**ANALYSIS OF THE PRICE AND INCOME ELASTICITIES OF ENERGY DEMAND IN NIGERIA. (1980-2019)**

**BY UMMUSALAMAH O. DANJUMA**

**BU/17C/BS/2791**

**A PROJECT SUBMITTED IN PARTIAL FUFILMENT OF THE REQUIREMENTS FOR THE AWARD OF BARCHELORS OF SCIENCE (B.Sc.) DEGREE IN ECONOMICS**

**TO THE**

**DEPARTMENT OF ECONOMICS,**

**FACULTY OF MANAGEMENT AND SOCIAL SCIENCES BAZE UNIVERSITY, ABUJA**

**SEPTEMBER 2020**

# TITLE PAGE

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# DEPARTMENT OF ECONOMICS

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# SEPTEMBER 2020

# DECLARATION

I, (UMMUSALAMAH O. DANJUMA, with ID NO BU/17C/BS/2791), hereby declare that this project titled ANALYSIS OF THE PRICE AND INCOME ELASTICITES OF ENERGY

DEMAND IN NIGERIA has been carried out by me, under the supervision of Dr. Ishaq Saidu. I also certify that it has not been presented for award of any degree in any institution, or elsewhere. All views and ideas are solely products of my research, and all sources of information are specifically acknowledged by means of reference.



## UmmuSalamah O. Danjuma Date

**BU/17C/BS/2791**

# APPROVAL PAGE

This is to certify that this project titled ‘ANALYSIS OF THE PRICE AND INCOME ELASTICITES OF ENERGY DEMAND IN NIGERIA’ by UMMUSALAMAH O. DANJUMA

meets the requirements governing the award of Bachelor of Science (BSc) in ECONOMICS and is approved by the department of Economics, Faculty of Management and Social Sciences, BAZE University, Abuja, Nigeria.

## Dr. Badamasi Babangida Usman Date

**Head of Department and supervisor**

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**Supervisor**

## Prof. Osita Agbu Date

**Dean, Faculty of Management, and social science**

**External Examiner Date**

# DEDICATION

I dedicate this project to God Almighty, my creator and source of inspiration and knowledge. I would also like to dedicate this project to my loving parents, Mr. Bello I. Danjuma and Mrs. Hauwa Danjuma, and my sisters Rabiaat Danjuma, Amina Danjuma and Hibatullah Danjuma for being my source of support and encouragement and for cheering me on from start to finish, which has brought me thus far. I also dedicate this project to Dr. Marafa and Miss Amina Danjuma for their guidance and the knowledge which they were able to impact me with during the course of this project.

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I would like to express my gratitude to my research coordinator Dr. Abbas Marafa for his constant words of encouragement, constructive recommendations and making sure the entire project process was as smooth as possible. I would like to also appreciate the entire Economics department, and my lecturers whom have been able to impact me with knowledge used in the preparation of this project. A big thank you to the economics department and the social science faculty of Baze University as a whole.

## ABSTRACT

*This study estimated price and income elasticities of energy demand in Nigeria. The objective of the study was to examine the responsiveness of demand for energy to changes in price of energy and per capita income in Nigeria. The demand for petroleum product (gasoline and diesel), proxy for energy demand is the dependent variable, while weighed average price for energy demand and per capita income are the independent variable. The study adopted regression analysis and vector error correction model to dichotomize the short run and long run in price and income of energy demand in Nigeria, using annual time series data over a period of 1980-2019. The cointegration test revealed that there is significant long run relationship between energy demand, price and per capita income. the result of regression analysis showed that the price and income elasticity of energy demand are moderately inelastic in the short run while the long run elasticities indicate that price and income responsiveness to demand are relatively elastic. The policy implication is that demand side management, through price change will be ineffective in influencing the demand for energy in short run. Therefore, any policy effort on the part of government to manage energy demand should focus on supply side and long term policy impact on the aggregate economy that has the potential of affecting the overall economic activity and aggregate income.*

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# CHAPTER 1: INTRODUCTION

## BACKGROUND OF THE STUDY

The Nigeria’s economic policies and growth have been influenced by energy sector for more than four decades, particularly, the oil and gas sector. Since the global energy crisis of 1972/73, the energy sector, particularly the petroleum subsector of the Nigerian economy has become the most important source of revenue and foreign exchange earnings. Although, crude oil production and export commenced in Nigeria in 1958, the oil sector of the economy did not achieve its present pre-eminent position until the mid-1970s, a rise aided by rising national production level and the hike in international price resulting from 1973 Arab-Israel war. The period of 1970 to 1980 represent Nigeria’s oil boom era in term of production, export and earnings. Peak production in the boom era was achieved in 1979 with a yearly production of 845.463 billion barrel representing an average daily production of 2.3bpd (CBN, 2008). In view of the strategic nature of the petroleum industry as the predominant source of global energy, it has become a prime source of revenue generation to many countries, particularly in Nigeria. The oil sector contribution to Gross Domestic Product (GDP) at current basic prices was as low as 0.9 percent of GDP in 1961. With increase in exploration and production related activities consequent on the boom of the 1970s, the sector contribution to GDP has risen to 28.48 percent by 1980. The slump in world price of crude- oil and the bust created dampened growth in the Nigerian oil sector throughout the 1980s. The industry contribution to Nigeria GDP commenced its impressive recovery from 1989 fiscal year. Its contribution to GDP increased to 37.46 percent in 1990. The sector continued its impressive performance throughout the 1990s such that by the year 2000, its percentage contribution stood at 47.72percent.

Similarly, oil export to total export was 2.3 percent as at 1960, this rose to 92.6 percent in 2010. Nigeria recorded total export revenue of $10.4 billion in 2019, the highest since 2008 which is farthest we can trace the country’s export data. According to the data from the CBN, total exports (Free on Board “FOB”) in 2019 was $64.9 billion. Thus for the first time ever, oil revenue as a percentage of total exports fell to 83.9% as against over 90% in previous years.

Latest data from the National Bureau of Statistics (NBS) has showed Nigeria’s crude oil exports which still cover a huge chunk of Nigeria’s total export of 85.6 per cent recorded an increase in the second quarter of 2019 of 16.5 percent compared to the corresponding period last year. This implies that Nigerian economy is still reliant on crude oil for foreign exchange earnings and by extension government revenue. According to the latest data from the state’s statistical agency, Nigeria recorded a total crude oil export of N3.9 trillion in Q2 2019 which was 16.5 percent higher than Q2 2018 and 4.40 percent higher than in Q2 2018.Further, breakdown revealed in April 2019 Nigeria’s total crude oil export was valued at N1.3 trillion, while in May and June the country recorded N1.2 trillion and N1.2 trillion respectively.

As impressive as the growth in Nigeria’s production and export of crude oil might be, Nigeria’s foreign trade record shows that petroleum products import out of national import has continued to rise over the years due to poor state of her refineries. Nigerian petroleum sector is the engine room of growth that drives the entire Nigerian economy and society (Iwayemi, 2001); however, the legacy of oil has also imposed economic costs on the economy such as price distortions, volatilities, Dutch disease, corruption and inefficiencies.

The demand for petroleum products in Nigeria (especially the PMS and Diesel) has been on the rise since the early 70’s when the golden water was first discovered in commercial quantities (Iwayemi, Adenikinju, and Babatunde, 2010). This continuous rise has been due largely to (not

until recently), the price of petroleum products which have been heavily subsidies in order to achieve some national objectives, as well as to protect the domestic consumers from the stochastic nature of the international crude oil market. The growth of GDP per capita as a result of the oil boom is another major factor that has contributed to the rise in the domestic demand of petroleum products. Industrial expansion through the influx of foreign direct investment has resulted in demand for energy, increase in demand for vehicles has also resulted in increase in demand for fuel, the epileptic nature of electric power has also increases the demand for private household generator, as well as for firm which has also heighten the demand for petroleum products. Lastly, the ever growing population and extension the adult population has also contributed to the increase in demand for petroleum products in Nigeria. In spite of the huge market presence of the country in the world oil market, the country still sometimes struggle to meet domestic demand for petroleum.

Nigeria’s economic policies and growth have been influenced by energy sector for more than four decades now, particularly the oil sector. Hence, the government usually determines the price point of all petroleum products which over the past years since the 1970’s caused an inconsistent upward adjustment by different political administration. With such substantial dependence on gasoline as a contribution in the production process, a significant proportion of firms earning which in any case would have been diverted into investment is utilized to meet energy shortage in the form of the demand for gasoline. In this manner, the extensive use of gasoline makes the various sectors of the economy inclined to unexpected price increase in gasoline. The demand for petroleum products in Nigeria (especially the PMS and Diesel) has been on the rise for nearly over a quarter of a century ago. It is against this bourgeoning demand that this study investigates the demand for petroleum products in Nigeria. The study employed the Error Correction Model to examine both

the short and long dynamics of petroleum in Nigeria. The study therefore found that price and income elasticity of demand for petroleum product have long run impact on the energy demand in Nigeria. Although, there are short run fluctuations, the impact of the elasticities on energy demand does not exist in the short run Therefore, this study seek to critically examine of impact of the short run and long run elasticities of petroleum demand in Nigeria.

## STATEMENT OF RESEARCH PROBLEM

The attention on oil demand studies has increased since the first oil price shocks of early 1970s, with a focus to generating accurate demand parameters for planning, projections and policy formulation. According to the study by Aigbedion and Iyayi (2007), Nigeria’s extreme reliance on the crude oil market has triggered structural difficulties for the economy, as earnings from crude oil fluctuate along with market trends which are exacerbated by the country’s neglect of other productive sectors of the economy. The dynamics of the petroleum sector in the Nigerian economy has made the study of the demand for petroleum products in the country highly imperative (Sulaimon Said, 2009; Iwayemi et al, 2010). This makes the knowledge highly fundamental for a more informed and effective understanding in energy policies in production and distribution of petroleum products.

Nigerian petroleum sector has been established as the major driver of growth in the entire Nigerian economy and society (Iwayemi, 2001). However, the heirloom of oil has also inflicted several economic costs such as price distortions, volatilities, Dutch disease, corruption and inefficiencies. Price fixing of energy products has been one of the major impairment to the development of energy sector, as there is a lack of incentive to encourage private individuals to participate and invest in this sector. Iwayemi, et al. (2007) has also identified the importance of understanding the energy industry dynamics in the design of policies for dealing with the negative environment side-effects

of the energy sector. Also, better understanding of the energy demand dynamic will is essential for more informed and successful energy policy decision making and implementation (Iwayemi, et 2007). Evaluating the short- and long-run amendments to energy price changes requires careful consideration of the energy consumption decisions, and past research has emphasized that the nature of the oil price change may be as important as its magnitude hence the need to have a full understanding of the elasticity dynamics. Also, some studies assumed that demand change is in a long run equilibrium based their use of static models for their analysis. However, the model does not factor the impacts of price and income shock lingering for more than a period, and causing adjustment lags in demands. This results in a discord on the short run and long run elasticites in the estimation of price and income that will be addressed in this study. Various studies on the demand for petroleum product, specifically gasoline consumption have mostly focused on developed countries like the United States and other advanced economics. This study therefore is an attempt to fill this vacuum in the literature. The study attempts to model short-run and long run price and income elasticities of demand of energy in Nigeria.

## OBJECTIVES OF THE STUDY

The aim of this study is to analyze the short-run and long-run elasticity of energy demand in Nigeria. The specific objectives are to determine:

* + 1. To investigate whether there is a long-run relationship between energy demand and prices and income.
    2. To examine the short run and long effect of energy price on energy demand.
    3. To examine short run and long run effect of income on energy demand.

## RESEARCH QUESTIONS

The following research questions are raised to guide the study:

* + 1. Is there a long run relationship between energy demand, price and income?
    2. What is the short and long run effect of energy price on demand for energy?
    3. What is the short and long run effect of per capita income on demand for energy?

## HYPOTHESES OF THE STUDY

Based on the above objectives, the following hypotheses (Ho) are formulated in null form to guide the study.

H1 There is no significant long run relationship between energy demand, price and income. H2 There is no significant short run or long run effect of energy price on energy demand

H3 There is no significant short run or long run effect of per capita income on demand for energy.

## SCOPE AND LIMITATION OF THE STUDY

This research covers the analysis of the short run and long run elasticity of petroleum/gasoline demand in Nigeria. The study covers the period of forty (40) years from 1980 – 2019. The dependent variable is gross domestic product (GDP) used as a proxy for Nigeria economic growth while the independent variables are: oil revenue used as a proxy for petroleum/gasoline demand.

As it is expected with written work of this kind, the completion of this project would not be possible without limitation or problems encounter in the course of writing this project which includes difficulties in obtaining relevant and up-to-date, data due to poor nature of Nigeria’s data collection and storage facilities**,** The first of such constraints or difficulties concerns data collection from different sources. Also was the reluctance of some library or Liberians to make data available.

The above-mentioned constraints are capable of adversely affecting the accuracy of the results of this research work**.**

## SIGNIFICANCE OF THE STUDY

The significant of this study is very important in much respect. Moreover, the oil sector is a key player in the Nigeria economy. In that regard anything that affects it in variable touches every sector. Therefore, to the manufactures, it’s of great interest to know possible solution to the persistent and intermittent supply of the petroleum products as a means of enhancing their capacity utilization profit level output.

Thus, the significance of this study cannot be overestimated, **fi**rst and foremost, the research work will be useful to Nigerian policy makers by assisting them in understanding clearly the impact of policies made on crude oil revenue on standard of living of the common man. Secondly, this research work on completion could assist students of related discipline in their course of study. Also, this study did not only add to the available literature on the research topic but also contributed to an area of study that has been scantily visited by scholars. This research work also has constituted a reference material to policy makers and prospective researchers who will be interested in topics related to this research work and hence would stimulate deep and fresh ideas, practically relevant to help key stakeholders enhance the management of oil revenue for the achievement of real economic growth and development in Nigeria. Nevertheless, this study will throw more light on the role which the crude oil plays in the reformation of the Nigerian economy.

## DEFINITION OF KEY CONCEPTS

**Economic growth:** This is the increase in the inflation-adjusted market value of the goods and services produced by an economy over time. It is conventionally measured as the percent rate of increase in real gross domestic product, or real GDP.

**Oil sector:** This is also known as the oil industry or the oil patch, includes the global processes of exploration, extraction, refining, transporting, and marketing of petroleum products. The largest volume products of the industry are fuel oil and gasoline.

**Oil Price Volatility**: This is the measure of the tendency of oil price to rise or fall sharply within a period of time, such as a day, a month or a year. Lee (1998) as cited in Mgbame, Donwa and Onyeokweni (2015) defines volatility as the standard deviation in a given period and noted that volatility has a negative and significant impact on economic growth instantly, while the impact of oil price changes delays until a year.

**Non-oil revenue**: This is the income or proceeds generated from the commodities that are sold in the international market excluding crude oil (petroleum product). Non-oil exports on the other hand are those commodities (excluding crude oil) that are sold abroad in order to generate revenue. These non-oil exports include agricultural products or crops, manufactured goods, tourist services/receipts, solid minerals, telecommunication services and other exports.

**Gross Domestic Product:** This implies the market value of all officially recognized final goods and services produced within a country in a given period. GDP per capita is often considered as an indicator of a country’s standard of living. GDP is related to national account, a subject in macroeconomics. It is customarily reported on an annual basis. It is defined to include all final goods and services, that is, those that are produced by economics resources located in that nation regardless of their ownership and are not resold in form.

**Inflation** is defined as a generalized increase in the level of price sustained over a long period in an economy. It is a rise in the general level of prices of goods and services in an economy over a period of time.

**Exchange rate:** An exchange rate (also known as foreign exchange rate) between two currencies is the rate at which one currency will be exchanged for another. It is regarded as the value of one country’s currency in terms of another currency. Exchange rates are determined in the foreign exchange market, which is open to a wide range of different types of buyers and sellers where currency trading is continuous.

**Non-oil export:** These include the exportation of the non-oil produces among which are agricultural, industrial and manufacturing outputs.

**Non-oil export index:** This is the fraction of the total export of goods and services that are produced within the economy that are not directly related to the oil sector of the economy. The non-oil products exports are unlimited as they include cash crops, food crops, manufacturing, entertainment, tourism etc. the value of the non-oil export index shall be used for measuring the non-oil export.

## 1 .9 RESEARCH OUTLINE

This research is presented in five chapters. Chapter one consists of the background of the study, statement of the problem, research questions, research objectives, hypotheses of the study, scope of the study, significance of the study, theoretical framework and organization of the study. Chapter two holds the review of related literature which includes conceptual issues, and empirical literature. Chapter three is the methodology of the study. Chapter four will focus on data presentation, data analysis and interpretation of results. Chapter five will summarize the major findings and presents the conclusion and recommendations.

# CHAPTER 2: LITERATURE REVIEW

## INTRODUCTION

Literature review is a well-integrated discussion and critical evaluation of different scholarly viewpoints on a given research problem as found in the previous relevant studies highlighting their strengths, weakness and indicating how a given study, for example this will make a contribution to the existing body of knowledge, especially on the research problem and on other related areas of investigation. A coherent literature review is characterized by a logical flow of ideas, current and relevant references with consistent, appropriate referencing style; proper use of terminology or terms and an unbiased and comprehensive view of the previous study or on the research topic.

## REVIEW OF RELATED LITERATURE

The dynamics of the petroleum sector in the Nigerian economy has made the study of the demand for petroleum products in the country highly imperative (Sulaimon Said, 2009; Iwayemi et al, 2010). As such, estimating the dynamics of petroleum products demand is pivotal in enriching our understanding of consumers’ responsiveness to change in relative energy prices and the level of income, since the impact the oil boom of the early 70’s and the oil glut of the early 80’s has on the economy is highly documented (Gate, 1993, Dahl, 1994; Liu, 2004; Akinboade et al, 2008; Iwayemi et al, 2010). The estimates of the dynamics of energy consumption is highly fundamental to one, our knowledge of the country’s (projected) future energy demand, two, how these estimates shape the direction of future energy policies in Nigeria, and lastly, the fact that our knowledge of the dynamics of petroleum products demand parameters is also highly fundamental to a more informed and successful energy policy making and implementations. Structurally, transport fuels and diesel constitutes for the bulk of oil consumption in Nigeria, with motor gasoline (petrol/PMS), automotive gas oil (diesel/AGO) and household kerosene (ATK) accounting for approximately

90% of total petroleum products consumption in 2012 alone. Based on data from the NNPC and the International Energy Agency (IEA), this structure has not changed significantly over the last two decades. Any significant growth in demand is most likely to come from the transport sector; mainly from PMS use (motor gasoline alone accounts for about 70% of the petroleum products demand spectrum). It is therefore imperative at this junction to examine the various dynamics and trends of petroleum products consumption as well as its prices and the level of economic activities in the country.

Another explanation for the upward trend observed in petroleum products consumption relates to the developments in real per capita national income proxy by real GDP per capita. The real GDP per capita has been on the rise since the early 80’s although it deepen during the SAP era, and picked up again in the post SAP period and has continue to rise, it stood at $1,052.34 in 2013. Interestingly, the continuous rise in petroleum demand has been partly attributed to the low relative prices of these petroleum products prior the SAP era (Iwayemi et al, 2010). Unfortunately, figure shows that the prices of these products have been rising over time although steady in some numbers of years. Another important development concerns the pattern to domestic petroleum demand in Nigeria. Gasoline continues to dominate the composition of total demand. Its share increased from 42 per cent in 1980 to 50.5 per cent in 1997 and 71.03 per cent in 2006, and the year 2010, the figure stood at 66.1 per cent. The figure now stood at 64.13 per cent in 2012. The share of diesel however fell from 28.4 per cent in 1980 to 9.24 per cent in 1990 and rose to 22.05per cent in 2000. The figure stood at 7.74 per cent at the end of 2012.

This development reflects the impact of rising prosperity of the oil boom period on the rapid acquisition of vehicles and the increasing use of private electric generators by the Nigerian

household and Firms as back up in response to the epileptic nature of power supply from the state- owned monopoly (now debunked) Power Holding Company of Nigeria (PHCN) (Iwayemi et al,).

Energy demand is influenced by both economic and non-economic factors. The major economic factors are price, income and energy efficiency. Non-economic factors may include tastes, preferences, policy and structural changes whose changes are usually non-linear and stochastic over time. Thus, the use of linear and deterministic trend to capture the influence of non-economic factors in demand modeling may not be appropriate. According to Hunt et al (2003b), the underlying energy demand trend (UEDT) will be affected for instance, by change in economic structure from manufacturing to a service sector there by affecting total energy demand. This change is not induced by change in output or prices, but rather switches to a sector with different level of energy intensity.

Thus, if UEDT is not included or modelled properly, these changes will be forced to be picked up by the income and price variables leading to bias in income and price elasticities. In the past, energy demand modelers usually ignore these factors or at most, approximated by a linear deterministic time trend which assumes that the underlying trend is fixed over time (Hunt and Ninomiya, 2003). The Structural Time Series Model (STSM) developed by Harvey (1989) permits a more general and flexible approach of modelling the trend component of time varying economic variables such as energy demand. It therefore allows for the estimation of non-linear Underlying Energy Demand Trend (UEDT) which can be negative, positive or zero as time changes. Moreover, the use of simple deterministic trend is not ruled out in the STSM, instead, it becomes a limiting case that is admissible only if statistically accepted by the data (Harvey, 1989; Harvey and Shephard, 1993; Hunt and Ninomiya, 2003, Dimitropoulos et al., 2005, Adeyemi and Hunt, 2007, Pedregal et al., 2009).

STSM decomposes a set of time series into unobservable components but having meaningful economic interpretation (mainly trend, seasonal and irregular components). A simple STSM is therefore a regression model in which the explanatory variables are a function of time and the parameters are time-varying (Harvey and Shephard, 1993). This important attributes of the STSM and its compatibility with ARDL models makes it a useful tool in estimating UEDT. The merit of the ARDL model is that it can be applied irrespective of the order of integration among the variables.

A number of studies on energy demand have estimated UEDT using various techniques such as STSM, OLS with deterministic trend and non-linear OLS with time dummies. There seem to be increasing popularity of the STSM in combination with ARDL in estimating UEDT (see for example Hunt and Ninomiya, 2003; Dimitropoulos et al., 2005; Ahmadian et al., 2007; Pedregal et al., 2009; Broadstock and Hunt, 2010). Just as the STSM is, a more general and flexible method of estimating trend in energy demand, the ARDL is also a more general and dynamic specification in contrast to PAM and static models. The STSM is consistent with the UEDT and ARDL specification which permits a more flexible approach to modelling the trend components. Table 2 presents some selected energy demand studies with UEDT. For example, Hunt and Ninomiya (2003) used STSM with ARDL specification to estimate transport oil demand in UK and Japan. Their estimated long-run elasticities of income and price for UK were 0.801 and -0.23 respectively while that of Japan were 1.080 and -0.083 for income and price respectively. The UEDT were found to be non-linear for both countries with periods where it is both upward and downward sloping. Dimitropoulos et al. (2005) also confirmed the presence of non-linear stochastic trends in UK UEDT due to technical change and other exogenous factors driving energy demand.

Their long-run elasticities for the whole economy with respect to income and price were reported as 0.583 and -0.133 respectively, while those of residential, manufacturing and transport sectors ranges between 0.807 to 0.304 and -0.232 to -0.113 for income and price respectively. Broadstock and Hunt (2010) attempted to quantify the impact of exogenous non-economic factors on oil demand in the UK transport sector by including fuel efficiency variable in addition to price and income among the determinants of energy demand in an UEDT framework. Broadstock and Hunt (2010) argued that since income, price and efficiency variables account for economic factors, the UEDT in their specification captures purely the effect of exogenous non-economic factors in driving energy demand. Their estimated elasticities for income, price and fuel efficiency were reported as 0.6, -0.1 and 0.3 respectively. The study indicates the presence of a stochastic rather than deterministic trend in UK transport energy demand. Most of the studies on energy demand and particularly those employing STSM to estimate UEDT were conducted on OECD countries with only few on the developing countries, such as Ahmadian et al. (2007) on Iran and Amarawickra and Hunt (2008) on Sri Lanka and most recently Ackah and Adu (2014) on Ghana. Ackah and Adu (2014) examined the effect of productivity, economic and non-economic factors on gasoline demand in Ghana using STSM. Both price and income were found to be inelastic in the short run and only income is elastic in the long run while productivity was negatively related to gasoline consumption. Iwayemi et al. (2009) estimated long run elasticities of petroleum product demand for Nigeria using multivariate cointegration approach which ignores structural or technical changes in their estimation.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Author(s)** | **Scope/sector** | **Country** | **Modelling technique** | **Treatment of trend** | **Type of data &**  **period** | **Estimated LR**  **elasticities** |
| Hunt and Ninomiya (2003) | Transport/oil | UK  an  d Japan | STSM; ARDL | Stochastic trend | Quarterly data 1972Q1-  1995Q4 | Price= - 0.08 to -0.12  Income= 0.08  to 1.08 |
| Griffin  and Schulman (2005) | Whole economy/oil | 16  OECD  countries | Non-linear OLS applied to panel data | Stochastic trend through time  dummies | Annual data 1961 -  1999 | Price= -0.044  to -0.093  Income=0.367 to 0.408 |
| Dimitropoulos et al. (2005) | Sectors/whole economy/energy | UK | STSM; ARDL | Stochastic trend | Annual data 1960 -  1999 | Price= -0.2 Income=0.7 |
| Adeyemi  and Hunt (2007) | Industrial/ aggregate energy | 15  OECD  countries | Non-linear OLS in panel data context | Asymmetric price/time dummies | Annual data | Price=-0.30 to  -0.68  Income=0.70 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | 1962 -  2003 |  |
| Ahmadian  et al. (2007) | Whole  Economy/ gasoline | Iran | STSM;ARDL | Stochastic trend | Annual data 1968 -  2002 | Price= - 0.63 to -0.74  Income=1.25 |
| Amarawickra and Hunt (2008) | Whole  economy/ electricity | Sri Lanka | EG, FMOLS, STSM;ARDL | Stochastic trend | Annual 1960 -  2007 | Price= 0 to - 0.006  Income=1.0  to 2.0 |
| Pedregal et al. (2009) | sectorial  /oil products | Spain | STSM;ARDL | Stochastic trend | Monthly Jan 1984  –  Dec 2006 | Price= -0.013  to -0.238  Income=0.441 to 1.581 |
| Broadstock and Hunt  (2010) | Transport/oil | UK | STSM;ARDL | Stochastic trend | Annual 1960 -  2007 | Price=-0.19 Income=0.53 to 0.57 |
| Ackah  and | Transport/Gasoline | Ghana | STSM | Stochastic Trend | Annual | Price=-0.065  Income=5.129 |

### Table 2:1 Selected Studies on Energy Demand with UEDT

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Adu (2014) |  |  |  |  | 1971 -  2010 | TFP=-2.935 |

Source: Aliyu Barde (2014).

Omisakin et al.(2012) test possibility of structural breaks/regime shifts and parameter instability in the gasoline demand function in Nigeria using Gregory-Hansen structural break cointegration approach. The study confirms the presence of cointegration relationship and structural break points in 1978, 1979 and 1980. Income and price terms were inelastic in both short and long run. The study offers little explanation on those structural breaks. Adeyemi and Hunt (2007) argued that over reliance on cointegration without due consideration to technical changes has the potential of significant bias in price and income elasticities of demand. Therefore, energy demand models for developing countries such as Nigeria will be unable to truly reflect the countries conditions if it ignores structural changes. This is because of the important implication of the declining role of traditional energy for demand, due to changes in lifestyle, consumer choices and socio- demographic and environmental changes which are difficult to measure in practice (Battacharyya and Timilsina, 2010). This further justifies the inclusion of a stochastic trend in estimation of long- run energy demand models (Hunt and Ninomiya, 2003; Ahmadian, et al., 2007; Hunt and Broadstock, 2010 and Adebisi, 2010.

In Nigeria, crude oil is the major export because of the large revenue it generates. This has led the economy to focus on the petroleum sector while ignoring the other sectors as well as the potential revenue they can generate. Again, It is evidence from the empirical review carried out that there are diverse result by various studies, where some studies found that crude oil export has negative and significant effect to economic growth (Eravwoke, Alobari & Ukavwe, 2014); Baghebo & Atima, 2013), Eravwoke, Alobari & Ukavwe, 2014; Kawai, 2016). Similar studies reveal that there

exist positive insignificant relationship between crude oil export and economic growth Usman, Madu & Abdullahi, 2015; Awujola, Adam & Alumbugu, 2015).

## THE CONCEPT OF OIL PRICE VOLATILITY

Oil price can be referred to as the price that can be used for the purchase of a barrel. Oil price volatility or fluctuation is change in oil prices. However, oil price can go up and down depending on the market mechanism (demand and supply). Petroleum products (Premium Motor Spirit (PMS), Dual Purpose Kerosene (DPK), Automobile Gas Oil (AGO) play important role in the economic activities of the citizens of Nigeria. Premium Motor Spirit (Fuel) serves as input source of energy for manufacturing industry and other small-scale businesses. However, despite its importance, the domestic management of petroleum resource is fraught with problems ranging from occasional shortages in the supply of the product, inefficient distribution and contending pump price of fuel (Ehinomen & Adeleke, 2012). PMS is a valuable commodity that is of high demand by Nigerians but yet posed with limited supply or non-availability of the product which cause may be attributed to many factors; such as canalization of oil pipelines, high level of corruption, smuggling of fuel product, hoarding, sabotage/fraudulent marketers, inadequate refineries and malfunctioning of existing ones in the country, and in recent times non-payment of subsidies by federal government.

Volatility in its price and shortage in quantity supplied which usually result to crisis (fuel crisis) has effect on various economic activities of citizens of Nigeria and this has implication on growth and development. However, fuel scarcity is no longer a new phenomenon in Nigeria. It has become a recurrent dilemma in the nations’ economy. Some unscrupulous marketers usually seize the opportunity of the situation to hoard the commodity in anticipation of announcement of a rise

in pump price. This incessant fuel crisis has led to long queues of vehicles at several filling stations across the country, in addition to skyrocketing, deviating pump price and racketeering.

***Table 2:2: Trend of Fuel Price Adjustment in Nigeria 1973 – 2018***

|  |  |  |  |
| --- | --- | --- | --- |
| **S/N** | **YEAR** | **ADMINISTRATION** | **PRICE**  **ADJUSTMENT** |
| 1 | 1973 | Gowon | 7k |
| 2 | 1976 | Murtala Muhamed | 8.5k |
| 3 | 1978 | Obasanjo | 12k |
| 4 | 1982 | Shagari | 17.5k |
| 5 | 1986 | Babangida | 29.5k |
| 6 | 1988 | Babangida | 40.5k |
| 7 | 1989 | Babangida | 51k |
| 8 | 1989 | Babangida | 60k |
| 9 | 1991 | Babangida | 65k |
| 10 | 1993 | Shonekan | 37.5k |
| 11 | 1993 | Abacha | 4.125k |
| 12 | 1994 | Abacha | 9.125k |
| 13 | 1994 | Abacha | N13 |
| 14 | 1998 | Abdulsalam Abubakar | N18 |

Source; Obi (2019)

|  |  |  |  |
| --- | --- | --- | --- |
| 15 | 1999 | Abdulsalam Abubakar | N22.5 |
| 16 | 2000 | Obasanjo | N25 |
| 17 | 2000 | Obasanjo | N26 |
| 18 | 2002 | Obasanjo | N24 |
| 19 | 2003 | Obasanjo | N34 |
| 20 | 2004 | Obasanjo | N46 |
| 21 | 2004 | Obasanjo | N57.5 |
| 22 | 2007 | Obasanjo | N70 |
| 23 | 2008 | Yar’Adua | N70 |
| 24 | 2012 | Jonathan | N103 |
| 25 | 2012 | Jonathan | N119 |
| 26 | 2014 | Jonathan | N92 |
| 27 | 2015 | Buhari | N145 |
| 28 | 2016 | Buhari | N145 |
| 29 | 2017 | Buhari | N145 |
| 30 | 2018 | Buhari | N145 |

The incessant fuel price hikes in Nigeria, seems unabated; judging by the frequencies of its

occurrence. The profile of fuel price increases shows that about twenty-seven of such cases have occurred between 1973 and 2017 (See table I). This situation has unleashed untold hardship on Nigerians. Despite the burden on citizens, Federal Government in 2012 declared that it could no

longer afford the payment of subsidy on oil products hence the announcement of subsidy removal in January 2012 that led to a sky-rocket price of PMS from N65 toN141 per litre and later fell to N97 after the protest by pressure groups. This hyperinflationary trend alongside black market prices has remained an unresolved issue even till date.

## Effects of Fuel Price Hike on Purchasing Power

There is no doubt that the recent increase in the price of fuel from time immemorial by the Federal Government of Nigeria has started to trim down the purchasing power of the people, especially the poor masses, who have always been at the receiving end of every harsh economic policy introduced by government. Gyoh (2012) has argued that an increase of such magnitude in the current Nigerian economic context is, without doubt, a process that is either inadvertently or deliberately conceived to take money away from the pockets of all Nigerian income earners, with over 70 per cent of Nigerians who live on below N360 per day, as the prime victims. In reality, anyone in this category will end up with over 50 per cent of his daily income, which is about N155 per day, inevitably dedicated to transport costs, while the remaining is expected to cater for family feeding, health, education and other social expenses.

Olorunfemi (2012) predicted that inflation rate would fluctuate between 13 and 14 per cent for most part of 2012.An investment and research firm, Renaissance Capital said it expected inflation to rise from a projected 10 per cent to between 13 and 14 per cent between January and March and average about 15 per cent for the year, 2012.It, however, said that should the government be persuaded to phase the removal of petrol subsidy as a means of easing the burden of price increases, then the increase in inflation could be lesser than 15 per cent for the year. The inflation rate had been a source of worry for the Central Bank of Nigeria, which struggled throughout 2011 to reduce the figure to a single digit rate. Nigeria’s inflation rates experienced a wavy flow for most parts of

2011, from January till December 2011. Although, the National Bureau of Statistics attributed the development to the upward and downward movement in the prices of food items, it also linked the movement to increase in the price of kerosene across the country (Stephen, 2015).

Inflationary figure for January 2011 was 12.1 per cent as against 11.8 per cent recorded in December 2010. This, according to the NBS, was due to hike in the price of kerosene experienced across the country and increase in the prices of some household items and building materials. In the month of February, inflation declined to 11.1 per cent. As the country was trying to regain its balance, the rate yet increased to 12.8 per cent in March, the highest in the year, as a result of the major determinant, according to the monthly release by NBS. April inflation rate was put at 11.3 per cent which was slightly lower than the 12.8 recorded in March. There was a huge jump again in May from 11.3 per cent recorded earlier to 12.4 per cent. The statistical data in May revealed that the percentage increase which was higher than the corresponding level a year ago was as a result of the planting season in the country (Stephen, 2015).

In June, the inflation reduced to 10.2 per cent as against the corresponding month which was 12.4 per cent. The CBN’s expected single digit inflation rate was recorded for the first time in the country in July as it declined to 9.4 per cent from the June rate of 10.2 per cent. From the first single digit recorded in July, the rate also declined with 0.1 per cent as it dropped to 9.3 per cent in August. In the month of September, the inflation rate rose to 10.3 per cent as against 9.3 per cent recorded in August. The inflation rate for October 2011 rose to 10.5 per cent as against 10.3 per cent recorded in the preceding month and was maintained at 10.5 per cent in November. The usual seasonal hike in commodity prices during Christmas was unable to push up Nigeria’s inflation which rather moderated to 10.3 per cent in December 2011, slightly lower than the 10.5 per cent recorded in November.

Analysts believe that the inflation rate this year would shoot up to at least 15 per cent, even as the CBN agreed that inflation would accelerate to 14 per cent or 15 per cent by mid-year, from 10.5 per cent in November, however, taking into account the initial full removal of fuel subsidy on January 1. The Managing Director, Sotice Investment Company Limited, Mr. Adedayo Toluwase, said several millions of Nigerians would live poorer and suffer more than they had ever done in recent history in 2012.He said, “More than ever in the history of the country, more Nigerians will sink further below the poverty line. The prices of goods and services have increased at the same time that wages remain stagnant and unemployment remains a nationwide scourge. More than 70 per cent of Nigerians lack the usual or socially acceptable amount of money or material possessions needed to live a happy life. This unfortunate category of Nigerians lack material comfort and in plain language they live from hand to mouth. “The increase in the price of fuel will automatically reduce the purchasing power of Nigerians. It will increase their fears and deteriorate their health status. Food, water and housing are three important parameters to measure the values of our lives and these things have become elusive to the masses in Nigerians (Stephen, 2015).

## Effect of the Increases in Fuel Prices on Economic Growth in Nigeria

It is a common knowledge today that fuel scarcity worsens inflation and poverty in Nigeria and many workers will lose their jobs as companies will find it difficult to cope. Arinze (2011) itemized the effect as follows:

* + - 1. Fuel crisis paralyzed social and economic activities, it brings about socio-economic unrest which result in increase in transport fare, skyrocketing of market prices and prices of building materials.
      2. High rate of inflation: this leads to increased spending both by government and private individuals. Fuel scarcity creates inflation in both public and private life with a consequent increase in prices of goods and services.
      3. Excessive corruption and mismanagement: Fuel crisis bring about corruption by both government and private individual. Corruption, however, discourages foreign direct investment.
      4. Retardation in economic growth: It slows down the pace of economic development because of its negative impact on the socio-economic life of the people.
      5. Importation cost of fuel: It leads to huge and excessive public expenditure on importation of fuel to augment local production which in itself is an indication of an unhealthy economy resulting in accumulated balance of payments deficit of a country. The attendant consequences of this includes abandonment of several on-going economic and infrastructural development projects to meet the foreign exchange requirements for the purchase of refined petroleum products from overseas countries to augment local consumption, poverty and underdevelopment.
      6. Fire disaster: During fuel scarcity, the product becomes more available in the hands of unauthorized road-side dealers (black marketers) who take undue advantage of the unfortunate situation to sell the product at exorbitant prices and engage in profiteering. The unauthorized dealers also engage in reckless storage of this product in exposed tanks, drums and buckets roadside to extort money from members of the public. This however has resulted in several economic losses, deepening underdevelopment and poverty in our society as in some cases, the exposed tanks get exploded into flames that have burnt people’s houses and vehicles and even loss of life in the process.

## HISTORY OF CRUDE OIL IN NIGERIA

Oil was discovered in Nigeria in 1956 at Oloibiri in the Niger Delta after half a century of exploration. The discovery was made by Shell-BP, at the time the sole concessionaire. Nigeria joined the ranks of oil producers in 1958 when its first oil field came on stream producing 5,100 bpd. After 1960, exploration rights in onshore and offshore areas adjoining the Niger Delta were extended to other foreign companies. In 1965 the EA field was discovered by Shell in shallow water southeast of Warri. In 1970, the end of the Biafran war coincided with the rise in the world oil price, and Nigeria was able to reap instant riches from its oil production. Nigeria joined the Organization of Petroleum Exporting Countries (OPEC) in 1971 and established the Nigerian National Petroleum Company (NNPC) in 1977; a state owned and controlled company which is a major player in both the upstream and downstream sectors [Blair 1976].

Following the discovery of crude oil by Shell D’Arcy Petroleum, pioneer production began in

1958 from the company’s oil field in Oloibiri in the Eastern Niger Delta. By the late sixties and early seventies, Nigeria had attained a production level of over 2 million barrels of crude oil a day.

Although production figures dropped in the eighties due to economic slump, 2004 saw a total rejuvenation of oil production to a record level of 2.5 million barrels per day. Current development strategies are aimed at increasing production to 4million barrels per day by the year 2010.Petroleum production and export play a dominant role in Nigeria's economy and account for about 90 % of her gross earnings. This dominant role has pushed agriculture, the traditional mainstay of the economy, from the early fifties and sixties, to the background. While the discovery of oil in the eastern and mid-western regions of the Niger Delta pleased hopeful Nigerians, giving them an early indication soon after independent economic development was

within reach, at the same time it signaled a danger of grave consequence: oil revenues fueled already existing ethnic and political tension and actually "burned" the country.

This tension reached its peak with the civil war that lasted from 1967 to 1970. As the war commenced, the literature reflected the hostility, the impact, and fate of the oil industry. (Falola,

T. Westport, 1999). Nigeria survived the war, and was able to recover mainly of the huge revenues from oil in the 1970s. For some three years an oil boom followed, and the country was awash with money. Indeed, there was money for virtually all the items in its developmental plan. The literature of the post-war years shifted to the analysis of the world oil boom and bust, collectively known as the "oil shock." Starting in 1973 the world experienced an oil shock that rippled through Nigeria until the mid - 1980s.

This oil shock was initially positive for the country, but with mismanagement and military rule, it became an all economic disaster. The larger middle class produced by the oil boom of the 1970s gradually became disenchanted in the 1980s, and rebellious in the 1990s.

The enormous impact of the oil shock could not escape scholarly attention. For almost twenty years (1970s - 1990s), the virtual obsession was to analyse the consequences of oil on Nigeria, using different models and theories. A set of radical-oriented writers was concerned with the nationalization that took place during the oil shock as well as the linkages between oil and an activist foreign policy. (Ajakaiye Olu, 2001) Regarding the latter, the emphasis was on OPEC, Nigeria's strategic alliance formation within Africa, the vigorous efforts to establish the Economic Community of West African States (ECOWAS), and the country's attempts to use oil as a political weapon, especially in the liberation of South Africa from apartheid.

If many had hoped that oil would turn Nigeria into an industrial power and a prosperous country based on a large middle class, they were to be disappointed when a formally rich country became a debtor nation by the 1980s.

The suddenness of the economic difficulties of the 1980s "bust years" had an adverse effect on class relations and the oil workers who understood the dynamics of the industry. As if to capture the labor crisis, writings on oil workers during this period covered many interrelated issues, notably working conditions, strikes, and state labor relations. To be sure, labor issues were not new in the 1980s, since the left-oriented scholars had made a point of exposing labor relations in the colonial era. What was new after 1980 was the focus on oil workers, unions, and class conflict [OPEC annual report 1983].

## The Performance of the Oil Sector in Nigeria

The Nigerian oil sector can be categorized into three main sub-sectors, namely, upstream, downstream and gas. The most problematic over the years has been the downstream sector, which is the distribution arm and connection with final consumers of refined petroleum products in the domestic economy. The incessant crisis in supply of products culminated in the decision by Government in 2003 to deregulate the downstream sub-sector.

However, the manner of its implementation has been controversial because it ignores the economic realities in Nigeria. Oil production by the joint venture (JV) companies accounts for about 95 % of Nigeria’s crude oil production. Shell, which operates the largest joint venture in Nigeria, with 55 % Government interest (through the Nigerian National Petroleum Corporation, NNPC), produces about 50 % of Nigeria’s crude oil. Exxon Mobil, Chevron Texaco, ENI/Agip and Total final Elf operate the other JV’s, in which the NNPC has 60 % stake. The over- dependence on oil has created vulnerability to the vagaries of the international market, as observed

in the preceding section that show the contribution of oil to some macro-economic variables. In particular, the place of oil in the mind of the average Nigerian has become more profound since the deregulation of the downstream segment of the Nigerian oil industry in 2003. (Genova, A; Toyin Falola, 2003).

The contradiction is more glaring now with the recent rise in crude oil prices at the global markets, which meant more external earnings for Nigeria, but also increased the expense burden on imported refined petroleum products! It is such contradictions that make the Nigerian economy appear strange at times, as policies seem to ignore what appears obvious to do. As such, policies designed to address the deficiencies and defects in the structure end up being poorly articulated and/or implemented because of regional, political or rent-seeking selfish interests. Obviously, it is the same rent-seekers that continually sabotage the reinvigoration of the domestic refineries, making Nigeria to depend on importation of refined products to meet the domestic need. At present, Nigeria has four refineries, with a combined installed refining capacity of 445,000 barrels per day (bpd).

These four refineries are:

1. The first Port Harcourt Refinery was commissioned in 1965 with an installed capacity of 35,000 Bpd and later expanded to 60,000 bpd.
2. The Warri Refinery was commissioned in 1978 with an installed refining capacity 100,000 bpd, and upgraded to 125,000 bpd in 1986.
3. The Kaduna Refinery was commissioned in 1980 with an installed refining capacity of 100,000 bpd, and upgraded to 110,000 bpd in 1986.
4. The second Port Harcourt Refinery was commissioned in1989 with 150,000 bpd processing capacity, and designed to fulfill the dual role of supplying the domestic market and exporting its surplus.

The combined capacities of these refineries exceed the domestic consumption of refined products, chief of which is premium motor spirit (gasoline), whose demand is estimated at 33 million liters daily.

The refineries are however operating far below their installed capacities, as they were more or less abandoned during the military era, skipping the routine and mandatory turnaround maintenance that made products importation inevitable.

Importation notwithstanding, there have been persistent product shortages that gave strength to the argument for deregulation of the downstream oil sub-sector in Nigeria. The monetization of oil revenue has been a major factor in liquidity management in Nigeria. Measuring liquidity as the narrow and broad money definitions by the CBN, the early 1990s saw increases that were dampened by 1995 up until the civilian administration came on board in 1999.

The new Government maintained disciplined fiscal operations for about one year and thereafter, the floodgates were opened. Since then, the CBN has been battling to keep liquidity in check, in order to ensure that it does not create adverse effects on the three key macroeconomic prices (i.e., interest rate, exchange rate and inflation rate). The greatest challenge is when Nigeria generates more revenue from crude oil sales than it budgeted, like now. Such excesses have always been monetized, creating market distortions and inflationary pressure [Biodun Adedipe 2004]. The same argument goes for deficit fiscal operations in comparison to the GDP.

The pattern of this ratio indicates the optimism that accompanies increase in oil revenue and makes Government to engage in frivolous spending or unnecessary projects. Deficit spending invariably makes Government resort to borrowing from the Central Bank through the instrument of Ways and Means Advances, which later convert into short-term debt instruments that are quite expensive to service at market rates. (Igbinedion University Okada, Eighth Convocation Lecture, 2010). At this point, there is sufficient ground to examine how economic policy formulation has been impacted or induced by petroleum oil in Nigeria. As much as possible, major economic policies since Nigeria gained political independence would be examined vis-а-vis the state of the oil sector. This should provide adequate basis for making a few specific recommendations on how to reduce the dependency.

## Contribution of the Oil Industry

Over the past twenty years the oil industry has made a variety of contributions to the Nigerian economy. These have included the creation of employment opportunities; local expenditure on goods and services; contributions to government revenues, to gross domestic product, and to foreign exchange reserves; and the supply of energy to industry and commerce.

## Employment Opportunities

One of the first contributions of the oil industry to the Nigerian economy was the creation of employment opportunities. From the start, Nigerians were employed in a variety of non-basic activities such as the building of roads and bridges, the clearing of drilling sites, transportation of materials and equipment, and the building of staff housing and recreational facilities. As time went on and as the industry's training programme progressed, they began to be employed in seismic and drilling operations, and in supervisory and managerial functions. However, direct oil industry employment in Nigeria is not likely to expand significantly in the future because the industry is

very highly capital intensive, as is illustrated by the size of the capital-labor ratio in the industry, compared with other industries.

The very high capital-labor ratio in the oil industry means that growth in oil operations is generally reflected, not in the relative expansion of employment, but in the expansion of capital investment. This will be particularly the case when, with the passage of time and increased extraction, the need arises for increased investment in costly techniques of secondary recovery. At the moment total oil industry employment in Nigeria (including employment by ancillary firms) represents only 1.3 per cent of total modern sector employment in the country.

## Contribution to gross domestic product

In general, the contribution of an industry or branch of activity to the gross domestic product (at factor cost) during any accounting period is measured by its gross output less the cost of inputs materials, equipment, services, etc. purchased from other industries or branches of activity. (Deduction of any taxes net of subsidies paid, gives the gross domestic product at market prices).

The gross output of the petroleum sector consists of the proceeds from oil exports, local sales of crude oil for local refining, and local sales of natural gas. But because of the massive involvement of foreign operators in the Nigerian petroleum industry, not all of the industry's value added is retained in the country; at the moment a substantial proportion is sent out in the form of factor payments profits, dividends, interest, fees, and wages and salaries paid abroad. It is therefore more realistic to consider the industry's contribution to gross national product i.e., gross domestic product less factor payments made abroad. The industry's value added can also be obtained by adding together the various payments to the government in the form of rents, royalties, profit taxes, harbor dues, etc.; the wages and salaries of employees paid locally; and any net retained earnings.

## Local Expenditure on Goods and Services

The oil industry's periodic injection of purchasing power through its local expenditure on goods and services is another of its important contributions to the Nigerian economy. Apart from direct payments to the government, oil industry expenditure in Nigeria takes the form of payments of wages and salaries, payments to local contractors, local purchases of goods and services, harbor dues, vehicle licenses, telephone and postal charges, local rents, educational grants and scholarship awards, donations and subventions, and other minor social charges Cumulative expenditure on these items totaled about N950 million by the end of 1974.

Apart from the direct stimulation given to the producers of these goods and services such injections also exert secondary influences, through the multiplier process, on the level of output and employment in other related sectors of the economy, the magnitude of the overall effect depending on the size of the initial injection and the extent of leakages out of the local economic system that may exist.

## Contributions to Government Revenues

The payment of substantial revenues to the government is another important aspect of the contribution of the oil industry to the Nigerian economy. The significant increase in government receipts in recent years is a reflection of three factors: increased crude oil production in Nigeria; the huge increase in crude oil prices and the more favorable fiscal arrangements obtained by the government as a result of its improved bargaining position over the years. At the early stages of oil operations when the prospects of establishing a viable oil industry in Nigeria were rather uncertain, the government was in a weak bargaining position via the oil companies. Consequently, the terms negotiated at that time with the Shell-BP Petroleum Company of Nigeria were favorable to the Company, and included relatively low concession rents, a 12.5 per cent royalty rate, a 50-

150 profit-sharing formula based on realized prices, and large capital allowances. The use of realized prices in the calculation of taxable profits meant that the country's oil revenues fell as oil prices fell throughout most of the 1960. But as the country's oil prospects improved and the government's bargaining power consequently increased, these terms were progressively revised to take account of the changed conditions. These changes resulted in a significant increase in government oil revenues, particularly in 1973 and 1974. As noted above, a large part of the increase in oil revenues was accounted for by the huge increase in crude oil prices during 1973-

74. How far oil prices will continue to be high in the future will depend on the balance between the demand for and the supply of energy-in particular, on the level of economy in energy consumption, and the speed of development of substitute fuels in consuming.

## Oil and Gas Reserves in Nigerian

Oil and Gas Journal (2005) estimates Nigeria’s proven oil reserve at 35.2 billion barrels. The Nigerian government plans to expand its proven reserves to 40 billion barrels by 2010 (Nwilo and Badejo 2005). In February 2005, Nigeria announced the award of five oil blocks in the Joint Development Zone (JDZ), shared by Nigeria and neighboring Sao Tome and Principe (STP). The JDZ reportedly holds reserves of 11 billion barrels and could potentially yield up to 3 million bbl/d in the next 2-3 years. Development is also occurring in the waters surrounding the JDZ (Nigeria Country Analysis Brief, 2005). Oil and Gas Journal (2005) further stated that Nigeria has an estimated 176 trillion cubic feet (Tcf) of proven natural gas reserves in 2005, giving the country one of the top ten natural gas endowments in the world and the largest endowment in Africa. The question has been, how sustainable are the mining of these natural resources in the Niger Delta region? This study recommends that the exploitation of these resources be carried out sustainably in such a manner that the environment is well protected by using clean technologies, with net

economic gains by the oil companies, and the local communities where these activities take place get better treatment by way of human and infrastructural development opportunities.

## RECENT DEVELOPMENTS IN THE OIL INDUSTRY IN NIGERIA

Since December 2005, Nigeria has experienced increased pipeline vandalism, kidnappings, and militant takeover of oil facilities in the Niger Delta. As of April 2007, an estimated 587,000 bbl/d of crude production was shut-in (could not be produced due to the problems mentioned above) according to NNPC (2007). The majority of shut-in production is located onshore in the Niger Delta, with the exception of the offshore 115,000 bbl/d EA Platform. Since December 2005, Nigeria has lost an estimated 16 billion dollars in export revenues due to shut-in oil production. Shell has incurred the majority of shut-in oil production (477,000 bbl/d), followed by Chevron (70,000 bbl/d) and Agip (40,000 bbl/d).

Militant attacks on oil infrastructure have also crippled Nigeria’s domestic refining capabilities. In February 2006, militant attacks in the western delta region forced the Warri (125,000 bbl/d) and Kaduna (110,000 bbl/d) refineries to shut down due to a lack of feed stocks (NNPC, 2007). In December 2006, operators shutdown Nigeria’s two Port Harcourt refineries for two months due to technical problems. The Niger Delta rebel group, Movement for the Emancipation of the Niger Delta (MEND) and other militia organizations in search of monetary compensation and/or political leverage are the ones behind the attacks.

In addition to abductions, thousands of foreign workers and their families have left the Niger Delta due to continued hostilities. At least three companies, including a private drilling company and pipeline laying company have also left. MEND has stipulated numerous conditions to the Nigerian government that it wants met or else it has vowed to continue the attacks. Chief among the

conditions is greater revenue sharing of the oil wealth, increased local control of oil property, the release of tribal prisoners, and transparency of government budgets.

## Production Capacity

Nigeria is the largest oil producer in Africa, the eleventh largest producer of crude oil in the world and a member of the Organization of Petroleum Exporting Countries (OPEC). According to EIA (2007) in 2006, total Nigerian oil production, including lease condensates, natural gas liquids and refinery gain, averaged 2.45 million bbl/d (2.28 million bbl/d was crude oil). If Nigeria could bring back online all oil currently shut-in, EIA estimates that Nigeria could reach crude oil production capacity of three million bbl/d. With the help of new projects coming online, the Nigerian government hopes to increase oil production capacity to four million bbl/d by 2010 (EIA, 2007).

Despite the recent attacks on Shell's oil facilities, the company’s deep-water Bonga field began producing oil at the end of 2005, reaching production of 225,000 bbl/d in April 2006 (EIA, 2007). Bonga is estimated to hold recoverable oil reserves of 600 million barrels. Oil from the field is stored in a floating production, storage and offloading (FPSO) unit, with capacity of two million barrels. In August 2008, Shell plans to bring online its Gbaran/Ubie field (220,000 bbl/d), located offshore of the eastern delta (EIA, 2007).

ExxonMobil produces around 750,000 bbl/d of oil in Nigeria. The company plans to invest $11 billion in the country's oil sector through 2011, with the hope of increasing production to 1.2 million bbl/d (EIA, 2007). In March 2006, ExxonMobil brought online its Erha development, which is located offshore of the western delta. Erha reached peak production of 200,000 bbl/d in July 2006. Oil from Erha is stored in a FPSO, with capacity of 2.2 million barrels of oil. Very Large Crude Carriers (VLCC), capable of holding up to 300,000 deadweight tons are used for exporting the oil from the terminal. ExxonMobil also operates the Yoho field; with current output

of around 150,000 bbl/d. Yoho contains around 400 million barrels of oil reserves. Yoho will be re-injected with natural gas to maintain field pressure. The $1.2 billion field is located in the shallow waters of the eastern delta. In June 2008, ExxonMobil plans to bring online its Bosi field (110,000 bbl/d) located offshore of the western delta (EIA, 2007).

Chevron’s offshore Agbami field is scheduled to come online in 2008, with peak production estimated at 250,000 bbl/d. The majority of Agbami lies in Block 127, while one-third of it lies in the adjacent Block 128. In February 2005, the Nigerian National Petroleum Corporation (NNPC) awarded Chevron a $1.1 billion contract for the construction of a FPSO for the field, which will be undertaken by Daewoo Shipping and Maritime Engineering (South Korea). The FPSO is expected to export up to 250,000 bbl/d of oil and 450 million cubic feet per day (MMcf/d) of natural gas (NNPC, 2006).

Total, Agip, and ConocoPhillips are also involved in the Nigerian oil sector. Output at Total's Amenam field reached 120,000 bbl/d in January 2005. The Amenam field contains reserves of around one billion barrels of oil equivalent (NNPC, 2006). In January 2009, Total plans to bring online its offshore Akpo field (180,000 bbl/d) and in January 2010, its offshore Usan field that will produce up to 150,000 bbl/d (EIA, 2007).

## Oil and the Nigerian Economy

Right from the creation of Nigeria in 1914 until the end of colonialism in 1960, and until the end of the first decade after independence, Nigerian economy was agro-based. Agriculture was the mainstay of the economy. Robinson (1996) wrote that ‘during the colonial period (1914-1959), Nigeria was exploited for its agricultural products’. The main agricultural products were cocoa (produced in the West), groundnut and cotton (produced in the North, and palm oil (produced in the East, which includes the Niger Delta region). However, oil exploration began in Nigeria in

1956, but it did not play any significant role in the Nigerian economy until the early 1970s (Robinson, 1996). According to Robinson, ‘in the early 1960s, revenue from oil accounted for less than 10 per cent of Nigeria’s revenue base’. For example, in 1963 and 1964 oil revenue was only

4.1 per cent and 5.9 per cent respectively, of the total revenue of the country (Graf, 1988 and Robinson, 1996). So on the contrary, the bulk of the country’s revenue during this period was from agriculture (Iwaloye and Ibeanu, 1997), and more than 70 per cent of the people employed in this sector (Robinson, 1996).

However, from the early 1970s, the yield of oil began to increase and the dominance of agriculture in the country’s economy began to decline. Figure 4 and Table 2 below show the statistical records of the importance of oil revenue as a percentage of the total revenue of Nigeria from 1970 to 1985.

The overbearing importance of oil in the Nigerian economy especially from 1973 (Graf, 1988). As a further demonstration of this importance, there is evidence to indicate that crude oil sales income as a percentage of foreign-exchange earnings escalated from 2.5 per cent of all such revenue to

58.1 per cent in 1970, to 93.6 per cent in 1975, and to 98 per cent and more through the first half of the 1980s (Graf, 1988). This trend has continued ever since. For instance, in 1997 oil revenue constituted 88 per cent of the federal government’s foreign exchange earnings as shown in 1998 Budget, and 83.5 per cent of the total gross revenue for the year 2000, which shows that Nigeria earned N1.59 trillion from oil (The Guardian, 5 July 2001). It was reported by the Central Bank of Nigeria that: “The Nigerian government earned N 209.2 billion (1.3 billion Euros) in excess oil revenue between January and May 2004 the Central Bank further announced that the country’s economy had grown at a record rate of 10.2 per cent in 2003. Growth is mostly driven by the oil sector and record of oil prices is producing more excess revenue… The Central Bank Governor was also optimistic about further growth in the future”.

The standard growth theories only built a nexus between primary inputs and output. While undermining energy inputs such as oil gas, fossil fuel etc. However, natural scientists and ecological economists have made effort at developing some theories that attempt to capture the role of oil price volatility on economic growth, thereby incorporating linkage between energy resources, its availability, volatility and economic growth (Oriakhi & Iyoha, 2013). Theories on oil price volatility are basically divided in two. They are theories explaining the channels through which oil price volatility impacts on macro-economy and theories explaining the causes of volatility in the international oil market.

## EMPIRICAL REVIEW

Since the oil price shock that engulfed the world in the early 70’s and 80’s, numerous literature has sprang up on the demand for petroleum products using either the aggregate analysis of petroleum demand in relation to prices and income, or at the disaggregate level that is the use of the simultaneous equation approach (Iwayemi et al). Although, research on the demand for petroleum product is flooded for the developed and OECD countries, little attention has been placed on research on this subject in Sub Saharan African countries. Irrespective of whether its conducted for developed, developing, regional or a carter (e.g OPEC), methodological and scope of study, the result of estimation is more or less the same .The only difference has always being in terms of the magnitude of elasticities of the parameters and this is due sometimes to the methodology employed in estimation (Macatangay, 2013). A common characteristic of petroleum products demand like other energy demand studies is that there is little consistency in terms of methodology, assumptions as well as the nature of data used in each study.

In spite of the enormous importance of energy in today’s world, especially in developing economies particularly Nigeria, few studies on energy demand have been done on developing

countries especially Nigeria whose economy life wire depends on crude oil, and whose petroleum consumption in recent years is threatening her future energy security. Apart from Bayo and Adegbulugbe (1987), and Iwayemi et al (2010), no other work has been done on the petroleum products demand analysis in Nigeria. The work available on this subject however, either fell short of scope or methodology and as such it is this research gap that this study intends to fill. Dahl (1994) using a survey to examine the demand for petroleum products in developing countries found the price elasticity of petroleum products demand to be −0.36 and the income elasticity of demand to be 2.20, this suggested that the demand for petroleum products is more responsive to changes in income than changes in real prices Suleiman (2009). Rao and Parikh (1996) employed the two-step co integration to study the energy demand in India. They found the price and income elasticity of energy demand for India to be −0.03 𝑡𝑜 − 0.25 and 0.02 𝑡𝑜 − 0.75 respectively. Using similar methodology to examine the demand for petroleum products in GCC (OPEC members) countries, Alfaris (1997) found that the price and income elasticity to be −0.11 𝑎𝑛𝑑 − 0.21 respectively. Also, Ramanathan (1999) examine the demand for oil India using the two-step co integration. He found the price and income elasticity of oil demand in India to be−0.32 𝑎𝑛𝑑 2.58 respectively. Hunt et al. (1999) employed the Engel–Granger technique to data for Honduras and reported the long-term price elasticity of gasoline demand to be −0.24 and long-term income elasticity to be 1.59. In studies of Indonesia, Dahl and Kurtubi (2001) used the Engel–Granger (two-step) and partial adjustment models to estimated demand for petroleum products in Indonesia. Under the former, long-term price and income elasticities were −0.59 and 1.35. Using a partial adjustment model for the same country, they estimated a long-term price elasticity of 1.34 and a price impact of −0.68. Akinboade (2008) studied the demand for petroleum products in South Africa using the ARDL or the Bound co integration methodology. He found the long-term price

elasticity of petroleum product demand to be −0.47, while the long-term income elasticity of demand to be 0.36. Sa’ad (2008) employed the structural time series model to estimate oil demand both in Indonesia and South Korea, then found the price and income elasticity of oil demand to be

−0.16 𝑎𝑛𝑑 0.47 respectively. Iwayemi et al (2010) examined the petroleum products demand elasticities for Nigeria using the multivariate co integration approach. They found the long run price and income elasticity of demand to be −0.106 𝑎𝑛𝑑 0.66 respectively. Lastly, we review the work done recently on the demand for petroleum products in Malawi. Using an Ordinary Least Square approach Macatangay (2013) found the price elasticity of demand to be 0.398, while the income elasticity stood at−0.368.

## THEORETICAL FRAMEWORK The Free Market Mechanism

The demand and supply of a commodity are both affected by the price of a commodity. But another interesting feature is that the demand and supply of a commodity both also influence the price of a commodity. The buyers of a commodity demand more of it at lower price and less of it at a higher price whereas the sellers of the commodity supply more of it at higher price and less of it at a lower price (Samuelson et al., 2004). These behaviors of buyer and sellers are explained by the law of demand and the law of supply. There can be a price of commodity at which its quantity demanded and quantity supplied will be equal. This price of the commodity is called the equilibrium price. Thus equilibrium price of a commodity is the price at which its quantity demanded and supplied are equal (Samuelson et al., 2004). Sellers are unaware of the intentions of the buyers. Similarly the buyers are also unaware of the intentions of the sellers. In other words neither the sellers know the market demand schedule of their commodity nor do the buyers know the market supply schedule. Their decisions about the quantity demanded and supplied at a price are independent

decisions. Actually at the price fixed by the sellers, the market supply may be greater or lesser than the market demand at that price. It means that at this price market demand and market supply are not equal. So it is not the equilibrium price. Suppose at the price quoted in the market by the sellers the supply is greater than demand i.e. the buyers are willing to buy less than what the sellers are ready to sell at that price. In this situation not finding enough customers the sellers will reduce the price in order to sell the quantity supplied falls. So as the price is reduced the demand increases and supply falls. This will reduce the original gap between supply and demand. This process of fall in price, rise in demand and fall in supply will continue till a price is reached at the quantity demanded and quantity supplied are equal. Thus the equilibrium price is reached (Samuelson et al., 2004).

The demand for petroleum products in Nigeria (especially the PMS and Diesel) has been on the rise since the early 70’s when the golden water was first discovered in commercial quantities (Iwayemi, Adenikinju, and Babatunde, 2010). This continuous rise has been due largely to (not until recently), the price of petroleum products which have been heavily subsidies in order to achieve some national objectives, as well as to protect the domestic consumers from the stochastic nature of the international crude oil market. The growth of GDP per capita as a result of the oil boom is another major factor that has contributed to the rise in the domestic demand of petroleum products. Industrial expansion through the influx of foreign direct investment has resulted in demand for energy, increase in demand for vehicles has also resulted in increase in demand for fuel, the epileptic nature of electric power has also increases the demand for private household generator, as well as for firm which has also heighten the demand for petroleum products. Lastly, the ever growing population and extension the adult population has also contributed to the increase in demand for petroleum products in Nigeria. In spite of the huge market presence of the country

in the world oil market, the country still sometimes struggle to meet domestic demand for petroleum.

This has been largely attributed to dilapidated, decayed states of the country’s refineries, lack of political will to have functioning refineries, the problem s of insecurity in the Niger Delta, and the most recently is the Boko Haram epidemic that is rocking the nation.

This is putting serious pressure on the oil production and distribution in the country. The key questions that however arise of this are: What are the dynamics and structure of the demand for petroleum products in Nigeria? What are the of the price and income elasticities of demand of petroleum products in Nigeria? In what ways will this dynamics shape direction of energy policies in Nigeria?

The dynamics of the petroleum sector in the Nigerian economy has made the study of the demand for petroleum products in the country highly imperative (Sulaimon Said, 2009; Iwayemi et al, 2010). As such, estimating the dynamics of petroleum products demand is pivotal in enriching our understanding of consumers’ responsiveness to change in relative energy prices and the level of income, since the impact the oil boom of the early 70’s and the oil glut of the early 80’s has on the economy is highly documented (Gate, 1993, Dahl, 1994; Liu, 2004; Akinboade et al, 2008; Iwayemi et al, 2010). The estimates of the dynamics of energy consumption is highly fundamental to one, our knowledge of the country’s (projected) future energy demand, two, how these estimates shape the direction of future energy policies in Nigeria, and lastly, the that our knowledge of the dynamics of petroleum products demand parameters is also highly fundamental to a more informed and successful energy policy making and implementation.

# CHAPTER 3: RESEARCH METHODOLOGY

## INTRODUCTION

This chapter is concerned with the methods used in collecting, analyzing and interpreting the data for the study, also explains the population of the study, sampling techniques and sampling size; model development, method used in recording and techniques used in data analysis.

## RESEARCH DESIGN

The design used in this research is ex-post facto, as the study entails the use of time series data for the periods under study as it allowed for the collection of past documented data. This provided the basis for the full establishment of the relationship between the variables. Therefore, the non-survey design is adopted to actualize the research objectives, which aim at analyzing the price and income elasticities of energy demand in Nigeria.

## METHOD OF DATA COLLECTION

The study employed secondary source of data for the analysis. The data are obtained from published statistical websites and bulletin from the International Monetary Fund (IMF) and Central Bank of Nigeria for a period of forty years (40) years from 1980 to 2019.

## TECHNIQUES OF DATA ANALYSIS

The techniques for the data analysis used in this study; include descriptive statistics, correlation technique and regression analysis using E-view version 9 statistical tool. The descriptive statistics aid in organizing and summarizing the data with a view of reducing the cumbersomeness and making it meaningful and comprehensive, and correlation is a technique of determining the degree

of relationship between two variables. The main objective of this method of determining correlation is to find out the extent to which two sets of ranking are similar or dissimilar while regression is a technique of determining the impact of the independent variable(s) on the dependent variable. The relationship is expressed as an equation that predicts a response variable from a function of regressor and parameters.

## Short Run effect

Error correction model (ECM) is use to test the short run elasticities of price and income on energy demand. ECMs are a theoretically-driven approach useful for estimating both short-term and long- term effects of one time series on another. The term error-correction relates to the fact that last- period’s deviation from a long-run equilibrium, the error, influences its short-run dynamics. Thus, ECMs directly estimate the speed at which a dependent variable returns to equilibrium after a change in other variables.

## Long Run effect

Unit root tests is use to test the long run elasticities of price and income on energy demand. The unit root tests are tests for stationarity in a time series. A time series has stationarity if a shift in time doesn’t cause a change in the shape of the distribution; unit roots are one cause for non- stationarity. These tests are known for having low statistical power. For the purpose of this study Augmented Dickey-Fuller (ADF) test is used.

## MODEL SPECIFICATION

This research set out to analyze the price and income elasticities of energy demand in Nigeria. This relationship is designed on a linear regression model assuming a linear relationship between the variables. The model is given as:

Y = β0 + β1X1 + ut

LOG EDM = β0 + β1PRF1 + β2PCI2 + ut

Where:

Log EDM = Energy Demand Log PRF = Price of Fuel Log PCI = per capita Income β0 = the constant coefficient.

β1 – β2 = the independent variables coefficient. ut = error term

# CHAPTER 4: DATA PRESENTATION, ANALYSIS AND

**INTERPRETATION**

## INTRODUCTION

This chapter presents and discusses the result of the data analysis. The chapter starts by presenting the data and analysis of the results obtained from descriptive statistics in tabular form followed by regression result, unit root test for long run analysis and error correction model for short run analysis.

## RESULTS AND INTERPRETATION

The descriptive statistics shows the mean and standard deviation of each independent variable from the mean and standard deviation of the dependent variables.

### Table 4:1: Descriptive Statistics of the Variables

|  |  |  |  |
| --- | --- | --- | --- |
|  | **EDM** | **PRF** | **PCI** |
| **Mean** | **723.14** | **43.62** | **1304.66** |
| **Maximum** | **798.63** | **145.00** | **3222.69** |
| **Minimum** | **665.44** | **0.15** | **270.22** |
| **Std. Dev.** | **39.56** | **49.48** | **882.07** |
| **Observations** | **40** | **40** | **40** |

Source: Computed using E-view version 9.

Table 4.1 shows the descriptive statistics result of the dependent and independent variable. A total of 40 observations were recorded. The table shows the mean and standard deviation with minimum and maximum range of the dependent and independent variables. Energy Demand (EDM in kg tone oil equivalent [ktoe]) has a mean of 723.14ktoe at a minimum point of 665.44ktoe and a maximum point of 798.63ktoe. PRF (Price of Fuel in Naira) has a mean of 43.62 naira at a

minimum point of 0.15 naira and a maximum point of 145.00 naira. PCI (Per Capita Income in Naira) has a mean of 1304.66 naira at a minimum point of 270.22 naira and a maximum point of 3222.69 naira.

## Correlation Result

The correlation result shows the relationship between each independent variable and the dependent variable. The values of the correlation coefficient range from -1 to 1. The sign of the correlation coefficient indicates the direction of the relationship (positive or negative) the absolute value of the correlation coefficient indicates the strength, with larger values indicating stronger relationships and lower values indicating weak relationships. The correlation coefficients on the main diagonal are 1.0, because each variable has a perfect positive linear relationship with itself.

### Table 4.2: Correlation Result

|  |  |  |  |
| --- | --- | --- | --- |
|  | **EDM** | **PRF** | **PCI** |
| **EDM** | **1.0000** |  |  |
| **PRF** | **0.8849** | **1.0000** |  |
| **PCI** | **0.7445** | **0.7500** | **1.0000** |

Source: Computed using E-view 9

Table 4.2 shows the correlation result of the dependent variable EDM and the independent variables PRF and PCI. The relationship between EDM and independent variable PRF is positive and strong with a coefficient value of 0.8849 representing 88.49 percent, this means that, all things being equal the higher the PRF the higher the EDM. The relationship between EDM and independent variable PCI is positive and strong with a coefficient value of 0.7445 representing

74.45 percent, this means that, all things being equal the higher the PCI the higher the EDM.

## Regression Result

The regression result shows the impact of each independent variable to the dependent variable. The regression coefficient values indicate the extent of the impact which range from 0% to 100%. This section also presents the F statistics, R2 and adjusted R2 of the model.

### Table 4.3: OLS Regression Results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable (EDM)** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
| **C** | **686.296** | **5.2949** | **129.6138** | **0.0001** |
| **PRF** | **0.5966** | **0.0893** | **6.6811** | **0.0001** |
| **PCI** | **0.0082** | **0.0050** | **1.6548** | **0.1064** |
| **R-squared** | **0.7980** |  |  |  |
| **AdjustedR-squared** | **0.7871** |  |  |  |
| **F-statistic** | **73.0999** |  |  |  |
| **Prob(F-statistic)** | **0.0001** |  |  |  |

Source: Computed using E-view version 9

Table 4.3 shows OLS regression results of the model. The model consists of dependent variable EDM and independent variables PRF and PCI. The impact of independent variable PRF on dependent variable EDM is positive with coefficient value of 0.5966, meaning that an increase in PRF by one naira while other variable remains constant lead to an increase in EDM by 59.66ktoe. The impact of independent variable PCI on dependent variable EDM is positive with coefficient value of 0.0082, meaning that an increase in PCI by one naira while other variable remains constant lead to an increase in EDM by 0.82ktoe. In the model the coefficient of determination R2 is 0.7980.

This means that 79.80 percent of change in EDM was caused by changes in independent variables while the 20.2 percent change in EDM was caused by other factors not included in the model. The f-statistics is 73.09 with p-value of 0.0001 which is less than 0.05 and is statistically significant.

## LONG RUN ANALYSIS

Unit root test is use to evaluate the behavior of the price, income and energy demand. Also, to examine how the data is trending; upward or downward, stabile or capable of predicting the future. If the data has unit root, that means the data is unstable or unpredictable and therefore may not be valid for prediction or forecasting. Using Augmented Dickey Fuller test, the following present the unit root test (long run analysis) of EDM, PRF and PCI.

### Table 4.4 Unit Root Test of EDM

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **t-Statistic** | **Prob.\*** |
| **Augmented Dickey-Fuller test statistic** | | **-0.9966** | **0.7451** |
| **Test critical values:** | **1% level** | **-3.6104** |  |
|  | **5% level** | **-2.9389** |  |
|  | **10% level** | **-2.6079** |  |

Table 4.4 shows the unit root test of EDM. The t-Statistic is -0.9966 which is greater than all the test critical values at 1%, 5% and 10% with an insignificant p-value of 0.745, therefore EDM has a unit root.

### Table 4.5 Unit Root Test of PRF

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **t-Statistic** | **Prob.\*** |
| **Augmented Dickey-Fuller test statistic** | | **0.4855** | **0.9840** |
| **Test critical values:** | **1% level** | **-3.6104** |  |
|  | **5% level** | **-2.9389** |  |
|  | **10% level** | **-2.6079** |  |

Table 4.5 shows the unit root test of PRF. The t-Statistic is 0.4855 which is greater than all the test critical values at 1%, 5% and 10% with an insignificant p-value of 0.984, therefore PRF has a unit root.

### Table 4.6 Unit Root Test of PCF

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **t-Statistic** | **Prob.\*** |
| **Augmented Dickey-Fuller test statistic** | | **-1.1066** | **0.7033** |
| **Test critical values:** | **1% level** | **-3.6155** |  |
|  | **5% level** | **-2.9411** |  |
|  | **10% level** | **-2.6090** |  |

Table 4.6 shows the unit root test of PCF. The t-Statistic is -1.1066 which is greater than all the test critical values at 1%, 5% and 10% with an insignificant p-value of 0.703, therefore PCF has a unit root.

## SHORT RUN ANALYSIS

Error Correction Model is used directly to estimate the speed at which energy demand returns to equilibrium after a change in price and income. Using Vector Error Correction Estimates, the following present the short run analysis of EDM, PRF and PCI.

### Table 4.7 Error Correction Estimate of ORV

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Dependent Variable: EDM** | | | | |
| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
| **C** | **693.8888** | **5.4352** | **127.6646** | **0.0001** |
| **PRF(-1)** | **0.562977** | **0.1027** | **5.4789** | **0.0001** |
| **PCI(-1)** | **0.006923** | **0.0055** | **1.2477** | **0.2209** |
| **ECM(-1)** | **0.034339** | **0.0127** | **2.6934** | **0.0110** |

Table 4.7 illustrates error correction results of the short run model. The P value of PRF (0.0001) suggests the significant influence of the PRF on the EDM showing that PRF has short run effect on EDM. The P value of PCI (0.2209) suggests the insignificant influence of the PCI on the EDM showing that PCI has no short run effect on EDM.

## DISCUSSION OF FINDINGS

In order to decide whether to reject or accept the null hypothesis at 0.05 (5%) level of significant, the rejection point is use which states that. (1) If the p value is equal to or less than 5%, the null hypotheses is rejected and the alternate hypotheses is accepted; (2) If the p value is more than 5%, the null hypotheses is accepted and the alternate hypotheses is rejected.

## The long-run relationship between energy demand, prices and income

The t-cal of PRF (0.4855) and PCI (-1.1066) in table 4.5 and 4.6 which are less than 0.05, therefore, the null hypothesis which states that there is no significant long run relationship between energy demand, price and income is rejected.

## The short run and long run effect of energy price on energy demand

The t-cal of PRF in table 4.3 is 6.6811 with p value of 0.0001 which is less than 0.05, therefore, the null hypothesis which states that there is no significant short run or long run effect of energy price on energy demand is rejected.

There is no significant long run relationship between energy demands, price and income is rejected.

|  |  |
| --- | --- |
| 6.6811 | 0.0001 |
| 1.6548 | 0.1064 |

## The short run and long run effect of income on energy demand

The t-cal of PCI in table 4.3 is 1.6548 with p value of 0.1064 which is greater than 0.05, therefore, the null hypothesis which states that there is no significant short run or long run effect of income on energy demand is not rejected.

# CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## SUMMARY

The principal concern of the study is to analyze the price and income elasticities of energy demand in Nigeria. In addition, this study also looks at the petroleum/gasoline demand in Nigeria. The study comprises of five (5) chapters. The first chapter of the study is an introduction to the subject matter of the research, it talks generally about the background of the study giving full insight to the issue of energy demand in Nigeria. A statement was provided on the problem that prompted the study and the objectives to be achieved as were stated. Also, in line with the objectives, research hypotheses were developed as well as the scope and significant of the study.

Literature review was conducted in chapter two; this chapter examined a number of journals and articles on the topic to determine the various elements and concepts that derive the analysis of price and income elasticities of energy demand in Nigeria. Empirical studies and theoretical framework were also reviewed.

Chapter three was centered on the methodology used for this research work. For the purpose of this study, data are extracted from published statistical websites and Central Bank of Nigeria; statistical bulletins covered the period of forty years (40) years from 1980 – 2019. It also went further to reveal the sampling technique and the method of data collection and techniques of data analysis employed.

Finally, the fourth chapter is on the presentation, interpretation and analysis of the data. This was done with use of data are extracted from published statistical websites and Central Bank of Nigeria; statistical bulletins computed using statistical for social science E-view version 9.

Based on the result this study, the following findings are:

* + 1. There is significant long run relationship between energy demand, price and income.
    2. There is significant short run or long run effect of energy price on energy demand
    3. There is no significant short run or long run effect of per capita income on demand for energy.

## CONCLUSIONS

The main thrust of this study is to analyze the price and income elasticities of energy demand in Nigeria. The study has shown that the incessant demand for petroleum/gasoline and the scarcity of the product has caused a lot of hardship to Nigerians. The burden of the petroleum/gasoline scarcity is borne more by the poor, thereby increasing their suffering and their poverty level. Increases in the price of petroleum/gasoline led to increase in transportation cost of consumables and in turn increased the prices of goods, resulting to inflation. Long queues at the fuel stations had led to man-hour loss, resulting to unemployment. These had affected the growth and development of the country. Increase in petroleum/gasoline demand result to an increase in exchange rate fluctuation, inflation rate and trade openness.

## RECOMMENDATIONS

Based on the above findings and conclusions, the study recommended:

1. Firstly, government should allow the market mechanism (demand and supply) to prevail in the distribution and pricing of petroleum/gasoline. This implies that government should remove subsidy on petroleum/gasoline products and allow the forces of demand and supply to allocate the resources among the citizens.
2. Secondly, Regulatory bodies must show capacity, sincerity and responsibility in their roles against hoarding, diversion, smuggling, activities of the union that leads to pump adjustment and put a check the activities of the cabals.
3. Government should carry on with the turnaround maintenance of the refineries if and only if the comparative advantage of producing locally is lower than importing petroleum/gasoline from abroad.

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**DATA FOR THE STUDY**

# APPENDICES

|  |  |  |  |
| --- | --- | --- | --- |
| YEAR | ENERGY  DEMAND (EDM) | PRICE OF  FUEL (PRF) | PER CAPITA  INCOME (PCI) |
| 1980 | 665.44 | 0.15 | 874.40 |
| 1981 | 676.76 | 0.15 | 2,180.20 |
| 1982 | 692.19 | 0.20 | 1,843.91 |
| 1983 | 693.97 | 0.20 | 1,222.63 |
| 1984 | 678.17 | 0.20 | 902.22 |
| 1985 | 683.23 | 0.20 | 882.52 |
| 1986 | 671.91 | 0.39 | 639.01 |
| 1987 | 677.27 | 0.39 | 598.26 |
| 1988 | 679.27 | 0.42 | 549.24 |
| 1989 | 684.86 | 0.60 | 474.23 |
| 1990 | 697.61 | 0.60 | 567.53 |
| 1991 | 712.68 | 0.70 | 502.91 |
| 1992 | 722.40 | 0.70 | 477.18 |
| 1993 | 715.86 | 3.25 | 270.22 |
| 1994 | 681.11 | 11.00 | 321.32 |
| 1995 | 682.67 | 11.00 | 408.18 |
| 1996 | 694.18 | 11.00 | 461.52 |
| 1997 | 700.05 | 11.00 | 479.98 |
| 1998 | 687.51 | 25.00 | 469.43 |
| 1999 | 694.56 | 20.00 | 497.84 |

|  |  |  |  |
| --- | --- | --- | --- |
| 2000 | 703.64 | 22.00 | 567.93 |
| 2001 | 720.45 | 22.00 | 590.38 |
| 2002 | 725.01 | 26.00 | 741.75 |
| 2003 | 747.02 | 42.00 | 795.39 |
| 2004 | 748.75 | 65.00 | 1,007.87 |
| 2005 | 758.37 | 65.00 | 1,268.38 |
| 2006 | 744.94 | 65.00 | 1,656.42 |
| 2007 | 751.18 | 75.00 | 1,883.46 |
| 2008 | 753.25 | 65.00 | 2,242.87 |
| 2009 | 721.81 | 65.00 | 1,891.34 |
| 2010 | 756.35 | 65.00 | 2,292.45 |
| 2011 | 778.84 | 65.00 | 2,520.40 |
| 2012 | 798.63 | 97.00 | 2,746.99 |
| 2013 | 780.14 | 97.00 | 2,998.07 |
| 2014 | 763.63 | 87.00 | 3,222.69 |
| 2015 | 763.45 | 145.00 | 2,730.43 |
| 2016 | 773.56 | 145.00 | 2,176.00 |
| 2017 | 776.07 | 145.00 | 1,968.56 |
| 2018 | 781.03 | 145.00 | 2,032.73 |
| 2019 | 788.01 | 145.00 | 2,229.86 |

**DESCRIPTIVE STATISTICS**

|  |  |  |  |
| --- | --- | --- | --- |
|  | EDM | PRF | PCI |
| Mean | 723.1458 | 43.62875 | 1304.668 |
| Median | 718.1550 | 22.00000 | 892.3700 |
| Maximum | 798.6300 | 145.0000 | 3222.690 |
| Minimum | 665.4400 | 0.150000 | 270.2200 |
| Std. Dev. | 39.56454 | 49.48536 | 882.0734 |
| Skewness | 0.289018 | 0.941008 | 0.578710 |
| Kurtosis | 1.687150 | 2.648207 | 1.941066 |
|  |  |  |  |
| Jarque-Bera | 3.429503 | 6.109567 | 4.101603 |
| Probability | 0.180008 | 0.047133 | 0.128632 |
|  |  |  |  |
| Sum | 28925.83 | 1745.150 | 52186.70 |
| Sum Sq. Dev. | 61048.75 | 95503.24 | 30344085 |
|  |  |  |  |
| Observations | 40 | 40 | 40 |

# CORRELATION RESULT

|  |  |  |  |
| --- | --- | --- | --- |
|  | EDM | PRF | PCI |
| EDM | 1.000000 | 0.884922 | 0.744568 |
| PRF | 0.884922 | 1.000000 | 0.750012 |
| PCI | 0.744568 | 0.750012 | 1.000000 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dependent Variable: EDM | | | | |
| Method: Least Squares | | | | |
| Date: 09/06/20 Time: 15:19 | | | | |
| Sample: 1980 2019 |  |  |  |  |
| Included observations: 40 | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| C | 686.2967 | 5.294934 | 129.6138 | 0.0000 |
| PRF | 0.596672 | 0.089307 | 6.681113 | 0.0000 |
| PCI | 0.008291 | 0.005010 | 1.654806 | 0.1064 |
| R-squared | 0.798035 | Mean dependent var | | 723.1458 |
| Adjusted R-squared | 0.787118 | S.D. dependent var | | 39.56454 |
| S.E. of regression | 18.25474 | Akaike info criterion | | 8.718765 |
| Sum squared resid | 12329.72 | Schwarz criterion | | 8.845431 |
| Log likelihood | -171.3753 | Hannan-Quinn criter. | | 8.764564 |
| F-statistic | 73.09997 | Durbin-Watson stat | | 0.695648 |
| Prob(F-statistic) | 0.000000 |  | |  |

**LONGRUN ANALYSIS**

|  |  |  |  |
| --- | --- | --- | --- |
| Null Hypothesis: EDM has a unit root | | | |
| Exogenous: Constant |  |  |  |
| Lag Length: 0 (Automatic - based on SIC, maxlag=9) | | | |
|  |  | t-Statistic | Prob.\* |
| Augmented Dickey-Fuller test statistic | | -0.996675 | 0.7451 |
| Test critical values: | 1% level | -3.610453 |  |
|  | 5% level | -2.938987 |  |
|  | 10% level | -2.607932 |  |
| \*MacKinnon (1996) one-sided p-values. | |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Augmented Dickey-Fuller Test Equation | | | | |
| Dependent Variable: D(EDM) | | | | |
| Method: Least Squares |  |  |  |  |
| Date: 09/06/20 Time: 15:20 | | | | |
| Sample (adjusted): 1981 2019 | | | | |
| Included observations: 39 after adjustments | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| EDM(-1) | -0.059287 | 0.059484 | -0.996675 | 0.3254 |
| C | 45.91706 | 42.97686 | 1.068414 | 0.2923 |
| R-squared | 0.026146 | Mean dependent var | | 3.142821 |
| Adjusted R-squared | -0.000175 | S.D. dependent var | | 14.16722 |
| S.E. of regression | 14.16846 | Akaike info criterion | | 8.189834 |
| Sum squared resid | 7427.573 | Schwarz criterion | | 8.275145 |
| Log likelihood | -157.7018 | Hannan-Quinn criter. | | 8.220443 |
| F-statistic | 0.993361 | Durbin-Watson stat | | 1.814444 |
| Prob(F-statistic) | 0.325396 |  | |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Null Hypothesis: PRF has a unit root | | | |
| Exogenous: Constant |  |  |  |
| Lag Length: 0 (Automatic - based on SIC, maxlag=9) | | | |
|  |  | t-Statistic | Prob.\* |
| Augmented Dickey-Fuller test statistic | | 0.485455 | 0.9840 |
| Test critical values: | 1% level | -3.610453 |  |
|  | 5% level | -2.938987 |  |
|  | 10% level | -2.607932 |  |
| \*MacKinnon (1996) one-sided p-values. | |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Augmented Dickey-Fuller Test Equation | | | | |
| Dependent Variable: D(PRF) | | | | |
| Method: Least Squares | | | | |
| Date: 09/06/20 Time: 15:21 | | | | |
| Sample (adjusted): 1981 2019 | | | | |
| Included observations: 39 after adjustments | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| PRF(-1) | 0.019762 | 0.040708 | 0.485455 | 0.6302 |
| C | 2.903281 | 2.529789 | 1.147637 | 0.2585 |
| R-squared | 0.006329 | Mean dependent var | | 3.714103 |
| Adjusted R-squared | -0.020527 | S.D. dependent var | | 11.74584 |
| S.E. of regression | 11.86578 | Akaike info criterion | | 7.835114 |
| Sum squared resid | 5209.478 | Schwarz criterion | | 7.920425 |
| Log likelihood | -150.7847 | Hannan-Quinn criter. | | 7.865723 |
| F-statistic | 0.235667 | Durbin-Watson stat | | 2.384245 |

|  |  |
| --- | --- |
| Prob(F-statistic) | 0.630216 |

|  |  |  |  |
| --- | --- | --- | --- |
| Null Hypothesis: PCI has a unit root | | | |
| Exogenous: Constant |  |  |  |
| Lag Length: 1 (Automatic - based on SIC, maxlag=9) | | | |
|  |  | t-Statistic | Prob.\* |
| Augmented Dickey-Fuller test statistic | | -1.106681 | 0.7033 |
| Test critical values: | 1% level | -3.615588 |  |
|  | 5% level | -2.941145 |  |
|  | 10% level | -2.609066 |  |
| \*MacKinnon (1996) one-sided p-values. | |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Augmented Dickey-Fuller Test Equation | | | | |
| Dependent Variable: D(PCI) | | | | |
| Method: Least Squares |  |  |  |  |
| Date: 09/06/20 Time: 15:21 | | | | |
| Sample (adjusted): 1982 2019 | | | | |
| Included observations: 38 after adjustments | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| PCI(-1) | -0.052186 | 0.047156 | -1.106681 | 0.2760 |
| D(PCI(-1)) | 0.180682 | 0.127855 | 1.413185 | 0.1664 |
| C | 63.20516 | 72.60752 | 0.870504 | 0.3900 |
| R-squared | 0.071549 | Mean dependent var | | 1.306842 |
| Adjusted R-squared | 0.018495 | S.D. dependent var | | 252.2434 |
| S.E. of regression | 249.8999 | Akaike info criterion | | 13.95565 |
| Sum squared resid | 2185749. | Schwarz criterion | | 14.08494 |
| Log likelihood | -262.1574 | Hannan-Quinn criter. | | 14.00165 |
| F-statistic | 1.348602 | Durbin-Watson stat | | 1.193567 |
| Prob(F-statistic) | 0.272760 |  | |  |

# SHORTRUN ANALYSIS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dependent Variable: EDM | | | | |
| Method: Least Squares |  |  |  |  |
| Date: 09/06/20 Time: 15:23 | | | | |
| Sample (adjusted): 1983 2019 | | | | |
| Included observations: 37 after adjustments | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| C | 693.8888 | 5.435249 | 127.6646 | 0.0000 |
| PRF(-1) | 0.562977 | 0.102753 | 5.478947 | 0.0000 |
| PCI(-1) | 0.006923 | 0.005549 | 1.247760 | 0.2209 |
| ECM(-1) | 0.034339 | 0.012749 | 2.693432 | 0.0110 |
| R-squared | 0.802205 | Mean dependent var | | 726.7957 |
| Adjusted R-squared | 0.784224 | S.D. dependent var | | 38.77140 |
| S.E. of regression | 18.00998 | Akaike info criterion | | 8.721535 |
| Sum squared resid | 10703.86 | Schwarz criterion | | 8.895689 |
| Log likelihood | -157.3484 | Hannan-Quinn criter. | | 8.782933 |
| F-statistic | 44.61318 | Durbin-Watson stat | | 1.080881 |

|  |  |
| --- | --- |
| Prob(F-statistic) | 0.000000 |

PROJECT

|  |  |  |  |
| --- | --- | --- | --- |
| ORIGINALITY REPORT | |  |  |
| 12%  SIMILARITY INDEX | | 8% 6%  INTERNET SOURCES PUBLICATIONS | 10%  STUDENT PAPERS |
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