

MULTIVARIATE ANALYSIS AND MODELING THE EFFECT OF THE GDP OF NIGERIA ON THE PETROLEUM PRODUCT PRICES (1987-2018)

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Abstract:

The study presented multivariate analysis and modeling of the effect of the GDP of Nigeria on the Nigerian petroleum product prices from 1987 to 2018. The petroleum products considered as the response variables were the Premium Motor Spirit (PMS(Y1), Automotive Gas Oil (AGO(Y2)) and Dual Purpose Kerosene (DPK(Y3)) while the predictors were GDP(Z1), Total Reserve(Z2), External Debt(Z3), Gross National Expenditure(Z4) and GDP/Capita(Z5). These predictors were studied in pairs on the responses and also studied jointly with all the five predictors on the responses. Comparisons were made among the pairs, also, each pair was compared with the joint analysis. SPSS software was used in the analysis in which Pillai's Trace, Wilks' Lambda, F-value, P-value, coefficient of determination and sum of square errors were applied to determine the contributions of each predictor variable in the models built, to the petroleum product prices. Correlation and covariance analysis were also applied to know the joint effects of the variables. It was observed that PMS was greatly affected by the economic policies of Nigeria, same to the AGO and then DPK. PMS is insignificantly impacted in an economy with two indicators where GNE is involved. PMS and AGO proved better than DPK in the economy of Nigeria. The relationship between GDP on Total reserve or External debt is positive. That is to say, any increase in these variables will result to an increase in the petroleum product prices. Correlation and Covariance analysis revealed that the analysis between GNE and External debt proved to be the worst pair. The analysis on all the five predictors, GNE and External Debt, Total Reserve and External Debt, Total Reserve and GNE and Total Reserve and GDP had no negative correlation, while GDP and GNE had negative correlations between AGO and DPK and AGO and PMS, also, GDP and GDP/Capita and GDP and Total Reserve recorded negative correlation respectively between PMS and AGO and AGO and PMS.

Keywords: *Petroleum products prices, GDP, GNE, Total Reserve, External Debt, economy*

1. INTRODUCTION

The petroleum products are mainly used industrially for the production of goods and services, such products are also used in our homes for many purposes, such as cooking (Dual Purpose Kerosene DPK) and (Automotive Gas Oil AGO), in Vehicles and Generators (Premium Motor Spirit PMS) etc. The importance of crude oil to Nigerian economy cannot be over emphasized, because it has the highest share in the economy of Nigeria as seen in Amagoh et al (2014) and Francis (2012). Eregha et al (2016) stated that petroleum sector accounts for over 90% of the foreign exchange earnings and gives jobs to Nigerians. See CBN (2010). The National Petroleum Corporation (NNPC) established on first of April, 1977 was given the mandate of the exploration

of oil in Nigeria and was charged with the powers of refining, transporting, and marketing the products of the crude oil exploration. The activities of NNPC and its subsidiaries were regulated by the Department of Petroleum Resources (DPR), it ensures compliance with the regulations of the industry and process applications for permits, licenses and leases. Crude oil has become one of the strongest indicators of worldwide economic activities according to Amagoh et al (2014), this was as a result of its ability in the supply of energy demand in the world. Prices of oil are usually not fixed and it is always dependent on the share of the cost of oil in the general GDP and the level of the countries' dependence on the product consumption on a domestic basis and its alternatives in obtaining the product.

Onu (2020) stated that PMS is highly affected by the economic development of Nigeria than the AGO and the DPK. Also, that PMS performs poorly in an economy paired where GNE is involved. The subsidy in PMS reduces the positive effects of PMS on the economy, thereby making AGO and DPK to perform optimally in some quarters.

Aliyu (2004) argued that the increase in price of the crude oil is considered positive for countries exporting oil and negative for countries importing oil and the reverse should be expected when the oil price decreases, all things being equal. But in Nigeria today, the masses suffer in both ways because if the price of crude oil is increased in the international market, Nigeria as an oil exporting country benefits from the high cost, but pays high to import the finished products from foreign countries, thereby making the end product of crude oil PMS, DPK, AGO etc, to be sold with high prices in our flow stations. Since the discovery of oil in Oloibiri in Bayelsa State, Nigeria in 1956 according to Monday et al (2016), the Gross Domestic Product of the country have been highly dependent on the petroleum products, thereby making Agriculture which was the main stay of the countries' economy to be under founded and attention been shifted to the petroleum products. Many researchers have studied the effect of price shock on the Gross Domestic Product GDP. Some of these studies include; macroeconomic implications of oil price shocks on macroeconomic performance in Nigeria, petroleum product prices and inflationary dynamics in Nigeria, relationship between energy pricing and finance, petroleum product pricing and complementary policies; experience of 65 under developed countries, and impact of oil price on Nigerian economy and On the pairwise multivariate analysis of Nigerian economy and the petroleum products prices. Some of these researches conducted in Nigeria did not take into consideration the actual areas of the Nigerian economy, while some of the researches were conducted outside Nigeria, where the economy of Nigeria was not considered. Amagoh et al (2014) who considered some other aspects of the Nigerian economy like GDP, Total reserve, external debt, Gross national income, Gross national expenditure and GDP per capita on the prices of the petroleum products, did not consider pairing the predictors on the response variables and compare the result with what was obtained when all the five predictors which are Gross Domestic Product(Z1), TOTAL RESERVE(Z2), EXTERNAL DEBT(Z3), GROSS NATIONAL EXPENDITURE(Z4) and GDP/CAPITA(Z5) were used together on the response variables. Here we will consider the effect of GDP(Z1) and EXTERNAL DEBT(Z3) on the response variables, GDP(Z1) and TOTAL RESERVE(Z2) on the response variables, GDP(Z1) and GROSS NATIONAL EXPENDITURE(Z4) on the response variables, GDP(Z1) and GDP/CAPITA(Z5), GDP/CAPITA(Z5) and TOTAL RESERVE(Z2), TOTAL RESERVE(Z2) and GROSS NATIONAL EXPENDITURE(Z4), TOTAL RESERVE(Z2) and EXTERNAL DEBT(Z3), GROSS NATIONAL EXPENDITURE(Z4) and EXTERNAL DEBT(Z3), EXTERNAL DEBT(Z3) and GDP/CAPITA(Z5) and GROSS NATIONAL

EXPENDITURE(Z4) and GDP/CAPITA(Z5), finally consider the three, PMS, AGO and DPK on the five economics variables from 1987 to 2018. We then compare the effects of each pair on the economy when the other variable is not significant or classified as error, may be due to unavailability of data. We compare each pair with the three responses and draw conclusion. Also Onu (2020) considered the pairwise multivariate analysis of Nigerian economy and petroleum products prices, here, he studied the effects of the petroleum products prices on the paired economic variables, but the study did not consider comparing the paired analysis with the analysis of all the five economic variables, it is against this backdrop this work was presented.

The study is aimed at determining the effect of petroleum prices (PMS, AGO and DPK) on some economic variables in pair when the other is insignificant or unavailable in other to determine the overall impact of these pairs on the Nigerian economy and compare the result with what is obtained when all the five predictors are considered. The study will consider the data of petroleum product prices as response variables from 1998 to 2018 on the economic variables such as GDP, Total reserve, External Debt, Gross national expenditure and GDP per capita. The petroleum products considered in this study are the premium motor spirit (PMS), popularly called fuel, the Dual Purpose Kerosene (DPK) simply called Kerosene, and the Automotive Gas Oil (AGO). Ten different multivariate multiple linear regressions with two predictors shall be analyzed and one multivariate multiple linear regression with five predictors shall also be considered.

2. MATERIALS AND METHODS

We designed this study to analyze the effects of the petroleum products' prices on the economy of Nigeria using multivariate settings. Analyzing the data by the use of Ordinary Least Square (OLS), Pillai's trace, Wilks' Lambda statistic, F-statistic, P-test statistic, covariance approach, correlation approach and coefficient of determinant were considered, whose methods are shown in the following sections. The analysis will be carried out using SPSS multivariate Software package.

The secondary data used in this research was an annual data obtained from National bureau of Statistics 2017, National bulletin, Amagoh et al (2014) and it spanned through 1987-2018, making 32 years' period covered in the research.

The multivariate multiple linear regression is one with more than one response variables and more than one predictor as seen in Richard and Dean (2002).

The multivariate processes are expressed as seen in Ilesanmi and Olurankinse (2010) and Amagoh et al (2014) as

$$Y_{nxm} = \begin{pmatrix} y_{11} & \cdots & y_{1m} \\ \vdots & \ddots & \vdots \\ y_{n1} & \cdots & y_{nm} \end{pmatrix} \quad (1)$$

Where Y_{nxm} represents the responses

The predictors can be given as

$$X_{nxm} = \begin{pmatrix} x_{10} & \cdots & x_{1m} \\ \vdots & \ddots & \vdots \\ x_{n1} & \cdots & x_{nm} \end{pmatrix} \quad (2)$$

With the parameters given as

$$\underline{\hat{\beta}}_{rxm} = \begin{pmatrix} \beta_{10} & \cdots & \beta_{1m} \\ \vdots & \ddots & \vdots \\ \beta_{r1} & \cdots & \beta_{rm} \end{pmatrix} \quad (3)$$

And the stochastic disturbance known as the error that follows normal with mean zero and constant variance, is given as

$$e_{rxm} = \begin{pmatrix} e_{11} & \cdots & e_{1m} \\ \vdots & \ddots & \vdots \\ e_{n1} & \cdots & e_{nm} \end{pmatrix} \quad (4)$$

The economic model used in this study is given as

$$Y_{n \times m} = X_{(n \times (r+1))} \beta_{(r+1) \times 1} + e_{n \times m} \quad (5)$$

Which can be reduced to

$$Y_{ij} = \beta_{ij} x_{ij} + e_i, \quad i = 1, 2, \dots, m \text{ and } j = 1, 2, \dots, m \quad (6)$$

Where $E(e_{(i)}) = 0_{n \times 1}$ and $cov(e_{(i)}, e_{(j)}) = \delta_{ij} I$.

With the outcome of the response Y given and the predictors x_i as full rank, the least square method is applied to estimate $\hat{\beta}_{(i)}$ and this is done particularly from the observations $Y_{(i)}$ on the least square given as

$$\underline{\hat{\beta}}_{(i)} = (x'x)^{-1}x'Y_{(i)} \quad (7)$$

Where x' is the transpose of x , which implies that if x is $n \times m$ then x' will be

$m \times n$. The reason for obtaining $x'x$ is to make the matrix a nonsingular matrix. We then obtain $x'Y_{(i)}$ by multiplying the transpose of x by the matrix of the predictor. The SPSS multiple regression is applied to this study. We then test for the significance of the variables and apply MANOVA in the study.

The model to be used can be expressed as

$$Y = \beta_0 + \beta_1 Z_1 + \beta_2 Z_2 + e \quad (8)$$

Where any of Z_2, Z_3, Z_4 or Z_5 can replace Z_1 in a paired model, while in the full model of the five economic variables it can be written as

$$Y_i = \beta_0 + \beta_1 Z_1 + \beta_2 Z_2 + \dots + \beta_5 Z_5 + e \quad (9)$$

The covariance of two random variables X_i and X_j , is defined as

$$cov(X_i, X_j) = E(x_i - u_i)(x_j - u_j) \quad (10)$$

Where $u_i = E(x_i)$, $u_j = E(x_j)$ and E denotes the expectation. If $i = j$ it is observed that the covariance of the variable x_i on itself and that of x_j on itself is known simply as the variance, hence, needless to define variances and covariance in an independent manner in the case of multivariate analysis.

The variances and covariance can be arranged in the symmetric matrix given as

$$\mathbf{\Sigma} = \begin{pmatrix} \delta_1^2 & \delta_{12} & \dots & \delta_{1q} \\ \delta_{21} & \delta_2^2 & \dots & \delta_{2q} \\ \vdots & \vdots & \ddots & \vdots \\ \delta_{q1} & \delta_{q2} & \dots & \delta_{qq}^2 \end{pmatrix} \quad (11)$$

Which can be estimated as

$$S = \frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})(x_i - \bar{x})^T \quad (12)$$

Where $x_i^T = (x_{i1}, x_{i2}, \dots, x_{iq})$ is the vector of numeric observations for the i th individual and

$\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$ is the mean vector of observations and the diagonal of S contains the sample variances of each variable which is denoted as S_i^2 . In a multivariate data, having q observed variables, indicates that we will have q variances and $\frac{q(q-1)}{2}$ covariance, also,

The correlation between two variables are estimated using the formula as seen

$$\rho_{ij} = \frac{\delta_{ij}}{\delta_i \delta_j} \quad (13)$$

Where $\delta_i = \sqrt{\delta_i^2}$

The Pearson's correlation coefficient denoted by R is given in multivariate settings as

$$R = D^{-1/2} S D^{-1/2} \quad (14)$$

Where $D^{-1/2} = \text{diag}(1/S_1, 1/S_2, \dots, 1/S_q)$ and $S_i = \sqrt{S_i^2}$ is the sample standard deviation of the variable.

Pillai's trace and Wilks' Lambda approaches

$$\text{The Pillai's trace} = \text{tr}[B(B+W)^{-1}] \quad (15)$$

$$\text{And Wilks' lambda statistic } \Lambda^* = \frac{|W|}{|B+W|} \quad (16)$$

Where B is the Residual sum of square error given as

$$B = \sum_{i=1}^n m(\bar{X}_i - \bar{X})(\bar{X}_i - \bar{X})' \quad (17)$$

And W is the sum of square treatment given as

$$W = \sum_{i=1}^n \sum_{j=1}^m (X_{ij} - \bar{X})(X_{ij} - \bar{X})' \quad (18)$$

$$\text{Sum of square total } (B+W) = \sum_{i=1}^n m(\bar{X}_i - \bar{X})(\bar{X}_i - \bar{X})' + \sum_{i=1}^n \sum_{j=1}^m (X_{ij} - \bar{X})(X_{ij} - \bar{X})' \quad (19)$$

A larger value of the Pillai's trace, the more the effects contributes to the model and also, a smaller the value of Wilks' Lambda, the better the effects contributes to the model. The two statistics are all positive-valued statistics and Wilks' Lambda lies between 0 and 1.

The analysis in this study made use of sum of square type III error imbedded in the SPSS software used in the analysis. Type III error just like type I and II, is correctly accepting or rejecting the null hypothesis for the wrong question or data. Since no research is 100% correct, there may be errors, may be type I, II, III, etc. We tried as much to minimize the error by ensuring that the study was properly designed and that the data is not a faulty data.

3. RESULTS

Multivariate Analysis of PMS(Y1), AGO(Y2), DPK(Y3) on paired variables

The SPSS result is as shown below

MULTIVARIATE ANALYSIS OF PMS (Y1), AGO (Y2), DPK (Y3) ON GDP (Z1), AND EXTERNAL DEBT (Z3)

General Linear Model

Table 1 (Multivariate Tests^a for paired analysis GDPZ1 and External Debt Z3)

Effect		Value	F	Sig.
Intercept	Pillai's Trace	.933	125.797 ^b	.000
	Wilks' Lambda	.067	125.797 ^b	.000
GDPZ1	Pillai's Trace	.984	541.444 ^b	.000
	Wilks' Lambda	.016	541.444 ^b	.000
EXTTERNALDEBT Z3	Pillai's Trace	.058	.554 ^b	.650
	Wilks' Lambda	.942	.554 ^b	.650

a. Design: Intercept + GDPZ1 + EXTERNALDEBTZ3

Table 2 (Tests of Between-Subjects Effects for paired analysis GDPZ1 and External Debt Z3)

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F
Corrected Model	PMSY1	63111.090 ^a	2	31555.545	322.985
	DPKT3	12594.432 ^b	2	6297.216	23.123
	AGOY2	116575.025 ^c	2	58287.512	216.906
Intercept	PMSY1	13783.578	1	13783.578	141.081
	DPKT3	1031.670	1	1031.670	3.788
	AGOY2	27088.386	1	27088.386	100.804
GDPZ1	PMSY1	63048.413	1	63048.413	645.329
	DPKT3	12472.456	1	12472.456	45.799
	AGOY2	116156.491	1	116156.491	432.254
EXTTERNALDEBT Z3	PMSY1	70.292	1	70.292	.719
	DPKT3	333.566	1	333.566	1.225

	AGOY2	2.849	1	2.849	.011
Error	PMSY1	2833.291	29	97.700	
	DPKT3	7897.592	29	272.331	
	AGOY2	7792.956	29	268.723	
Total	PMSY1	137514.013	32		
	DPKT3	49541.563	32		
	AGOY2	245935.623	32		
Corrected Total	PMSY1	65944.381	31		
	DPKT3	20492.024	31		
	AGOY2	124367.981	31		

a. R Squared = .957 (Adjusted R Squared = .954)

b. R Squared = .615 (Adjusted R Squared = .588)

c. R Squared = .937 (Adjusted R Squared = .933)

MULTIVARIATE ANALYSIS OF PMS(Y1), AGO(Y2), DPK(Y3) ON THE FIVE VARIABLES

MULTIVARIATE ANALYSIS OF PMS(Y1), AGO(Y2), DPK(Y3) ON GDP (Z1), TOTAL RESERVE (Z2), EXTERNAL DEBT (Z3), GROSS NATIONAL EXPENDITURE (Z4) AND GDP/CAPITA (Z5)

General Linear Model

Table 3 (Multivariate Tests^a for combined analysis of the five variables)

Effect		Value	F	Sig.
Intercept	Pillai's Trace	.848	44.712 ^b	.000
	Wilks' Lambda	.152	44.712 ^b	.000
GDPZ1	Pillai's Trace	.588	11.426 ^b	.000
	Wilks' Lambda	.412	11.426 ^b	.000
TOTALRESERVEZ2	Pillai's Trace	.341	4.146 ^b	.017
	Wilks' Lambda	.659	4.146 ^b	.017
EXTERNALDEBTZ3	Pillai's Trace	.272	2.996 ^b	.051
	Wilks' Lambda	.728	2.996 ^b	.051
GROSSNATIONALEXP ENDITUREZ4	Pillai's Trace	.586	11.323 ^b	.000
	Wilks' Lambda	.414	11.323 ^b	.000

GDPPERCAPITAZ5	Pillai's Trace	.301	3.448 ^b	.032
	Wilks' Lambda	.699	3.448 ^b	.032

a. Design: Intercept + GDPZ1 + TOTALRESERVEZ2 + EXTERNALDEBTZ3
GROSSNATIONALEXPENDITUREZ4 + GDPPERCAPITAZ5

Table 4 (Tests of Between-Subjects Effects for combined analysis)

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F
Corrected Model	PMSY1	64099.662 ^a	5	12819.932	180.688
	AGOY2	121388.788 ^b	5	24277.758	211.877
	DPKY3	17913.181 ^c	5	3582.636	36.120
Intercept	PMSY1	1736.747	1	1736.747	24.478
	AGOY2	11550.339	1	11550.339	100.802
	DPKY3	36.689	1	36.689	.370
GDPZ1	PMSY1	307.956	1	307.956	4.340
	AGOY2	3326.139	1	3326.139	29.028
	DPKY3	843.599	1	843.599	8.505
TOTALRESERVEZ2	PMSY1	495.379	1	495.379	6.982
	AGOY2	216.674	1	216.674	1.891
	DPKY3	903.844	1	903.844	9.113
EXTERNALDEBTZ3	PMSY1	402.698	1	402.698	5.676
	AGOY2	353.483	1	353.483	3.085
	DPKY3	.899	1	.899	.009
GROSSNATIONALEXP ENDITUREZ4	PMSY1	136.467	1	136.467	1.923
	AGOY2	3609.769	1	3609.769	31.503
	DPKY3	259.495	1	259.495	2.616
GDPPERCAPITAZ5	PMSY1	77.236	1	77.236	1.089
	AGOY2	64.995	1	64.995	.567
	DPKY3	494.308	1	494.308	4.984
Error	PMSY1	1844.718	26	70.951	
	AGOY2	2979.193	26	114.584	
	DPKY3	2578.844	26	99.186	

Total	PMSY1	137514.013	32		
	AGOY2	245935.623	32		
	DPKY3	49541.563	32		
Corrected Total	PMSY1	65944.381	31		
	AGOY2	124367.981	31		
	DPKY3	20492.024	31		

a. R Squared = .972 (Adjusted R Squared = .967)

b. R Squared = .976 (Adjusted R Squared = .971)

c. R Squared = .874 (Adjusted R Squared = .850)

4. DISCUSSION OF RESULTS

Finding for PMS(Y1), AGO(Y2), DPK(Y3) ON GDP(Z1) AND EXTERNAL DEBT(Z3)

The analysis revealed that Nigeria economy has higher contribution to the prices of PMS than the AGO(Y2) and then the DPK(Y3) for this model. The intercepts of the model of PMS(Y1), AGO(Y2) and DPK(Y3) are negative. The AGO(Y2) has the highest intercept followed by the PMS(Y1). Generally, it was revealed that in the analysis of the multivariate test, the contribution of the GDP(Z1) to PMS(Y1), AGO(Y2) and DPK(Y3) is higher than the contribution of the intercept and also higher than the contribution of External Debt(Z3) which is shown by the F-value, P-value, Pillai's trace and Wilks' lambda values. The PMS(Y1) is majorly affected by the economy of Nigeria than AGO(Y2) and AGO(Y2) is affected by more than DPK(Y3) when the GDP(Z1) and External Debt(Z3) are used as the indicator of the Nigerian economy.

Findings for PMS(Y1), AGO(Y2), DPK(Y3) ON GDP(Z1) AND TOYAL RESERVE(Z2)

The multivariate test reveals that GDP(Z1) contributes more to the prices of these petroleum products under study than the Total Reserve(Z2). The test of between-subject effects reveals that PMS(Y1) is highly influenced by the Nigeria economic polices followed by the AGO(Y2) and then the DPK(Y3) when GDP(Y1) and Total Reserve(Z2) are used as indicator. In the estimation of parameters of the model, it was revealed that all the intercept for PMS(Y1), AGO(Y2) and DPK(Y3) models are negative. The correlation between AGO(Y2) and DPK(Y3) is higher than any other joint effect in the study, showing that the joint effect of the two responses will be greatly affected by the economic policies of Nigeria. The joint effect of AGO(Y2) and PMS(Y1) gave negative value, implying that, their joint effect may be negatively affected by the economic policies of Nigeria.

Findings for PMS(Y1), AGO(Y2), DPK(Y3) ON GDP(Z1) AND GROSS NATIONAL EXPENDITURE GNE(Z4)

The multivariate test reveals that the GDP(Z1) provides the highest contribution to Nigerian's economic growth and has the highest impact in the regulation of the Nation's petroleum products price than the GNE(Z4). All the variables under study are significant in the analysis. These are revealed by the values of Pillai's trace and Wilks' lambda. In the test of between-subject effects, it was revealed that AGO(Y2) is seriously affected by the economy of Nigeria when the indicators of the economy are GDP(Z1) and GNE(Z4) than PMS(Y1) as revealed by the value of R^2 in the corrected model. The estimation of parameters also shows that the intercepts are all negative which could mean the negative effect of the instability in prices of these petroleum

products to the poor masses in Nigeria. In the correlation analysis, it was revealed that the relationship between PMS(Y1) and DPK(Y3) is higher than others, while AGO(Y2) and DPK(Y3) and AGO(Y2) and PMS(Y1) have negative relationships.

Findings for PMS(Y1), AGO(Y2), DPK(Y3) ON GDP(Z1) AND GDP/CAPITA(Z5)

Multivariate test shows that GDP(Z1) contributes more to the regulation of the petroleum products prices than the GDP/CAPITA(Z5), but the GDP(Z1) and GDP/CAPITA(Z5) are significant in the analysis as shown in the F-value, P-value, Pillai's trace and Wilks' lambda statistic. The test of between-subject effects shows that PMS(Y1) is highly affected by the economic policies of Nigeria than AGO(Y2) and DPK(Y3) which is revealed by the F-value in the corrected model and the intercepts followed by AGO(Y2) and then DPK(Y3), but same is not true for GDP(Z1) and GDP/CAPITA(Z5), where the opposite is witnessed. The mean square error revealed that PMS(Y1) is generally the highest to be affected by the Nigerian economic policies followed by DPK(Y3) in this model under study. R^2 revealed that the model of PMS(Y1) is better in analyzing the economy of Nigeria followed by that of AGO(Y2) and DPK(Y3). The estimation of parameters shows that the intercepts for PMS(Y1) and AGO(Y2) are negative showing how their negative impact of their instability in price will be on the poor masses and DPK(Y3) has a positive intercept which reveals the positive impact its price has been on the masses, may be, this could be as a result of the relative stability of the price of DPK(Y3) in Nigerian Filling Stations. The correlation between PMS(Y1) and DPK(Y3) recorded the highest value which suggests that their joint effect will be better than the joint effect of the others. PMS(Y1) and AGO(Y2) has a negative relationship.

Findings for PMS(Y1), AGO(Y2), DPK(Y3) ON GDP/CAPITA(Z5) AND TOTAL RESERVE(Z2)

This test reveals that GDP/CAPITA(Z5) contributes more to Nigerian economy than Total Reserve(Z2) and all the factors are significant in the analysis as revealed by the F-value, Pillai's and Wilks' statistic and the P-value. In the test of between-subject effects, it was revealed that PMS(Y1) proves to be better than AGO(Y2), DPK(Y3) for both corrected model, intercept model, model of GDP/CAPITA(Z5) and Total Reserve(Z2), this is as revealed by the F-value, mean square errors and R^2 for model having GDP/CAPITA(Z5) and Total Reserve(Z2) as the indicators of the economy. Parameter estimate shows that the intercept for PMS(Y1) and AGO(Y2) are negative while DPK(Y3) is positive. Correlation shows that AGO(Y2) and DPK(Y3) are jointly affected in a maximum level, followed by PMS(Y1) and DPK(Y3), there is no negative relationship in the correlation in the analysis of GDP/CAPITA(Z5) and Total Reserve(Z2) because, increase in the prices of the petroleum products under study is favored by Total Reserve(Z2) and the GDP/CAPITAL(Z5).

Findings for PMS(Y1), AGO(Y2), DPK(Y3) ON GDP/CAPITA(Z5) AND TOTAL RESERVE(Z2)

This test reveals that GDP/CAPITA(Z5) contributes more to Nigerian economy than Total Reserve(Z2) and all the factors are significant in the analysis as revealed by the F-value, Pillai's and Wilks' statistic and the P-value. In the test of between-subject effects, it was revealed that PMS(Y1) proves to be better than AGO(Y2), DPK(Y3) for both corrected model, intercept model, model of GDP/CAPITA(Z5) and Total Reserve(Z2), this is as revealed by the F-value, mean square errors and R^2 for model having GDP/CAPITA(Z5) and Total Reserve(Z2) as the

indicators of the economy. Parameter estimate shows that the intercept for PMS(Y1) and AGO(Y2) are negative while DPK(Y3) is positive. Correlation shows that AGO(Y2) and DPK(Y3) have the highest joint contribution followed by PMS(Y1) and DPK(Y3), there is no negative relationship in the correlation in the analysis of GDP/CAPITA(Z5) and Total Reserve(Z2) because, increase in the prices of the petroleum products under study is favored by Total Reserve(Z2) and the GDP/CAPITAL(Z5).

Findings for PMS(Y1), AGO(Y2), DPK(Y3) ON TOTAL RESERVE(Z2) AND EXTERNAL DEBT (Z3)

The Total Reserve(Z2) favors the fluctuations of the prices of the petroleum products than the External Debt(Z3) this is revealed by the F-value, P-value, Pillai's trace and Wilks' lambda value. In the test of between-subject effects, the PMS(Y1) is affected more than AGO(Y2) and DPK(Y3) by the economic policies of Nigeria for the corrected model, while for model of Total Reserve(Z2), it shows that the prices of DPK(Y3) is favored by the Total Reserve(Z2), the prices of PMS(Y1) is favored by the External Debt(Z3) in the model of External Debt(Z3). R^2 reveals that PMS(Y1) generally, is affected more than the other two, followed by the AGO(Y2) by the growth of Nigerian economy. The intercepts are all positive this is because, the increase in prices of the petroleum products is resulted by the increase in the Total Reserve(Z2) and decrease in the External Debt(Z3) of Nigeria, hence reducing inflation and making the country stable economically. The correlations are all positive in this analysis.

Findings for PMS(Y1), AGO(Y2), DPK(Y3) ON GROSS NATIONAL EXPENDITURE(Z4) AND EXTERNAL DEBT (Z3)

The multivariate test reveals that the GNE(Z4) contributes more to the economy of Nigeria than External Debt(Z3), this is evident from F-value, Pillai's trace and Wilks' lambda values. The test of between-subject effects shows that PMS(Y1) is affected more by the Nation's economic growth for corrected model, intercept model and GNE(Z4) model, but AGO(Y2) is also affected more by the External Debt(Z3). All the intercepts are positive and the correlation are also positive.

Findings for PMS(Y1), AGO(Y2), DPK(Y3) ON EXTERNAL DEBT (Z3) AND GDP/CAPITA(Z5)

The multivariate test reveals that GDP/CAPITAL(Z5) contributes more to the economy of Nigeria than the External Debt(Z3). The intercept model and the model of GDP/CAPITAL(Z5) are significant while the model of External Debt(Z3) is not. AGO(Y2) is affected more than the other two followed by the PMS(Y1) by the economy of Nigeria. All the parameters including the intercepts are negative, except that of GDP/CAPITA(Z5) on PMS(Y1) and GDP/CAPITA(Z5) on AGO(Y2). All the correlations are positive and the highest correlation is between DPK(Y3) and PMS(Y1) followed by DPK(Y3) and AGO(Y2).

Findings for PMS(Y1), AGO(Y2), DPK(Y3) ON GROSS NATIONAL EXPENDITURE (Z4) AND GDP/CAPITA(Z5)

The multivariate test reveals that GDP/CAPITAL(Z5) contributes more than the GNE(Z4) in the economy of Nigeria, but all the economic variables are significant in the analysis. AGO(Y2) is affected more than the other two in the economy having GDP/CAPITA(Z5) and GNE(Z4) as

indicator. This is also true from the value of R^2 for test of between-subject effects. All the intercepts are negative in the analysis, also, all the correlations showed positive relationships.

Findings for PMS(Y1), AGO(Y2), DPK(Y3) ON Z1, Z2, Z3, Z4, AND Z5

In the multivariate test for all the five economic variables, it was revealed that the intercept, GDP(Z1) and GNE(Z4) are significant in the combined analysis. In the test of between-subject effects, it was revealed that AGO(Y2) is affected more than the other two, followed by the DPK(Y3) and this is true for intercept model, GDP(Z1) model, Total Reserve(Z2) model and GNE(Z4) model but for External Debt(Z3) and GDP/CAPITA(Z5) the PMS(Y1) is affected more than the other two. The PMS(Y1) model still recorded the smallest mean square error, where AGO(Y2) shows slight increase in R^2 than the PMS(Y1). The PMS(Y1) and AGO(Y2) has negative intercept while DPK(Y3) has positive intercept. The PMS(Y1) and AGO(Y2) has negative correlation, where the rest have positive correlation.

5. CONCLUSION

Based on the findings so far, we conclude that PMS is greatly affected by the economic policies of Nigeria, followed by the AGO and then DPK. PMS is insignificantly affected in an economy with two indicators where GNE is involved. PMS and AGO proved stronger than DPK in the economy of Nigeria. The negative values obtained in the intercept of the petroleum products especially the PMS signifies the negative impact of the increase in prices of the products have on the poor masses. The subsidy on PMS makes the product weaker in its performance to the economy of the Nation. The parameters of the models both for paired models and the full model, showed low values as the gradients of the economic variables to the economy of Nigeria using the three petroleum products as the responses. This tell us that each of the five economic variables may not marginally have significant impact to the prices of petroleum products, unless in combined form. It is because of this reason that the R^2 value showed that the combined analysis was better than each of the paired analysis. The paired analysis is better if there are no resource or no data on all the economic variables, others can be used as error. Also if you want to obtain the individual contributions and their joint effects as revealed by the analysis of correlation, the paired analysis mostly had higher values than the combined model. We also conclude that GDP plays major role in the regulation of the prices of the petroleum products than any other economic variables. The relationship between GDP to any of Total reserve and External debt is positive because the increase in the prices of the petroleum products results in decrease in the external debt, and increase in total reserve.

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Data of petroleum products prices and real economy used in this research is as shown below.

Year	PMS	AGO	DPK	Z1	Z2	Z3	Z4	Z5
1987	0.5	0.4	0.3	2.74E+10	1.5E+09	2.22E+10	2.24E+10	303.66
1988	0.5	0.4	0.3	3.02E+10	9.33E+08	2.9E+10	2.25E+10	325.2
1989	0.6	0.5	0.4	3.23E+10	2.04E+09	2.96E+10	2.26E+10	339.82
1990	0.6	0.5	0.4	3.5E+10	4.13E+09	3.01E+10	2.2E+10	358.55
1991	0.7	0.5	0.5	3.66E+10	4.68E+09	3.34E+10	2.43E+09	366.46
1992	0.7	0.55	0.5	3.77E+10	1.2E+09	3.35E+10	2.57E+10	368.1
1993	3.25	3	2.75	3.85E+10	1.64E+09	2.9E+10	3.21E+10	367.28
1994	11	9	6	3.86E+10	1.65E+09	3.07E+10	2.2E+10	359.03
1995	11	9	6	3.95E+10	1.71E+09	3.31E+10	2.34E+10	359.43
1996	11	9	6	4.62E+10	4.33E+09	3.41E+10	2.75E+10	366.22
1997	11	9	6	4.24E+10	7.78E+09	3.14E+10	2.8E+10	367.46
1998	11	9	6	4.32E+10	7.3E+09	2.85E+10	3.36E+10	365.75
1999	20	19	17	4.36E+10	5.65E+09	3.03E+10	3.36E+10	361.2
2000	22	21	17	4.6E+10	1.01E+10	2.91E+10	3.62E+10	371.77
2001	22	21	17	4.74E+10	1.06E+10	3.14E+10	3.59E+10	374.17
2002	26	26	24	4.81E+10	7.57E+09	3.1E+10	4.29E+10	370.81
2003	39.5	41.5	41	5.31E+10	7.42E+09	3.05E+10	5.95E+10	399.06
2004	48	48	48	5.87E+10	1.73E+10	3.46E+10	6.61E+09	430.58
2005	50	60	50	6.19E+10	2.86E+10	3.78E+10	7.65E+10	442.72
2006	65	60	50	6.57E+10	4.27E+10	2.21E+10	9.49E+10	458.63
2007	65	60	50	7E+10	5.19E+10	7.69E+09	1.25E+11	476.21
2008	70	80	70	7.42E+10	5.36E+10	8.53E+09	1.41E+11	492.34

2009	65	110	95	7.94E+10	4.55E+10	1.13E+10	1.82E+11	513.77
2010	65	140	50	8.56E+10	3.59E+10	7.71E+09	1.55E+11	540.21
2011	65	150	50	9.13E+10	3.63E+10	7.88E+09	1.84E+11	561.9
2012	97	155	50	9.28E+10	3.92E+10	6.9E+11	1.5E+13	690.5
2013	97	155	50	9.55E+10	3.02E+10	9E+14	2.78E+13	712.91
2014	97	155	50	1.01E+11	3.72E+10	1.02E+14	8.46E+13	768.13
2015	97	155	50	1.1E+11	3.88E+10	1.21E+14	1.03E+14	801.49
2016	145	155	50	1.15E+11	4.03E+10	2.68E+14	1.92E+14	846.92
2017	145	155	50	1.2E+11	4.33E+10	2.17E+14	3.14E+14	892.87
2018	145	155	50	1.27E+11	5.72E+10	2.29E+14	5.03E+14	928.13

Source: National bureau of Statistics 2017, National bulletin, Amagoh et al (2014)

Appendix

Table 5 (Parameter Estimates for paired analysis, GDPZ1 and External Debt Z3)

Dependent Variable	Parameter	B	T	Sig.
PMSY1	Intercept	-50.429	-11.878	.000
	GDPZ1	1.533E-9	25.403	.000
	EXTTERNALDEBT Z3	2.801E-20	.848	.403
DPKT3	Intercept	-13.796	-1.946	.061
	GDPZ1	6.817E-10	6.767	.000
	EXTTERNALDEBT Z3	6.102E-20	1.107	.278
AGOY2	Intercept	-70.695	-10.040	.000
	GDPZ1	2.080E-9	20.791	.000
	EXTTERNALDEBT Z3	5.639E-21	.103	.919

Table 6 (Parameter Estimates for combined analysis)

Dependent Variable	Parameter	B	t	Sig.
PMSY1	Intercept	-40.887	-4.948	.000
	GDPZ1	7.537E-10	2.083	.047
	TOTALRESERVEZ2	5.183E-10	2.642	.014
	EXTERNALDEBTZ3	3.431E-14	2.382	.025
	GROSSNATIONALEXPENDITUREZ4	3.446E-14	1.387	.177
	GDPPERCAPITAZ5	.055	1.043	.306
AGOY2	Intercept	-105.443	-10.040	.000
	GDPZ1	2.477E-9	5.388	.000
	TOTALRESERVEZ2	-3.428E-10	-1.375	.181

	EXTERNALDEBTZ3	-3.214E-14	-1.756	.091
	GROSSNATIONALEXPENDITUREZ4	-1.772E-13	-5.613	.000
	GDPPERCAPITAZ5	.050	.753	.458
DPKY3	Intercept	5.943	.608	.548
	GDPZ1	1.247E-9	2.916	.007
	TOTALRESERVEZ2	7.001E-10	3.019	.006
	EXTERNALDEBTZ3	-1.621E-15	-.095	.925
	GROSSNATIONALEXPENDITUREZ4	-4.751E-14	-1.617	.118
	GDPPERCAPITAZ5	-.139	-2.232	.034

Table 7 (Residual SSCP Matrix for combined analysis)

		PMSY1	AGOY2	DPKY3
Covariance	PMSY1	70.951	-3.031	36.816
	AGOY2	-3.031	114.584	7.398
	DPKY3	36.816	7.398	99.186
Correlation	PMSY1	1.000	-.034	.439
	AGOY2	-.034	1.000	.069
	DPKY3	.439	.069	1.000