

The Effect of Petroleum Product Prices Adjustment on Inflation Rate in Nigeria (1980-2021)

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Abstract

This paper examined the impact of petroleum products price regulation on inflation rate in Nigeria using secondary data extracted from the Central Bank of Nigeria annual report and National Bureau of Statistics publications spanning from 1980 - 2021. Descriptive statistics, unit root test, Johansen cointegration test and error correction model were employed to analyse the collected data. The result showed that a 1% increase in the prices of PMS and AGO increased inflation rate by 0.073985 and 0.021989 respectively. Although, PMS recorded the highest positive value, the prices of PMS and AGO have no statistical significant impact on inflation rate in Nigeria within the period of this study. The simple interpretation is that, Nigeria becoming importer of petroleum products and other macroeconomics variables such as misguided exchange rate policy should be blamed for the level of inflation rate in Nigeria. Based on the findings, the following were recommended; Government should reduce PMS Price by truly deregulating the downstream sector and equally inspiring private company participation in crude oil refining in order to inspire competition thus bringing down the price of PMS. Government should make sure that the existing refineries are functioning at full capacity and also build new ones; by so doing the existing refineries can meet Nigerians internal petroleum products needs and export the excess. This can be made possible when the nation refineries Turn-Around-Maintenance are consolidated with transparency and accountability.

Keywords: *Petroleum Products, Price Adjustment and Inflation Rate.*

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1. INTRODUCTION

Nigerian constitutional administrations increased fuel prices a total number of 29 times. Most of the increase occurred in the 1990-2020 period when petroleum products prices were adjusted severally. The upward adjustments of petroleum products have resulted in inflation, high cost of living, and inequitable distribution of income in Nigeria. Between 1978 and 2007, the various Nigeria regimes increased fuel prices more than 22 times. One major problem this has caused was the instability of the prices of goods and services in the country. Whenever there is an increase in the prices of oil products, it affects transportation, cost of goods and services.

The challenges in the downstream subdivision of the nations' petroleum sector are a grave concern to most persons in the country. Experience has revealed that adjustment in PMS pump price has been on the increase (ascending drift) since 1970. Between 1970 and 1980 it increased from 3kobo to 15 kobo, in 1981, it increased from 20 kobo to 70 kobo in 1990, in 1991 it also increased from 70 kobo to ₦22 in the year 2000. Also, it was adjusted upward in the year 2001 from ₦26 to ₦97 in 2013. Presently, the same product range from ₦165 to ₦170 per liter. Dike (2007) observed that in the past years, Nigeria as a nation has been adjusting the price of petroleum products upwardly with the aim of removing fuel consumption subsidy in accordance to the free market system. The rise in fuel price could be of great challenge to firms who depend more on fuel as an input to power the factory machines in their production process.

This situation may affect the productivity of such firms that may be finding it hard to take care of their rising energy cost. This incessant increase in fuel price and its attendant effects on the economy and Government foot dragging in full deregulation of petroleum products such as Premium Motor Spirit (PMS) and Automated Gas Oil (AGO) informed the interest of the researcher in conducting this study. The study examined the impact of domestic pricing of PMS and AGO on inflationary pressure in Nigeria with a forty two (42) years' time frame (1980-2021) both years inclusive.

2. LITERATURE REVIEW

Many researchers reasoned that the causes of inflation in Nigeria are basically fiscal and monetary in perception. Accordingly, their focus on fiscal and monetary policy has been predicated on controlling the monetary aggregates, a policy stance which has largely been based on the belief that inflation is essentially a monetary phenomenon. Targeting inflation through monetary variables seems to have yielded protracted results. It becomes expedient to examine the persistent increase in the prices of petroleum products on the level of inflation in Nigeria. One area of value that strengthens justification for this study is its relevance to the Nigerian economy. This study recognizes the significance of the multiplier effect increase of domestic petroleum product prices have on the prices goods and services in the economy. Also, the study adds value in both theoretical and empirical result. The innovations introduced are more likely to generate better empirical results. This study serve as reference for future study and can give insight to Central Bank of Nigeria (CBN) and policy makers that persistent increase in petroleum product prices serves as a major cause of inflation in Nigeria. Thus the need to carry out such a study on a continuous basis in an economy becomes topical as any other economic issue of national discourse.

Several scholars in the past have talk extensively on the issue of incessant effect of price changes on petroleum products in Nigeria but most of them have failed to capture its effect on the inflation rate in Nigeria. Ogunbodedi, Ilesanmi and Olurankinsa (2010), only limit their work to

price hike of petroleum products crisis and transportation system. Hammoudeh and Reboredo (2018) examined the link between oil prices and market-based inflation expectations in the United States. Using linear ARDL model, the study found that the impact of oil price changes on inflation expectations is more intense when oil prices are above a threshold of 67 USD per barrel. Shaari et al. (2018) investigated the effects of retail selling prices of petrol and diesel on inflation in Malaysia using monthly data from 2010 to 2015. The ARDL result shows that there are significant effects of retail selling prices of petrol and diesel on inflation in the long run.

Binder (2018) examined the dynamics of consumers' gas price and inflation expectations using data from the Michigan Survey of Consumers (MSC). Employing Panel Analysis, the findings revealed that, consumers on average view gas price and inflation as negatively correlated and they do expect gas price inflation to feed into future core inflation, but this quickly decreases with forecast horizon. Živkov et al. (2018) investigated the impact of oil price changes on inflation in Central and Eastern European countries with a monthly time-series data from January 1996 to June 2018. The study applied wavelet-based Markov switching approach, and found that exchange rate does not significantly affect inflation in the process of transmission mechanism between oil price and exchange rate unless there is depreciation in the exchange rate.

In other sets of cross countries analysis, Bala and Chin (2018) investigated the linear relationship between and impact of oil price on changes in inflation in Algeria, Angola, Libya, and Nigeria for the period 1995 to 2014. They employed the ARDL dynamic panel and the result shows that there is positive and significant relationship between money supply, exchange rate, Gross Domestic Product (GDP) and inflation; while food production shows a negative and significant impact on inflation.

Anwar, Khan, and Khan (2017) studied the impact of oil price increase on persistent increase in price level in Pakistan from a period of 2002:1 to 2011:12. The study employed ordinary least square method and the result shows that there exist a positive and significant impact of oil price on inflation while exchange rate also shows a significant impact; however, it has a negative relationship with inflation. Also, Using granger causality test, Rangasamy (2017) investigated how the movements in the petrol price affects inflation in South Africa using yearly data from January 1976 to December 2015. The result of the Granger causality test and the Auto-Regressive Distributed Lag Approach (ARDL) revealed that petrol price has significant impact on the level of inflation, and this is not only so, as oil price also granger causes other prices in South Africa.

Eregbe et al (2017) they discovered that there exists a positive relationship between oil price and inflation. In this study, it was found that the price of Premium Motor Spirit (PMS) remained stable until the entry of the military into the administration of the country when the then military heads of state arbitrarily increased the prices of petroleum products. They also found that there exists high positive relationship between the prices of PMS, AGO and inflation in Nigeria. Therefore, they concluded that rises in petroleum products prices, especially PMS and AGO, significantly impact inflation in Nigeria.

Malik (2016) investigated how oil price affect inflation in Pakistan with data from 1979:1 to 2014:12. The study employed Augmented Phillips curve framework and the study revealed that, continuous increase in oil price have a strong relationship with inflation. Omoke and Ugwuanyi (2015) tested the relationship between money, inflation and output by employing co integration and Granger-causality test analysis. The findings revealed no existence of a co integrating vector

in the series used. Money supply was seen to Granger cause both output and inflation. The result suggest that monetary stability can contribute towards price stability in Nigerian economy since the variation in price level is mainly caused by money supply and also conclude that inflation in Nigeria is to much extent a monetary phenomenon. They find empirical support in context of the money-price-output hypothesis for Nigerian economy.

Akinleye and Ekpo (2013) examined the macroeconomic implications of oil price shocks on macroeconomic performance in Nigeria. The study employed the vector autoregressive estimation technique and observed that both positive and negative oil price shocks influence real government expenditure only in the long run rather than in the short run. It also found that positive rather than negative oil price shocks have stronger short and long run effects on real gross domestic product, thereby triggering inflationary pressure and domestic currency depreciation in the process as importation increases. The study posits that crude oil price shocks are capable of impeding economic growth only in the long run while raising general price levels marginally in the short run leading to exchange rate depreciation and high importation.

Also, Subhani et al. (2012) investigate the connection among crude oil price and inflation in Pakistan using annual time series-data from 1980 to 2010. The result reveals that, crude oil price granger causes inflation and inflation does not granger causes crude oil price in Pakistan for the period of study.

Ehinomeri and Adeleke (2012) shared their views that the distribution of petroleum products in the Nigerian economy is fraught with complex problems resulting sometimes in products outages, inflated price of products and contentions on the pump price of products. Their research examines the various issues regarding the distribution of products and recommends that the downstream activities of the industry be completely deregulated to allow private sector and entrepreneur's full participations in the distribution of the products. Their findings hypothesized that the participation of entrepreneurs will drive effectiveness into the sector. This effectiveness will bring down operations cost as well as the price level for the benefit of all the stake-holders in the country.

Bobai (2012) analyzed the relationship between petroleum prices and inflation in Nigeria. The study focused on the impact of petroleum product price increase on the Nigerian economy from 1990 to 2011. Employing the empirical econometric analysis approach and using variables like inflation rate and petroleum prices, the results shows that positive relationship exists between PMS, AGO and inflation. It however found PMS to exert higher effect on inflation than AGO, while negative relationship exists between inflation and DPK. The overall effect clearly indicates that increase in petroleum product price contributes significantly to the rate of inflation in Nigeria.

Arinze (2011) focused on the impact of oil price on the Nigerian economy. The study contends that upward review of petroleum products prices have resulted in inflation, high cost of living, and inequitable income distribution in Nigeria between the period of 1978 and 2020. The study revealed that petroleum price increase spur inflation rate to increase also. It therefore recommended diversification of the Nigerian economy to curb macroeconomic instability which may arise from over dependence on crude oil.

Orgunbodede et al (2010) studied petroleum price crisis and the Nigerian public transportation system. The study claimed that incessant petroleum products price hike led to crisis and industrial actions in the country. They used perception scale on a 4-point Likert scale to elicit

response from the operators of public passenger transport system using a 4-point Likert scale. The Mean Weight Value (MWV) was compared with the Group Arithmetic Mean (GAM) of each group and the results indicated that price increase significantly increased transport fare and fuel hoarding in Nigeria.

Nwosu (2009) researched into the impact of fuel price on inflation. The study employed the variance Autoregressive analysis to assess the relative contribution of fuel price on inflation. Result from the study showed there exist a positive relationship between fuel price and inflation and therefore advocated that the policy of subsidizing fuel price should continue in Nigeria so as to help cushion the economy from the adverse effects of oil-price shock. Labys (2006) observes that higher oil prices can lead to higher inflation, lower corporate profits, higher unemployment and reduced national economic growth. Higher price volatility can lead to a reduction in investment, leading in turn to a long term reduction in supply, higher prices, and even reduced macroeconomic activity.

3. METHODOLOGY

This study employed the quasi-experimental research design. In this type of design, like the experimental design method used in the natural sciences, researchers depend on data analysis techniques as a method of control. Specifically, it adopted the time - series type of the quasi-experimental design. This is because the time - series design is the most predominant design employed in the social sciences. According to Frankfort-Nachmias and Nachmias (2009), “in time - series designs, multivariate methods of statistical analysis such as elaboration by descriptive, multiple regression, and path analysis are the most common alternatives to experimental methods of control and the drawing of causal inferences”. This type of design will be adopted because it allows researchers to make statistical inferences to broader statistical variables and permit them to generalize their findings to real-life situations, thereby increasing the external validity of the study.

In terms of strategy, this study employed the econometric technique of Ordinary Least Square Multiple Regression (OLS), Unit Root Test, and Co-Integration. Our choice of OLS is informed by its quality of Best, Linear, Unbiased and Efficiency (BLUE). Unit Root test will be used to test for stationarity, while Co-integration will be employed to test for long run relationship among the variables.

Model Specification

The theoretical framework of this work is anchored on the Çatik and Önder (2011) augmented backward looking short-run Phillip curve equation, which is specified as:

$$i = \alpha(L)i_{t-1} + \mu(L)y_t + \delta(L)\Delta oil_t + \varepsilon_t \dots \dots \dots (1)$$

Where i is inflation; y is the output gap; oil is oil price and ε is the aggregate supply curve. Also, $\alpha(L)$, $\mu(L)$, $\delta(L)$ are the polynomials in the lag operator (L) of inflation rate, output gap and oil price inflation, respectively (Salisu et al., 2017) The estimated coefficients of all parameters; α , μ , and δ are expected to be positive (Çatik and Önder, 2011), even as the magnitude of the coefficient of δ depends on the structure of the economy and lies between 0 and 1 (Marquez and Pauly, 1984). This implies that the closer the coefficient to 1, the higher the degree of oil price pass-through and vice versa. Further, is the argument that oil pass-through could be asymmetric due to an oligopoly structure (Meyer and Cramon-Taubadel, 2004), policy environment or regulation (Ibrahim, 2015), and cost structures or market power (Karantininis et al., 2011).

The Model

$$\text{INFR}_t = f(\text{PPMS}, \text{PAGO}) \dots \dots \dots (2)$$

Linearizing the function gives multiple regression equation below as:

$$\text{INFR}_t = b_0 + b_1\text{PPMS}_{t-1} + b_2\text{PAGO}_{t-1} + U_t \dots \dots (3)$$

Apriori Expectation $b_0, b_1, b_2, > 0$

Where,

INFR = Inflation Rate

PPMS = Prices Premium Motor Spirit

PAGO = Prices of Automotive Gas Oil

b_0 = Constant

b_1, b_2 = Coefficients

t = is the time trend

U_t = Error Term

The data used for this study came primarily from secondary sources. Publications of the Central Bank of Nigeria's (CBN) Annual Reports and Statement of Accounts; Economic and Financial Review: and Principal Economic Indicators. Furthermore, publications from the National Bureau of Statistics (NRS): Annual Abstract of Statistics and World Development Index (WDI). Empirical investigations were carried out on the basis of a sample of 42 annual observations covering the period 1980 – 2021. Three (3) variables were considered in this study: Two basic techniques were employed in the analysis of the study. They are descriptive as well as econometric method of analysis (Ordinary Least Square OLS). In order to achieve this, the study used unit root test, co-integration modeling technique to analyze the relationship.

4. DATA PRESENTATION AND ANALYSIS.

Equation 3 above is estimate of the basic model of inflation rate and petroleum products prices variations. The result of the model is presented below.

Table 1. Regression of Inflation Rate and Prices of Petroleum Products

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	20.14524	3.508481	5.741870*	0.0000
PPMS	0.204097	0.119730	1.704649	0.0964
PAGO	-0.169067	0.086641	-1.951350	0.0584

$$R^2 = 0.147951 \quad R^{-2} = 0.080684 \quad F^c = 2.199466 \quad \text{Prob}(F\text{-statistic}) = 0.103972 \quad DW = 0.814734$$

Source: Author's computation

Note: t^ means significant at 5% level of significance so also the rule apply to the F-statistics.*

Interpretation of table 1

Coefficient of variables: PPMS (Price Petroleum Motor Spirit): for a unit point increase in PPMS, then INFR (Inflation Rate) will increase about 0.204097 percent.

PAGO (Price Automotive Gas Oil): for a point increase in PAGO, then INFR (Inflation Rate) will decrease by about 0.169067percent. R^2 (coefficient of determination): R^2 with the values of 0.15 indicated that 15 percent of systematic variations in Nigeria Inflation Rate could be explained by the explanatory variables viz: Price Petroleum Motor Spirit and Price Automotive Gas Oil. The remaining 85percent could be attributed to some other forces affecting INFR outside the models. This signified a weak of fit.

T-statistics: revealed that none of the explanatory variables is statistically significant at 5% level; **F- statistics:** from the tables also shows overall significance of all the variables in the model and this indicate that collectively both explanatory variables are not important determinant of Inflation Rate.

DW test (serial autocorrelation): table value DW at 5% level of $k=3$ $N=41$ gives $DL=1.24$ $DU=1.73$ indicating the presence of autocorrelation.

As incongruous as the above OLS results might be, it can be misleading to draw a conclusion in the analysis of a regression result due to stochastic trend of time series data therefore the need to test for the stationarity of the data sets.

The Unit Root (Stationarity) Results

Macroeconomic data usually exhibit stochastic trend that can be removed through only differencing. The Phillips-Perron test statistic (PPTS) was employed to test the order of integration of the variables. The regressions were run for all the series at both level and first difference and, with constant and trend in the equation. As usual, the appropriate lag level applied in the unit root test follows the SIC criterion. The results of the PPTS test are presented in the table below.

TABLE 2. The Stationarity Test in Summary and the Order of Integration

Variables	Phillips-Perron test statistic	5% Test critical values	Remark	Order of Integration
INFR	-2.959736***	-2.935001	Stationary	I(1)
PPMS	-15.00335***	-2.936942	Stationary	I(1)
PAGO	-6.540752***	-2.936942	Stationary	I(1)

Source; author's computation

Note:*** statistically significant at 5%, Significant levels.

The unit root result above shows that both variables were stationary at first difference i.e. I(1) series. The result from the stationary test therefore calls for long run relationship.

Johansen Co-Integration Test

The co-integration test establishes whether a long-run equilibrium relationship exist among the variables. To establish co-integration, the likelihood ratio must be greater than the Mackinnon Critical Value @ 5% levels of significance and the co-integrating equation is chosen from the normalized co-integrating coefficient with the lowest log likelihood.

Table 3 Johansen Co-integration Result of Inflation Rate and Prices of Petroleum Products

Maximum Eigen Value	Trace Statistics	5% Critical Value	Probability	Hypothesized No. CE(S)
0.481431	56.77063	47.85613	0.0058	$r = 0^{**}$

0.353674	30.50331	29.79707	0.0414	$r \leq 1^{**}$
0.261911	13.04528	15.49471	0.1132	$r \leq 2$
0.022192	0.897676	3.841466	0.3434	$r \leq 3$

Source: Author's Computation.

***denotes rejection of the hypothesis at 5% significance level*

Using the trace statistics, table 3 shows two co-integrating equations at 5% significance levels. This implied that long run relationship exists among the variables. This led to the rejection of the hypothesis of no co-integration. Co-integration is a prerequisite for the error correction mechanism. Since co-integration has been established, it is pertinent to proceed to the error correction model

Error Correction Representation (Short- run)

This section deals with error correction estimation of the relationship among the series, since we have evidence of co-integration among the series through Johansen Co-integration Test. The ECM results are depicted as follows:

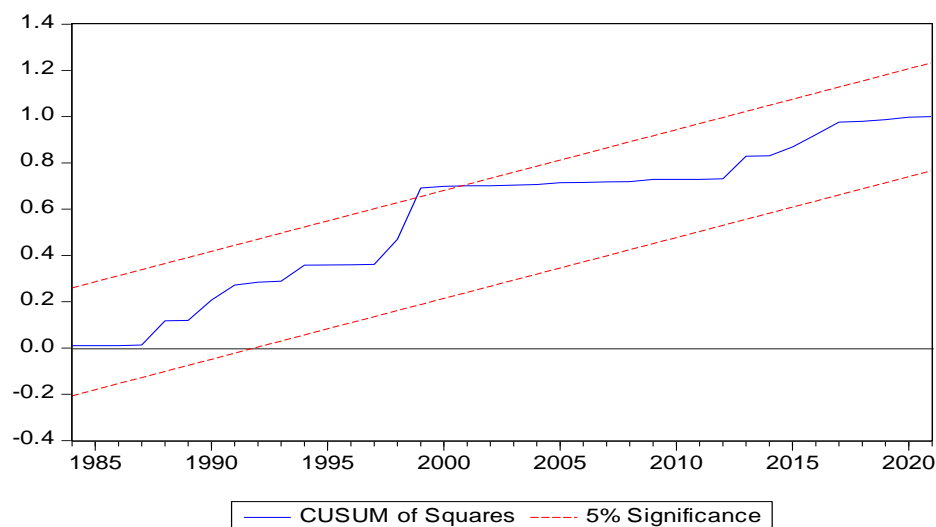
Table 4. ECM RESULT FOR INFLATION RATE MODEL

Variables	Coefficient	Standard Error	t-statistics	Prob. Value
C	-0.654603	2.440917	-0.268179	0.7903
D(PPMS)	0.296081	0.093399	3.170071	0.0033
D(PPMS(-1))	0.073985	0.097555	0.758396	0.4538
D(PAGO)	-0.034502	0.100191	-0.344368	0.7328
D(PAGO(-1))	0.021989	0.098426	0.223406	0.8246
ECM(-1)	-0.400065	0.140972	-2.837908	0.0078
$R^2 = 0.358812$	$R^2 = 0.218552$	f-statistics =2.558196	Prob. F-statistics =0.032717	DW=1.487918

Source: Author's computation using E-Views 9.0

Stability Test

The stability test is conducted to confirm the stability of the coefficients of the independent variables. The CUSUM of Squares Test was used to test the firmness of the coefficients.



The result obtained from the stability test from the above showed that there is evidence of stability of the coefficient at 5% level of significance in CUSUM of Square test since the cumulative sum is inside the area between the two critical lines.

Implication of Empirical Results

PPMS: The ECM result indicates that PPMS has a positive but statistically insignificant effect on inflation rate; an increase PPMS means a statistically insignificant increase in inflation rate by 0.073985. PAGO also positively and insignificantly impacted inflation rate in Nigeria by 0.021989. This result shows that a unit increase in the prices of PMS and AGO will insignificantly increase inflation rate by 0.073985 and 0.021989 respectively. The positive impact of PMS on inflation rate shows that out of both products studied, PMS has the highest impact on inflation rate. This gives evidence to the fact that virtually all economic activity such as transportation, electricity generators, and some light machineries exclusively depend on PMS for optimum running. The Error Correction Mechanism is expected to be between zero and one, negative and significant, The ECM coefficient exhibited the hypothesized negative sign (-0.400065). The speed of adjustment to long run steady state is about 40 per cent and importantly, it is statistically significant at 5 per cent level judging by the corresponding probability value of 0.0078 which is less than the conventional 0.05 level. The variables in the model explained about 36 per cent of total variation in inflation rate.

The combined impact of the both explanatory variables judging from the ECM model is significant as evident from the F-statistic value of about 2.55819 and a corresponding probability value of 0.032717. The Durbin Watson value of 1.487918 or approximately 1.5 indicates the presence of positive serial correlation. This is not unexpected since the government controls the prices of petroleum product in Nigeria.

The basic implication of these results is that, forces beyond government pump price increase could be held responsible for inflation rate in Nigeria. Such factors could include hoarding of petroleum products by independent marketers, smuggling of products across national boundaries of Nigeria nation, inability of the four government refinery to meet up daily demand of petroleum products and imported inflation rate brought about by Nigeria being also an importer of petroleum products. The crux is that being an importer of petroleum products, the exchange rate of Naira in terms of other international currencies fuel what is known as imported inflation into the domestic economy of Nigeria nation. This is what purchasing power parity (PPP) seeks to explain in economics. PPP computes an inflation and exchange rate as the ratio of the price of the basket in one location to the price of the basket in the other location.

5. SUMMARY, FINDINGS AND RECOMMENDATION

In this study, we have empirically investigated the effect of petroleum products prices adjustment on inflation rate in Nigeria for the period 1980-2021. In order to achieve the above, the study adopted an error correction mechanism approach. Empirical investigation of the trends of petroleum products prices adjustment in Nigeria using graph showed that the prices of PMS and AGO in Nigeria has recorded a continuous upward movement from 1980-2021. Statistical evidence shows that prices PMS and AGO had a positive but insignificant relationship with inflation rate in Nigeria. Only 36 percent variations in the INFR could be explained by the model (products prices adjustment). Although, the combined impact of products prices could affect domestic consumers' prices index (inflation rate). However, Nigeria dual roles as exporter of crude oil and at the same time importer of petroleum products should be blame for importing

inflation via exchange rate of naira to other international currencies into her economy.

Having recognized the fact that increases in the prices of PMS and AGO have an increase but insignificant impacts on Nigerian inflation rate, the study therefore recommends the following:

1. Petroleum products has a derived demand i.e. it serve as one of the major domestic and industrial input in the country, the government should strive to see that the products are made available in the country locally through local refineries all the time.
2. Government should reduce PMS Price by truly deregulating the downstream sector and equally inspiring private company participation in crude oil refining in order to inspire competition thus bringing down the price of PMS.
3. The distribution channel of the flow of the petroleum products should be well monitored to avoid disruption of distribution or scarcity. Concerted measure must be employed to deal with those who hoard or smuggle the product to other countries thereby creating artificial scarcity.
4. The forces of demand and supply should be allowed to regulate the prices of petroleum products in the country rather government arbitrarily manipulation of prices.
5. Government should make sure that the existing refineries are functioning at full capacity and also build new ones; by so doing the existing refineries can meet Nigerians internal petroleum products needs and some excess for export. This can be made possible when the nation refineries Turn-Around-Maintenance are consolidated with transparency and accountability.
6. The independent marketers and their marketing activities should be well regulated and controlled.

Exchange rate could be referred to as a key determinant of inflationary level in Nigeria. Its fluctuation affects the Nigerian economy because we are an importing nation. We depend so much on import for our goods and petroleum products. Nigerian as a sovereign nation depends so much on imported goods including petroleum products. A direction of exchange rate gets our economy destabilized particularly in terms of inflation.

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