1))	-0.013647	0.000661	-20.63443	0.0002
D(PPETROL(-2))	0.018010	0.000621	29.00960	0.0001
D(PDIESEL)	0.009488	0.001829	5.186394	0.0139
D(PDIESEL(-1))	-0.017403	0.001992	-8.734763	0.0032
D(PDIESEL(-2))	0.037301	0.001433	26.02241	0.0001
D(PKEROSENE)	-0.011171	0.000219	-51.07270	0.0000
D(PKEROSENE(-1))	-0.013086	0.000325	-40.25621	0.0000
D(PKEROSENE(-2))	-0.011823	0.000225	-52.57189	0.0000
C	0.857433	0.071554	11.98303	0.0013

Source: Author's Extract from own computations from Eview 9 analysis

Table 4.7(b) shows the short run effect in the transportation (trans) sector of the economy. The effect of Ppetrol on CPI is the same as in the *Manu* sector. From the result Pdieisel has direct impact on CPI at present and 1-lag periods. At 2-lag period the impact of Pdieisel indicates an inverse effect on CPI. The impacts are all significant at 1% level except at 1-lag period which is not significant. The sectors ECM coefficient (-0.0076) shows the correct sign and significant at 1% level. However, only 0.8% of the disequilibrium in the model is correct, this is also very low as showcased in Table 4.6.

Table 4.7b. Result of Short Run Coefficient of Transportation Sector (Trans)

Variable	Coefficient	Std. Error	t-Statistic	Prob. *
COINTEQ01	-0.007676	1.28E-05	-600.1702	0.0000
D(CPI(-1))	-0.181792	0.003986	-45.61241	0.0000
D(PPETROL)	0.006831	0.000268	25.46536	0.0001
D(PPETROL(-1))	-0.006827	0.000300	-22.77575	0.0002
D(PPETROL(-2))	0.025804	0.000278	92.89738	0.0000
D(PDIESEL)	0.011322	0.000809	14.00317	0.0008
D(PDIESEL(-1))	0.000110	0.000886	0.124547	0.9088
D(PDIESEL(-2))	-0.018712	0.000640	-29.25755	0.0001
D(PKEROSENE)	-0.017379	0.000101	-172.4392	0.0000
D(PKEROSENE(-1))	-0.015595	0.000146	-107.1281	0.0000
D(PKEROSENE(-2))	-0.011214	0.000100	-112.0048	0.0000
C	0.667915	0.049428	13.51287	0.0009

Source: Author's Extract from own computations from Eview 9 analysis

In the food sector, Ppetrol still shows the same impact indication as in the two preceding sectors. Little difference is experienced in the Pdieisel with an unexpected negative impact in the present period and 2-lag periods and the effects are significant at 1% level, which means an increase in diesel price will, on the average, lead to the decrease in consumer price. The Pkerosene indicates the same impact with the two previous sectors explained. Also, the ECM is not different from that of *Trans*.

Table 4.7c. Result of Short Run Coefficient of Food Sector

Variable	Coefficient	Std. Error	t-Statistic	Prob.
COINTEQ01	-0.008317	1.66E-05	-499.9524	0.0000
D(CPI(-1))	0.324885	0.003682	88.23340	0.0000
D(PPETROL)	0.009811	0.000117	83.70065	0.0000
D(PPETROL(-1))	-0.013318	0.000126	-105.7984	0.0000
D(PPETROL(-2))	0.006711	0.000112	59.77114	0.0000
D(PDIESEL)	-0.018009	0.000320	-56.19776	0.0000
D(PDIESEL(-1))	0.017445	0.000354	49.33351	0.0000
D(PDIESEL(-2))	-0.011790	0.000260	-45.31139	0.0000
D(PKEROSENE)	-0.016120	4.62E-05	-348.8322	0.0000
D(PKEROSENE(-1))	-0.011188	5.98E-05	-186.9906	0.0000
D(PKEROSENE(-2))	-0.013982	3.97E-05	-351.8156	0.0000
C	0.347432	0.035973	9.658073	0.0024

Source: Author's Extract from own computations from Eview 9 analysis

The results of Domact sector shows similar coefficients with those of Manu except for the Pdieisel which shows that Pdieisel has inverse impact on CPI in both 1-lag and 2-lag periods.

Table 4.7d. Result of Short Run Coefficient of Food Sector

Variable	Coefficient	Std. Error	t-Statistic	Prob.
COINTEQ01	-0.006250	8.18E-06	-764.4624	0.0000
D(CPI(-1))	0.093907	0.003730	25.17812	0.0001
D(PPETROL)	0.007061	0.000117	60.44284	0.0000
D(PPETROL(-1))	-0.013675	0.000129	-105.6759	0.0000
D(PPETROL(-2))	0.058221	0.000122	475.5069	0.0000
D(PDIESEL)	0.004607	0.000347	13.28577	0.0009
D(PDIESEL(-1))	-0.030626	0.000377	-81.29598	0.0000
D(PDIESEL(-2))	-0.005377	0.000274	-19.60541	0.0003
D(PKEROSENE)	-0.014255	4.45E-05	-319.9716	0.0000
D(PKEROSENE(-1))	-0.016934	6.26E-05	-270.6100	0.0000
D(PKEROSENE(-2))	-0.009648	4.27E-05	-226.0902	0.0000
C	0.496287	0.027297	18.18070	0.0004

Source: Author's Extract from own computations from Eview 9 analysis

Tables 4.7(a)(b)(c)(d) are clear indication of the correctness of the pooled mean results in Table 4.5.

Previous research used many techniques to analyze data but not panel data with the division of the economy into 4 sectors – Manufacturing (Manu), Transportation (Trans), Food and domestic activities (Domact) with the sole intention to further examine how these PPP affected these sectors, differentially the impact was split into short run and long run impacts.

Findings of our result showed that as a whole, Ppetrol on consumer price averagely was positive and significant at 1% level in the short run and this result is in line with the findings of Akinleye and Ekpo (2013) who used oil price as a whole, though their results indicated a marginal positive impact. The result is also in concord with the findings of Bobai (2012) whose result revealed a direct relationship between Premium Motor Spirit (petrol) and price level (inflation), and also Nwosu (2009) got a positive impact of fuel price on general price level. This result is not different from that of Isaac (2019). The study also indicated that, on a general note, price of diesel did not have any significant impact on the economy, viz-a-viz the whole economy pooled together. This is because Nigerian people use less of diesel in most activities in their lives. Most vehicles for transportation use petrol, so the impact of change in diesel price will not be felt in all the sectors except in manufacturing which uses big plants and machines, thus, the findings of the study indicated that in the short run, increase in diesel price had a significant positive impact on consumer price. This is only for the manufacturing sector, however, in the long run, it had an insignificant impact. That could be the reason why the government has totally removed subsidy on this product.

Lastly, on Pkerosene. The study found that, increase in price of kerosene reduced the consumer price index, which is still in line with the study of Bobai (2012) and the impact was significant. It is also not different from the findings of Nwaoha et al (2018) who used two models to explain the impact. Kerosene is only used for domestic activities like lighting and cooking food in areas with low income. As such, hike in kerosene price makes users abandon the product for a more stable, reliable and convenient source of fuel like gas and fire-wood. The findings also indicated the presence of alternative for kerosene and thus, users do not border whenever there is an increase or it is not available, therefore, the price of kerosene revealed the same inverse effect on consumer price in both the short run and the long run.

In reality, whenever the price of petrol increases in the economy, the first impact will be scarcity. Prior to the increase, the rumour would have been spread and expectations built. Many petrol stations would have started to hoard the product and sell at an exuberant price in order to register fast gain. Dealers would sell to the so-called black marketers to further create artificial scarcity in the system. All these activities happen in the short run period with effect on virtually all sector of the economy most especially on the transportation, food and on domestic sectors. At this instance, consumer prices shoot up and it would take some time before the economy regain its steady state. This realistic situation is in line with the outcome of this study. Meaning that, in the short run, an increase in the price of petrol has positive and significant impact on all the main sectors of the Nigerian economy. The dichotomy between transporters and passengers is quite unbearable especially those who would travel before getting to their work places. The short run effect of petrol price was heavily felt in 2016 when petrol price increased from N86.5 to N145.00 and then to N152.00 in 2020. During the short run period, many sectors were affected, casual workers lost their job because they could not bear the increase in transport fare and their employers were not ready to increase

their salaries. After a long period, the impact of this increase gradually decreased, pointing to the fact that the impact is only in the short run but insignificant in the long run.

The implication of the findings of this study shows that, an increase in the prices of petrol will have positive and significant impact on consumer prices of all sectors of the economy except on domestic activities, in the short run, while increase in the price of diesel will increase consumer price in only manufacturing and transportation sectors in the short run. However, in the long run, changes in the prices of the duo will have an insignificant impact on consumer price. Change in the price of kerosene will lead to an inverse and significant impact on consumer price in both the short and long run. In essence kerosene is not often used and it has close substitute, removal of total subsidy on kerosene will not have any significant impact on the economy through consumer price, while the implication of total removal of subsidy on petrol will only be felt in the short run and not in the long run period.

5. Conclusion

The study investigated the impact of petroleum pump price (PPP) on consumer price index (CPI) in Nigeria between 2000 and 2019, in order to have empirical support for or against total removal of subsidy on petroleum pump price. Three pump prices, price of petrol, diesel and kerosene, were used to represent PPP. The economy was sub-divided into four-manufacturing, transportation, food and domestic activities. Monthly Data were collected from both the NBS 2020 and CBN 2020 bulletins, which amounted to 240 observations. CPI was made the dependent variable and PPP, the independent variable. After the usual stationarity test, CPI was stationary at level while others were stationary at first difference. This informed the study to employ Panel pooled mean/ARDL cointegration technique, which separated the impact into short and long run periods. Findings in the short run revealed that, price of petrol has significant direct impact on consumer price in the short run. While these prices had no significant impact in the long run, the price of kerosene indicated a significant inverse impact on consumer price in both periods. Results of cross-section short run coefficient revealed that prices of petrol and diesel had significant positive effect on manufacturing sector of the economy.

Based on findings, the study suggests that, the government should remove subsidy totally on petrol and kerosene prices and reinvest the surplus into the economy most especially in revamping the refineries. Prices of alternative products to kerosene should remain stable to further reduce domestic use of kerosene in the economy.

The main limitation of this study is in the area of getting the exact pump prices of these petroleum products. The official price of selling will not be ideal since that is not the reality.

Thought this study took cognizance of this, but could not source for the data in practical terms as most filling stations did not keep records of the pump prices, and as such this study only relied on secondary data. In essence, future research could be on getting primary data for the analysis in order to be more realistic.

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