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Petroleum Pricing and Inflation Rate in Nigeria

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Abstract

This study examined the impact of petroleum product prices on inflation in Nigeria over the period 1980–2020. Specifically, it assessed the effects of the prices of Premium Motor Spirit (PMS), Automotive Gas Oil (AGO/diesel), and Dual-Purpose Kerosene (DPK) on the inflation rate. The study employed the Autoregressive Distributed Lag (ARDL) method to estimate the specified model. The findings revealed that PMS price had a significant positive short-run effect on inflation, but its long-run effect was not significant. The prices of diesel and kerosene were found to have no significant effect on inflation in either the short or long run, although the long-run coefficient of kerosene was positive. The study concludes that petroleum price increases contribute to Nigeria's inflation problem, particularly through changes in PMS prices. It therefore recommends that the government ensure a stable supply of petroleum products and avoid unnecessary increases in PMS prices, while maintaining stable diesel and kerosene prices to minimize inflationary pressures.

Keywords: ***Petroleum prices, inflation, PMS, diesel, kerosene, ARDL, Nigeria***.

1. Introduction

Nigeria is blessed with abundant natural resources foremost of which is crude oil which in turn is the source of various petroleum products. Petroleum products are the products obtained after refining crude oil through physical separation or breaking down. These include but not limited to, Premium Motor Spirit (PMS), Dual Purpose Kerosene (DPK), Automotive Gas Oil (AGO), Low Pour Fuel Oil (LPFO), High Pour Fuel Oil (HPFO), Special Naphtha, Waxes etc.

Nigeria is the eleventh largest producer and seventh largest exporter of crude oil. Nigeria holds 37,070,000,000 barrels of proven oil reserves as of 2016**,** ranking 10th in the world and accounting for about 2.2% of the world's total oil reserves of 1,650,585,140,000 barrels (Statistical Review of World Energy, 2021). The petroleum sector is dominant in the Nigerian economy, generating over 90% of the country's foreign exchange earnings, and providing employment in various forms to the country's labour force. In addition, the tremendous growth in oil earnings has influenced significantly Nigeria's international relations, and sometimes the politics of oil has taken centre stage in the nation's history of international relations in the last few decades (Nigerian National Petroleum Corporation, NNPC, 2016).

Oil products are derived from crude oil and they include petrol, diesel, kerosene, natural gas, bitumen, etc. In technical terms petrol is known as Premium Motor Spirit (PMS), diesel as Automotive Gas Oil (AGO), and kerosene as Dual Purpose Kerosene (DPK) because it can be for household use or used as aviation fuel. According to Dharam (1991), oil was discovered in Nigeria in 1956 at Oloibiri in the present-day Bayelsa State, after a century-long search. Oil products are basically used in industries for production of goods and services and they are also used domestically for personal consumption in which the greater percentage of it comes from developed countries.

However, the persistent instability of crude oil prices in the global market has adversely affected all the sectors of the Nigerian economy negatively. The price instability of the crude oil in the world market has led to the downfall of Nigerians economy in various sectors, such as the production, manufacturing and services sectors. This is because Nigeria is a monoculture economy.

Historically, the price of petroleum (PMS) increased from ₦0.125 in 1980 to ₦0.63 in 1990 to ₦22 in 2000, to ₦65.7 in 2010 and then to ₦165 in 2020 (more detail at: https://nigerianprice.com/petrol-price-in-nigeria/). According to the government, the upward review of domestic prices of petroleum products was necessitated by the high spot market price of crude oil and the need for higher margins for the Nigerian National Petroleum Corporation (NNPC) to meet operational and capital costs. These increases have had upward effect on price level of goods and services across the economy. For instance, consumer price index (CPI) inflation rose from 12.4% in 1980 to 29.3% in 1996 and then settled at 13.25% in 2020. In fact, inflation rate averaged 18.8% annually between 1980 and 2020 which is not so good for the Nigerian economy.

Increases have also been recorded in the other petroleum products, namely diesel (AGO), and kerosene (DPK). The pump price of AGO and DPK per litre averaged ₦0.37 and ₦0.24 per year respectively between 1980 and 1990 but those figures had risen to ₦216 and ₦228 per annum respectively between 2011 and 2020. These no doubt have far-reaching implications on the Nigerian economy in terms of domestic prices of goods and services and that is the interest of this study. It is evident that petroleum and money are so important to modern living that shortages disrupt essential transactions. The links between petroleum and money are easily obvious. More important, a proper grasp of the relationship between the domestic and the world economy is essential to the identification of these relationships. The monetization of petro-dollars shows how closely related petroleum is to money stock, which in essence has direct bearing on the inflationary pressures in the economy (Sikkam, 1999).

The petroleum industry is very important to the Nigerian economy. It provides among other things the greatest part of the foreign exchange earnings and total revenue needed for socio economic and political development of Nigeria. Between 1978 and 2007, the various Nigerian regimes increased fuel prices a total of 18 times. Most of the increase occurred in the 1990-2007 period when prices were adjusted, sometimes twice a year. Upward adjustments of petroleum products prices have resulted in inflation, high cost of living, and inequitable distribution of income in Nigeria (Nwosu, 2009).

Labys (2006) observes 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. Gbadomosi et al., (2007) noted that with increases in petroleum products pricing, transport fares have sky-rocketed; there have been general increase in cost of production of goods and services; and the prices of food stuff in the economy have always been increasing.
Government has often explained increases in the price of petroleum products as being necessary to reduce or remove the subsidy on petroleum products much of which has to be imported because of the inability to meet products demand domestically. The increases in the prices of these products have a chain effect on the prices of other goods and services in the economy. Between 1980 and 2007, the various Nigerian regimes increased fuel prices more than 15 times. Most of the increase occurred in the 1990-2007 period when petroleum

products prices were adjusted upwards sometimes twice in one year. However, the rising earnings have not significantly affected key macroeconomic indicators in the economy. In specific terms, the increases in petroleum prices have negatively affected inflation in Nigeria. The rise in price of PMS seems to have contributed to the rise in general price level.

One major problem this has caused was the instability of the prices of goods and services in the country. Mba-Afolabi (1999) therefore said that whenever there is an increase in prices of petroleum products, it affects costs of goods, transportation, and those of other services; and the end-result would be lowering of living standard due to rising cost of living. This claim therefore spurred this study to review the inflationary impact of petroleum products pricing in Nigeria over the period 1980-2020. The study aims to: ascertain whether changes in the pump price of premium motor spirit (PMS) significantly impact on inflation rate in Nigeria, determine how changes in the pump price of diesel affect inflation rate in Nigeria, and determine the extent to which price of kerosene affects inflation rate in Nigeria.

2. Review of Related Literature

2.1 Theoretical Review

2.1.1 Price Determination Theory

Price determination theories are associated with Khan (1984) who argued that in the long run, prices are determined by aggregate demand and long-run aggregate supply. This opens up a demand-side versus supply-side analysis of price determination in the economy. Based on this theory, Adesete and Bankole (2020) developed a theoretical explanation of the link between petroleum prices and inflation which is relevant to the present study. The said authors stated that the impact of shock to oil price on macroeconomic variables, such as inflation, can be explained using the basic demand and supply channels. From basic economic theory, the effect of changes in price on economic activity can be shown using the demand and supply channels. This highlights the relevance of the demand and supply theory to explaining the impact of crude oil price changes in the economy. The theory of production can be used to explore the supply side effect, which is relevant to the present study, while the theory of consumer demand can be used to analyse the demand side.

This study assumes that oil is an important input in production in an economy with no substitute. From the demand side, there are different factors that can influence the demand for crude oil which includes crude oil price, population and consumer income. If there is an increase in the price of oil, the demand for oil is expected to increase. On the other hand, this will raise the cost of production of firms thereby negatively impacting firms' productivity, revenue and profitability. Increased crude oil price can also result in inflationary pressures on the economy thereby reducing aggregate demand for commodities.

Since oil is an important component of capital as a factor of production of most industries, changes in oil prices will significantly impact firms' production costs. Furthermore, a rise in crude oil price will directly result in an increase in cost of production which could translate to contraction of firms' output and a rise in the price of final output. Also, according to Patti and Ratti (2007), increase in input costs can drive down non-oil potential output supplied in the short run given existing capital stock and sticky wages. In addition, increasing oil price will lead to decline in real wages, raise labour cost of industries and reduce profit margin.

2.1.2 Modern Theories of Inflation

The modern approach to inflation follows the theory of price determination. The price theory tells us that, in a competitive market, price of a commodity is determined by the market demand for and the market supply of the commodity and that the variation in the price of the

commodity, if any, is caused by the variation in the demand and supply factors. Likewise, the aggregate price level is determined by the aggregate demand and aggregate supply and variation in the aggregate price level is caused by the variations in the aggregate demand and aggregate supply (Dwivedi, 2007). The modern theory of inflation is, in fact, a synthesis of classical and Keynesian theories of inflation. The modern analysis of inflation shows that inflation is caused by both demand-side and supply-side factors. The demand-side factors are called demand-pull factors and supply-side factors are called cost-push factors. Accordingly there are two kinds of inflation: Demand-pull inflation and Cost-push inflation.

(i) Demand-pull Inflation

The demand-pull inflation occurs when the aggregate demand increases much more rapidly than the aggregate supply. The demand-pull inflation occurs, given the aggregate supply (AS), when the aggregate demand (AD) curve shifts upward to right. The rightward shift in the AD curve may be caused by (a) monetary factors, i.e., increase in money supply, and (b) real factors i.e. increase in demand for real output (Dwivedi 2007).

(ii) Cost-push Inflation

Cost-push inflation is inflation caused by an increase in prices of inputs like labour, raw material, etc. The increased price of the factors of production leads to a decreased supply of these goods. While the demand remains constant, the prices of commodities increase causing a rise in the overall price level. This is in essence cost push inflation. This is inflation triggered from supply side, i.e., because of less supply. Generally, cost push inflation may occur in case of an inelastic demand curve where the demand cannot be easily adjusted according to rising prices. In Nigeria, petroleum products enjoy inelastic demand such that increase in the prices of petroleum products especially premium motor spirit (petrol) has the tendency to trigger inflation.

(iii) The Structuralists' Approach to Inflation

According to the structuralists' view, inflation is inevitable in the less developed countries embarking on ambitious development programmes and is caused mainly by the characteristic structural imbalance in such countries. Major structural imbalances include: scarcity in the supply of some major goods and services, resource imbalance, foreign exchange bottleneck, infrastructural bottleneck and social and political constraints (Dwivedi, 2007). The implication of the scarcity of petroleum products on the growth of output and price level in the economy cannot be overemphasized. However, this has led to imbalance on the demand for and supply of petroleum products due to inelastic products supply in the country, which had often led to rise in the prices of petroleum products in the country.

According to Isaac (2017) some of the reasons for low petroleum product supply are: technological backwardness, low level of petroleum infrastructure, low rate of saving and investment, high rate of mismanagement and corruption in the economy, etc., which also hold petroleum products supply at low level against the rising demand due to increase in population and urbanization, which bring about a widening gap between demand for and supply of petroleum products in Nigeria. Speculative hoarding of the petroleum products in the country also increase the prices of the products. Since the demand for petroleum products is always greater than supply of the product government has to import the shortage to meet up with the demand. Rise in the prices of petroleum products in Nigeria lies as one of the major price structures in the economy and a cause of inflation in the Nigerian economy.

(iv) Relationship between Oil Prices and Domestic Inflation

Higher oil prices impact the economy in a number of ways: transfer of income from oil importing economies to oil exporters; rise in the cost of production of goods and services in an economy emanating from an upsurge in the relative price of energy inputs; it impacts on the price level; decline in economy's productive capacity as producers respond to higher oil

prices by reducing their utilization of both oil and capital; and uncertainty in investment decisions by households and firms owing to uncertain oil prices in the future. Others include direct and indirect impacts on financial markets and the incentive for providers of energy to increase production and investment (Bala & Chin, 2018; Trang, Tho, & Hong, 2017; Álvarez, Hurtado, Sánchez & Thomas, 2011; Bataa, 2010; DePratto, Resende, & Maier, 2009; Blanchard & Gali, 2007).
The magnitude and direction of its impact, however, differ between industrial and developing countries as well as between oil producing and consuming economies (International Monetary Fund, 2000). Oil price shocks affect domestic inflation in countries through both direct and indirect channels: directly through increases in prices of refined oil products, which spill over to the Consumer Price Index (CPI), and indirectly through price changes in goods and services, which utilize oil or oil products as inputs in the production process (Zivkov, Duraskovic, & Manic, 2019). The direct impact would depend, among others, on the expenditure share of households on refined oil products over total expenditure. Alvarez et al. (2011) have shown that the direct impacts tend to exhibit higher pass-through to inflation than the indirect impacts.

Meanwhile, inflationary pressures emanating from rising oil prices through these channels (first round effects) may trigger behavioural responses from firms and workers, leading to revision of inflation expectations, increase in nominal wages, transferring the marginal increase in cost of production to consumers and further changes in the price level through the second round effects.
Corroborating this, Conflitti and Luciani, (2017) state that oil price hikes may have an inflationary effect in four ways – increase in production costs, higher inflation expectations, demand for higher wages by workers to compensate for the increase in energy prices and an adverse supply shock if real wages do not decrease sufficiently, thus triggering an adjustment in employment. However, it can have a deflationary effect through a demand shock as higher oil prices tend to reduce net disposable income, hence consumption and investment.

2.2 Empirical Review

Various empirical studies have reported the impact of petroleum pricing on inflation rate in different countries. Renou-Maissant (2019) empirically investigated the effects of oil price changes on inflation over the period 1991-2016 for eight industrial countries: the United States, Canada, Japan, Australia, Germany, France, Italy, and the UK. The author used an oil-augmented Phillips curve with unobserved components and considered time-varying coefficients. The results show that even over a period of low and stable inflation, oil prices play a significant role in the dynamics of inflation. The study further reported that in all the countries except Germany, oil pass-through into inflation increased from the early 2000s up until the global financial crisis. In the United States it has nearly doubled in the last fifteen years. These findings suggest that central banks must continue to monitor oil prices closely.

Ibrahim (2015), Abdlaziz, Rahim, and Adamu (2016), and Lacheheb and Sirag (2019) applied the non-linear autoregressive distributed lag (NARDL) approach to examine the oil price-inflation nexus in Malaysia, Indonesia, and Algeria respectively. Ibrahim (2015) found that food price, oil price and real GDP were cointegrated with asymmetries in the food price behaviour in Malaysia. The study established a significant relationship between oil price hikes and increases in food prices in both the long and short runs, but could not find any significant influence of oil price decline on food prices both in the long-and short-run. Abdlaziz, Rahim and Adamu (2016) revealed evidence of a strong positive relationship between food and oil price increase in both the long-run and short-run. Their results indicated that a 10% increase in oil prices induced a 3.6% rise in food prices in the long-run. Lacheheb

and Sirag (2019) also found a non-linear effect of oil price on inflation, with oil price increases significantly impacting on inflation, while oil price declines do not have a significant impact.

Rangasamy (2017) studied the impact of petrol price movements on inflation outcomes in South Africa over the period since the 1975-2015. The study used the autoregressive distributed lag (ARDL) technique and results show that, over time, the direct contribution of petrol inflation to headline inflation has not only increased, but has also exceeded its weight in the consumer price index. In addition, Granger causality tests and the autoregressive distributed lag approach to co-integration testing reveal that petrol prices have an important bearing on the prices of other (non-petrol) commodities in the economy. The results essentially show that petrol price increases had an important bearing on inflation outcomes in South Africa, implying that petrol price movements warrant special attention in policy formulation and implementation in South Africa if inflation outcomes were to be kept in check.

Choi, Furceri, Loungani, Mishra, and Poplawski-Ribeiro (2017) studied the impact of fluctuations in global oil prices on domestic inflation using an unbalanced panel of 72 advanced and developing economies over the period from 1970 to 2015. The study found that a 10% increase in global oil inflation increases, on average, domestic inflation by about 0.4 percentage point on impact, with the effect vanishing after two years and being similar between advanced and developing economies. The study also found that the effect is asymmetric, with positive oil price shocks having a larger effect than negative ones. The impact of oil price shocks, however, has declined over time due in large part to a better conduct of monetary policy. The study further examined the transmission channels of oil price shocks on domestic inflation during the recent decades, by making use of a monthly dataset from 2000 to 2015. The results suggest that the share of transport in the consumer price index (CPI) basket and energy subsidies are the most robust factors in explaining cross-country variations in the effects of oil price shocks during the period.

Lacheheb and Sirag (2016) examined the relationship between oil price changes and inflation rate in Algeria for the period 1970 – 2014. The study used the nonlinear autoregressive distributed lags (NARDL) method for its ability to capture for asymmetries in the relationship between oil price and inflation. The estimated model revealed the existence of nonlinear effect of oil price on inflation. Specifically, their study found a significant relation between oil price increases and inflation rate, whereas, a significant relation between oil price reduction and the inflation was absent.

Sek, Teo, and Wong (2015) examined the effects of oil price changes on inflation in two groups of countries, namely the high versus low oil dependency groups. The authors also compared the relative effect of oil price with other types of shocks such as real exchange rate, domestic output, and exporters' production cost. They modelled the pass-through equation in an autoregressive distributed lag (ARDL) format and the model was estimated using pooled mean group method. Their study revealed that oil price change has its direct effect on domestic inflation in low oil dependency group but its impact is indirect on affecting the domestic inflation in the high oil dependency group through changes on the exporter's production cost. The study pointed out that the main determinants of domestic inflation are real exchange rate and exporter's production cost (high oil dependency group) and domestic output and exporter's production cost (low oil dependency group).

In Nigeria, the study by Bawa, Abdullahi, Tukur, Barda, and Adams (2020) examined the impact of oil price shocks on inflation in Nigeria. The authors applied a Non-Linear Autoregressive Distributed Lag (NARDL) approach on quarterly data spanning 1999:Q1 to

2018:Q4 and found that oil price increases led to increase in headline, core and food measures of inflation in Nigeria. However, a decline in oil price resulted in a decline in the marginal cost of production and culminated in moderation of domestic inflation. Furthermore, the study reported that negative oil price shocks led to higher inflation in Nigeria when exchange rate is dropped from the models, indicating that exchange rate absorbed the impact of oil price declines earlier, as lower oil prices culminated in lower external reserve, depreciation of the naira and ultimately higher inflationary pressures. The study therefore emphasized that core inflation tends to respond more to oil price increases than food inflation. The authors however failed to justify the application of NARDL in the study.

The study by Apere (2017) investigated the relationship between inflation and oil price fluctuations in Nigeria with quarterly data over the period 1980:1 to 2015:4. Using secondary data obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin 2015 and Energy Information Administration (EIA) short-term outlook, December, 2016. Vector autoregressive model econometric technique was adopted in analysing the data The study revealed that the response of inflation to oil price fluctuation is that as oil prices falls inflation fall also and a stable and positive oil price results in a stable negative inflation rate. The author concluded that the relationship between the variables – oil price and inflation – is negative.

Isaac (2017) investigated the impact of change in petroleum products prices on inflation in Nigeria. The study employed ARDL model to analyse the data spanning 1980 to 2016. The study found that petroleum pump price has a positive impact on inflation and the result is statistically significant at 5% level of significance. Given the fact that virtually everyone is directly or indirectly connected to the usage of petroleum products, increase in the price of petroleum products is felt by everyone. The study also found out that automotive gas oil (AGO) and bonny light crude oil has a positive relationship with the level of inflation in Nigeria.

Eregha, Mesagan, and Ayoola (2015) researched on petroleum products prices and inflation dynamics in Nigeria within the period 1994 to 2012. The authors used error correction approach to cointegration and the study found that the price of Premium Motor Spirit (PMS) remained stable until the entry of the military into the administration of the country when the then military heads of state arbitrarily increased the prices of petroleum products. The authors also reported that there exists high positive relationship between the prices of PMS and AGO and inflation in Nigeria. The study concluded that rises in petroleum products prices, especially PMS and AGO, significantly impact inflation in Nigeria.

Arinze (2011) investigated the impact of oil price on the Nigerian economy between 1991 and 2010 with the objective to examine the economic impacts on price instability of increase in prices of oil products. The assumptions of the study are that the rise in price of petroleum products has contributed significantly to inflation in Nigeria, using simple regression analysis of data to find out the relationship between dependent and independent variables. The study revealed that whenever petroleum increases, the inflation rate also increases. The explanation for the above result is that the relationship between the inflation rate and the price of petrol is significant. The study concluded that upward adjustments of petroleum products prices have resulted in inflation, high cost of living, and inequitable distribution of income in Nigeria.

3. Methodology

3.1 Model Specification

This study focuses on the impact of changes in petroleum products prices on inflation rate in

Nigeria over the period 1980 to 2020. The price determination theory coupled with the cost-push inflation theory were combined to provide the theoretical basis for the model of the study. Those two theories complement each other and recognise oil as an important input in the economy. As such, increase in the price of crude oil leads to increase in cost of production which leads to output loss and then high prices of the produced items. Based on these theories and following the work of Eregha, Mesagan, and Ayoola (2015), with some modifications, the empirical model of this study is specified thus:

INF = f(PMS, AGO, DPK, EXR) 1

Where;

INF = Inflation (CPI) rate

PMS = Average pump price of premium motor spirit (petrol) per litre

AGO = Average pump price of automotive gas oil (diesel) per litre

DPK = Average pump price of dual-purpose kerosene (DPK) per litre

EXR = Nominal official Exchange rate of Naira/Dollar (US)

The econometric form of the function is stated as follows,

$INF = \beta_0 + \beta_1 PMS + \beta_2 AGO + \beta_3 DPK + \beta_4 EXR + \varepsilon_t$

Where β_0 is the intercept, β_1-β_4 represent the coefficients of the independent variables in respective order. The a priori expectations are,

$\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 > 0$, and $\beta_4 > 0$.

This means that the slopes are all expected to be positive due to the expected upward pressure on inflation rate (general price level) of increases in the prices of the petroleum products under review.

3.2 Estimation Procedure

The time series properties of the data will be examined in order to avoid spurious results emanating from the non-stationarity of the data series and to analyse the dynamic structure of the relationship. The estimation will begin with a unit root test to confirm the stationarity states of the variables that entered the model. The Augmented-Dickey fuller (ADF) test was used for this test. The method of estimation will be determined by the result of the unit root test.

The estimated model will be evaluated using three criteria: theoretical, statistical, econometrics. The theoretical criterion is also known as test of economic a priori expectations, which is done to check whether the signs of the estimated model parameters are in tandem with relevant economic theory. Second, the statistical tests are conducted to check whether the estimated results are significant. Such tests include T-Test and F-Test. Lastly, the econometrics tests are used to ascertain whether the assumptions of the classical regression model are not violated. Such assumptions include no autocorrelation, no heteroscedasticity, and normality of the residuals.

3.3 Sources of Data

The study used secondary data in the form of annual time series data. The data were obtained from Central Bank of Nigeria (CBN) official website and from World Bank (2020) development indicators available at: https://databank.worldbank.org/source/world-development-indicators. Average pump prices of the petroleum products are available at: http://statistics.cbn.gov.ng/cbn-onlinestats/QueryResultWizard.aspx; while inflation rate data is available from the CBN Statistical Bulletin of 2020 available at: https://www.cbn.gov.ng/documents/Statbulletin.asp.

4. Results

4.1 Unit Root Test Result

The unit root test was conducted using the Augmented Dickey-Fuller method and the results are summarized in Table 1.

Table 1: Summary of Augmented Dickey Fuller (ADF) unit root test results

Series	ADF Test Statistic @ level	5% critical value @ level	P-value @ level	ADF Test Statistic @ 1st Difference	5% critical value @ 1st Difference	P-value @ 1st Difference	Order of Integration
INF	-3.795	-3.5298	0.03	-	-	-	I(0)
LPMS	-1.394	-3.5298	0.85	-4.613	-3.5298	0.004	I(1)
LAGO	-2.069	-3.527	0.547	-5.698	-3.533	0.000	I(1)
LDPK	-2.337	-3.5298	0.405	-4.947	-3.533	0.002	I(1)
LEXR	-1.176	-3.527	0.902	-5.691	-3.5298	0.000	I(1)

Source: EViews 10 results (2022)

The result in Table 1 presents a summary of the unit root test results based on the ADF method. The variables used in the analysis are inflation rate (INF), log of premium motor spirit (LPMS), log of automotive gas oil (LAGO), log of dual-purpose keroses (LDPK), and log of exchange rate (LEXR). The result shows that only INF is stationary at level because the ADF Test statistic is greater than its 5% critical value in absolute terms, and the p-value of the Test statistic is less than 0.05. However, the rest of the variables, namely, LPMS, LAGO, LDPK, and LEXR, are stationary at the first difference because it was at this point that the two conditions for stationarity, as explained above, are met. This means that the series are a mixture of order zero and order one integrations base on the 5% level of significance, as shown in the last column. Consequently, the Autoregressive Distributed Lag (ARDL) model was employed to estimate the regression model of the study.

4.2 ARDL Results

4.2.1 Short-run Results

The short-run result from the ARDL method is presented in Table 2.

Table 2: ARDL short-run result

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
INF(-1)	0.361577	0.139537	2.591253	0.0143
LPMS	15.71428	10.62576	1.478885	0.1489
LPMS(-1)	-24.16547	8.075467	-2.992454	0.0053
LAGO	-2.489488	6.376026	-0.390445	0.6988
LDPK	1.462957	6.062519	0.241312	0.8109
LEXR	-4.044908	7.617600	-0.530995	0.5991
LEXR(-1)	13.95210	8.130056	1.716114	0.0958
C	-3.394953	7.711608	-0.440239	0.6627
R-squared	0.587781	Mean dependent var		18.97374

Adjusted R-squared	0.497608	S.D. dependent var	16.87904
S.E. of regression	11.96380	Akaike info criterion	7.978504
Sum squared resid	4580.237	Schwarz criterion	8.316280
Log likelihood	-151.5701	Hannan-Quinn criter.	8.100633
F-statistic	6.518380	Durbin-Watson stat	2.033462
Prob(F-statistic)	0.000081		

Source: EViews 10 results (2022)

The short-run result in Table 2 shows that one-year lag of inflation rate, INF(-1), has significant positive impact on the current level inflation rate. In other words, past year inflation rate induces current inflation rate to rise by 0.36% in the short run. That is to say, increase in inflation rate in any period is likely to exert positive pressure on the inflation rate in the next period.

The result also indicates that the log of current price of premium motor spirit (PMS) did not have significant impact on the current inflation rate though the result has positive coefficient (15.71428). However, the one-year lag of the variable, LPMS(-1), has significant negative impact on current inflation rate in the short run, reducing inflation by up to 24% in response to one per cent rise in PMS in the previous year.
The result also shows that the short-run coefficient on log of price of automotive gas oil (LAGO) is -2.49 with T-statistic equal to -0.39 and p-value 0.699 which means the variable did not have significant short-run impact (at the 5% level) on current inflation rate within the period of 1980-2020. In the same vein, the coefficient of log of price of dual-purpose kerosene (LDPK) is 1.463 with T-value of 0.24 and p-value 0.811 which also means that the variable had no significant impact on current inflation rate in the short run. Lastly, the regression coefficient of log of exchange rate (LEXR) is -4.045 with T-value estimated at -0.53 and p-value 0.599 which again means that the variable had no significant impact on current inflation rate in the short run. Lastly, the coefficient of log of one-year lag of exchange rate ($LEXR_{-1}$) is 13.95 with T-statistic equal to 13.95 and p-value equal to 0.096, meaning the result is not significant at the 5% level but is at the 10% level. These results are not significant at the 5% level because their p-values are greater than 0.05.

4.2.2 Long-run and Bounds Test Results

The long-run and Bounds test results from the ARDL method are presented in Table 3.

Table 3: ARDL long-run and Bounds Test result

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPMS	-13.23760	10.90155	-1.214286	0.2335
LAGO	-3.899432	10.05281	-0.387895	0.7007
LDPK	2.291516	9.600790	0.238680	0.8129
LEXR	15.51823	6.706721	2.313832	0.0273
C	-5.317717	12.39139	-0.429146	0.6707

EC = INF - (-13.2376*LPMS -3.8994*LAGO + 2.2915*LDPK + 15.5182*LEXR
-5.3177)

F-Bounds Test			Null Hypothesis: No levels relationship	
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	4.539556	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Actual Sample Size	40	Finite Sample: n=40		
		10%	2.427	3.395
		5%	2.893	4
		1%	3.967	5.455

Source: EViews 10 results (2022)

The Bounds test is one for determining whether long-run relationship exists among the variables of the study. The decision rule is that there is long-run relationship if the F-Statistic is greater than the upper bound value, and the level of interest is 5%. The result indicates F-Statistic of 4.54 whereas the 5% upper bound is 3.49. The result meets the condition for rejective the null hypothesis of no long-run relationship. We therefore conclude that there is long-run relationship among the variables of the study.

The result shows that the long-run coefficient of the log of price of premium motor spirit (LPMS) is -13.24 with T-statistic -1.21 and p-value 0.23 which means the variable has no significant long-run influence on inflation rate in Nigeria. secondly, the long-run coefficient of the log of price of automotive gas oil (LAGO) is -3.899 with T-statistic -0.39 and p-value 0.7 which also means the variable has no significant long-run influence on inflation rate. Third, the long-run coefficient of the log of price of dual-purpose kerosene (LDPK) is 2.29 with T-statistic 0.24 and p-value 0.81 which also implies that the variable has no significant long-run influence on inflation rate. Lastly, the long-run regression coefficient of the log of exchange rate (LEXR) is 15.52 with T-statistic equal to 2.31 and p-value 0.027 which means that the variable has significant positive influence on inflation rate in the long run. That is to say, 1% increase in the official nominal Naira/Dollar exchange rate (i.e., depreciation of the Naira against the US dollar) will drive inflation rate up 15.52% in the long run.

4.2.3 Error Correction Result

The error correction is a mechanism that ties short-run disequilibrium to long-run equilibrium. The result is presented in Table 4.

Table 4: Error correction result

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPMS)	15.71428	6.315208	2.488323	0.0182
D(LEXR)	-4.044908	6.200226	-0.652381	0.5188
CointEq(-1)*	**-0.638423**	**0.113763**	**-5.611878**	**0.0000**
R-squared	0.467548	Mean dependent var		0.020759
Adjusted R-squared	0.438767	S.D. dependent var		14.85154
S.E. of regression	11.12610	Akaike info criterion		7.728504
Sum squared resid	4580.237	Schwarz criterion		7.855170
Log likelihood	-151.5701	Hannan-Quinn criter.		7.774302
Durbin-Watson stat	2.033462			

* p-value incompatible with t-Bounds distribution.

Source: EViews 10 results (2022)

The result in the table indicates that the first difference of the log of petroleum motor spirit pump price, D(LPMS), has positive impact on inflation rate such that one percent rise in PMS causes inflation rate to rise by 15.71 per cent in the short run, everything else equal, and the result is significant at the 5% level. However, the log of the first difference of the Naira/Dollar exchange rate, D(LEXR), has no significant impact on inflation rate in the short run.

The error correction coefficient is denoted as CointEq(-1) in the result presented in the table and it has a coefficient of -0.638 (t* = -5.6, p = 0.00) which means that about 64% of the error due to disequilibrium in the modelled inflation function occurring in the previous year is corrected in the current year. This implies that equilibrium can be restored within a period of 1.6 years (1 year and six months) following a period of disequilibrium. Since it takes relatively short time to restore equilibrium, we can say that the inflation model estimated in this study has high speed of adjustment from short-run towards long-run equilibrium. Moreso, the result is highly significant at the 1% level considering that the absolute value of the t-statistic is far greater than 2.0 and its p-value is much less than 0.01.

4.3 Diagnostics Test Results

(i) Autocorrelation Test

Autocorrelation was tested using the Breusch-Godfrey Serial Correlation LM test and the summary of the result is presented in Table 5 while the complete result is available in Appendix II of this report.

Table 5: Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.025073	Prob. F(1,31)	0.8752
Obs*R-squared	0.032326	Prob. Chi-Square(1)	0.8573

Source: EViews 10 results (2022)

In the result presented in Table 5, the null hypothesis of no serial correlation in the estimated ARDL model is accepted at the 5% level of significance since the P-values of the F-statistic and that of the Chi-Square statistic (i.e., 0.8752 & 0.8573 respectively) are both greater than 0.05. The conclusion is that there is no evidence of positive serial correlation in the estimated result which is what it should be. In other words, this important assumption of the classical linear regression model, i.e., no autocorrelation in the estimated model, has not been violated.

(ii) Heteroscedasticity Test

The heteroscedasticity test shows whether the assumption that the regression residuals is characterized by constant variance is satisfied. The autoregressive conditional heteroscedasticity (ARCH) method was employed to conduct the test in this study and the summary of the result is presented in Table 6.

Table 6: Heteroskedasticity Test: ARCH

F-statistic	0.047593	Prob. F(1,37)	0.8285
Obs*R-squared	0.050101	Prob. Chi-Square(1)	0.8229

Source: EViews 10 results (2022)

The result in Table 6 shows that the null hypothesis of 'no heteroscedasticity' cannot be rejected at the 5% level of significance, given that the P-values of the F and the Chi-Square statistics of 0.8285 and 0.8229 respectively is each greater than 0.05. This implies that the distribution of the regression residuals is characterized by constant variance which is desirable.

4.4 Test of Hypotheses

4.4.1 Hypothesis One

H_0: The pump price of premium motor spirit (PMS) does not significantly impact on inflation rate in Nigeria.

H_1: The pump price of premium motor spirit (PMS) has significant impact on inflation rate in Nigeria.

Decision Rule: Reject H_0 if the estimated t-Statistic of the log of the pump price of premium motor spirit (LPMS) variable is greater than the 2.0 rule of thumb, or its p-value is less than 0.05; otherwise, do not reject H_0.
Result and Conclusion: The estimated short-run coefficient of D(LPMS) in the ARDL error correction model result is 15.714 with t-Statistic of 2.488 and p-value of 0.0182. However, the long-run coefficient of the variable, LPMS, is -13.24 with t-Statistic equal to -1.214 and p-value equal to 0.234. Since the short-run result is significant at the 5% level, the null hypothesis under review stands rejected. The conclusion is that the pump price of premium motor spirit (PMS) has significant positive short-run impact on inflation rate in Nigeria, while the long-run impact is not significant.

4.4.2 Hypothesis Two

H_0: Changes in the pump price of diesel has no significantly impact on inflation rate in Nigeria.
H_0: Changes in the pump price of diesel has significant impact on inflation rate in Nigeria.
Decision Rule: Reject H_0 if the estimated t-statistic of the log of automotive gas oil (LAGO), which is diesel, is greater than 2.0 and its p-value is less than 0.05; otherwise, do not reject H_0.
Result and Conclusion: The estimated short-run coefficient of LAGO is -2.489 with t-Statistic of -0.39 and p-value of 0.6988 based on the ARDL result presented in Table 2. Similarly, the long-run coefficient of the variable is -3.8994 with t-Statistic of -0.388 and p-value of 0.7. The p-values of both results are greater than 0.05, so the results are not significant at the 5% level. Consequently, the null hypothesis two under review cannot be rejected. The conclusion is that changes in the pump price of diesel has no significant impact on inflation rate in Nigeria whether in the short run or in the long run.

4.4.3 Hypothesis Three

H_0: Price of kerosene does not significantly affect inflation rate in Nigeria.
H_0: Price of kerosene significantly affects inflation rate in Nigeria.
Decision Rule: Reject H_0 if the estimated t-statistic of the log of dual-purpose kerosene (LDPK), is greater than 2.0 and its p-value is less than 0.05; otherwise, do not reject H_0.
Result and Conclusion: The estimated short-run coefficient of LDPK is 1.463 with t-Statistic equal to 0.24 and p-value of 0.81 based on the ARDL short-run result. Similarly, the long-run coefficient of the variable is -2.29 with t-Statistic equal to 0.239 and p-value equal to 0.81. The p-values of both results are greater than 0.05, so the results are not significant at the 5% level. Consequently, the null hypothesis three under review cannot be rejected. The conclusion is that price of kerosene does not significantly affect inflation rate in Nigeria in the short run and in the long run.

4.5 Discussion of the Findings

In an oil-producing country like Nigeria, the oil sector has much significance because of its contribution to government revenue. However, dependence on oil revenue over other sources has not particularly favoured the country. This is because the country would easily be affected by shocks – unexpected and sudden changes – in the price of oil in the international market. For instance, sharp increases in oil price would bring in more revenue to the country from oil export but such inflow of money may filter into the economy and lead to increase in the general price level due to too much money chasing few goods, especially when production does not increase to accommodate the increase in demand owing to the inflow of money into the economy.

Having investigated the impact of petroleum pricing on inflation rate in Nigeria, the study found that (i) the pump price of premium motor spirit (PMS) has significant positive short-run impact on inflation rate in Nigeria, while the long-run impact is not significant, (ii) pump price of diesel has no significant impact on inflation rate in Nigeria whether in the short run or in the long run, and (iii) price of kerosene does not significantly affect inflation rate in Nigeria in the short run and in the long run. The implication of the findings is that increase in the price of PMS or petrol is a significant force behind rising inflation in Nigeria more than the other two petroleum products considered. Of course, petrol is the most consumed of all three.

Transportation is one of the first areas to be affected by increase in the price of the PMS. In turn, such would immediately shoot prices upward because goods must be moved from place to place. In another case, most business rely on petrol as source of power due to poor power supply in Nigeria. Hence, when the price of PMS increases it constitutes an increase in cost of production to manufacturing firms and even service-rendering firms and this usually translates into increase in the price of goods and services. This finding is in line with the price determination theory and the cost-push inflation theory which posit that increase in cost of production often leads to inflation. This finding is similar to those of previous studies on the subject matter such as Bawa, Abdullahi, Tukur, Barda, and Adams (2020), Isaac (2017), Eregha, Mesagan, and Ayoola (2015), and Arinze (2011). These studies all imply that increase in the prices of petroleum products, especially PMS, worsen inflation situation in Nigeria. As such, regular supply of the products, especially petrol, is necessary to keep prices stable.

5. Conclusion

This study has explored whether inflation is linked to petroleum prices in Nigeria and to what extent. The study had three specific objectives. The first was to ascertain whether changes in the pump price of premium motor spirit (PMS) significantly impact on inflation rate in Nigeria and the study found this to be the case, especially in the short run. The second objective was to determine how changes in the pump price of diesel affect inflation rate in Nigeria to which the study found that diesel prices have no significant impact on inflation rate in Nigeria. The third was to ascertain the extent to which price of kerosene affects inflation rate in Nigeria and the study found that the price of DPK has no significant impact on inflation rate in Nigeria though the long-run regression coefficient is positive. In the light of these findings, the study concludes that increase in the price of petroleum products drives inflation in Nigeria mostly through the petrol component more than diesel or kerosene. In other words, this factor has been partly responsible for the inflation problem in Nigeria within the 41-year period covered by this study.

Based on the findings of this study, the following recommendations were proffered.

(1) The government of Nigeria should not deliberately increase the pump price of petrol (PMS) because it will worsen inflation problem in the country. Instead, regular supply of the product is necessary to keep its price stable.

(2) The Nigerian government should keep the price of diesel stable so that it does not eventually lead to increase in inflation rate.

(3) The government should also ensure regular supply of kerosene so as to keep the prices stable and avoid triggering inflation from this source. This is because this variable has the tendency to impact positively on inflation rate in the long run.

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