



Effect of Changes in Petroleum Products Prices on Human Welfare in Nigeria: 1992 – 2022

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Abstract

This study examined the effect of changes in petroleum products prices on human welfare in Nigeria using secondary data from 1992 and 2022. The work aims at assessing the effect of changes in the petroleum products prices on human welfare in Nigeria. Unit Root Test and Auto Regressive Distributed Lag (ARDL) bound test were employed to examine the objectives and inferences were made at 5% significant level. To wholly conceptualize human welfare, this study used Household Consumption, Life Expectancy Ratio and Human Development Index as its measure which is one of the value-addition the work has introduced in this regard. The findings from ARDL results on the model of changes in petroleum products prices on household consumption revealed that the effect of changes in inflation rate and GDP per capita on household consumption in Nigeria is positive and significant. Second, the long run effect of model on changes in petroleum products prices and life expectancy rate showed that the effects of changes in DPK and inflation rate were positive and statistically significant while the effect of changes in interest rate is negative and statistically significant. Lastly, on the model of changes in petroleum products prices and human development index, the long run result revealed that the effect of changes in DPK, changes in inflation rate and changes in interest rate on human development index were positive and statistically significant but only the changes in inflation rate was positive and statistically significant on human development index in the short run. The study observed that a continuous increase in the cost of production would increase the price of goods and services consequently hurt the people in the short run but improve living standard when employment and income increase in the long run. It recommends that government should channel oil trade towards exportation of finished petroleum products so as to expand oil revenue base of the economy, zero import expenditure on finished petroleum products, and reduce the domestic pump price of these products in Nigeria.

Keywords:

Poverty line
Petroleum Products' Prices
Human Welfare
Household Consumption
Human Development Index

JEL Classification:

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1. Introduction

On the global socioeconomic scene, energy costing and pricing has continued to challenge economic agents especially the government as different combination of energy plans has different budget and welfare implications. As the economic agents strive to minimize energy cost, they configure their energy plans amongst electricity, petroleum products, gas, solar energy, biofuel and so on. One of the primary objectives of economic development is the reduction of poverty and, more specifically, the promotion of social welfare. To achieve this macroeconomic goal, it is necessary to formulate and implement policies that will improve human welfare which will also translate to economic growth. The concept of welfare for people pertains to the efficient distribution of resources aimed at promoting the overall health and prosperity of individuals within a given population. In order to attain and uphold a superior quality of life, it is imperative that the cost of commodities and amenities remain relatively constant so as to ensure accessibility for individuals. The concept of contentment of fundamental human needs encompasses the fulfillment of essential requirements for survival, such as sustenance, hydration, housing, and other vital resources that support the continuity of life. Rational individuals endeavour to maximize their utility subject to their money constraint.

The prices of goods and services determine the quantities one can get and the major cause of increase in any of these prices is the increase in petroleum products' prices. In fact, Petroleum pump price plays a critical role in economic growth of any economy, whether developed or developing. Changes in petroleum pump price arise from changes in the price of crude oil in the international markets and these are passed on to consumers in form of change in prices of the final petroleum products (Babalola & Salau, 2020). The attainment of a stable price for petroleum products is a significant hurdle faced by developing economies, given its adverse impact

on the pricing of commodities and services, as well as its repercussions on national and regional outputs.

Nigerian Government has introduced different measures to control the effect of fluctuations in petroleum products prices over time. Iwayemi and Adenikinju (1996) identify three factors that have influenced government position on controlling petroleum prices in the domestic market. First, is the desire to protect the interest of the poor who could be hurt from higher prices? The second is the need to reduce industrial cost as energy products are seen as critical inputs in production processes. The third factor relates to the potential inflationary impact of higher energy prices. Government of both oil producing and consuming countries invariably intervene in the market to influence product price and that of petroleum products as they impact the inflationary gap. So, the predominant view in Nigeria is that any petroleum product price increase will cause inflation and reduce economic welfare (Yakubu, Abdullahi, Maijam & Musa, 2023)

Nigeria oil sector has no doubt contributed immensely to economic growth and development of the country as it accounts for over 90% of the country's foreign exchange earnings (Sulaimon 2014). Despite Nigeria's abundance in both human and natural resources, the country still struggles with myriad of economic challenges that have continued to impede her journey on the path of economic growth and prosperity. Presently, the country is highly dependent on crude oil for export and as major revenue source. As a result, it is customary for organizations to formulate yearly financial plans that are anchored on a projected cost of crude oil and production volume. The current state of affairs has rendered the economy vulnerable and subject to the vicissitudes of fluctuations in the cost of the petroleum products. Human welfare is deteriorating over time due to continuous increase in petroleum products prices which has

caused the prices of goods and services to increase and results to fall in purchasing power. As a result there has been a persistent inflation in the economy causing the citizens not to be able to afford conveniently the basic necessities of life which affect negatively households' consumption, life expectancy rate and causing a fall in the human development index.

Despite the various measures by the government to reduce the effect of changes in petroleum products prices on human welfare, the problem still persist. This is due to inconsistency in government policies, change in administration, lack of maintenance and capacity utilization of the refineries, corruption, lack of check and balances, lack of institutional framework and incompetency of our political leaders among others. Lasting solution is needed to be put in place to correct the market failure in the oil sector so as to improve human welfare and bring about stability of petroleum products' prices in Nigeria. It is on this background that this research examines the impact of changes in petroleum products' prices on human welfare in Nigeria.

2. Literature review

2.1 Conceptual review

2.1.1 Crude Oil Price

The significance of petroleum product prices is widely acknowledged by most economies due to their observed impact on global output and the cost of products and services. Specifically, empirical evidence suggests that a rise in these costs is associated with a decline in worldwide output and an adverse impact on prices of goods and services. The study conducted by Baumeister and Kilian (2016) posited that the variability in oil prices constitutes an unforeseen element of a significant shift in the cost of oil, which is characterized as the disparity within the projected and actualized cost of oil. Petroleum products are among the most valuable natural resources abundantly available in Nigeria. Nigerians and people everywhere use petroleum

products as a fuel in their automobiles, generating sets, industrial plants and for cooking purposes, thus making petroleum products an essential commodity that is needed for the daily operations of individual, industrial and national activities. It has been discovered that in this part of the world Nigeria, we depend majorly on the petroleum products for our daily activities that is geared towards productivity and profitability either through the sales of goods or rendering of services. This means the oscillations in the prices of petroleum products may have a favourable or unfavourable impact on the economic conditions of a country. This study categorize petroleum commodities into three distinct types, namely premiums motors spirits (PMS), automobile petroleum-powered oil (AGO), and double-purpose gasoline (DPK).

2.1.2 Human Welfare

Pigou remains the founder of Welfare Economics. His prominent ideas on welfare economics are found in his *Economics of Welfare* published in 1920. He popularized the word welfare as an entrenched concept in Economics and gave it a concrete meaning. According to him, individual welfare is the sum of satisfactions obtained from the use of goods and services while social welfare is the summation of all individual welfare in a society. Since general welfare is very wide and complicated, Pigou limited his study to economic welfare. He defined economic welfare as that part of social welfare that can be brought directly or indirectly into relation with the measuring rod of money. According to the United Nations Development Programme (UNDP), human welfare is concerned with quality education, improved health and equitable income, as seen in the Human Development Index (HDI). The Human Development Index (HDI) measures the performance in the key areas of human development which include (1) how healthy and long the people live (2) access to quality and affordable education and (3) having a decent

standard of living. To Maku *et al* (2018), human welfare is the satisfaction of needs-food, drink, shelter and other things that contribute to ‘bodily flourishing.’ The presence or absence of such satisfaction is surely better measured by levels of health in the population than income. Nigeria will develop if the welfare of the citizens are properly taken care of by the government. Prioritize the health and wellbeing of the populace, expand economic prospects, and adopt technology to boost the nation's total economic productivity and citizens' opportunities (Dolgoft & Stolnik, 1997).

2.2. Theoretical Review

The Renaissance Growth Theory

This research is premised on the renaissance growth theory providing theoretical background of the effect of changes in petroleum products prices on the welfare of people wallowing in an economy with electricity supply almost nonexistent as a viable energy substitute.

Renaissance growth theory as pioneered by Lee (1998) is an off-shoot of symmetric theory which postulates that it is the volatility or change in oil prices rather than oil price level that has significant influence on economic growth (Lee, 1998). Lee and Ratti (1995) made frantic efforts to distinguish between oil price changes and oil price volatility. Their study found that oil price changes and oil price volatility both have negative impacts on economic growth but in different ways. The effects of volatility are felt immediately while that of oil price change has a one-year lag effect. In the study's proposition, volatility is defined as the standard deviation in a specified period while change is defined as the mean in a given period. The study posits that it is the change or volatility in crude oil prices that has a substantial influence in GDP growth and not the level of oil prices.

The appropriateness of this theory for the current work underscores the rationales behind the Nigerian frequent upward adjustment of petroleum products prices which has untold

effects on the welfare of the masses as superior or even perfect substitutes don't exist or more expensive within the economy.

2.3 Empirical Review

Majority of scholarly works has been done to unravel the impacts of changes in oil prices on welfare, consumer price index, inflation rate and overall economic growth in different economies across developmental divides. The pricing of petroleum products has over the years been a contentious issue and has dominated public discourse, policy makers and policy contestants for years in Nigeria (Babalola & Salau, 2020). The relationship between oil price asymmetry and sectoral output in Nigeria was examined by Ogunjimi (2019). Time series data from 1981 to 2017 were used and the estimation model was Non-Auto-Regressive Distributed Lag. The study found that the impact of oil price on the performance of both the oil and non-oil sectors of the Nigerian economy is asymmetric in the short run. However, the long-run effects of oil price asymmetry are only asymmetric on the non-oil sector.

Using annual time series data from 1980 to 2016, Akinlo (2020) examined the asymmetric effects of oil price shocks on unemployment in Nigeria. The findings derived from the ARDL model suggest that the impact of oil price shock on unemployment is not statistically significant in the long run. However, the NARDL model reveals that there exist long-run effects of oil price shocks on the rate of unemployment, albeit asymmetric in nature.

In a study by Maku *et al.* (2018), they investigated the impact of petroleum product price on human welfare in Nigeria. They found that prices of premium motor spirit and dual purpose kerosene have an important and adverse impact on the welfare of people in Nigeria over the long term. Additionally, the prices of premium motor spirit and dual purpose kerosene, as well as the inflation rate, have a significant and negative effect on human welfare in Nigeria over

the short term. The study recommended that Government should ensure that petroleum pump prices are regulated because they have a long term effects on the market.

Kamasa et al. (2020) investigated the impact of crude oil price fluctuations on the economic welfare of Ghana. Employing the Auto-regressive distributed lag model, the study analysed data spanning from 1983 to 2017. The findings of the study reveal that crude shifts in oil prices exert a statistically significant and negative influence on the economic welfare of Ghana in both the short and long run.

Mamdouh and Mohamed (2020) explore the extreme effect of crude oil price fluctuations and its volatility on the economic growth of Middle East and North Africa (MENA) countries with the adoption of Panel Quantile Regression approach with other linear models such as fixed effects, random effects and panel generalized method of moments. The findings summarize that changes in oil price and its volatility have an opposite effect for each oil-export and oil-import countries.

Similar research was conducted by Nusair (2019), who looked at the impact of oil price shocks on the economies of the Gulf Cooperation Council countries and employed the Nonlinear cointegrating NARDL approach. The findings of the investigation revealed that positive fluctuations in oil prices have an advantageous influence on the real GDP, while negative fluctuations have an adverse effect on the real GDP. Also, the results shows that the influence of upward fluctuations in oil prices on the actual gross domestic product is significantly greater in magnitude than that of downward fluctuations.

The empirical study on the relationship between Oil Price and inflation from 1970-2017 in India using Johansen Cointegration Method was conducted by Sultan, et al. (2020). It was found that oil price does affect the inflation level in India both in the short run as well as in the long run. Adagunodo and Oladeji, (2020) studied

welfare and Distributional Impacts of Petroleum Products Pricing Policy in Nigeria using quintile analysis approach and the study revealed that petroleum products subsidies do not have the same welfare and distributional impacts across the households in Nigeria.

Topbie and Ibiware (2022) empirically look into the relationship between petroleum resource as measured by oil rent, and official exchange rate, and economic welfare as measured by gross domestic product per capita of five-selected lower-middle-income of oil producing countries (i.e. Nigeria, Pakistan, Indonesia, Egypt and India), using annual time-series data sourced from World Bank for the periods 2010-2020. The study employed static panel data method coupled with other linear models such as; Pooled OLS, Fixed effects, and random effects models. It was revealed that petroleum resource had significant bearings on economic welfare as measured by gross domestic product per capita. The study concluded that for these five-oil producing countries to achieve their economic welfare, they must adopt mixed effects model as portrayed by the findings.

From the foregoing, extensive research works have been done on petroleum products prices on economic growth, consumer price index, stock market performance, human welfare to mention a few. Most of these studies however are conducted outside Nigeria while the fewest conducted in Nigeria are either on subsidy component or not including adequate number of independent variables as impacting human welfare. Therefore, this work is the first of its kind to examine the effect of changes in petroleum products prices on human welfare to factor changes in the prices of Premium Motor Spirit, Automotive Gas Oil, Dual Purpose Kerosene, Inflation Rate and Interest Rate with extensive measure of human welfare proxied by Human Development Index, Life Expectancy Rate and Household Consumption.

3. Methodology

3.1 Model Specification

This study anchored on the Renaissance Growth Theory to verify the effect of changes in petroleum products prices on human welfare in Nigeria and adapting a model from the previous work of Adagunodo (2013), Maku et al (2018) and Kamasa et al (2020) who studied the effect of changes in petroleum products price on human welfare in Nigeria. The model used in the study is specified thus;

$$HDI = f(PMS, AGO, DPK, INF \& INT) \quad 1$$

HDI is Human Development Index, PMS is Changes in the Price of Premium Motor Spirit

AGO is Changes in the Price of Automotive Gas Oil, DPK is Changes in the Price of Dual Purpose Kerosene, INF is Inflation Rate and INT is Interest Rate.

In order to make this work unique from past studies, this study adapts and modified the model to include Gross Domestic Product Per Capita (GDPPC), Life Expectancy Rate (LER) and Household Consumption (HC). Therefore, the functional mathematical models become:

$$HDI = f(PMS, AGO, DPK, GDPPC, INF, INT) \quad 2$$

$$LER = f(PMS, AGO, DPK, GDPPC, INF, INT) \quad 3$$

$$HC = f(PMS, AGO, DPK, GDPPC, INF, INT) \quad 4$$

Thus, the econometric representation is expressed as:

$$HDI_t = \alpha_{10} + \alpha_{11}LPMS + \alpha_{12}LAGO + \alpha_{13}LDPK + \alpha_{14}GDPPC + \alpha_{15}INF + \alpha_{16}INT + \mu_{t,1} \quad 5$$

$$LER_t = \alpha_{20} + \alpha_{21}LPMS + \alpha_{22}LAGO + \alpha_{23}LDPK + \alpha_{24}GDPPC + \alpha_{25}INFLR + \alpha_{26}INT + \mu_{t,2} \quad 6$$

$$HC_t = \alpha_{30} + \alpha_{31}LPMS + \alpha_{32}LAGO + \alpha_{33}LDPK + \alpha_{34}GDPPC + \alpha_{35}INFLR + \alpha_{36}INT + \mu_{t,3} \quad 7$$

where: μ = Disturbance Term, α_{10} , α_{20} , α_{30} = Intercept, $\alpha_{11} - \alpha_{36}$ = Coefficient of exogenous (independent) variable, t = Time, L = Logarithm.

According to Pesaran et al. (2001), equation (5 – 7) can be expressed in the unrestricted form of the ARDL model as presented below:

ARDL Model

$$\begin{aligned} \Delta LHDI_t = & \alpha_{20} + \sum_{k=1}^n a_{11} \Delta LHDI_{t-k} + \sum_{k=1}^n a_{12} \Delta LPMS_{t-k} + \sum_{k=1}^n a_{13} \Delta LAGO_{t-k} + \sum_{k=1}^n a_{14} \Delta LDPK_{t-k} \\ & + \sum_{k=1}^n a_{15} \Delta LGDPPC_{t-k} + \sum_{k=1}^n a_{16} \Delta LINFL_{t-k} + \sum_{k=1}^n a_{17} \Delta LINT_{t-k} + \lambda_{11} \Delta LHDI_{t-1} \\ & + \lambda_{12} \Delta LPMS_{t-1} + \lambda_{13} \Delta LAGO_{t-1} + \lambda_{14} \Delta LDPK_{t-1} + \lambda_{15} \Delta LGDPPC_{t-1} \\ & + \lambda_{16} \Delta LINFL_{t-1} + \lambda_{17} \Delta LINT_{t-1} + \mu_t \end{aligned} \quad 8$$

$$\begin{aligned} \Delta LER_t = & \alpha_{20} + \sum_{k=1}^n a_{11} \Delta LER_{t-k} + \sum_{k=1}^n a_{12} \Delta LPMS_{t-k} + \sum_{k=1}^n a_{13} \Delta LAGO_{t-k} + \sum_{k=1}^n a_{14} \Delta LDPK_{t-k} \\ & + \sum_{k=1}^n a_{15} \Delta LGDPPC_{t-k} + \sum_{k=1}^n a_{16} \Delta LINF_{t-k} + \sum_{k=1}^n a_{17} \Delta LINT_{t-k} + \lambda_{11} \Delta LHDI_{t-1} \\ & + \lambda_{12} \Delta LPMS_{t-1} + \lambda_{13} \Delta LAGO_{t-1} + \lambda_{14} \Delta LDPK_{t-1} + \lambda_{15} \Delta LGDPPC_{t-1} \\ & + \lambda_{16} \Delta LINF_{t-1} + \lambda_{17} \Delta LINT_{t-1} + \mu_t \end{aligned} \quad 9$$

$$\begin{aligned} \Delta LHC_t = & \alpha_{20} + \sum_{k=1}^n a_{11} \Delta LHC_{t-k} + \sum_{k=1}^n a_{12} \Delta LPMS_{t-k} + \sum_{k=1}^n a_{13} \Delta LAGO_{t-k} + \sum_{k=1}^n a_{14} \Delta LDPK_{t-k} \\ & + \sum_{k=1}^n a_{15} \Delta LGDPPC_{t-k} + \sum_{k=1}^n a_{16} \Delta LINF_{t-k} + \sum_{k=1}^n a_{17} \Delta LINT_{t-k} + \lambda_{11} \Delta LHDI_{t-1} \\ & + \lambda_{12} \Delta LPMS_{t-1} + \lambda_{13} \Delta LAGO_{t-1} + \lambda_{14} \Delta LDPK_{t-1} + \lambda_{15} \Delta LGDPPC_{t-1} \\ & + \lambda_{16} \Delta LINF_{t-1} + \lambda_{17} \Delta LINT_{t-1} + \mu_t \end{aligned} \quad 10$$

where α_0 represents drift component while Δ shows the first difference, ϵ_t shows the white noise. The ARDL framework allows the Bounds test to swiftly determine the cointegrating relation in small sample cases (Tang, 2003). For this study, 31 annual observations (i.e., 1992–2022) are explored, thus, the utilization of this approach is very appropriate. This technique is appropriate and flexible to any explanatory order

of integration, either I (0) or I (1) or mutually cointegrated while the endogenous variable is expected to be I(1).

4. Results and discussion of findings

4.1 Unit Root Test

Augmented Dickey Fuller was used for the Unit root testing. While the ADF unit root testing of intercept was employed.

Table 1. Augmented Dickey-Fuller Test in Intercept Model at Levels and First Difference

Variables	ADF		Critical Values @ 5%	Order of Integration
	@ Levels	@ First Difference		
ΔHLC	-6.232773	-10.17189	-2.981038	$I(0)$
ΔLER	-3.327708	-3.242398	-2.981038	$I(0)$
ΔHDI	-4.982585	-4.982585	-2.981038	$I(0)$
ΔPMS	-6.487597	-4.072172	-2.960411	$I(0)$
ΔDPK	-4.137580	-5.918442	-2.960411	$I(0)$
ΔAGO	-4.596531	-5.163246	-2.960411	$I(0)$
$\Delta GDP \text{ per Capita}$	-2.535574	-7.296125	-2.971853	$I(1)$
$\Delta InflRate$	-5.478869	-8.895983	-2.967767	$I(0)$
$\Delta IntRate$	-6.351619	-9.558443	-2.976263	$I(0)$

Source: Authors' Computation

Table 1 results indicate that all the variables of interests are stationary at levels except for the changes in GDP per capita that is stationary at first difference. The series are integrated in different orders, that is, a combination of both level and first difference stationarity. Thus, co-integration test is necessary to establish a long-run relationship. Hence, the study adopts an Autoregressive Distributed Lag Model (ARDL)

because one of the variables are integrated in order 2 (stationary at 2nd difference).

4.1.1 Bound Test for Co-Integration Test

The bound testing for the individual co-integration is in Table 2. The bound test compares the F-value of a model at 5% level with the lower bound and the upper bound values

Table 2. Bound Test for Co-integration Test

	F-statistic	K		Lower Bound	Upper bound
Model 1	13.63880	6	10%	1.99	2.94
Model 2	3.859597	6	5%	2.27	3.28
Model 3	94.86249	6	2.5%	2.55	3.61
			1%	2.88	3.99

Source: Authors' Computation

Based on the results of the bounds test, there is co-integration and there is long run relationship among the three models, since the F-statistic is greater than the upper bound at all levels of significance.

4.2 Interpretation of Short-Run Estimates

4.2.1 *Objective One*:-To determine the effect of changes in petroleum product prices on changes in household consumption in Nigeria.

Table 3. Short-Run Estimates of Changes in Petroleum Product Prices and HC

Dependent Variable: Changes in Household Consumption				
Variables	Coefficient	Std. Errors	T-Statistics	Prob.
<i>D(Changes in Infl. Rate)</i>	-0.001763	0.000933	-1.889503	0.0734*
<i>CointEq(-1)*</i>	-1.468206	0.107672	-13.63586	0.0000***

Note: ***, ** and * indicates 1%, 5% and 10% levels of significance respectively

Source: Authors' Computation

Changes in inflation rate is found to exert a significant negative effect on changes in household consumption [$\beta = -0.0018$; p-value = 0.07]. The statistically significant effect is negative; suggesting that about 0.002 unit increase in changes in household consumption in the short run resulted from a unit increase in changes in inflation rate.

The coefficient of the error correction term is negative and statistically significant. It confirms

the existence of a short-term relationship in the model and reveals that the speed of adjustment from short-term disequilibrium to long-term equilibrium is 147% implying that when there is any disturbance, convergence to equilibrium is relatively test with 147% of adjustment occurring in the first year. So, for an initial error of 1%, 147% of the error would be corrected in the first year.

Table 4. Long-Run Estimates of Changes in Petroleum Product Prices and HC
Dependent Variable: Changes in Household Consumption

Variables	Coefficient	Std. Errors	T-Statistics	Prob.
$\Delta HC(-1)$	-1.468206	0.160114	-9.169752	0.0000***
ΔPMS	0.001356	0.019205	0.070583	0.9444
ΔDPK	-0.000761	0.028410	-0.026790	0.9789
ΔAGO	-1.41E-05	0.000772	-0.018210	0.9857
$\Delta GDP \text{ Per Capita}$	2.300138	0.708496	3.246508	0.0040***
$\Delta Infl. \text{ Rate}$	0.005714	0.002439	2.342823	0.0296**
$\Delta Int. \text{ Rate}$	0.170727	0.170540	1.001095	0.3287
C	0.031737	0.031584	1.004852	0.3270
R-Squared	0.723461			
Adjusted R-Squared	0.612845			
F-Statistics	31.76650 (0.000315***)			
Durbin Watson	2.290122			

Note: ***, ** and * indicates 1%, 5% and 10% levels of significance respectively

Source: Authors' Computation

The significant values of the computed F-statistics [F-Stat. = 31.7665; p-value = 0.00032] provide evidence against the null hypotheses, implies that the overall regression result is statistically significant in the long run. Thus, the null hypothesis is rejected. Then, the study

concludes that changes in petroleum product prices have significant effect on household consumption in Nigeria.

Objective Two: To examine the relationship between changes in petroleum products prices and changes in life expectancy rate in Nigeria.

Table 5. Short-Run Estimates of Changes in Petroleum Product Prices and LER
Dependent Variable: Changes in Life Expectancy Rate (LER)

Variables	Coefficient	Std. Errors	T-Statistics	Prob.
$D(\text{Changes in PMS})$	-0.000178	5.38E-05	-3.303321	0.0042***
$D(\text{Changes in AGO})$	4.83E-06	2.38E-06	2.031554	0.0581*
$D(\text{Changes in Infl. Rate})$	2.43E-05	5.46E-06	4.438738	0.0004***
$D(\text{Changes in Int. Rate})$	-0.003375	0.000537	-6.281646	0.0000***
$CointEq(-1)^*$	-0.110995	0.012144	-9.140202	0.0000***

Note: ***, ** and * indicates 1%, 5% and 10% levels of significance respectively

Source: Authors' Computation

The results in Table 5 revealed that the Short-run estimation indicated that changes in PMS is negative but statistically significant at 1% level [$\beta = -0.0002$; p—value = 0.0042]. This implies that about 0.002 percent increase in changes in

life expectancy rate (LER) in the short run is due of 1 percent increase in changes in PMS.

Also, the short run effect of changes in automotive gas oil (AGO) is statistically significant at 5% level [$\beta = 0.000048$; p—value = 0.00581]. The statistically significant effect is

positive, suggesting that about 0.005 percent increase in changes in life expectancy rate (LER) in the short run is as a result of 1 percent increase in changes in automotive gas oil (AGO).

Short run effect of changes in inflation rates (Infl) is statistically significant at 5% level [$\beta = 0.00024$; p—value = 0.0004]. The statistically significant effect is positive which explains that about 0.0002 percent increase in changes in life expectancy rate (LER) in the short run is as a

result of 1 percent increase in changes in inflation rates.

The coefficient of the error correction term is negative and statistically significant at the percentage. It confirms the existence of a short-term relationship in the model and reveals that the speed of adjustment from short-term disequilibrium to long-term equilibrium is 11.1%.

Table 6. Long-Run Estimates of Changes in Petroleum Product Prices and LER

Dependent Variable: Changes in Life Expectancy Rate (LER)				
Variables	Coefficient	Std. Errors	T-Statistics	Prob.
<i>Changes in LER(-1)</i>	-0.110995	0.032253	-3.441361	0.0031** *
<i>Changes in PMS(-1)</i>	-0.000611	0.000343	-1.784992	0.0921*
<i>Changes in DPK</i>	0.001210	0.000362	3.339968	0.0039** *
<i>Changes in AGO(-1)</i>	9.92E-06	6.03E-06	1.644515	0.1184
<i>Changes in GDP Per Capita</i>	0.018726	0.003557	5.265219	0.0001** *
<i>Changes in Infl. Rate(-1)</i>	5.51E-05	1.43E-05	3.853893	0.0013** *
<i>Changes in Int. Rate(-1)</i>	-0.008442	0.002139	-3.947652	0.0010** *
<i>Changes in PMS</i>	-0.000178	0.000129	-1.374384	0.1872
<i>Changes in AGO</i>	4.83E-06	4.07E-06	1.185691	0.2521
<i>Changes in Infl. Rate</i>	2.43E-05	9.06E-06	2.676595	0.0159**
<i>Changes in Int. Rate</i>	-0.003375	0.001040	-3.243544	0.0048** *
C	9.58E-05	0.000288	0.332780	0.7434
R-Squared	0.991169			
Adjusted R-Squared	0.985454			
F-Statistics	173.4526 (0.000000***)			
Durbin Watson	1.127834			

Note: ***, ** and * indicates 1%, 5% and 10% levels of significance respectively

Source: Authors' Computation

From Table 6, the significant values of the computed F-statistics [F-Stat. = 173.4526; p-value = 0.0000] provide evidence against the null hypotheses, implies that the overall regression result is statistically significant in the long run.

Thus the null hypothesis is rejected. Then, the study concludes that changes in petroleum products prices have significant effect on life expectancy rate in Nigeria.

Objective Three: To investigate the impact of changes in petroleum products prices on changes in human development index (HDI) in Nigeria. From the Table 7, the short-run estimation indicated that changes in inflation rate is positive and significant at 5% level [$\beta = 0.0006$; p —value

$= 0.0248$]. The result implies that about 0.0006 percent increase in human development index (HDI) in the short run is due of 1 percent increase in changes in inflation rate.

Table 7. Short-Run Estimates of Changes in Petroleum Product Prices and HDI
Dependent Variable: Changes in Human Development Index (HDI)

Variables	Coefficient	Std. Errors	T-Statistics	Prob.
$\Delta(\text{Changes in Infl. Rate})$	0.000580	0.000239	2.426586	0.0248**
$\text{CointEq}(-1)^*$	-1.891889	0.059160	-31.97931	0.0000***

Note: ***, ** and * indicates 1%, 5% and 10% levels of significance respectively

Source: Authors' Computation

The coefficient of the error correction term is negative and statistically significant at the percentage. It confirms the existence of a short-term relationship in the model and reveals that the speed of adjustment from short-term disequilibrium to long-term equilibrium is

189.19%. This implies that when there is any disturbance convergence to equilibrium is relatively test with 189.19% of adjustment occurring in the first year. Therefore, for an initial error of 1%, 189.19% of the error would be corrected in the first year.

Table 8. Long-Run Estimates of Changes in Petroleum Product Prices and HDI
Dependent Variable: Changes in Human Development Index (HDI)

Variables	Coefficient	Std. Errors	T-Statistics	Prob.
$\text{Changes in HDI}(-1)$	-1.891889	0.155362	-12.17729	0.0000***
Changes in PMS	0.008801	0.008214	1.071465	0.2967
Changes in DPK	0.052774	0.012295	4.292366	0.0004***
Changes in AGO	-0.000224	0.000188	-1.191466	0.2474
$\text{Changes in GDP Per Capita}$	0.029253	0.136369	0.214511	0.8323
$\text{Changes in Infl. Rate}(-1)$	6.35E-05	0.000607	0.104577	0.9178
$\text{Changes in Int. Rate}$	0.202711	0.040922	4.953656	0.0001***
$\text{Changes in Infl. Rate C}$	0.000580	0.000476	1.219546	0.2368
R-Squared	0.015005	0.007746	1.937136	0.0670
Adjusted R-Squared	0.905118			
F-Statistics	0.867165			
Durbin Watson	23.84855 (0.000000***)			
	1.640108			

Note: ***, ** and * indicates 1%, 5% and 10% levels of significance respectively

Source: Authors' Computation

From 8, the significant values of the computed F-statistics [F —Stat. = 23.8486; p -value = 0.0000] provide evidence against the null hypotheses,

implies that the overall regression result is statistically significant in the long run. Thus, the null hypothesis is rejected. Then, the study

concludes that changes in petroleum products prices have significant effect on human development index in Nigeria.

5. Conclusion

The finding from this study led to the conclusion that changes in petroleum products prices has influences on human welfare in Nigeria. This is in tandem with some previous studies among which are Maku *et al.* (2018) and Sultan, et al. (2020). The study also affirmed that in the short run, the effect of changes in Premium Motor Spirit (PMS) and Automotive Gas Oil (AGO) on human welfare were negative and positive respectively while only the changes in Dual Purpose Kerosene (DPK) has a positive effect on human welfare in the long run in Nigeria. Thus, the people tend to be worse off and better off when there is increase in the prices of PMS and AGO respectively; but people welfare tend to improve on the account of changes in the DPK in Nigeria. Apart from this, the study observed that the relationship between the changes in inflation and human welfare has been negative in the short run but positive in the long run in Nigeria – therefore, a continuous increase in the price of goods and services would increase the costs of production and prices of finished products, consequently hurt the people in the short run but improve living standard when employment and income increase in the long run in Nigeria.

For the welfare of the citizens to continually improve, policy makers should implement policies aimed at influencing economic welfare in Nigeria with some level of consideration to stabilize petroleum products prices as a prominent energy source with inelastic demand. More so, the study showed no statistical evidence of increase in human consumption in Nigeria, therefore introduction of less expensive alternative sources of energy that is also renewable would ease the oil price vulnerability on Nigeria's economy and improve upon Nigerian's welfare.

Above all, in order to improve the standard of living in Nigeria, the study recommends that government should channel oil trade towards exportation of crude oil and finished petroleum products so as to expand oil revenue base of the economy, zero import expenditure on finished petroleum products, and reduce the domestic pump price of these products in Nigeria.

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