

## **An Analysis of the Relationship between Petroleum Prices and Inflation in Nigeria**

*Francis Danjuma Bobai*

Department of Economics,

Ahmadu .Bello University Zaria - Nigeria

[fdbobai@yahoo.com](mailto:fdbobai@yahoo.com)

+23408062481407

### **Abstract**

*The study examined the impact of increase of petroleum prices in the Nigerian economy. The methodology is empirical econometric analysis approach. Variable used for analysis were inflation rate and petroleum prices in Nigeria. These variables were considered appropriate indicators of petroleum products and inflation rate responses. The main tool of analysis was a multiple regression model which examines the relationship between petroleum prices and inflation in Nigeria from 1990-2011. Data on the variables were used to estimate parameters of the model through the OLS techniques. Estimates of model parameters were evaluated based on relevant statistics from the regression. The results shows positive relationship exists between PMS, AGO and inflation. PMS had more effect on inflation, while negative relationship exists between inflation and DPK. However, the overall effect showed increase in petroleum product price increase the rate of inflation in Nigeria.*

**Keywords:** *petroleum prices, inflation, error correction mechanism, variation, multiple regression*

### **1. Introduction**

The origin of the persistent rise in prices of goods and services can be traced to government and its use of the oil revenue. It is evident that export of petroleum earns valuable foreign exchange in Nigeria, and that petroleum and money are so important to modern living that shortages disrupt essential transactions. Indeed, the occasional petrol shortages experienced by Nigerian towns and villages due to inefficient distribution, which is as a result of incompetence and corruption on the part of bureaucrats and the business class. The links between petroleum and money are easily obvious. More important, a proper grasp of the relationship between the domestic and the world economy is essential to the identification of these relationships. The monetisation of petro dollars shows how closely related petroleum is to money stock, which in essence has direct bearing on the inflationary pressures in the economy (Sikkam 1999).

This annual growth rate of money supply especially in 1974 and 1975 far outstrips those of all the developed industrial countries as well as the developing countries of the world. Even compared with other OPEC countries where the growth rate of the money supply has been generally high, the recent growth rates of money supply in Nigeria is alarming. The alarming rate of money supply is influenced by the earnings from petroleum (Osagie 1981).

The oil industry is very important to the Nigerian economy. It provides among other things the greatest part of the foreign exchange earnings and total revenue needed for socio-economic and political development of Nigeria. The bulk of Nigerian crude oil is sold unrefined and when refined, the products range from petrol to heavy liquids for road tarring. Government has been the custodian of petroleum and its products in Nigeria. The persistent instability of crude oil prices in the global market has adversely affected all the sectors of the Nigerian economy negatively. This is because Nigeria is a monoculture economy.

From 1990 to 2011, the prices of petroleum products were reviewed more than ten times. The adjustment in 2000 under the democratically elected government marked a turning point in the economy as petrol moved up to ₦30 per litre, diesel to ₦29 and kerosene to ₦27. According to the government, the upward review of domestic prices of petroleum products was necessitated by the high spot market price of crude oil and the need for higher margins for the Nigerian National Petroleum Corporation (NNPC) to meet operational and capital costs.

The upward adjustments of petroleum products have resulted in inflation, high cost of living, and inequitable distribution of income in Nigeria. However, this has led to one major problem which is instability of the prices of goods and services in virtually all the sectors of the economy.

**Table A:** Empirical Econometric Analysis Data Inflation rate (INF), Premium Motor Spirit (PMS), Automotive Gas Oil (AGO) and Dual Purpose Kerosene (DPK).

Year	INF	PMS	AGO	DPK
1990	7.5	0.6	0.5	0.4
1991	12.7	0.7	0.5	0.5
1992	44.81	0.7	0.55	0.5
1993	57.17	3.25	3	2.75
1994	53.03	11	9	6
1995	72.81	11	9	6
1996	29.29	11	9	6
1997	10.67	11	9	6
1998	7.86	11	9	6
1999	6.62	20	19	17
2000	6.94	22	21	17
2001	18.87	22	21	17
2002	12.89	26	26	24
2003	14.03	40	38	38
2004	15.01	49	48	48
2005	17.85	65	60	50
2006	8.24	65	60	50
2007	5.38	65	60	50
2008	11.6	65	60	50
2009	11.5	65	145	50

2010	11.9	65	145	50
2011	12.6	65	145	50

**Sources:** Gbadamosi, R. Kupolokun, F. and Oluleye, O. (2007) A Story of The Deregulation of the Nigerian Downstream Oil Sector (PPPRA) No. 1/3 Sankuru Close off Rima/Gurara Street Maitama, Abuja.

Olorunfemi S, Natural gas option in Nigeria and International Monetary Fund World Economic outlook, 2010.

The table above shows the relationship between inflation and petroleum prices in Nigeria. The inflation rate as at 1990 was 7.5 percent. 1995 being the year with the highest rate of inflation was 72.81 percent; it seriously declined to 6.62 percent in 1999. In 2005 it was 17.5 percent as at the end of 2011 the inflation rate was 12.6 percent. While the prices of PMS, AGO and DPK per litre for each product in 1990 were 0.60 kobo, 0.50 kobo and 0.40 kobo as at 2011 the prices of the same product per litre were ₦65:00, ₦145:00 and ₦50:00.

## 2. Literature review

Siddy (1999) asserted that the causes of price instability is attributed to scarcity caused by refinery maintenance and rehabilitation problem, low capacity utilization, supply, and demand inequality. The political change that Nigeria went through, which turned over the administration and endured a lingering economic down turn is enough reason to cause price instability of oil products in Nigeria. The author opined that trailing oil products prices down to crude oil prices has revealed that the instability in the prices of oil products was due to cost of refining, storing, transporting distributing and inefficiencies in the process.

Mbendi (2000) argued that in theory, Nigeria's refineries capacity is sufficient to meet its domestic consumption requirement. In practice, however, according to the author, the country has experienced frequent shortage of refined products since it refineries have poor configuration and operation inefficiency. The author stated that it has been estimated that smuggling amounts to over 320,000 barrels per day largely to Benin Republic, Niger, Chad, and Cameroon. The author noted that Nigeria has become a large importer of light petroleum products, importing thousands of tons of refined products.

Onwioduokit and Adenuga, (2000) in their work "empirical analysis of the demand for petroleum products in Nigeria", were able to find that there has been perennial petroleum products scarcity in the country over the past few years; inadequate energy planning had compounded the problem of scarcity. The empirical findings reveal that urbanisation was one of the principal factors that have a positive impact on the consumption of liquified petroleum gas and premium motor spirit. The impact of urbanisation on the consumption of household kerosene is negative, showing that kerosene is not urbanisation elastic.

Ewa and Agu (2003) shared their view that the dominance of petroleum in Nigerian economy has led to instability in the economy, which as a result makes price instability of oil products to be more prevalent in Nigeria than other countries. The author observed that smuggling is attractive and profitable due to price differential. This act of smuggling oil products from Nigeria to her neighbouring countries is one of the factors which made price instability of oil products to be prevalent in Nigeria.

Nwosu (2009) in her work the impact of fuel price on inflation, which used the variance Autoregressive analysis model to asses the relative contribution of fuel price on inflation. The study used available

quarterly data series spanning 1995 to 2008. The finding of the study revealed that the policy of subsidizing the price of fuel should be continued so as to help cushion the economy from the adverse effects of oil-price shock.

Runl (2010) asserted that people say Nigeria is dominated by oil and they are right because Nigeria seems to be exporting nothing but oil. The government revenues are so dependent on oil, which has been managed quite protectively. But it's still extremely undesirable that internally generated revenue are such a small part of Nigeria's revenue because essentially, it means that all the revenues of the government is just coming down from heaven. It's like a gift and it is easy to waste a gift. The author noted that Nigeria is poor because of oil.

Arinze (2011) in his work "the impact of oil price on the Nigerian economy," he asserted that there is a direct relationship between fuel price increase and inflation rate in Nigeria and also recommended that more resources should be tapped to diversify the economy.

In this paper, effort has been made to look at the adverse effect of petroleum product prices increase on the Nigerian economy. Is the discovery of oil in the country a blessing or a curse to Nigerians? Works reviewed have shown concern in this area of study, while the main objective of the paper is to examine the effect of price increase of petroleum products on the Nigerian economy.

### **3. Data and Methodology**

This study perceives a relationship between petroleum product prices and inflation rate as postulated by the theoretical foundation and espoused in the analytical framework explored in section two, and that changes in petroleum prices cause changes in inflation rate in Nigeria. Consequently, causal research design is adopted to investigate the cause and effect relationship between the time series values of variables of the problem of research interest. Empirical econometric approach is adopted in analyzing data on the research variables. The data are indicators of petroleum product prices and inflation within the Nigerian context. Data collection procedure is nonprobabilistic. Data is extracted from the Statistical Bulletin of the Central Bank of Nigeria, Annual reports of private petroleum producing companies and papers presented on related issue. Based on the perceived causal relationship between the identified variables of the research problem of interest, a multiple regression model is specified to forge a link between the four sets of variables. The model is stochastic in nature in that the study recognizes the fact that other variables than those identified and included in the model are likely to exert influence on inflation rate. However, the variables included in the model are considered appropriate indicators of petroleum product innovations and inflation level, and used as classified from data source.

The collected data are used to estimate the specified model for numerical values of the coefficients of explanatory variables. The estimated model is discussed vis-à-vis stated a priori theoretical expectations about the sign of the numerical values of model coefficients. This provides insight into the nature and magnitude of the effect of a unit change in the respective explanatory variables on the response variable, and induce informed basis to conclude on the nature of the relationship between inflation and each of the indicator variables of petroleum product. Subsequently, the estimated model is evaluated for statistical significance and explanatory power. Discussion and evaluation of the model provide insight into the behavioural characteristics of the selected indicators of petroleum products and the effects on inflation and, thus, provide basis for acceptance or rejection of the research hypothesis, and the impetus for analysis of implications and policy relevance of findings and subsequent recommendations.

The empirical analysis process is anchored on the multiple regression model of the perceived functional relationship between inflation rate (INF as a proxy) and petroleum product (PMS, AGO and DPK as proxies). Numerical values of the model parameters are estimated via the ordinary least squares (OLS) techniques facilitated by the application Econometric Views (E-Views), software for empirical econometric analysis. The regression output includes other relevant statistics that enhance further analysis and evaluation. Estimates of model coefficients are evaluated for isolated and joint statistical significance based on t- and F-statistics respectively at 0.05 level of significance and relevant degrees of freedom. Explanatory power of the model, as a measure of goodness of fit and confirmation of overall statistical significance, is determined from the coefficient of determination (R-Square and adjusted R-Square). These statistics enhance insight into the extent to which the petroleum variables explain the effect on inflation rate during the study period.

#### 4. The Model

From theoretical perspective, the model says that inflation rate (INF as a proxy) depend on petrol (PMS), diesel (AGO) and kerosene (DPK). However, the inflation rate, INF, is a weighted combination of premium motor spirit (PMS), automotive gas oil (AGO) and dual purpose kerosene (DPK). The weights,  $\beta_1$ ,  $\beta_2$  and  $\beta_3$ , are the respective effects of a unit change in the increase in the prices of petroleum product on INF through price change. Thus, the INF is expressed as follows:

$$INF = \beta_0 + \beta_1PMS + \beta_2AGO + \beta_3DPK + ECM (-1) \quad \dots \quad (1)$$

$$\text{Where } ECM (-1) = INF - \beta_0 - \beta_1PMS - \beta_2AGO - \beta_3DPK \quad \dots \quad (2)$$

On estimation, the intercept ( $\beta_0$ ) and slope coefficients ( $\beta_1$ ,  $\beta_2$  and  $\beta_3$ ) are expected, a priori, to have positive sign,  $\beta_i$  ( $i = 0, 1, 2, 3$ )  $> 0$ , implying that inflation rate are expected to correlate positively with the increase in the prices of petrol, diesel and kerosene. While ECM is the error correction mechanism at lag one. Facilitated with the E-Views software, the model was estimated via the ordinary least squares (OLS) techniques, and the results obtained are presented and discussed in section five below.

#### 5. Discussion of Empirical Results

Estimation of model parameters is based on INF, PMS, AGO and DPK in Table A. The estimated model and relevant statistics for analysis are presented below.

**Table: B:** Coefficient estimated from equation 1

Variable	Coefficient	S.E	t-statistics	Prob
Intercept	-5.363	3.311	-1.619	0.1261
PMS	50.324	18.756	2.683	0.0170
AGO	9.702	5.958	1.628	0.1242
DPK	-34.372	17.061	-2.015	0.0622
ECM (-1)	-0.717	0.185	-3.882	0.0015

**Source:** Author's Estimation using Eviews 4.0.

R-Square = 0.533842

Adjusted R-Square = 0.409533

F-stat = 4.294483

Prob.(F-stat): 0.016342

Durbin-Watson stat = 1.294483

\* PMS, AGO and DPK are logged transformed while PMS DPK and ECM were lagged.

The interpretation of slope estimated in this study is straight forward because all variables have been transformed in their natural logarithms except inflation while PMS, DPK and ECM were lagged. The intercept ( $\beta_0 = -5.363$ ) suggests that inflation would perhaps stabilize negatively at zero value of PMS, AGO and DPK. By implication, the model suggest that a unit change in PMS has the potential to induce about 50.324 percentage change in the response of inflation rate in the same direction. Similarly one percentage change in AGO has the potential to induce about 9.702 percentage change in the response of inflation also in the same direction. This shows that a positive relationship exist between PMS, AGO and INF. However, a one percentage change in DPK is induce by -34.372 percentage change in the response of inflation indicating an inverse relationship between DPK and inflation, i.e dependent variable decrease by 34.372 percent. That is negative relationships exist between inflation and DPK in Nigeria. This is in line with the findings of Onwioduokit and Adenuga (2000). The Error Correction Mechanism is expected to be between zero and one, negative and significant, ECM from the study is (-0.717) and the t-value (-3.882) therefore it is significant and the expected value is close to one. Implying that inflation rate will adjust to change in petroleum products in the short-run at the rate of 72 percent. Durbin-Watson statistic (DW) of (1.29) indicates the presence of positive serial correlation. This is not unexpected since the government controls the prices of petroleum product in Nigeria. The causal variable exhibited power in explaining adjustments in inflation rate during the period, as indicated by the coefficients of multiple determinations. R-square of 0.533842 implies that about 53% of the total variation in inflation rate is explained by petroleum product prices included model. After adjusting for degree of freedom, these indicators still explain about 41% variation in inflation rates. The model exhibits a high explanatory power and thus is considered a good fit.

Smuggling and diversion of products from their approved destinations to neighboring country were these products are sold at higher prices and hoarding of the product in anticipation of an increase in prices is another cause of scarcity in the country. The rapid growth of population in the country and drift of people from rural to urban cities has seriously increased the demand for petroleum product in Nigeria while the supply of the product is unable to meet with the country's demand.

This is in line with the structuralist's view that inflation is inevitable in the less developed countries embarking on ambitious development programmes and is caused mainly by the characteristic structural imbalance in such countries. Major structural imbalance include: scarcity in the supply of some major goods and services, resource imbalance, (petroleum products). Above all, the results suggest that increase in the prices of petroleum products in Nigeria is one of the major causes of inflation.

## 6. Recommendations

Having established the fact that increase in the prices of petroleum product has serious impact on Nigerian economy, the paper recommends the following solutions:

1. Petroleum product serve as one of the major industrial input in the country the government should strive to see that the products are made available in the country all the time.
2. Cohesive measure must be implemented to deal with those who hoard or smuggle the product to other countries to create artificial scarcity.
3. The market forces should be allowed to determine the prices of petroleum product in the country this will mean total removal of subsidies. Even though the price will be high but with time it will adjust.
4. The federal government as well as the state and local government must begin to source fund from other sectors of the economy that is by tapping other resources in the country and stop to depend only oil as the main source of revue

## References

- Arinze P. E. 2011: "The impact of oil price on the Nigerian economy"  
www.transcampus.org/journals. *www.ajol.info/journals/jorind* JORIND (9)1
- Central Bank of Nigeria 2003: *Annual Report and Statement of Account*, Vol.12, CBN Publications.
- Central Bank of Nigeria 2005: *Economic and Financial Review*, Vol.14, CBN
- Gbadamosi, Kupolokun & Oluleye 2007 "*Deregulation of the Nigerian Downstream Oil sector*". Abuja
- Lukman, R. 1988. *OPEC and the Nigerian Petroleum Industry*
- Mba-Afolabi, J. 1999 "The Oil Price of Hike Blunder", *Newswatch*, January 18, pp. 8 – 16.
- Mbendi, M.L. 2000: "*Law and Petroleum Industry in Nigeria Lagos*", Nigeria: African Books Publishers.
- Olorunfemi, S. 2003 "*Natural Gas option in Nigeria Industrial Development Process*", CBN Economic and Financial Review, Vol.14.
- Onwioduokitanda E. A. and Adenuga O. 2000 "Empirical Analysis of the Demand for Petroleum Products in Nigeria". C.B.N 2000 Journal Publication pp 33-57
- Osagie. E 1981: *Petroleum and money* pp. 22-28.
- Nwankwo, G. O. 1981: Nigeria and OPEC To be or not to be pp. 6(1-112
- Nwosu, Chioma P. 2009 "Import of Fuel Prices on Inflation: Evidences from Nigeria". *Research Department, Central Bank of Nigeria* [SSRN: <http://ssrn.com/abstract=1365820>]
- Runl, O. 2010 "*Nigeria is poor because of oil alternative view publication of change Africa New work Africa Centre for Leadership Strategy and Development*", August, 2010.
- Sikkam B. S. 1999 "*Inflationary Effects of the Petroleum Industry on the Nigerian Economy*" pp 128-129