EMPIRICAL ANALYSIS OF THE DEMAND FOR PETROLEUM PRODUCTS IN NIGERIA

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ABSTRACT

There has been perenial petroleum products scarcity in the country over the past few years. Inadequate energy planning had compounded the problem of scarcity. The paper identifies the various variables in the consumption framework for policy simulation purposes regarding energy planning in the country. Elasticities were also estimated for proportions of GDP contributed by agriculture, manufacturing and services. The empirical findings reveal that urbanisation was one of the principal factors that has 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. The policy implications of the findings include the need to keep track of the proportion of the population moving into the urban centres, and the relative shift in the importance of the major sectors of the economy. These were significant in the estimation of the demand for petroleum products.

1. INTRODUCTION

The structure of the Nigerian economy has undergone changes in recent times. The relative importance of some sectors as well as levels/degrees of population concentration, accentuated by increasing urbanization caused mainly by geo-political cum economic developments, have resulted in rising petroleum products demand, especially fuel requirements and use propensities. This is to be expected as secondary and tertiary activities gradually replace primary production and subsistence activities and use of the more efficient and convenient commercial energy expands (Amann, 1969).

[1] The views expressed in this paper are those of the authors and do not represent the official position of the CBN. Messrs Onwioduokit and Adenuga are staff of International Economic Relations Department.

The movement of larger proportions of the population to commercial centres promotes high petroleum products needs and use tendencies. This involves increased reliance on the fuel intensive transport sector propelled by enhanced rural-urban, inter urban and intra urban travel requirements, provision of public services, and a proliferation of commercial and industrial activities for urban needs and wants. It could be observed that most of the energy needed for urban household and industrial consumption are mainly petroleum products such as petrol, diesel, cooking gas, kerosene and Jet fuel. Others are fuel oil, lubricating oil, brake fluid and petroleum jelly. In this regard, urbanization is therefore anticipated to have a positive relationship with petroleum products consumption. The paper seeks to determine and analyse the impact of urbanisation on the consumption of three out of the various petroleum products sold in Nigeria. The products are liquefied petroleum gas (cooking gas), premium motor spirit (petrol) and household kerosene. These products are considered to be urban biased, (Kimuyu, 1993). The objective of this paper is to apply Nigerian data to empirically investigate the response of the impulse-receiving (objective) variables to the impulse-generating (policy) variables for simulation purposes and adoption by policy makers. It is to be noted that these products are inadequate in terms of supply most of the time. Kimuyu (1993) identified urbanization as the major structural phenomenon generated from the increased shift in large proportions of the population to commercial and administrative centres during development and this structural shift was identified as the major factor responsible for the unprecedented increase in the demand for petroleum products in Nairobi.

In Nigeria, the tempo of urbanization has been really high. This is due principally to the political developments in the country. At independence in 1960, Nigeria operated a three region structure of government. In 1963, when Nigeria became a republic, a fourth region - Mid-western region was created. In 1967 the twelve states structure emerged. This was further stratified into 19 states in 1976. By 1987, two additional states were created bringing the total number of states to twenty one. In 1991, nine additional states were created. This figure nudged upward by the creation of six additional states in 1996. In all, the number of states in Nigeria today stands at thirty-six (36). The local governments have also undergone similar fragmentation during the review period. Thus, with the creation of new states and local governments areas, the new seat of governments which were mainly rural in context and structure have assumed urban status. What this entails for petroleum products consumption in the country is

essentially an empirical matter. There has been sporadic petroleum products scarcity in the country over the past few years. As noted earlier, the economic developments led to increased demand for products consumption. The main thrust of this paper is to empirically examine the impact of urbanisation on petroleum products consumption in Nigeria so as to identify the important variabies for policy simulation purposes. To this end, the rest of the paper is organised in five sections. Following this introduction, Section 2 examines the structure of the Nigeria economy and the consumption of petroleum products. This is followed by review of related literature in Section 3; the sources of data and methodology are examined in section 4; the analysis of regression results is contained in Section 5; and some concluding remarks are made in Section 6.

II. STRUCTURE OF THE NIGERIAN ECONOMY AND THE CONSUMPTION OF PETROLEUM PRODUCTS

II. 1 Structure of the Nigerian Economy

Prior to the oil boom of 1970, the Nigerian economy could be described as agrarian in nature. The agricultural sector accounted for more than 70.0 per cent of the gross domestic product (GDP). In addition, about 80.0 per cent of the Federal Government revenue was derived from the sector, while about 80.0 per cent of the workforce was engaged in agriculture. The contribution of the sector to foreign exchange earnings was between 70.0 and 80.0 per cent, (Ihimodu, 1993; p.6). The agricultural sector's contribution to GDP increased from 25.3 per cent in 1981 to 30.0 per cent in 1991. It increased slightly further to 31.0 per cent in 1995. The contribution of the manufacturing sector increased from 9.9 per cent in 1981 to 11.2 per cent in 1982 before declining to 7.3 per cent in 1993. It decreased further to 7.2 per cent in 1994 and later to 6.6 per cent in 1995. The shares from other major sectors such as transport showed a declining trend. Its contribution fell from 6.0 per cent in 1981 to 3.1 per cent at the end of 1991. Thereafter, it rose marginally to 3.2 per cent in 1995. The corresponding figures for wholesale and retail trade sectors declined from 13.0 in 1981 to 12.5 per cent in 1992, and fell further to 12.2 per cent in 1995, (see table 1, as derived from CBN Statistical Bulletin, Vol. 9, No. 2, December, p. 114).

By 1970, the petroleum sector had become a very important factor in the Nigerian economy after the agricultural sector, contributing 10.0 per cent of the GDP in 1980 compared to 7.0 per cent in the early 1970s. It increased to 13.4 per cent in 1992. The contribution of this sector of GDP has continued to be on the upward trend. Thus, beginning late 1970 there was a structural shift in the economy from the dominance of the agricultural sector in terms of revenue generation to the oil sector. For instance, in 1990 the Federal government derived 81.0 per cent of its revenue from oil as against 24.0 per cent in 1970. Comparatively, 96.0 per cent of the export earnings came from petroleum sector in 1980 compared with 40.0 per cent in 1970, (Ihimodu, 1993; p.7). The share of petroleum products in total energy consumed in 1992 was 54.2 per cent. It fell to 47.6 per cent in 1993 and thereafter, rose to 49.9 per cent in 1994. In 1995, the share of petroleum products in total energy consumed was 41.8 per cent while in 1996 it was 37.4 per cent.

The focus of policy makers has been on how to ensure availability of natural resources to cope with the increasing population. This is particularly true of the urban areas which have become densely populated as a consequence of the rural-urban migration and the attendant increase in the demand for petroleum products in these areas. For example, according to the Pipelines and Products Marketing Company (PPMC) data, average national daily demand for petrol, is estimated at 18 million litres. Out of this, the urban centres account for more than 60.0 per cent. The projected annual growth rate (based on the revised 1991 census) of 2.8 per cent by the National Population Commission puts Nigeria's population at 102.3 million in 1996 compared to 64.7 million in 1980[2]. This is expected to increase by 3.5 per cent in the year 2000[3]. The drift continues unabated and with the employment opportunities and improved purchasing power, economic activities expanded leading to increase in the demand for petroleum products such as; liquefied petroleum gas (cooking gas), premium motor spirit (petrol), household kerosene, aviation turbine kerosene (Jet fuel) and automotive gas oil (diesel), for personal and industrial uses.

Consequent upon the oil boom, there was a general neglect of the agricultural sector leading to a drift in the agrarian population from the rural areas to the

urban centres. The boom was accompanied by positive economic growth and development, which altered the structure of the economy and spatial population distribution and concentration of infrastructures. The occasioned urban drift resulted to changes in the structure of petroleum products demand arising from the changes in products requirements and use by different sectors and urban cities e.g Lagos, Port Harcourt, Kano etc. This issue of rural-urban drift has always been a matter of concern to decision makers and energy planners.

II.2 CONSUMPTION OF PETROLEUM PRODUCTS

Consumption of petroleum products grew tremendously from the middle of the 1980s, reflecting the rapid growth in the number of automobiles, industries, households, intensified rural-urban migration, economic and political developments. The bulk of products consumption has been the premium motor spirit (PMS) or petrol, automotive gas oil (AGO) or diesel, dual purpose kerosene and bitumen/asphalt. Together, they account for more than 60.0 per cent of the total consumption of petroleum products. Petrol and diesel are the major fuels utilized in the road transportation sector as well as for small to medium sized electricity generation plants for power supply in homes and locations detached for NEPA, as well as standby power sources in industries. Specifically, petrol is used in vehicles, small electricity generating plants, drives for compressors, etc, while diesel is used largely on heavier engines. Household kerosene, is mostly used in homes and industries to produce insecticides and other pest control products.

From the level of 13.9 million tonnes in 1981, consumption of petroleum products rose by 2.0 per cent to 14.2 million tonnes in 1982 but dropped to 7.7 million tonnes in 1990. It subsequently increased to 10.7 million tonnes in 1993, and has since maintained a downward trend to 7.9 and 7.7 million tonnes in 1994 and 1995, respectively. Generally, the demand for petroleum products has continually been on the increase. Most of the demand for the products is usually supplied by the domestic refineries. However, owing to the poor conditions of three of the four refineries, there has been shortages which had to be augmented with importation from time to time. For instance, such importation was put at 3.4

million metric tonnes in 1993, 2.9 million metric tonnes in 1994, 2.2 million metric tonnes in 1995, 3.9 million metric tonnes in 1996 and 2.1 million metric tonnes in 1997, respectively.

III. REVIEW OF RELATED LITERATURE

There is scanty evidence of efforts to empirically measure the impact of urbanisation on petroleum products demand. The past studies by Hoffman (1978), Kimuyu (1988 and Jones (1989) are examples of the limited effort.

Using pooled times series cross-sectional data for selected country groups, Hoffman (1978) showed that the impact of structural changes on the demand for energy was significant. The explanatory variables in his analysis included population, income and shares of major sectors in GDP. The elasticities of shares of the manufacturing, transport and electricity sectors were positive while that for agriculture was negative. However, the elasticity of the share of transport was insignificant. The estimated elasticities were long-term as a result of the cross-sectional dimension of data used, and it is possible that the estimates were grossed up by aggregating data from different countries and fuels[4].

In order to investigate the structure of commercial energy demand in Kenya, Kimuyu (1988), following Hoffman, demonstrated that changes in the relative importance of major sectors and urbanization had significant but differential effects on the consumption of different commercial fuels. The considered sectors included agriculture, manufacturing, transport and services, and the fuels analysed were petroleum products, coal and electric power sold to different categories of consumers. However, gross domestic products (GDP) was not included as an explanatory variable, exposing the economy - structure fuel models to misspecification. This form of misspecification potentially leads to biased and inconsistent parameter estimates with spurious regression. The study underscored the significance of energy considerations in development planning, since each planning can alter the relative importance of sectors, and therefore affect energy requirements.

Using 1980 cross-sectional data for 60 countries, Jones (1989) discussed energy consumption in terms of GDP, urbanization, industrial composition, population density and fuel prices. The findings showed urbanization elasticities of energy demand between 0.30 and 0.45, with urbanization having a stronger impact on commercial than total energy, including traditional energy.

Al-Sahlawi and Royboyd (1987) showed that the demand functions for oil, gas and coal in third world countries was based on standard utility analysis. It was assumed that the utility of consumers is a function of oil, natural gas, coal and a composite good.

Over the past decade, a number of studies (Mork 1989, Mory 1993, Mork 1994, Lee et al. 1996, Hamilton 1996, Huntington 1998, Davis and Haltiwanger 1998, and Hamilton and Herrera 1999) have investigated and confirmed an asymmetric relationship between oil prices, demand for petroleum and aggregate economic activity. Although asymmetry is not fairly well accepted, few studies have attempted to determine through what channels demand for petroleum products and oil price tend to produce an asymmetric response in aggregate economic activity. However, Huntington (1998) attributes the assymmetry to the relationship between crude and petroleum product prices. Hamilton (1988) explains that asymmetry could be the result of adjustment costs to changing oil prices. Falling oil prices stimulate economic activity, and rising oil prices retard economic activity, but the costs of adjusting to changing oil prices also retard economic activity. Combining these elements, it could be said that rising oil prices present two negative effects for economic activity. The converse holds true for falling oil prices.

Another possibility is that monetary policy may account for the demand for petroleum products. Bohi (1989) and Beranke et al (1997) maintains that contractionary monetary policy accounts for decline in aggregate economic activity and consequently demand for petroleum products. Tatom (1988, 1993) argues that the apparent asymmetric response in U.S. economic activity to oil prices disappears when the stance of monetary policy or changes in the misery index (which combines unemployment and inflation rate) are taken into account. Most of these studies were conducted in the industrial countries, it would be interestng

to empirically verify the demand for petroleum products in Nigeria. This is the focal point of this Study.

IV. DATA SOURCE, METHODOLOGY AND THE MODEL

IV.1 Data Source

Data for this study was sourced principally from the NNPC, CBN, FOS, National Population Commission and the World Bank publications. The period of the study covered is 1970-1996.

IV.2 Methodology

Ordinary least squares were used, in which per capita consumption of three different petroleum products were regressed against GDP per capita, proportion of urban population in total population, contribution of agriculture to GDP, contribution of manufacturing to GDP and contribution of services to GDP. The specific products considered were liquefied petroleum gas (cooking gas), premium motor spirit (petrol) and household kerosene measured in tonnes per capita.

IV.3 The Model

The log-linear formulation of equation (2) derives from a multiplicative one of the form:

$f_i = a_0 GDP^{a1} URP^{a2} AGR^{a3} MFG^{a4} SVR^{a5} e^u$ ----------(1)

where e = limit of $(1+(1/n)^n)$ as n approaches infinity and all other variables are as defined below.

The log transformation of equation (1) gives:

$\ln F_i = a_0 + a_1 \ln GDP + a_2 \ln URP + a_3 \ln AGR + a_4 \ln MFG + a_5 \ln SVR + U_{ti}$ --(2)

where F_i = per capita consumption of petroleum for product i, i = 1,2,3.

Following from equation (2), we generated equations (3), (4) and (5) for

the three products, therefore we have:

Model 1: liquefied petroleum gas

$$\ln F_i = a_0 + a_1 \ln GDP + a_2 \ln URP + a_3 \ln AGR + a_4 \ln MFG + a_5 \ln SVR + U \text{ ----(3)}$$

Model 2: premium motor spirit

$$\ln F_2 = a_0 + a_1 \ln GDP + a_2 \ln URP + a_3 \ln AGR + a_4 \ln MFG + a_5 \ln SVR + V \text{ ----(4)}$$

Model 3: household kerosene

$$\ln F_3 = a_0 + a_1 \ln GDP + a_2 \ln URP + a_3 \ln AGR + a_4 \ln MFG + a_5 \ln SVR + W \text{ ----(3)}$$

The variables are defined as follow:

GDP = GDP per capita,
URP = proportion of urban population in total population[5]
AGR = contribution of agriculture to GDP
MFG = contribution of manufacturing to GDP
SVR = contribution of services to GDP
U V and W are error terms

Where a_1, ... a_5 are the relevant elasticities, a_0 is the regression constant, and U, V, W are the error terms subject to the usual stochastic assumptions. The a-priori expectations are generally expressed by the signs attached to the variables.

The estimation of the model proceeded along the theoretical stages of Engle - Granger (1987) two-step procedure. In order to avoid analysing clearly non-stationary series which could lead to the so called "nonsense" or "spurious" regression (Granger and Newbold 1974), we determined the order of integration of the variables in the regression employing the Dickey Fuller (DF) (1979) and Augmented Dickey Fuller (ADF) set of unit root tests to correct for autocorrelation in the error term. In order to search for the existence of a long run equilibrium

relationship between the per capita consumption of PMS (petrol), LPG (cooking gas) and household kerosene (HHK) and all the other variables we have adopted the concepts of cointegration and error correction technique, Granger (1981) and Mills (1990). This technique has become attractive, in econometrics as it combines both the changes (difference variables) and the levels (the estimated error term from the cointegration regression). The new concept ensures that all its components are stationary. It also preserves the long-run relationship, while specifying the system in a short-run dynamic manner.

The cointegration technique with its implied error - correction specification has been claimed to have certain merits over the traditional partial adjustment model. The merits include stable parameter estimates, since analysis are based on stationary time series data. It is also data admissible and theory consistent, which would enhance the forecasting power and policy formulation capabilities of the model, (Essien, 1997). Finally, it is central to econometric modelling of integrated variables as well as investigation of long-run relationships among those variables. The specification for testing the stationarity of the residuals is of the form.

$$\Delta u_t = x u_{t-1} + \varepsilon_t \text{ ---------(6)}$$

for the DF.

In order to overcome the underlying process generating the observation which is an autoregressive process of order 1 {AR(1)}, the ADF test would also be used. It is identical to the standard DF, but is of the form:

$$\Delta u_t = x u_{t-1} + \sum_{i=1}^{p} y_i \Delta u_{t-i} + \varepsilon_t \text{ ---------(7)}$$

where the lag, P is set so as to ensure that any autocorrelation in:

$$\Delta u t$$

is absorbed and that a reasonable degree of freedom is preserved, and also the error correction is white noise. The testing procedure is similar to the DF.

V. ANALYSIS OF REGRESSION RESULTS

V.1 Static Regresion

The long run static regression was run for each of the three models. For the first model, the result is as follow:

Table 1

Variables	Coefficient
Costant	11.645
	(3.339)
LGDP	0.202
	(2.189)
LURP	1.903
	(2.601)
LAGR	1.307
	(3.862)
LMFG	0.545
	(1.910)
LSVR	-0.672
	(-1.005)

R^2 Adj. = 0.756261, F(5,21) = 13.03 (.0000),
DW = 2.2, Information Criteria: SC = -3.657891.
t values are in parenthesis.

From the above result, the structural variables explain the consumption of cooking gas reasonably well, as indicated by the high adjusted coefficients of multiple determination (R^2 Adj.) which is 0.76. The Durbin Watson (DW) statistics was high at 2.2, showing the absence of serial correlation and the apriori expectations for the explanatory variables were satisfied, confirming the economic acceptability and plausibility of the estimates as they are all theoretically justifiable. It shows therefore that GDP per capita, urbanisation, contribution of agriculture, manufacturing and services jointly account for at least 76.0 per cent of the variations in petroleum products consumption in Nigeria. Similarly, the estimated F-value is reasonably high; the results can therefore be considered broadly significant, as all the independent variables as a group adequately explain the model. The estimation elicited positive urbanisation elasticity of consumption of cooking gas, everything else remaining the same; liquefied petroleum gas is mainly used for cooking. The urbanisation elasticity was 1.903. The consumption of cooking gas is urbanisation elastic, since a 10.0 per cent increase in urban population would lead to an increase of 19.0 per cent in consumption of cooking gas. Liquefied petroleum gas is mainly used for cooking and also in the commercial sector. A high urbanisation elasticity for its consumption reflects the increasing trend for its demand, particularly in the urban centres. The estimated GDP per Capita elasticity for cooking gas was 0.202. The consumption of cooking gas is therefore not GDP elastic. This is the result of the netting out effect of the economy structure variables in the consumption model, leaving out the pure GDP per Capita elasticity. The elasticity of the contribution of agriculture to GDP is significant and is correctly signed. Increasing the proportion of agriculture to GDP will lead to a rise in the consumption of cooking gas. A 10.0 per cent in the proportion of GDP generated from manufacturing

would lead to an increase of 5.5 per cent in the consumption of cooking gas. The estimated elasticity for services is not significant, though rightly signed.

For models 2 and 3, the static regression results are as shown below, with the t-values in the parenthesis.

Table 2

Variable	Model 2	Model 3
Constant	0.9453	0.0384
	(0.3760)	(0.3076)
LGDP	0.1415	0.692
	(0.9660)	(0.1052)
LURP	0.8406	1.4026
	(0.4324)	(1.4638)
LAGR	-0.1675	1.2534
	(0.2010)	(5.67719)
LMFG	0.6672	-1.7049
	(0.3214)	(-5.2311)
LSVR	0.3217	0.1602
	(0.1872)	(0.3651)
R^2 Adj.	0.99	0.93
DW	1.20	0.67
F	46.7436	16.6359

A cursory perusal at the static regression shows inconsistencies in the results of the two models. The two mdels showed high R^2 but very low Durbin Watson statistics which reflects the presence of high serial correlation among the variables as shown, especially by the DW statistics. The admixture of low DW and high explanatory power of the model might be misleading. The parameters are not likely to be stable and thus, the results, even though consistent with theory, could be misleading. The specification of the two models as earlier stated could lead to spurious interpretation.

We then proceeded to confirm the stationarity of the variables by carrying out unit root tests. Results from the tests is as stated below:

Table 3: Unit Root Tests for Variables Without Trend

Variable	DF	ADF	Order of Integration
DLF2	-5.6637 (-2.9528)	-4.3089 (-1.9558)	1
DLF3	-3.5508 (-2.9528)	4.5206 (-1.9558)	1
DLGDP	-4.1688 (-2.9528)	-3.7934 (-1.9558)	1
DLURP	-3.2890 (-2.9528)	-3.0392 (-1.9558)	1
DLAGR	-4.9093 (-2.9528)	-3.2130 (-1.9558)	1
DLMFG	-4.7170 (-2.9528)	-3.6732 (-1.9558)	1
DLSVR	-3.5325 (-2.9528)	-3.5500 (-1.9558)	1

Critical values for DF and ADF are in parenthesis.

Thus, we test $H_0: Y_t \sim I(1)$ against $H_1: Y_t \sim I(0)$, with critical values which are all negative and larger (in absolute terms) than standard critical values. This will then lead to the rejection of the null hypothesis, meaning that the variables are stationary. The results in Table 3, above show that all the variables achieved stationarity in their first difference, hence they are integrated of order 1 i.e are I(1) variables.

V. 2 Testing for Cointegration

The residual from the results of the static regression in Table 2, as earlier shown was tested and stationarity was also established for the two models as confirmed by the following Tables. It showed that a long-run relationship exists between the variables. hence the variables are cointegrated.

Table 4a: Residual Stationarity Test for Model 2

Model	DF	ADF	Order of Integration
Model 1:U1	-4.0172 (-3.9962)	-2.9653 (-2.9488)	1(0)
Model 2:U2	-4.0614 (-4.0496)	-2.9863 (-2.9834)	1(0)

Table 4b: Residual Stationarity Test for Model 3

Model	DF	ADF	Order of Integration
Model 1:U1	-4.5274 (-3.9962)	-3.6064 (-2.9488)	1(0)
Model 2:U2	-4.3465 (-4.0496)	-2.9851 (-2.9834)	1(0)

The general - to - specific (GTS) framework was adopted which specifies an over parameterized error - correction model for the two models to capture the dynamics of per capita consumption of premuim motor spirit (Petrol) and household kerosene by introducing the error correction terms into the two models, after differencing, and to ensure that the dynamics of the models have not been restricted by a too short lag length. A lag of period is considered appropriate, (Mickinnon, 1990). The results were inconclusive. A step-wise regression methodology was thereafter applied.

Model 2: Petrol

$$DLF2 = 0.0328 - 0.531\,DLF2(-1) - 0.568DLF2(-2 + 0.409DLGDP + 0.664DLURP -$$
$$(2.842) \qquad (2.103) \qquad (5.517) \qquad (3.612)$$

$$0.198DLAGR + 0.850DLMFG + 0.460DLSVR - 0.382\,ECM$$
$$(2.249) \qquad (2.672) \qquad (2.813) \qquad (-4.237)$$

R^2Adj = 0.89, F = 65.1, DW = 2.05

Mode 3: Household Kerosene

$$DLF3 = 0.058 + 0.248\,DLF3\,(-1) + 0.349\,DLGDP - 0.983\,DLURP$$
$$(2.649) \qquad (2.070) \qquad (3.845)$$

$$-0.939\,DLURP(-1) + 0.182\,DLAGR + 0.524\,DLMFG\,(-1)$$
$$(-1.426) \qquad (2.251) \qquad (2.335)$$

$$+0.292\,DLSVR - 0.293\,ECM\,(-1)$$
$$(2.864) \qquad (-3.595)$$

R^2Adj. 0.84, F = 37.8, DW = 2.64

An examination of the above results for the parsimonious error correction model shows that the a-priori expectations about the signs of all the parameter estimates were met. Other observations about the results for model 2 included the following:

The structural variables explain the consumption of petrol adequately well as reflected by the adjusted R^2 which is 0.89. The DW is 2.05, showing the absence of serial correlation and the a-priori expectation for the explanatory variables were satisfied, confirming the plausibility of the estimates. The independent variables used in the model jointly account for 89.0 percent of the variations in petrol consumption. Also, the F - value is quite high, the results showed that the model adequately explained the petrol consumption in Nigeria.

The urbanisation elasticity was 0.664. The consumption of petrol is urbanisation elastic, since a 10.0 percent increase in urban population would lead to an increase of 6.6 percent in consumption of petrol, all things being equal. Petrol is mainly used in the transport sub-sector and industry. An upward trend in the urbanisation elasticity indicated the rising pattern for its demand.

The parameter estimate for GDP per capita was 0.409, which is statistically different from zero. The elasticity of the portion of agriculture acruing to GDP is negative. For an increase in the contribution of agriculture to GDP would reduce the consumption of petrol. The elasticity of the proportion of GDP accruing from manufacturing is 0.850 which is positive. A 10.0 per cent increase in the proportion of GDP generated from manufacturing would increase the consumption of petrol by 8.5 per cent. The contribution of services to GDP showed a similar trend. The error correction variable (ECM) was highly significant and had the appropriate sign. The disequilibrium error from the long run elasticity of per capita consumption of petrol was 38.2 per cent. The strong significance of the ECM is an indication of the existence of a long run equilibrium relationship between per capita consumption of petrol and the factors affecting it.

Also, for Model 3, the structural variables adequately explain the consumption of household kerosene as indicated by the adjusted R^2 which is 0.84 and Durbin Watson of 2.64. The a-priori expectations for the explanatory variables

were confirmed. The explanatory variables used in the model jointly account for 84.0 per cent of the variations in household kerosene consumption. Also, the results showed that the model quite explained the petrol consumption in Nigeria.

The estimation elicited negative urbanisation elasticity of consumption of household kerosene, which is used mainly by rural and low income urban households for lighting and cooking. The elasticity of the portion of GDP accruing from agriculture is positive. The elasticity estimate for manufacturing is also positive.

A 10.0 per cent increase in the proportion of GDP generated from manufacturing would increase the consumption of household kerosene by 5.2 per cent. It should be noted however, that this is for the contribution of manufacturing sector to GDP lagged by one year.

VI. CONCLUDING REMARKS

Population in Nigeria has been really high. The projected annual growth rate of the total population is expected to increase by 3.5 per cent in the year 2000 and the drift towards the urban centres continues unabated, affecting the provision and demand of economic activities. Meanwhile, these activities are usually propelled significantly by increase in the incomes and demand by household and businesses. Petroleum products based energy accounts for approximately 47.0 per cent of the country's total energy consumed, the rest deriving from electricity, coal, crude oil etc. Over the years, most of the energy needed for urban household and industrial consumption are mainly petroleum products such as petrol, diesel, cooking gas, household kerosene and aviation turbine kerosene. Others are fuel oil, lubricating oil, brake fluid and petroleum jelly.

This study has sought to shed some light by exploring the magnitude and direction of the elasticities of the consumption of some specified petroleum products in Nigeria. Elasticities were also estimated for proportions of GDP contributed by agriculture, manufacturing and services. The empirical findings of the study reveals that urbanisation has a positive impact on the consumption of liquified petroleum gas (cooking gas). The elasticity for petrol also showed a positive

trend. Conversely, the consumption of household kerosene is negative showing that kerosene is not demand elastic. This result, though different from every day experience which seems to suggest that there are more urban poor than urban rich in Nigeria could be explained thus, whereas the urban rich can assess alternative sources of energy such as electricity and gas, the same can not be said about the urban poor. This result is interestingly showing that all things being equal, the urban poor are hurt more than the rich when prices of kerosene are raised. Although, petroleum product crisis stemmed from other factors identified in the study, urbanization has contributed to increased demand for the petroleum products. The policy implication of this study therefore is that projection of demand could be carried out more appropriately.

In summarry, the transfer of an increasingly large proportion of the population, as well as changes in the relative importance of the major sectors of the economy, have definite impacts on the consumption of petroleum products in Nigeria. In that regard, expected urban expansion should be given direct consideration in petroleum products demand planning, especially by the Pipelines and Products Marketing Company - a subsidiary of NNPC in their estimation of the demand for petroleum products.

FOOTNOTES

1.0 Any errors or omissions should be traced to the authors.

2.0 Central Bank of Nigeria Annual Report, 1996.

3.0 The World Bank Social Indicators of Developments, 1992.

4.0 Grossing up inhibits elicitation of correct behavioural responses, and general unrepresentative parameter estimates.

5.0 The proportion of people living in twelve selected cities with population greater than 200,000 was used as proxy for proportion of people in urban centres in Nigeria.

TABLE 1
NIGERIA'S GROSS DOMESTIC PRODUCT AT 1984 CONSTANT FACTOR COST AND SHARE OF SOME SELECTED SECTORS

Year	GDP at 1984 ContantFactor =N=" Million	Contribution by Agriculture =N=' Million	Share of Agric in total GDP(%)	Contribution by Manufacturing =N=' Million	Share of Manuf. in Total GDP(%)	Contribution by Petroleum =N=' Million	Share of Petroleum in total GDP(%)	Contribution by Transport =N=' Million	Share of Transport Total GDP(%)	Contribution by Wholesale & R/T =N=' Million	Share of Wholesale & Retail Trade in Total GDP(%)
1981	70,395.9	17,840.0	25.3	6,964.2	9.9	9,866.5	14.0	4,216.5	6.0	9,155.9	13.0
1982	70,157.0	18,247.0	26.0	7,860.7	11.2	8,741.0	12.5	3,298.7	4.7	9,551.9	13.6
1983	66,389.5	17,724.0	26.7	5,549.4	8.4	8,465.5	12.8	2,853.3	4.3	9,318.3	14.0
1984	63,006.4	16,920.0	26.9	4,926.2	7.8	9,569.4	15.2	2,639.7	4.2	8,597.0	13.6
1985	68,916.3	20,977.0	30.4	5,903.5	8.6	10,379.1	15.1	3,164.4	4.6	8,936.6	13.0
1986	71,075.9	23,345.0	32.8	5,673.9	8.0	9,834.7	13.8	2,767.7	3.9	9,251.0	13.0
1987	70,741.4	22,411.0	31.7	5,963.2	8.4	8,871.8	12.5	2,766.7	3.9	9,831.1	13.9
1988	77,752.3	24,831.0	31.9	6,729.5	8.7	9,590.9	12.3	2,794.2	3.6	10,725.0	13.8
1989	83,495.2	26,072.6	31.2	6,840.2	8.2	11,034.2	13.2	2,797.7	3.4	11,154.0	13.4
1990	90,342.1	27,206.7	30.1	7,361.4	8.1	11,645.8	12.9	2,853.6	3.2	11,488.6	12.7
1991	94,614.1	28,431.0	30.0	8,046.0	8.5	12,717.2	13.4	2,950.6	3.1	11,856.3	12.5
1992	97,431.4	29,238.9	30.0	657.2	7.9	13,060.5	13.4	3,083.7	3.2	12,223.8	12.5
1993	100,015.1	30.132.2	30.1	7,341.0	7.3	13,086.6	13.1	3,215.8	3.2	12,590.5	12.6
1994	101,330.0	31,037.2	30.6	7,280.0	7.2	12,746.4	12.6	3,220.0	3.2	12,593.0	12.4
1995	103,502.9	32,090.0	31.0	6,880.0	6.6	13,070.0	12.6	3,260.0	3.1	12,601.8	12.2

Source: Central Bank of Nigeria Statistical Bulletin Vol. 9, No. December, 1998, P. 114.

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