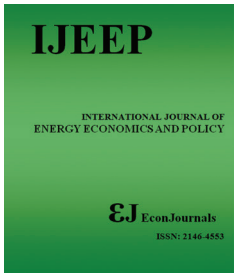

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# Petroleum Subsidy Withdrawal, Fuel Price Hikes and the Nigerian Economy

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**ABSTRACT**

The study investigated petroleum subsidy withdrawal, fuel price hikes and the Nigerian economy. The purpose of the study was to determine the extent to which the removals of petroleum subsidies stimulate hikes in fuel prices and increases in the prices of products of other sectors in the Nigerian economy. It employed input-output model to determine the value added per sector from the computed table of flow of goods. Subsequently, the impacts of reductions in petroleum subsidies (10%, 20%, 30%, 40% and 50%) on the prices of products from the other sectors were computed. Results showed that reduction in petroleum subsidies stimulate increases in prices of petroleum products and such increases trigger increases in transport fares; increases in transport fares subsequently lead to increases in prices of other products owing to the degree of interdependency among the various sectors. The need for policy makers to be mindful of the economic implications of subsidy removal was suggested, among others.

**Keywords:** Petroleum Subsidy, Petroleum Subsidy Removal, Fuel Price Hike
**JEL Classifications:** H25

## 1. INTRODUCTION

Since the discovery of oil in commercial quantities at Oloibiri in the late fifties and the subsequent relegation of the agricultural sector, crude oil has been and is still the mainstay of the Nigerian economy. Society's heavy dependence on oil for her foreign exchange earnings has made the Nigerian economy a monoculture. There have been interests in understanding the causes and consequences of oil price shocks ever since the 1970s (Lorussoa and Pieronib, 2018; Fueki et al., 2018; Amaiquema and Amaiquema, 2017, Jo et al., 2017; Obi et al., 2016; Kilian, 2014) United States recessions and soaring inflation and the subsequent slowdown in productivity and for stagflation (a combination of inflation and economic stagnation which occurred during the 1970s) have been largely attributed to oil price shocks (Kilian, 2014). Changes in monetary policy associated with far-reaching labour market adjustments as well as for energy technologies changes have also been attributed to oil price shocks.

Most of the extant studies on oil price fluctuations focused on crude oil prices in the upstream sector. While the upstream sector prices impact on the prices on refined products in the downstream sector, it is the price increases in the downstream petroleum sector occasioned by gradual removal of petroleum subsidies that has been largely responsible for most of the increases in the prices of petroleum products. Specifically, the Nigerian government has been involved in deregulation policy in the downstream petroleum sector which requires withdrawal of petroleum subsidy. Withdrawal of petroleum subsidy often stimulates increases in the prices of petroleum products and hence, increases in transportation cost and prices of other commodities. Thus, there is a linkage between the oil sector and every other sector in the Nigerian economy. To this end, the dearth of literature on downstream sector and fluctuations in the prices of petroleum products is seen as a gap in literature. This study seeks to feel this gap. Thus, the intention was to investigate the extent to which withdrawal

of petroleum subsidies influence increases in sectorial prices in Nigerian economy.

This study sought to investigate the effect of petroleum subsidy withdrawals on the prices of petroleum products and the degree of influence of fuels price hikes on the other sectors of the Nigerian economy by estimating the extent to which such fuel price hikes impact on the prices of other sectors of the economy using the input-output model of the Nigerian economy.

## 2. LITERATURE REVIEW

The Nigerian economy is largely dependent on the oil sector and so oil price fluctuations and the direction of such fluctuations are of significant concern to policy makers and other stakeholders alike because such fluctuations influence the prices of refined products in the downstream sector.

### 2.1. Oil Price Fluctuations and its Causes

Changes or fluctuations in oil prices have been defined as the barometer of worldwide economy whose importance transcends the political and economic circle in every country (Lingyu, 2012). Oil price volatility has been attributed to so many factors ranging from instability in the major oil producing countries in the Middle-East occasioned by wars; as well as the interactive forces of demand and supply of crude oil in the world oil market; others include, the decisions of the organisation of oil exporting countries (OPEC), as well as economic fluctuations consistent with business cycles. Merino and Ortiz (2005) used traditional approach to evaluate why there was a slim margin between demand and supply in the oil market. He argued that oil inventories should reflect the interaction between supply and demand forces with a view to making meaningful contribution to explaining the changes in oil prices in the world market. There is no gainsaying that crude oil is the driving force of modern economics and when oil producing countries demand for increases in oil prices; unforeseen economic developments could, in principle, stir crude oil markets and stimulate volatility in oil prices (Eryiğit, 2009). This was the case with the unforeseen sudden movements in energy demand from China and India, which culminated in the exhaustion of worldwide crude oil safety stocks and the decline in the value of the U.S dollar vis-à-vis the currencies of her international trading partners are some examples (Guo and Kliesen, 2005).

Oil price fluctuation has also been attributed to the dwindling of the world crude oil reserve. Other causes of price fluctuations include political instability in the producing countries, decisions on the quota system of OPEC, as well as panic buying and selling to forestall the consequences of stochastic eventualities (Pirog, 2004). Whereas physical disruptions of supply have been attributed to historical oil price shocks, the oil price build-up of 2007-2008 was caused by the inability of supply (world production) to match up with demand (Hamilton, 2009; and Cale, 2004). Violent oil price movements have been attributed to the oil market's way of seeing the state of solidarity of the organisation of oil producing countries as well as the anticipated interactions between demand and supply of futures markets (Mabro, 2001). The activities of various militant groups in oil producing countries of the world and middle-east crisis have also influenced oil price fluctuations; some examples include the concerns about violence in Nigeria and Algeria owing to persistent attacks on oil facilities by militants as well the Iraqi War (Lee et al., 1996), among others.

### 2.2. Oil and the Macro Economy

Owing to the heavy dependence on crude oil earnings by many countries, including Nigeria, the relationship between oil production and prices, especially the dependence of oil prices on real output has received considerable attention in recent times. This is easily attributable to the realisation that oil price increase is inversely proportional to GDP growth and directly proportional to production costs (Papapetrou, 2009) empirically showed that the degree of inverse relationship between oil prices and economic activity is enhanced during periods of swift changes in oil price and high oil price volatility. Despite numerous debates on the possible consequences of oil price volatility, empirical evidence suggests lack of a general consensus on the exact economic consequences of oil price volatility (Schmidbauer and Kalaycioglu, 2008). Gronwald et al. (2009) found that global economic development as well as power and speculative behaviour of OPEC, which makes oil stochastic; are the main factors that influence oil prices. Because of the heavy dependence on oil by many countries, oil prices are crucial to the movements of many macroeconomic variables and therefore very significant to the macroeconomy (Ewing and Thompson, 2007). Consequently, oil price volatility is presumed to have have an impact on government expenditure (Varjavand et al. 2008) and on stock market performance (Cunado and Gracia, 2004).

### 2.3. Petroleum Subsidy Removal and the Nigerian Economy

Following the structural adjustment programme adopted by Nigeria in 1986, part of the conditions given to Nigeria by IMF was the deregulation of the downstream sector, which was supposed to culminate in complete absence of government regulation of the sector. Given that the sector had been fully regulated by government, it became necessary for policy makers to embark on gradual removal of petroleum subsidies, which was part of the regulation policy. However, the gradual removal of petroleum subsidies has had significant implications on fuel prices and transport cost and attendant increases in prices of other goods. Consequently, removal of fuel subsidies now has two effects; information and macroeconomic effect.

Each planned partial removal of subsidy sends information to the petroleum marketers; fuel dealers and transport operators shift additional cost of petroleum products to them. This prompts an increase in pump prices of petroleum products. The transport operators get the message and adjust their fairs to absorb the additional cost and subsequently, the producers in other sectors factor in the marginal transport costs into their cost of production and reflect it at a profit in their product pricing. Thus each time there is news about increases in the prices of petroleum prices; it triggers a wave of price increases. The macroeconomic effect concerns the interdependency between the prices of petroleum products and cost of transportation on one hand and the cost of transportation and cost of goods on the other hand. Since petroleum products are major inputs in transportation and power generation,

increases in petroleum product trigger increases in the cost of power generation and transportation and subsequently lead to increases in the cost of goods.

### 2.4. Empirical Review

Akinyemi et al. (2017) analysed the impact of refined petroleum subsidy removal on the agricultural sector in Nigeria, the results support a complete removal of fuel subsidy for better performance of the agricultural sector. Olaniyi (2016) investigated the effects of fuel subsidy on transport costs and transport rates in Nigeria. He observed that fuel subsidy is a major tool for enhancing citizen's welfare, especially among the middle and low income countries but that removal of fuel subsidies significantly influence the factors that influence transport costs and transport rates, thus leading to higher transport cost and rates. Obo et al. (2017) investigated fuel subsidy removal and the ubiquity of hardships in Nigeria. They opined that removal of fuel subsidy has dire consequences on the wellbeing of the people. According to them, fuel subsidy removal can stimulate the promotion of the public good if such removal is well-articulated, managed and targeted. They suggested the need to put an end to the importation of refined petroleum products in Nigeria.

Kilian (2014) "investigated oil price shocks: Causes and consequences." He observed real price of oil originate from economic fundamentals and that oil price shocks do not occur under normal circumstances. To this end the need to explicitly explain the changes in demand and supply which are may explain oil price shocks when studying their transmission to the domestic economy becomes inevitable. He therefore suggested the use of structural models of the global economy explaining the relationships between oil price fluctuations and the economy, including the oil market. Lorussoa and Pieronib (2018) investigated the "causes and consequences of oil price shocks on the UK economy." They assessed the consequences of oil price fluctuations on the UK economy by employing a method which permitted the decomposition of oil price fluctuations from the root causes of the shock. They found that different types of oil shocks were responsible for the consequences that oil price fluctuations had on macroeconomic aggregates in the UK and that a rise in real oil price causes increases in domestic inflation.

Fueki et al. (2018) investigated "the role of expectations in the crude oil market on oil price shocks and their consequences" they employed structural vector autoregressive model to examine the factors that were crucial to oil price fluctuations by assessing the extent to which expectations influenced future aggregate demand and supply of crude oil. The results showed that future demand and supply shocks explain about 30-35% of historical oil price fluctuations. Lee and Ni (2002) showed in a seminal finding, that almost all U.S. industries experience oil price shocks which manifest largely through reduction in demands. Jo et al. (2017) re-examined "industry effects of oil price shocks" by re-examining Lee and Ni's (2002) seminal finding by updating the data with two additional decades and employed enhanced empirical methods, including structural factor-augmented vector autoregressions. The results were consistent with those of Lee and Ni (2002).

Obi et al. (2016) investigated "oil price shock and macroeconomic performance in Nigeria" using annual data from the 1979 to 2014. The study was underpinned by unrestricted vector auto regression model by Sims (1980). The relationship between oil price changes and inflation rate, gross domestic product (GDP) and real exchange rate were estimated by the model. The speed of adjustment of the variables from the short run dynamics to the long run was examined using the vector autoregressive model. A given change in oil price was found to yield more than proportionate change in real exchange rate, interest rate and GDP in Nigeria.

## 3. RESEARCH METHODS

### 3.1. Model Formulation

This study utilized the input-output model; specifically, it utilized the open input-output model.

$$\text{Thus, } X+Y = D \quad (1)$$

$$Y = AX \quad (2)$$

Equations (i) and (ii) imply that $X+AX = D$ (3)

Equation (iii) implies that $X(I–A) = D$. Thus, $X = (I–A)^{-1}D$ (4)

Where
Y = Inputs into the various industries or sectors
X = Outputs from the various industries
D = Vector of final demand.

In this model,
X = Prices of the outputs from all the industrial sectors under focus, including the oil sector
A = Input – output matrix
D = Value added in each of the sectors.

The basic assumptions of the input-output model, being the major model in this study, are as follows:

i. All sectors produce according to the Leontief (fixed coefficient) production function. Therefore, there are constant returns to scale in the use of all factors of production and there is no substitution between any pair of inputs
ii. The production process is irreversible. This assumption implies that inputs cannot be recovered from the outputs; to this end, there are no negative outputs
iii. There is excess supply of labour and there is no appreciable capacity constraint in the various sectors of the economy
iv. Prices are set by producers so as to cover all costs, that is, per unit cost of intermediate inputs, per unit wage cost, per unit operating surplus, per unit depreciation allowance, as well as per unit indirect taxes less per unit subsidies
v. All firms in each industry or sector use the same technology in the production of their various commodities
vi. Production in certain sectors requires locally produced and imported intermediate inputs
vii. There is no price discriminatory practice on the part of the products, thus implying that all users of a given output pay the same cost-determined price (Inegbedion, 2012).

### 3.2. The Quantity Model

Using the above assumptions, production can be described by the following equations:

$$Q = Y+C+I+G+X–M \quad (7)$$

Where Q = n × 1 vector of sectorial gross output
Y = n × 1 vector of sectorial inputs
C = n × 1 vector of sectorial household consumption expenditure
I = n × 1 vector of sectorial investment expenditure
G = n × 1 vector of sectorial government expenditure
X = n × 1 vector of sectorial exports
M = n × 1 vector of sectorial imports.

Also Y = AQ (ii), where A = n × n matrix of technical coefficients. To this end, equations (i) and (ii) can be re-stated as:

$$Q = AQ+C+I+G+X–M \quad (8)$$

Also $M^c$ = h'Q' where $M^c$ is = 1 × n vector of sectorial complementary imports;

h' = 1 × n vector of sectorial per unit complementary imports.

From (iii) Q–AQ = C+I+G+X–M

i.e. Q (I–A) = C+I+G+X–M. Therefore, $Q = (I–A)^{-1}(C+I+G+X–M)$ (9)

$$Mc = h'Q \quad (10)$$

The matrix $(I–A)^{-1}$ is the Leontief inverse matrix which measures the full effects of changes in any or a combination of the final demand elements like household consumption expenditure, investment expenditure, as well as government consumption expenditure on sectorial outputs. However, in this study, D represents the value added in each of the sectors or industries. The effect of changes in any of the final demand elements is obtained as follows:

Suppose there is a change in the vector of investment expenditure then, the effect of such a change on sectorial outputs is determined by:

$\Delta Q = (I–A)^{-1} \Delta I$ and equation (i) becomes $\Delta M^c = h\Delta I$

### 3.3. The Price Model

Value added per unit = $\frac{V_j}{X_i}$,

Where $X_j$ = output in the $j^{th}$ sector

$V_j$ = value added in the $j^{th}$ sector

$P_j = (I–A)^{-1} \frac{V_j}{X_i}$

Where
$P_j$ = unit price in the jth sector

The above price equation can be used to measure the sectorial price effects of a change in sectorial per unit price. Suppose there is a uniform reduction in sectorial subsidies, then the effect of such a change in sectorial subsidies on sectorial prices can be determined as:

$$\Delta P = (I–A)^{-1} \Delta V$$

Where ΔV = change in value added per sector as a result of change in subsidy

The above equation measures the full (direct and indirect) sectorial price effects of a uniform reduction in sectorial subsidies.

## 4. FINDINGS

Nigeria's Input – output table is a 32 × 32 matrix. However, given that elements representing sectors that are not interdependent are zero coupled with the need to ease computation, the matrix was consolidated to obtain a 4 × 4 matrix. The original (32 × 32) matrix is attached as appendix. Agriculture, livestock, fishing, and forestry were collapsed into agriculture; crude petroleum and refineries – oil; transport retained its status; all the remaining twenty-five were collapsed to form "others." The resulting matrix is presented below (Table 1):

$$A = \begin{array}{c} \\ \text{Agric} \\ \text{Oil} \\ \text{Transport} \\ \text{Others} \end{array} \begin{bmatrix} \text{Agric} & \text{Oil} & \text{Transport} & \text{Others} \\ 0.08 & 0 & 0 & 0.04 \\ 0.02 & 0.016 & 0.024 & 0.03 \\ 0.03 & 0.27 & 0.02 & 0.45 \\ 0.06 & 0.01 & 0.014 & 0.20 \end{bmatrix}$$

$$I – A = \begin{array}{c} \\ \text{Agric} \\ \text{Oil} \\ \text{Transport} \\ \text{Others} \end{array} \begin{bmatrix} \text{Agric} & \text{Oil} & \text{Transport} & \text{Others} \\ 0.92 & 0 & 0 & -0.04 \\ -0.02 & 0.984 & -0.024 & -0.03 \\ -0.03 & -0.27 & 0.98 & -0.45 \\ -0.06 & -0.01 & -0.014 & 0.80 \end{bmatrix}$$

$$I – A^{-1} = \begin{array}{c} \\ \text{Agric} \\ \text{Oil} \\ \text{Transport} \\ \text{Others} \end{array} \begin{bmatrix} \text{Agric} & \text{Oil} & \text{Transport} & \text{Others} \\ 0.92 & 0 & 0 & -0.04 \\ -0.02 & 0.984 & -0.024 & -0.03 \\ -0.03 & -0.27 & 0.98 & -0.45 \\ -0.06 & -0.01 & -0.014 & 0.80 \end{bmatrix}^{-1}$$

$$I – A^{-1} = \begin{array}{c} \\ \text{Agric} \\ \text{Oil} \\ \text{Transport} \\ \text{Others} \end{array} \begin{bmatrix} \text{Agric} & \text{Oil} & \text{Transport} & \text{Others} \\ 1.10 & 0.001 & 0.001 & 0.055 \\ 0.027 & 1.024 & 0.260 & 0.0543 \\ 0.079 & 0.2904 & 1.040 & 0.5980 \\ 0.084 & 0.0180 & 0.0185 & 1.2653 \end{bmatrix}$$

**Table 1: Outputs of various sectors (N billion)**

| Sector | Output (X) | (%) |
|---|---|---|
| Agriculture | 39273.94 | 41.72 |
| Oil | 15073.78 | 16.01 |
| Transport | 1361.07 | 1.45 |
| Others | 38436.17 | 40.83 |

Source: Central Bank of Nigeria (2015)

$$X = I - A^{-1} D = \begin{matrix} \text{Sector} \\ \text{Agriculture} \\ \text{Oil} \\ \text{Transport} \\ \text{Others} \end{matrix} \begin{pmatrix} \text{Output} \\ 39273.94 \\ 15073.78 \\ 1361.07 \\ 38436.17 \end{pmatrix}$$

$$\text{Sectorial inputs} = AX \begin{bmatrix} 0.08 & 0 & 0 & 0.04 \\ 0.02 & 0.016 & 0.024 & 0.03 \\ 0.03 & 0.27 & 0.02 & 0.45 \\ 0.06 & 0.01 & 0.014 & 0.20 \end{bmatrix} \begin{pmatrix} 39273.94 \\ 15073.78 \\ 1361.07 \\ 38436.17 \end{pmatrix}$$

$$\text{Value added per unit} = \frac{V}{X}$$

$$\text{Thus, } V = \begin{pmatrix} 0.81 \\ 0.70 \\ 0.94 \\ 0.28 \end{pmatrix}$$

$$\text{Value added per unit} = \frac{V}{X} = \begin{pmatrix} \text{Agriculture} & \text{Oil} & \text{Transport} & \text{Others} \\ 0.810 & 0.704 & 0.940 & 0.280 \end{pmatrix}$$

$$\text{Unit price per sector} = (I - A)^{-1} V =$$

$$\begin{matrix} \text{Agric} \\ \text{Oil} \\ \text{Transport} \\ \text{Others} \end{matrix} \begin{bmatrix} 1.10 & 0.001 & 0.001 & 0.055 \\ 0.027 & 1.024 & 0.260 & 0.0543 \\ 0.079 & 0.2904 & 1.040 & 0.5980 \\ 0.084 & 0.0180 & 0.0185 & 1.2653 \end{bmatrix} \begin{pmatrix} 0.81 \\ 0.70 \\ 0.94 \\ 0.28 \end{pmatrix}$$

$$= \begin{matrix} \text{Agric} \\ \text{Oil} \\ \text{Transport} \\ \text{Others} \end{matrix} \begin{pmatrix} 0.9001 \\ 0.7778 \\ 1.4085 \\ 0.4519 \end{pmatrix}$$

The above are the unit prices of the outputs in the various sectors

### 4.1. Effect of a 10% Reduction in Oil Subsidy on the Prices of Products from Other Sectors

A reduction in oil subsidy will automatically lead to an increase in the prices of oil products and hence provoke an increase in value added in all sectors as well as increase value added in the oil sector proportionately. For simplicity sake, we assume that x% reduction in oil subsidy will trigger x% increase in the prices of petroleum products. Using the oil input required in each sector as a standard, the increase in value added in all the sectors will be obtained as:

$$P = (I - A)^{-1} V = \begin{bmatrix} 1.10 & 0.001 & 0.001 & 0.055 \\ 0.027 & 1.024 & 0.260 & 0.0543 \\ 0.079 & 0.2904 & 1.040 & 0.5980 \\ 0.084 & 0.0180 & 0.0185 & 1.2653 \end{bmatrix} \begin{pmatrix} 0.99 \\ 0.86 \\ 1.41 \\ 050 \end{pmatrix}$$

$$= \begin{matrix} \text{Agric} \\ \text{Oil} \\ \text{Transport} \\ \text{Others} \end{matrix} \begin{pmatrix} 1.12 \\ 1.30 \\ 2.13 \\ 0.78 \end{pmatrix}$$

New sector prices

$$P = (I - A)^{-1} V = \begin{bmatrix} 1.10 & 0.001 & 0.001 & 0.055 \\ 0.027 & 1.024 & 0.260 & 0.0543 \\ 0.079 & 0.2904 & 1.040 & 0.5980 \\ 0.084 & 0.0180 & 0.0185 & 1.2653 \end{bmatrix} \begin{pmatrix} 1.08 \\ 0.94 \\ 2.63 \\ 054 \end{pmatrix}$$

$$= \begin{matrix} \text{Agric} \\ \text{Oil} \\ \text{Transport} \\ \text{Others} \end{matrix} \begin{pmatrix} 1.22 \\ 1.70 \\ 3.42 \\ 0.84 \end{pmatrix}$$

$$P = (I - A)^{-1} V = \begin{bmatrix} 1.10 & 0.001 & 0.001 & 0.055 \\ 0.027 & 1.024 & 0.260 & 0.5043 \\ 0.079 & 0.2904 & 1.040 & 0.5980 \\ 0.084 & 0.0180 & 0.0185 & 1.2653 \end{bmatrix} \begin{pmatrix} 1.17 \\ 170 \\ 3.42 \\ 0.84 \end{pmatrix}$$

$$= \begin{matrix} \text{Agric} \\ \text{Oil} \\ \text{Transport} \\ \text{Others} \end{matrix} \begin{pmatrix} 1.32 \\ 1.84 \\ 3.70 \\ 0.92 \end{pmatrix}$$

$$P = (I - A)^{-1} V = \begin{bmatrix} 1.10 & 0.001 & 0.001 & 0.055 \\ 0.027 & 1.024 & 0.260 & 0.0543 \\ 0.079 & 0.2904 & 1.040 & 0.5980 \\ 0.084 & 0.0180 & 0.0185 & 1.2653 \end{bmatrix} \begin{pmatrix} 1.26 \\ 1.092 \\ 3.07 \\ 0.63 \end{pmatrix}$$

$$= \begin{matrix} \text{Agric} \\ \text{Oil} \\ \text{Transport} \\ \text{Others} \end{matrix} \begin{pmatrix} 1.42 \\ 1.98 \\ 3.99 \\ 0.98 \end{pmatrix}$$

$$P = (I - A)^{-1} V = \begin{bmatrix} 1.10 & 0.001 & 0.001 & 0.055 \\ 0.027 & 1.024 & 0.260 & 0.0543 \\ 0.079 & 0.2904 & 1.040 & 0.5980 \\ 0.084 & 0.0180 & 0.0185 & 1.2653 \end{bmatrix} \begin{pmatrix} 1.35 \\ 1.17 \\ 3.29 \\ 0.68 \end{pmatrix}$$

$$= \begin{matrix} \text{Agric} \\ \text{Oil} \\ \text{Transport} \\ \text{Others} \end{matrix} \begin{pmatrix} 1.53 \\ 2.13 \\ 4.23 \\ 1.06 \end{pmatrix}$$

### 4.2. Discussion of Findings

The table of flow of goods is presented in Table 2. From this table, the value added and the sectorial prices are computed (Table 3). From the results in Table 3 the sectorial prices are computed using the sectorial value added and matrix of interdependency ($(I–A)^{-1}$). Based on these initial sectorial prices, the impacts of subsequent removal of petroleum subsidies (10%, 20%, 30%, 405 and 50%) are considered (Tables 4-13). The analyses of the impact of petroleum subsidies removal on sectorial price changes indicate that a 10% reduction in petroleum subsidy will lead to 26.6%, 66.7%, 51.1%, and 68.9% increases in the sectorial prices of agriculture, petroleum products, transport and other sectors, thus leading to significant reduction in the purchasing power of the

**Table 2: Table of flow of goods with a row of value added (shows a flow of sectorial outputs to the inputs of other sectors)**

| Input/output | Agriculture | Oil | Transport | Others | Demand | Total |
|---|---|---|---|---|---|---|
| Agriculture | 3142 | 0 | 0 | 1538 | 34594 | 39273.94 |
| Oil | 786 | 241 | 33 | 1153 | 12864 | 15073.78 |
| Transport | 1178 | 4070 | 27 | 17296 | 21210 | 1361.07 |
| Others | 2356 | 151 | 19 | 7687 | 28223 | 38436.17 |
| Value added | 31811 | 10612 | 1282 | 10762 | | |
| Total | 39273 | 15073.78 | 1361.07 | 38436.2 | | |

**Table 3: Value added in the major sectors of the Nigerian economy**

| Sector | Value added per unit |
|---|---|
| Agriculture | $\frac{31811}{39273}=0.810$ |
| Oil | $\frac{10612}{15073.78}=0.704$ |
| Transport | $\frac{1282}{1361.07}=0.942$ |
| Others | $\frac{10762}{38436.2}=0.280$ |

**Table 4: Increase in value added due to 10% reduction in petroleum subsidy (10% increase in value added)**

| Sector | Increase in value added |
|---|---|
| Agriculture | 1.1×0.90=0.99 |
| Oil | 1.1×0.78=0.86 |
| Transport | 1.1×2.19=1.41 |
| Others | 1.1×0.45=0.50 |

**Table 5: Change in prices due to 10% reduction in petroleum subsidy (10% percent increase in prices of petroleum products)**

| Sector | Old price | New price | Change in price | Percentage change |
|---|---|---|---|---|
| Agriculture | 0.90 | 1.12 | 0.22 | 26.6 |
| Oil | 0.78 | 1.30 | 0.52 | 66.7 |
| Transport | 1.41 | 2.13 | 0.72 | 51.1 |
| Others | 0.45 | 0.78 | 0.31 | 68.9 |

**Table 6: Effect of a 20% reduction in petroleum subsidy on the sectorial value added and prices of products from other sectors (20% percent increase in value added)**

| Sector | Increase in value added |
|---|---|
| Agriculture | 1.2×0.90=1.08 |
| Oil | 1.2×0.78=0.94 |
| Transport | 1.2×2.19=2.63 |
| Others | 1.2×0.45=0.54 |

local currency (Tables 4 and 5). In the same vein, a 20% reduction in petroleum subsidy will lead to 35.6%, 117.7%, 142.6%, and 86.7% increases in the sectorial prices of Agriculture, petroleum products, transport and other sectors (Tables 6 and 7). Also, a 30% reduction in petroleum subsidy will lead to 46.7%, 135.9%, 158.2%, and 104.4% increases in the sectorial prices of agriculture, petroleum products, transport and other sectors (Tables 8 and 9).

**Table 7: Change in prices due to 20% reduction in petroleum subsidy (20% increases in petroleum prices)**

| Sector | Old price | New price | Change in price | Percentage change |
|---|---|---|---|---|
| Agriculture | 0.90 | 1.22 | 0.32 | 35.6 |
| Oil | 0.78 | 1.70 | 0.92 | 117.7 |
| Transport | 1.41 | 3.42 | 2.01 | 142.6 |
| Others | 0.45 | 0.84 | 0.39 | 86.7 |

**Table 8: Effect of a 30% reduction in oil subsidy on the sectorial value added and prices of products from other sectors (30% increase in value added)**

| Sector | Increase in value added |
|---|---|
| Agriculture | 1.30×0.90=1.17 |
| Oil | 1.30×0.78=1.014 |
| Transport | 1.30×2.19=2.85 |
| Others | 1.30×0.45=0.59 |

**Table 9: Change in prices due to 30% reduction in petroleum subsidy (30% increases in prices of value added)**

| Sector | Old price | New price | Change in price | Percentage change |
|---|---|---|---|---|
| Agriculture | 0.90 | 1.32 | 0.42 | 46.7 |
| Oil | 0.78 | 1.84 | 1.06 | 135.9 |
| Transport | 1.41 | 3.70 | 2.23 | 158.2 |
| Others | 0.45 | 0.92 | 0.47 | 104.4 |

**Table 10: Effect of a 40% reduction in oil subsidy on the sectorial value added and prices of products from other sectors (30% increase in prices of value added)**

| Sector | Increase in value added |
|---|---|
| Agriculture | 1.40×0.90=1.26 |
| Oil | 1.40×0.78=1.092 |
| Transport | 1.40×2.19=3.07 |
| Others | 1.40×0.45=0.63 |

**Table 11: Change in prices due to 40% reduction in petroleum subsidy (40% increases in the prices of petroleum products)**

| Sector | Old price | New price | Change in price | Percentage change |
|---|---|---|---|---|
| Agriculture | 0.90 | 1.42 | 0.52 | 57.8 |
| Oil | 0.78 | 1.98 | 1.20 | 154.0 |
| Transport | 1.41 | 3.99 | 2.58 | 183.0 |
| Others | 0.45 | 0.98 | 0.53 | 117.8 |

Similarly, a 40% reduction in petroleum subsidy will lead to 57.8%, 154.0%, 183.0%, and 117.8% increases in the sectorial prices of Agriculture, petroleum products, transport and other

sectors (Tables 10 and 11). Lastly, a 50% reduction in petroleum subsidy will lead to 70.0%, 173.1%, 202.8%, and 177.8% increases in the sectorial prices of agriculture, petroleum products, transport and other sectors (Tables 12 and 13). The foregoing analysis shows that the unending deregulation of petroleum products has brought untold hardships to the citizens of Nigeria because of the vicious circle of price increases and the low purchasing power of the currency arising from the devaluation of the naira (the local currency) which is often the major reason for removal of fuel subsidies. Results are consistent with Lee and Ni (2002), Akinyemi et al. (2017), Obo et al. (2017).as well as Lorussoa and Pieronib (2018).

### 4.3. Proposed Model of Petroleum Subsidies and the Nigerian Economy

Based on the findings, a model of petroleum subsidy removal and the Nigerian economy is proposed with a view to explaining the relationship between petroleum subsidy removal and the products of the other sectors of the Nigerian economy (Figure 1). The model shows that a partial removal of fuel subsidy will cause an increase in the prices of petroleum products which serve as inputs to the transport sector and generating systems. Since the end products of the agricultural and manufacturing sector as well as all the other sectors have to be transported to the end consumers,

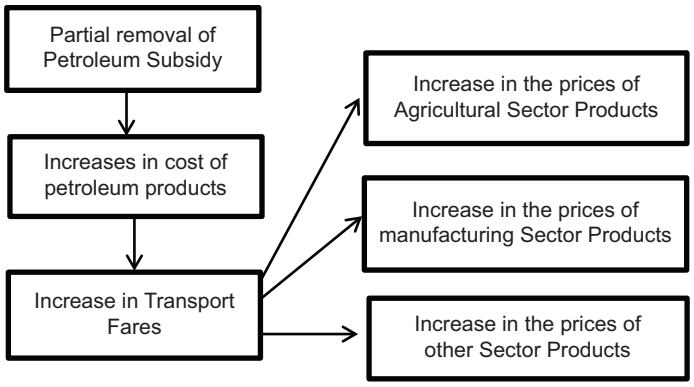
**Table 12: Effect of a 50% reduction in oil subsidy on the sectorial value added and prices of products from other sectors (50% increase in value added)**

| Sector | Increase in value added |
|---|---|
| Agriculture | 1.50×0.90=1.35 |
| Oil | 1.50×0.78=1.17 |
| Transport | 1.50×2.19=3.29 |
| Others | 1.50×0.45=0.68 |

**Table 13: Change in prices due to 50% reduction in petroleum subsidy (50% increases in the prices of petroleum products)**

| Sector | Old price | New price | Change in price | Percentage WSchange |
|---|---|---|---|---|
| Agriculture | 0.90 | 1.53 | 0.63 | 70 |
| Oil | 0.78 | 2.13 | 1.35 | 173.1 |
| Transport | 1.41 | 4.27 | 2.86 | 202.8 |
| Others | 0.45 | 1.25 | 0.80 | 177.8 |

**Figure 1:** Proposed model of petroleum subsidies and the Nigerian econom




increase in transport cost will stimulate increases in the prices of the products from the agricultural sector and the manufacturing sector as well as all the other sectors of the economy. Thus, partial removal or complete removal of petroleum subsidy leads to increases in transport cost, which culminate in increases in the prices of agricultural products, manufactured products and prices of products from other sectors.

## 5. CONCLUSIONS AND POLICY IMPLICATIONS

### 5.1. Conclusions

All the sectors in any economy and the Nigerian economy in particular, are interdependent since the outputs of a given sector in one period may serve as input requirement for one or more sectors of the economy's production in another period. The interdependency of the sectors of the Nigerian economy as portrayed by the input-output matrix (matrix of technological coefficients) shows that all the sectors of the economy are significantly dependent on the oil sector, increases in the prices of petroleum products, through the removal of oil subsidy, leads to significant increases in transport fares and thus cause increases in the cost of production since transport cost is part of the distribution cost of products. The associated spate of increases lead to a fall in the purchasing power of the local currency (naira) thus precipitating a fall in the standard of living. Lastly, removal of fuel subsidies has information and macroeconomic effects.

This study has made significant contribution to knowledge in the management science and economics literature by demonstrating how the interdependency among the sectors and the dependence of the economy on the oil sector influences price increases each time oil prices increase. Although empirical studies abound on the impact of oil price shocks and oil price fluctuations on economic growth, most of those studies employed econometric models to analyse their data. Specifically, most of these models focused on oil price shocks and the impacts of such shocks on the macroeconomic variables such as GDP, inflation rate, exchange rate as well as stock market returns like all-share index and market capitalisation. This study is about the only one that employed the input-output matrix and concept of "Table of flow of goods and value added" to explain the impact of crude oil price changes, through oil subsidy removal, on the prices of other sectors of the economy. Besides, this study is the only one that has disintegrated fuel subsidy removal into information and macroeconomic effect. The study is thus unique in these respects.

The study is not without limitations which indicate the need for future studies to rectify the observed shortcomings. A major limitation to the results of this study bothers on the validity of the input-output table of the Nigerian economy, which is obviously out-dated. The input-output table is that of 1991. This table is 28 years behind schedule. This development was informed by the Central Bank of Nigeria's inability to publish any input-output table since 1991. Since no system is static, the relationships between the thirty-two sectors of the Nigerian economy must have changed since the last input-output matrix was published. If that be the case, a new

input-output (technological coefficients) matrix ought to have been published to capture this relationship. A current input-output table will be more reliable in capturing the interdependency between the sectors of the Nigerian economy. However, in the absence of an updated matrix, the old input-output matrix can still be relied on to present the desired inter-sectorial such as in this study. It is suggested that future studies employ current input-output tables when they become available. Another limitation of the study is the assumption that a given percentage reduction in subsidy (x%) will trigger the same percentage increase in value added and prices of petroleum products. In practice, the percentages may vary. The use of the same percentage was informed by the need to avoid complexities

### 5.2. Policy Implications

The federal government through the Central Bank of Nigeria and other policy makers should take note of the devastating negative impacts of oil price changes on the citizens through the drastic reduction in their purchasing power each time there is a reduction in petroleum product subsidy. While devaluation may yield marginal increases in government revenues, the trade-off between these marginal returns and the gross loss in earnings by the productive factors in the country is often negative since Nigerian economy is not an export driven economy. Given that the national income of the country is a function of the earnings of all the productive factors in the country, due cognisance should be taken of any government policy that will impact negatively on the purchasing power of the people. It is pertinent for policy makers in government to also be mindful of the fact that economic development is a function of the extent to which the citizens have access to the basic necessities of live and that access to these basic necessities is influenced by the purchasing power of the local currency (naira). To this end, petroleum subsidy removal should be hinged on the provision of adequate financial measures to ensure that the impact of such removal does not erode the purchasing power of the local currency. Such measures may include but are not limited to price controls, minimum wage review and/or government massive investment in food products to be sold at very affordable prices when such subsidy withdrawals occur. Alternatively, complete removal of petroleum subsidy should be done once to forestall the negative implications once.

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