
Determinants of Domestic Energy Expenditure in Nigeria

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Abstract

The study investigated the factors that determine domestic energy expenditures in Nigeria. The price of the premium motor spirit PMS was used as a proxy for the domestic energy expenditure while oil output, oil importance, inflation, and exchange rate are used as other independent variables. The model was analyzed using the Auto-regressive Distributed Lag method and the result confirms the existence of the long-run relationship between domestic energy expenditures and the determinants. Findings from the studies underscore the importance of an increase in domestic output of oil and a reduction in the importation of oil as the main drivers of the expenditure on domestic energy in Nigeria. The remaining recommendation is that the Government of Nigeria should endeavor to increase the domestic production of refined oil in Nigeria and reduce the importation of fuel to reduce expenditure on domestic energy in Nigeria.

Keywords: Domestic Energy Expenditure, Oil output, oil Import. Premium Motor Spirit PMS prices

1. Introduction

Nigeria is an oil-exporting developing country with a population of about 178 million (2014 gradual economies) and the most populous country in Africa. The country is endowed with significant energy resources such as oil reserves of 70 billion barrels (2014 estimates); Gas reserves of 187 trillion cubic feet (2009 estimates) and Oil production of 2.016 mbd. The Oil sector has influenced significantly the growth potential of the country since 1970. Oil contributed \$391b to government revenue during the years 1970 to 2005, and Oil exports \$593.6b during 1970-2005. These represent 75% of total government revenue and 96% of foreign exchange earnings over the period. Apart from its direct fiscal benefits, the energy sector is strategic for enhancing the competitiveness of the Nigerian business environment and economy. The legacy of oil has also imposed significant costs on the economy such as price distortions, Volatilities, Dutch disease, Corruption, and inefficiencies. A major feature of the sector is the dominance of the government in pricing, supply, and investment. Despite cumulative efforts by successive governments, oil subsidy remains one of the most intricate socio-economic policy issues in Nigeria. By the time Nigeria became politically independent in October 1960, agriculture was the dominant sector of the economy, contributing about 70% of the Gross Domestic Product (GDP), employing about the same percentage of the working population, and accounting for about 90% of foreign earnings and Federal Government

revenue. The early period of post-independence up until the mid-1970s saw a rapid growth of industrial capacity and output, as the contribution of the manufacturing sector to GDP rose from 4.8% to 8.2%. This pattern changed when oil suddenly became of strategic importance to the world economy through its supply-price nexus.

However, since oil was discovered in commercial quantity in Nigeria, oil has dominated the economy of the country. In Nigeria, oil accounts for more than 90 percent of its exports, 25 percent of Gross Domestic Product (GDP), and 80 percent of its government total revenues [1]. Thus, small oil price changes can have a large impact on the economy as a whole. For instance, a US\$1 increase in the oil price in the early 1990s increased Nigeria's foreign exchange earnings by about US\$650 million (2 percent of GDP) and its public revenues by US\$320 million a year. Nigeria's reliance on oil production for income generation has serious implications for its economy. Secondly, oil is an important commodity in the economy of any country in the world because it is a major source of energy for domestic and industrial use. Oil, therefore, serves as an intermediate product and as well as a consumer commodity. There are different end products of oil; these include kerosene, diesel, gasoline, and others. Changes in the prices of either the crude oil or any of the end products are expected to have an impact on users and the business environment at large. Oil prices traditionally have been more volatile than many other commodities or asset prices since World War II. The trend of demand and supply in the global economy coupled with the activities of OPEC consistently affects the price of oil. The recent changes in the global economy are so rapid and unprecedented. This is partly due to the increased demand for oil by China and India. However, the current global economic meltdown suddenly counteracted the skyrocketing oil price. For instance, in 2006, the oil price per barrel was between \$59.4 – 65.4 in the world market. By 2007, it rose significantly to \$83.73 – 93.40 per barrel and dropped to about \$75.3 - \$64.4 per barrel. In October 2009 it rose again to \$78.25 and dropped to about 75.1% per barrel in December of this same year. The price later picked up to \$84.42 to \$93.00% in March and December 2010 respectively, with the fiscal budget which led to the downward review of the budget oil benchmark price. Today oil prices are oscillating between 38.78b and 40.11b per barrel (CBN Banking/rates/crude oil asp). The oil volatility in the world market had serious consequences on Nigeria's Fiscal budget which has led to the downward review of the budget oil benchmark price. This rapid change has become a great concern to everybody including academics and policymakers; therefore a study of this kind is timely.

Nigeria has been coping with changes in domestic energy prices over the years and this has serious implications for domestic expenses on oil products which has been affecting the economic growth of the country even though Nigeria is one of the most endowed countries in terms of domestic energy production. Petroleum has become an important source of revenue for the Nigerian government (both federal and state). The rise and falling of Petroleum prices per barrel in the international market have been a major problem and have also affected the price per liter in the country. Price per liter was increased from 145naira per liter to 212naira per liter in March 2021 which has led to the increase in expenditures on goods and services in the country. The Government does not seem to worry about the spike in oil prices because they cannot control the prices of fuel. Fuel Prices are partly shaped by actual supply and demand and mostly by taxation and dealer commission. Consumers consider fuel too expensive in

which lower-income motorists cannot afford essential vehicle travel. The economic costs and risks of importing petroleum are high. Per-mile fuel costs and emissions are excessive. This opinion has made it essential to research to examine the determination of petroleum prices in Nigeria from 1980-2019.

Consequently, this study set out to investigate the factors that drive domestic expenses on petroleum products in Nigeria. The rest of the paper is divided into a literature review, methodology, results, discussion, conclusion, and recommendations

2. Literature Review

The Determinants of Petroleum expenditures or prices have been discussed by various specialists with different views. The study looks at past empirical works in this area as follows:

A research study carried out by Nwaoha, Onwuka, Ejem, Obiseke, and Ogbuewu(2018) stated that In Nigeria, the pump price of petroleum products has been adjusted severally by different administrations, and the burden rest more on the citizen. Hence, the study examined the movements of petroleum (PMS, AGO, DPK) pump prices and the standard of living in Nigeria from 1981 to 2016. The study made use of secondary data and adopted the OLS technique of analysis. The data set was subjected to a preliminary test and the ADF result revealed that all the variables were integrated at I(0) indicating a long-run relationship between the independent and independent variables. Economically, none of the explanatory variables confirmed a priori expectation. Statistically, they stated that both individual and overall results revealed that MOPPMS, MOPAGO, and MOPDPK have a statistically significant impact on the standard of living (PCI and INFL) in Nigeria. Based on the findings, the researchers recommend that government should channel oil trade towards the exportation of crude oil and finished petroleum products to expand the oil revenue base of the economy, zero import expenditure of finished petroleum products, and reduce the domestic pump price of these products.

Another study carried out by Sanni (2014) stated that Nigeria is one of the leading oil-producing countries in the world, but despite this abundant natural resource, The country still suffers from a massive shortage of premium motor spirit (PMS) and distribution to cater for the needs of the numerous users of its ends product. The study investigates the implications of price changes on petroleum product distribution in Gwagwalada for a period of 12 years (2000-2012). The questionnaire was used to collect primary data from ten wards within Gwagwalada Area Council which were used as a study area. The statistical package for social sciences (SPSS) was used to analyze the raw data and determined whether to accept or reject a problem item as being a reflection of the thinking of the majority for taking a decision. The results from the study show that there was a statistically significant effect of price changes of petroleum products distribution in Gwagwalada, that the price changes significantly cause fluctuation to supply and distribution of petroleum products, and the price increases of PMS significantly lead to an increase in the cost of distribution of other commodities including agricultural products and there exists a statistically significant relationship between price increase and the development of "Black Market" and long queues at filling stations across Nigeria. The study recommends that government should strive to make the product available at all times, monitor effectively the distribution channels to avoid disruption of distribution or scarcity, Consistency,

and efficiency of government pricing policy, the government to encourage more private participation and deregulation of the downstream sector, and fight corruption as well as total market concept in the chain of petroleum product supply and distribution.

Another study carried out by Buba, Abdu, Adamu, Jibir, and Usman (2017) noted that the attainment of universal access to affordable, reliable, sustainable, and present-day power is one of the dreams for Sustainable Development Goals (SDGs). Existing information and statistic advocate that an excessive share of households in much less developed international locations closely be counted on strong fuels for home requirements. Also, current information printed that in Nigeria over 70 percent of households depend on gas timber for cooking which points out the assignment in advance of coverage makers. For making sure to get admission to environment-friendly sources of strength earlier than the expiration of sustainable improvement goals. In this learn about the empirically examined socio-economic elements that have an impact on households' probability of electricity consumption in Nigeria. To obtain their unique objectives, they undertake a 2013 demographic fitness survey dataset for Nigeria, and multinomial logistic regression was used to be carried out in examining the elements affecting households' selection for electricity demand. Evidence from the find out about printed that demographic characteristics, financial status, public focus, and social variables are sturdy determinants of households' electricity preference in us and conformed to the propositions of the "Energy Ladder Hypothesis". They concluded using imparting concluding remarks and policy implications for decision making towards ensuring affordable, sustainable, and efficient strength in Nigeria.

Litman (2016) referred to that the paper evaluates policy options for responding to rising gas prices. There is a famous guide for insurance policies that reduce gas expenses via subsidies and tax reductions, however such insurance policies damage customers and the economic system universal due to the fact they amplify whole gasoline consumption and car travel, and consequently related prices such as site visitors and parking congestion, infrastructure costs, site visitors crashes, exchange imbalances, and air pollution emissions. Fuel charge discount rates are an inefficient way to assist low-income households; different techniques do extra to expand affordability and grant different benefits. Because many transport choices are durable, low gas rate insurance policies are mainly detrimental over the lengthy term. This record identifies responses that maximize whole benefits, which include mobility administration techniques that extend transport device efficiency, incentives to pick gas environment-friendly vehicles, and revenue-neutral tax shifts. With these insurance policies, gas expenses can considerably expand except harming customers or the economy, whilst supporting attain different planning objectives.

Hassan and Musa (2016) stated that how the sector was managed attracted a wide range of comments on the rationale for the administration's handling of the petroleum industry. Between 1999 and 2007, President Obasanjo's Government failed to reposition the Nigerian oil sector in such a way that it will benefit all Nigerians. Instead, the administration opened the sector to the foreign exploitative economic order. The policy during the period is tantamount to the development of underdevelopment in the oil sector in terms of management, administration, and control. It is a situation in which while oil is produced in Nigeria, Nigerians do not produce

oil. The paper starts with an introduction, followed by a brief history of refineries and the development of the petroleum industry in Nigeria, and then the state of refineries during the period between 1999 and 2007. The third aspect is the theoretical framework and conceptual issues, deregulation, withdrawal of subsidy, and hike in the price of petroleum products.

Ologundudu and Abioro (2018) cited that there have been a lot of theories that explain the impact of petroleum price increases on the business and economic growth of a country, mainly Nigeria which has been one of the predominant oil-producing international locations in the World. In the previous years, oil has grown to be greater risky and has grown worse in current Nigeria and this has affected the stability of payments, oil change, and income from oil. This paper empirically examined the impact of fee expansion on the monetary increase in Nigeria between the years 1985 – 2015 with the use of normal least rectangular (OLS), linear more than one regression mannequin evaluation in assessing 5 key macroeconomic variables. The information has been extracted from the Central Bank of Nigeria (CBN) statistical bulletin whilst the average evaluation indicates that the oil rate makes bigger has a relationship with Gross Domestic Product (GDP) and each of them has a substantial effect on the other.

Adeniran (2016) cited that an expansion or limit in crude oil fees can each be ache and reap to the Nigerian's financial system simultaneously, this is due to the fact a sturdy hyperlink between the country's budgetary operations and the happenings in the global oil market exists. Therefore, this lookup employed the constrained vector autoregression (VAR) technique, to empirically check out into the influence of oil charge volatility on Nigeria's financial system from 1981 to 2014. Both the Augmented Dickey-Fuller and Philip Perron unit root test, published that all the variables regarded in the learn about are non-stationary at levels, however, done stationary after estimating their first difference. Furthermore, the majority of the variables had been discovered to have long-run relationships, justifying the want to estimate the mannequin via the vector error correction model. The quick run coefficient deduced from the VECM published that oil fee shock considerably influences financial boom in the quick run. Also, both the impulse response feature and variance decomposition consequences established the Dutch sickness syndrome related to Nigeria's economy, actual GDP negatively replied to oil fee shock in all the durations no matter the high-quality response of actual authorities expenditure to oil shock in the most period. This implies that the financial boom is negatively affected in the lengthy run, even though it has an impact on the actual authorities expenditure appears to be advantageous mostly, the Pass-through impact it has on the excessive inflation rate, declining trade fee explains its bad impact on actual GDP.

Roland (2017) stated that the study investigated the impact of Premium Motor Spirit (PMS) Price on the growth of the Nigerian economy as well as the effect of gross domestic investment (GDI), labor employment (LEMP), and lending interest rate (LIR) between 1970 and 2013 on the economic growth of Nigeria. The study focused on PMS pricing due to government footdragging on the deregulation of PMS prices in Nigeria. For this study, secondary data were obtained from Statistical fact sheets of the National Bureau of Statistics (NBS) and Central Bank of Nigeria (CBN) publications. Using the Error Correction Mechanism approach, the study reveals that an increase in PMS Price had a negative significant impact on the Nigerian economy (Real GDP) at a 5% level of significance.

3. Methodology

This empirical investigation focus on the impact of changes in petroleum product expenditures in Nigeria over the period 1980 to 2019.

Model Specification

Based on the above empirical review on the changes in domestic energy prices in Nigeria, and following the work of Nwaoha, Onwuka, Ejem, Obiseke, and Ogbuewu (2018), we specify our empirical model thus:

DOMESTIC ENERGY EXPENDITURE= f(oil output, inflation rate, oil import, EXR)

Where; PMS = price of petrol and proxy for the domestic energy expenditure, EXR = Exchange rate. Therefore, the mathematical form of the model is thus:

DOMESTIC ENERGY EXPENDITURE = $\beta_0 + \beta_1 OILI + \beta_2 OILO + \beta_3 INF + \beta_4 EXC + \mu_i$.

Note that, PMS = Premium Motor Spirit price and a proxy for the domestic energy expenditure, OILI= Oil Import, OILO = Oil Output., INFL = Inflation Rate, EXC = Exchange Rate. $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ are parameters to be estimated. β_0 = Constant

μ_i = error term\

Estimating Techniques

To facilitate the estimation of the time series data generated for the study, the Autoregressive Distributed Lag method for multiple regressions was employed. This method of analysis is employed because some of the variables are stationary at the level and some of them are stationary at first difference. The ARDL has been used in a wide range of economic relationships with fairly satisfactory results. (Koutsoyiannis, 1977). The general purpose of multiple regressions is to learn more about the relationship between several independent variables and a dependent or criterion variable. Also, Pre-estimation tests such as the unit root tests using Augmented Dickey-Fuller and Philips Perron were carried out. The need for unit root is due to the choice of time series analysis. The pre-test for possible unit roots in the series is carried out to avoid spurious regression results. The descriptive text of the data was also carried out.

Also, the post-estimation diagnostic tests are also conducted to ensure the goodness of fit of the model. These tests examine the serial correlation and normality associated with the selected model. Among the tests are the stability test, normality, autocorrelation, and heteroscedasticity tests. The data were then estimated using the ordinary least square with a focus on the signs and the value of the coefficients and the probability values to determine the significance levels.

4. Results and Discussions

This aspect of the paper discusses the empirical results and also interprets them accordingly. It starts with the descriptive statistics

Table 1: Descriptive Statistics

	PMS	LOILI	LOILO	INF	EXC
Mean	55.27611	12.20202	14.22664	19.32119	111.8784
Median	35.00000	12.73438	14.69006	12.00000	119.5724
Maximum	165.6100	15.28986	16.83476	76.75887	358.8108
Minimum	0.200000	3.947390	9.032230	0.223606	0.893774
Std. Dev.	55.82488	2.757295	2.317524	18.43841	100.1713
Skewness	0.732440	-1.075556	-0.786077	1.762009	0.784745
Kurtosis	2.110741	3.612001	2.415040	5.023032	2.875050
Jarque-Bera	4.404979	7.502743	4.220775	24.76704	3.718367
Probability	0.110528	0.023486	0.121191	0.000004	0.155800
Sum	1989.940	439.2726	512.1590	695.5627	4027.624
Sum Sq. Dev.	109074.6	266.0937	187.9821	11899.12	351199.8
Observations	36	36	36	36	36

Source: Authors Computation using E-views 10, 2021

Table 2: Correlation Matrix

	PMS	LOILI	LOILO	INF	EXC
PMS	1	0.781251669990 0002	0.793162609728 5572	0.341313758596 7786	0.940651145197 8608
LOIL I	0.781251669990 0002	1	0.976824167923 278	0.281232598274 3683	0.793323089205 4736
LOIL O	0.793162609728 5572	0.976824167923 278	1	0.384168102443 2151	0.806721783354 8862
INF	0.341313758596 7786	0.281232598274 3683	0.384168102443 2151	1	0.355573088712 9056
EXC	0.940651145197 8608	0.793323089205 4736	0.806721783354 8862	0.355573088712 9056	1

Source: Authors Computation using E-views 10, 2021

From the table above, there is a positive relationship between domestic energy expenditure proxied by Premium Motor Spirit (PMS) prices and Oil Import (LOILI), Oil Output (LOILO), and Exchange rate (EXC). However, there is a negative relationship between Premium Motor Spirit (PMS) and Inflation (INF).

Unit Root Test

Due to the result obtained from the descriptive analysis above, it is important to determine the stationarity properties of the time series under consideration by conducting the unit root test. Therefore, the unit root test was conducted using the Augmented Dicky-Fuller (ADF) test, and the outcome of the unit root test is summarized in the table below:

Table 3: Unit Root Analysis

Augmented Dickey Full (ADF) Test						
Variables	AT LEVEL			A DIFFERENCE		
	t-statistics	Prob.Value	Status	t-statistics	Prob.Value	Status
PMS				-6.765785**	0.0459	I(1)
LOILI	-5.37676**	0.0005	I(0)			
LOILO				-5.309488	0.0008	I(1)
INF				-5.576222	0.0006	I(1)
EXC	-4.445635	0.0062	I(0)			

Source: Authors' Computation 2021, Using E-views 10.

The outcome of the ADF unit root test above indicated that PMS, LOILO, and INF are stationary at the first difference since their probability value are less than 0.05 after the first differencing, which implies that they are integrated of order 1 i.e I(1).

However, LOILI and EXC are stationary at level, which implies that they are integrated of order 0 i.e I(0).

Lag Length Criteria

From the table below, the optimal lag length of 1 was selected based on the AIC and HQ criterion

Table 4: Optimal Lag Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-554.0271	NA	1.32e+08	32.88394	33.10841	32.96049
1	-411.3256	235.0377*	131875.6*	25.96033*	27.30712*	26.41962*
2	-395.3329	21.63721	248036.8	26.49017	28.95928	27.33221

Source: Authors Computation using E-views 10, 2021

Note: * indicates lag order selected by the criterion.

Table 5: ARDL Bound Test

Significant Level	F-statistics	Lower Bound I(0)	Upper Bound I(1)
5%	1.737637	2.56	3.49
1%		3.29	4.37

From the table above, the hypothesis that there is no long-run relationship between Premium Motor Spirit (PMS) price, Oil Import (LOILI), Oil Output (LOILO), Inflation (INF), and Exchange rate (EXC) because the F-statistics is lower than the lower bound 2.39 and the higher bound 3.38. Hence, it is necessary to estimate only the short-run dynamic model.

Table 6: Short Run Analysis

Variable	Coefficient	Std.Error	t-Statistics	Prob
LOILI	3.555590	5.885801	0.604096	0.0405
LOILO	-2.222959	6.282876	-0.353812	0.0260
INF	-0.028538	0.123565	-0.230958	0.0592
EXC	0.048652	0.058722	0.828509	0.4141
CointEq(-1)*	-0.118253	0.033823	-3.496194	0.0015
R ²	0.967911			
Adjusted R ²	0.962379			
S.E. of Regression	10.82770			
Sum Squared Resid	3399.934			
Log-likelihood	-129.7457			
F-statistic	174.9495			
Prob(F-statistic)	0.000000			
Durbin-Watson stat	2.250834			

Source: Authors Computation using E-views 10, 2021

In the short run, it can be observed that Oil import has a significant and positive relationship to determining energy prices in Nigeria. A 1% increase in oil import will lead to a 3.55 increase in energy prices. This is by a priori expectation. Hence, to discourage an increase in energy

prices, the importation of oil needs to be discouraged. Oil output on the other hand has a significant and negative relationship with determining domestic energy prices. This indicates that a 1% increase in oil output will decrease domestic energy prices by 2.22 in the short run. Hence, to reduce the prices of domestic energy, oil output is needed to be encouraged.

Inflation and exchange rate have no significant relationship in determining domestic energy prices as observed in the figure above. The short-run error correction term, ECM from the ARDL model estimate is negative as expected with a value of -0.118253 and is statistically significant. Thus, the gap between the long-run equilibrium value and the actual value of the dependent variable is corrected with the speed of adjustment equal to 11% (percent) annually.

The coefficient of determination (R^2) shows that the explanatory variables employed in the study explain approximately 96.79% of the total variation in economic growth. This indicates that the variables used in the model are appropriate and suitable for the analysis.

The Durbin Watson statistics of 2.25 shows that the variables are sufficient to explain the dependent variables.

Post Estimation Analysis

Table 7: Breusch-Godfrey Serial Correlation LM Test

F-statistic	1.230510	Prob. F(2,27)	0.3080
Obs*R-squared	2.923718	Prob. Chi-Square(2)	0.2318

Source: Authors Computation using E-views 10, 2021

The serial correlation test result obtained shows that the null hypothesis of a serial correlation is rejected and the corresponding probability values of the F-statistics are statistically insignificant at the 5% level. Thus, there is a conclusion that there is no serial correlation among the variables under consideration.

Table 8: Heteroscedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.642541	Prob. F(5,29)	0.6692
Obs*R-squared	3.490692	Prob. Chi-Square(5)	0.6248

Source: Authors Computation using E-views 10, 2021

From the result, the probability of Chi-Square (5) is 0.6248 and this is greater than 0.05 at a 5% significant level therefore, the null hypothesis is accepted. This implies and therefore confirms the absence of heteroscedasticity in the model. That is the error terms are homoscedastic i.e., they have constant variance in repeated sampling.

5. Conclusions and Recommendations

Using the Auto Regressive Distributed Lag, it was observed that there was only a short-run relationship between the dependent and independent variables, hence only the short-run

dynamic model was analyzed. From the result, it was observed that Oil Output has a negative and significant relationship with determining domestic energy expenditure in Nigeria. This indicates that an increase in oil output will lead to a decrease in domestic energy expenditure. Hence, the government of Nigeria needs to increase oil output in its objective to reduce the prices of domestic energy.

Oil import was observed to have a significant and positive relationship with domestic energy expenditure in Nigeria, this is in line with a priori as the importation of oil has a huge tendency to increase the price of domestic energy. Inflation and exchange rate were observed not to have a significant effect on the exchange rate in the short run.

Recommendations

In line with the findings of the study, the followings are recommended;

- 1) Since the prices of petroleum products have a chain effect on the prices of other goods and services in the country. Government should continue to subsidize their prices by so doing it will stabilize the prices of other goods and services and this will go a long way in reducing the rate of inflation in Nigeria. This will not only save us the cost of exporting the product in the first instance but also create more employment opportunities at home.
- 2) Government should make sure that the existing refineries are functioning at full capacity and also build new ones; by so doing the existing refineries can meet Nigerians' internal petroleum products needs and some excess for export and strategic reserve of product demand. This can be made possible when the nation's refineries' Turn-Around-Maintenance is consolidated with transparency and accountability.
- 3) Government should introduce a very strong and strict policy that will severely deal with citizens who smuggle, hoard, and create artificial scarcity and black marketers of petroleum products to make an abnormal profit to the detriment of the whole country.
- 4) Government should always carry along Labor Union, Trade Union, and Private sector before it increases the prices of petroleum products because of its critical nature to cost of production and the welfare of people in the country to avoid unnecessary crises.
- 5) To control the fluctuation in the Nigerian exchange rate, there is a need for more investment in the agricultural sector, or better still the Nigerian economy should diversify. This will promote export thereby improving our balance of payment.

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