Sokoto Journal of the Social Sciences Volume 8. Number 2, August, 2018 *Print ISSN* **1595-2738**
© Faculty of Social Sciences, Usmanu Danfodiyo University, Sokoto *Online ISSN* **2384-7654**

WELFARE AND MACROECONOMIC EFFECTS OF THE SALE OF FUEL FOR ₦200 PER LITRE IN NIGERIA: POLICY ANALYSIS IN A STRUCTURALIST CGE MODEL

Ernest Simeon O. Odior
Department of Economics, Faculty of Social Sciences
University of Lagos, Akoka, Lagos, Nigeria
Corresponding Author's email: *odiore@yahoo.com; eodior@unilag.edu.ng*

DOI: *10.29816/sjss.8.2.3*

ABSTRACT

The paper addressed the likely short and long run effects of 142.8 percent (₦200 Per Litre) of fuel subsidy removal on household welfare and macroeconomic growth in Nigeria. The study use a Structuralist Computable General-Equilibrium (CGE) model to run simulations that indicate the nature of the effects of fuel subsidy removal over the period 2015 – 2020. The findings show that 142.8% increases in thePremium Motor Spirit (PMS) (fuel sell at ₦200 per litre) will have several implications on some of the defined variables in this study. The findings show that ₦200 per litre pricing of petroleum products will amplify both the income and consumption losses of fuel subsidy removal, worsen inflation. The findings also show that, government income witnessed positive yearly growth, while government account balance also witnessed positive yearly growth but not at a constant rate. The fuel subsidy removal impacted positively on the output growth but reduced the level of domestic investments. This study provides a basis for recommendations on the adjustment path that the country need to take in order to mitigate the adverse impact of fuel subsidy removal on the Nigeria economy.

Keyways: *Welfare, Macroeconomic, 142.8 % Fuel Subsidy Removal, CGE*
JEL classification: E03, I31, H22, C68

1.0 Introduction

The application of or the use of subsidies is not exclusive to developing economies. Subsidies span different types of economic activities the most featured in popular press tend to be agricultural and energy related subsidies. The subsidy could be direct in the form of price controls, tax exemptions or the provision of grants – this more or less entails the injection of cash back into the hands of either the consumer or the producer.

At their core, fossil-fuel subsidies, which include; coal, diesel, gasoline, natural gas, kerosene, electricity and energy, have an economic impact by distorting prices and therefore affecting production and consumption decisions. Increases in petrol, coal, oil and natural gas prices. would ripple throughout other sectors of the economy, affecting the costs of production, and therefore the prices of other goods, particularly energy-intensive ones. (OECD, 2002).

Fuel subsidies have a variety of aggregate impacts on the economy. Subsidies also affect government accounts, the balance of payments and government budgets by imposing fiscal burdens, which in turn reduce the amount of money available to spend on social programs (Saunders and Schneider, 2000; World Bank, 2010). According to a recent study by the International Monetary Fund (IMF, 2015) in its latest survey on 'Counting the Cost of Energy Subsidies', most of this arises from countries setting energy taxes below levels that fully reflect the environmental damage associated with energy consumption. IMF projects subsidies to remain high despite sharp declines in international energy prices. The International Monetary Fund has revealed that subsidies in energy are projected at $5.3 trillion in 2015, or 6.5 per cent of global Gross Domestic Product (GDP) (IMF, 2015).

With the major buyers of crude oil becoming increasingly self-sufficient, the prices of crude oil has witnessed downward slide in June, 2014, with Brent tumbling from $115 per barrel in June 2014 to a four-year low of $80.60, after a record peak of $147 in July 2008. As the prices are falling, OPEC has not yet indicated any plan to curb production to drive prices back up and the United States crude inventories has risen by 7.11 million barrels, more than double the 2.7 million-barrel increase analysts had predicted, according to EIA. With this scenario, it is expected that the prices will tumble below $80 per barrel, a prediction that has forced the Nigerian Government to benchmark the 2015 budget to $78 per barrel, up from $77.50 in 2014 (**Ejiofor,** 2014).

Nigeria is the world's 13th largest producer of (Index Mundi in CIA, 2016) with10th largest proven reserves) crude oil. It possesses the world's 8th largest provennatural gas reserves. The country has an installedproduction capacity of 445,000 barrels of fuel per day, adequate to meet its domestic needs with a surplus for export. Yet the country is a large net importer of gasoline and other petroleum products. The country relies on importation for most of its fuel needs as the country's four refineries are in a poor state of disrepair most often has witnessed a drop in importation of refined petroleum products in recent years, leading to acute scarcity of the products across the country. With the consumption of 48 million litre of fuel per day, the country is expected to spend about N2.2 billion on fuel subsidy. From a theoretical perspective, in a solely dependent economy like Nigeria where subsidies are the only existing price distortions, removing these subsidies should reduce energy related GHGs emissions, while bringing real income gains to the country that removes the subsidies. These gains originate from an increase of consumer welfare and from a more efficient reallocation of resources (Emeka, 2011; Izielen, 2012).

In 2010, fuel subsidy gulps ₦1.3 trillion according to the Nigerian Government. In 2015, the Nigerian Government claimed that it spends ₦1.69 billion daily to subsidise petrol consumption despite the decline in the country's oil exports and the resultant squeeze on the nation's revenues.Some analysts who argued in support of subsidy removal said that even if the government doesn't remove subsidy now, it must certainly remove it's sometime in the future, adding that Nigerians'

refusal of subsidy removal is mere delay of the evil day (*Esiedesa, 2015)*

On the current debate on removal of fuel subsidy in Nigeria, there are two major concerns of the Nigeria citizens: one that the current high price of Premium Motor Spirit (PMS) will lead to increase in poverty and two, that the removal of fuel subsidy will exert insignificant impact on war against corruption rather worsen it. Generally, most of the studies carried out on this issue have focused on the qualitative analysis of the fuel subsidy removal particularly in the developed economies (see CPPA, 2011; Uzonwanne, et al., 2015), Few studies exist yet on the quantitative analysis and the effect of fuel subsidy removal on key macroeconomic variables and welfare for an oil exporting country like Nigeria. This study intends to fill this gap. In view of the stated problems and the justification, the study is set to address the following relevant policy questions.

(1) To what extent will the sale of fuel ₦200 per/litre affect the general price level and the key macroeconomic variables in Nigeria? (2) To what extent will fuel subsidy removal impact on household income and consumption in Nigeria? (3) How much gain will the removal of fuel subsidy accrue to government revenues? (4) What changes are needed in macroeconomic policies to ensure effective economic and welfare growth in the face of fuel subsidy removal? While the overall objective of this study is to analyse the implication of fuel subsidy removal on key macroeconomic variables in oil exporting and importing country like Nigeria and measure the magnitude of such impacts on household welfare both on the short and long run period.

After the introductory part in section 1, the rest of the study is organised as follows; 2 is the brief review of literature, section 3 provide an overview fuel subsidy expenditure**. Section 4 is the**computation of fuel subsidy**.** The analytical framework and methodology of the study are provided in section 5 and 6 covers the computable general equilibrium findings, section 7 is conclusion, findings and summary of the keys issues and policy implications. Sections 8 is the study policy responses and measures

2. Brief Literature Review

Marc Burniaux and Chateau (2010) viewed the economic implications of phasing-out fossil-fuel subsidies in non-OECD countries. According to them, if each non-OECD country were to remove its fossil-fuel subsidies unilaterally, it would generally record welfare gains, in line with what is suggested by the theory. Most countries or regions report welfare gains ranging from 0.3% in the rest of the world regional aggregate to more than 4% in the oil-exporting countries in 2050. These gains correspond to the welfare improvement associated with the subsidy removal together with, in most cases; a more efficient allocation of resources across sectors. Therefore, from this perspective, the removal of fossil fuel subsidies brings in both environmental and economic benefits

In the view of Grosh et al (2008), if subsidies linked to the price of energy are to be phased out, there are a number of alternative policies that can provide direct assistance to the poor who would be adversely affected by the subsidy removal. These policies, known as social safety nets, can take a number of forms. Direct transfers may include targeted cash payments, or near-cash payments (such as vouchers and food stamps), while indirect transfers may include fee waivers for essential services such as health, education, or transport. The advantage of these policies is their ability to be well targeted to the poor, resulting in a lower cost to the government to deliver the same benefits to low-income households. In particular, in countries where several different consumer goods are subsidized, there can be

an important economy of scale and scope in using a social safety net program to protect poor households from the removal or reduction of all these different subsidies.

Clements et al (2003) constructed a CGE model to explore the impact of subsidy removal on petroleum products in Indonesia. Two scenarios were run. The first used a Keynesian scenario in which real output declined, leading to a fall in household incomes. The second was a non-Keynesian scenario that left aggregate output unchanged. In both scenarios the prices of all goods rose as a result of the subsidy removal. Although the higher-income households were more affected by the subsidy removal, the overall level of poverty in the economy increased, in part because employment fell among low-income households. The authors suggest that these results point to the need for targeted support to the poor if universal subsidies were to be removed.

3. Overview of Fuel Subsidy Expenditure in Nigeria (2006 – 2015)

In mid-2015, the Nigerian Extractive Transparency Initiative (NEITI), released its audit report indicating that the Federal Government spent about ₦4.5 trillion between 2006 and 2012, a period of seven years, as subsidy on petroleum products imported into the country. The breakdown shows that ₦816.554 billion was paid between 2006 and 2008. While the Business Day's analysis of figures on fuel subsidies from 2006 to 2008, has shown. In 2006, subsidy cost on petrol was ₦151.9 billion, ₦188 billion in 2007, ₦256.3 billion in 2008 (from January to July).

The Petroleum Products Pricing and Regulatory Agency (PPPRA) put the amount spent on fuel subsidy from 2006 to 2008 to be ₦1.185 trillion. PPPRA said that it paid a total subsidy of ₦272.713 billion in 2006 out of which the Nigerian National Petroleum Corporation (NNPC) got ₦243.603 billion, while the oil majors and independent marketers received ₦19.212 billion. According to PPPRA, "In 2007, the people of Nigeria, through their government, paid a total subsidy of ₦278.86 billion; NNPC took ₦227.47 billion and the oil majors and independent marketers received ₦51.388 billion.In 2008 according to PPPRA, a total subsidy of ₦633.192 billion was paid, out of which NNPC received ₦370.490 billion and oil majors and marketers received ₦260.08 billion. NNPC, in the three years that you (PPPRA) administered the subsidy, received ₦841.536 billion while oil majors and independent marketers received ₦330.016 billion, and a total of ₦1.185 trillion was paid as subsidy in the last three years (PPPRA, 2009). The drastic increase in cost was partly attributed to a depreciation of currency and the very high global prices of oil products.

The breakdown of the ₦4.5 trillion spent by Nigerian Government between 2006 and 2012 also showed that ₦3 trillion was paid on subsidy between 2009 and 2011 and ₦690 billion in 2012. According to the then Executive Secretary of NEITI, Zainab Ahmed, the Audit report of 2012 showed that a total of ₦1.355 trillion was processed for payment as subsidy. Out of this amount, ₦690 billion was actually paid, putting a debt burden of ₦665 billion on the government. Specifically, in 2009, ₦421.5 billion was spent, ₦673 billion in 2010, and ₦1.3 trillion spent in 2011 was revised up to 2.19 trillion by the Ministry of Finance, after arrears were paid in 2012 for PMS consumption in 2011. Fuel subsidy cost the Nigerian state ₦1.3 trillion (about $8.38 billion) in the 2010 fiscal year alone, about 25 per cent of the entire budget expenditure for the year under review

In January 1, 2012, according to the pricing template posted on the website of the PPPRA, a litre of petrol should have been sold in Nigeria at ₦142.92 as against the official price of ₦65, if petrol prices remain at the present level when the subsidy on the product

is withdrawn. Nigerians would have paid ₦142.92 for a litre of petrol. Because by then Nigeria was consuming about 32 million litres of petrol daily for ₦65, while the expected price for the product is ₦142.92, which means government pays a subsidy of ₦77.92 per litre. In 2012, the sum of ₦888 billion was allocated for subsidy payments in the budget for petroleum product importers (Asu, 2013).

Okonjo-Iweala (2013) also reported that Nigeria spent a total of ₦971 billion naira ($5.99 billion) on fuel subsidy payments in 2013. The amount the Federal Government is paying on subsidy for Premium Motor Spirit (PMS) has dropped to ₦4.48 per litre, as global oil prices continue to decline. The Petroleum Products Pricing Regulatory Agency (PPPRA), at December 12, 2014 put the market price of PMS at ₦101.48 per litre. While the Petroleum Products Pricing Regulatory Agency (PPPRA) stated that it paid about ₦832.06 billion in 2013 as subsidy claims to petroleum products marketers under the Petroleum Support Fund (PSF) (PPPRA, 2014).

On the flip side of the decline in crude oil prices, which has affected the country's revenue from oil exports, analysts expect the Federal Government's spending on fuel subsidy to reduce by up to ₦600 billion in 2014 (Asu, 2014). In 2015, Government planned the sum of ₦971 billion to subsidise the supply of petrol to Nigerians, an indication that the administration has no plan to do away with subsidising petrol. In the same vein, the government plans to give out a total of ₦260 million to the Subsidy Reinvestment Programme, SURE-P, for intervention in various development agencies. This was contained in the 2015-2017 Medium Term Expenditure Framework and Fiscal Strategy paper, which President Goodluck Jonathan sent to the National Assembly for approval as the basis for the 2015 budget (Soni, 2014). According to the argument, Nigerian domestic consumption and demand for the key petroleum products, the Premium Motor Spirit (PMS) was 30 to 34 million litres per day and the Federal Government spent over ₦1trillion on the payment of petroleum subsidy in 2015 (Kachikwu, 2015).

4. Computation of Fuel Subsidyin Nigeria

According to information derived from the website of Petroleum Products Pricing Regulatory Agency (PPPRA, 2014) - the agency charged with the control and regulation of domestic fuel consumption, Petroleum Product Pricing templates are being used – a formatted and standardized formula for calculating the final landed cost of petroleum products.

According toEzeigbo (2013), the total landing cost of fuel in Nigeria is ₦153.64: where the product, insurance and freight is₦141.40 + trader's margin:₦1.19 + financing (SVH):₦2.60 + NPA ports charge: ₦0.62 + lightering expenses (SVH): ₦4.03 + storage charge:₦3.00 + jetty depot throughout charge: ₦0.80. Where the total distribution margin amounted to ₦15.49. The total landing cost + total distribution margin brings the market price of petrol without subsidy to ₦169.13. If fuel is sold for ₦97.00, it implies that a subsidy of ₦72.13 is been paid. At this point it is 0% subsidy removal.

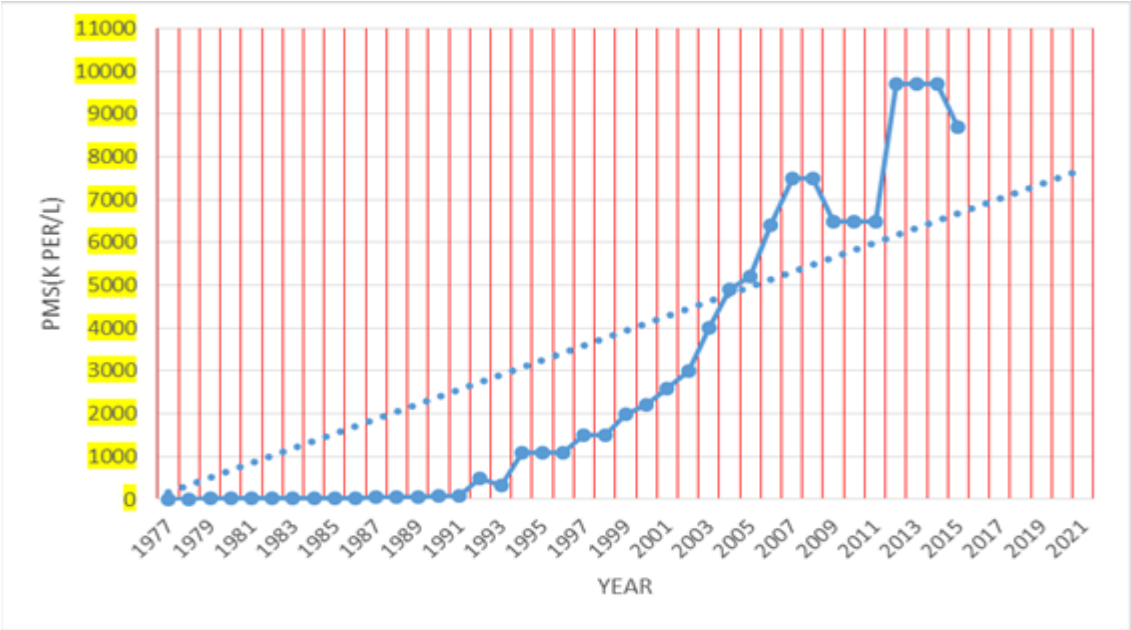
The PPPRA templates gives the approved list of components of PMS cost, (Cost + Freight) being the largest. The Gasoline (Petrol) Price per Metric Ton being the most important, and is largely determined by factors beyond their control. The freight is the amount charged for transporting a metric ton of PMS from a refinery (Mostly Europe or Eastern US seaboard to Nigeria). The exact freight costs used by the PPPRA to know if it is competitive and this omission might lead to exploitation as every $10 per metric ton infreight costs would lead to a ₦1.3 increase in PMS cost per Litre.

Another Component of the PPPRA template, the traders' margin is also another point of worry as it is difficult to know what exactly it is. It is the profit of the trader who sells the petrol and brokers the deal that set the figure ($10), despite fluctuations in crude oil prices. There is no a trading desk in the National Oil Company, NNPC. Traders margin yields 100 million dollars per annul for the trader. The PPPRA maintained that the traders' margin is factored into freight costs. It appears as a separate component from cost and freight. (PPPRA, 2014)

Retail Price of *PMS* in Nigeria, 1977-2015 in Kobo/Per Litre)

Typical Retail Price of PMS in Nigeria projecting from1977-2020 in Kobo/Per Litre. In 1977, 1978, 1983, 1985, 1991, 1992, 1994, 1997, 2002, 2004, 2005, 2006, 2007,2009, 2012 and 2015, PMS price in Kobo/Per Litre were 3, 8.5, 30, 39.5, 70, 500, 1100, 1500, 3000, 4900, 5200, 6400, 7500, 6500, 9700, 8700, respectively (*Ogunbodede et al, 2010).* An assumption of linear deterministic trend is projected in Figure 1. The dotted slope assumed a linear trend without price distortions, while the stochastic trend shows the actual PMS trend in Kobo/Per Litre from 1977 to 2015)

Fig 1: **Linear Analysis (If PMS Assumed a Deterministic Trend)** *(1977 – 2020)*



Author's Computations

5. Analytical Framework and Methodology

5.1. Model Structure and Description of the CGE Model

The analysis is based on a structuralist CGE model of a small-open economy. The approach of this study proposed model belongs to the class of new open-economy macroeconomic models, which have become the main tool used in modern international and developmental macroeconomics. The model is flexible enough that it can capture the complex realities of the Nigerian economy. In order to apply the framework to the

Nigerian economy, the model is modified to fit the real data and to handle the policy issues. The model is calibrated using data for 2014 and Existing Social Accounting Matrices (SAMs) of the Nigerian economy, when the price of fuel was relatively stable (₦97 per litre). The SAMs have the following accounts: commodity accounts, activity accounts, household accounts, value-added accounts (sale tax and export duty accounts), government accounts, capital (savings-Investments) accounts and Rest of the World accounts. The Nigerian's SAMS is updated to 2014 base values to suit our current analysis. In updating the Macro SAM data the SAM is weighted by GDP share and its average annual growth rate from 1999-2014 (IFS, 2014, WDI, 2014). Each entry was normalized to shares of GDP at market prices. The constant elasticity of substitution (CES) and the constant elasticity of transformation (CET) values used in the calibration of the model were derived from literatures (Devarajan et al, 1993)

5.2 Model Specification

The primary interest of this study is to ascertain the effect (positive or negative) of 142.8% removal of fuel subsidy or of ₦200 per/litre on some macroeconomic variables and national poverty level by evaluating the overall effects of the removal on the national household income and household consumption volume. The analysis and specifications of the removal scenarios in this model are done with a standard model structure derived from Dervis et al (1984), Devarajan, et al, 1993). It is a general equilibrium model in which the tradable sector is divided into importables and exportables.

Specification of Equations of the Model

A non-linear programming (NLP) model of five blocks of 28 simultaneous equations are specified as follows:

Price Block

PMDEF: PM =E= pwm * (1+TMS) * ER (1)
PEDEF: PE =E= pwe * (1+TE) * ER (2)
PDSDEF: PDS =E= PDD (3)
PQDEF: PQ*(1-TS)*Q =E= (PDD*DD) + (PM*M) (4)
PXDEF: PX*X =E= (PDS*GDP) + (PE*E) (5)

Supply Block

CET: X =E= at*(gamma*E**rhot + (1-gamma)*GDP**rhot)**(1/rhot) (6)
ESUPPLY: E =E= XD*((PE/PDS)*((1-gamma)/gamma))**(1/(rhot-1)) (7)
ARMINGTON: Q =E= ac*(delta*M**(-rhoc)+(1-delta)*DD**(-rhoc))**(-1/rhoc) (8)
COSTMIN; M =E= DD*((PDD/PM)*(delta/(1-delta)))**(1/(1+rhoc)) (9)
(where ρ = rho, γ = gamma, δ = delta)

Income Block

YHEQ: YH =E= (PX*X) + hogovconst + (howor*ER) (10)
YGEQ: YG =E= TARIFF + STAX + HTAX + (govwor*ER) (11)
TOTSAVEQ: TOTSAV =E= (CAPHOSH*(YH*(1-TY)))+(CAPWOR*ER)+CAPGOV (12)

Expenditure Block

CDEQ: CD*PQ =E= (YH*(1-TY))*(1-CAPHOSH) (13)
INVESTEQ: INVEST =E= (PQ*INVD) (14)
TARIFFEQ: TARIFFE=E= (TMS*pwm*ER*M) (15)
STAXEQ: STAX =E= (TS*PQ*(CD+GD+INVD)) (16)
HTAXEQ; HTAX =E= (TY*YH) (17)
EXSUBEQ: EXSUB =E=(TE*pwe*ER*E) (18)
GOVSUEEQ: GOVSUE=E=(TMS*pwm*ER*DD) (19)

Market Clearing Block

QEQUIL: Q =E= CD + GD + INVD (20)
DOMEQUIL: DD =E= GDP (21)
CAPWOREQ: CAPWOR =E= pwm*M – pwe*E – howor – govwor (22)
CAPGOVEQ: CAPGOV =E= YG – (PQ*GD) – hogovconst –GOVSUE (23)
WALRASEQ: TOTSAV =E= INVEST + WALRAS (24)

Elasticity Related Parameters

Trade substitution elasticity: rhoc = $\rho c = \left(\frac{1}{\sigma}\right) - 1$ (25)

Export transformation elasticity: rhot = $\rho t = \left(\frac{1}{\Omega}\right) + 1$ (26)

Where σ =sigma and Ω =omega

Fuel subsidy Variable Initialisation

GOVSUE.L = (TMS.L*pwm*ER.L*DD.L) (27)
pwm = PM0/((1+TMS0)*ER0) (28)

Thus, the complete model has twenty-eight (28) equations with equation (27) capturing the fuel subsidy variable initialization (see Appendixes 5, 6 and 7 for the definition of variables of the model, definition of the parameters of the model, the specification of variables as positive or free positive variables)

Model Calibration

Thus, whether macroeconomic and welfare variables decrease or increase in response to the 142.8% removal of fuel subsidy depends on the CES. We analyzed the impact of 0 and 142.8% fuel subsidy removal effects on macroeconomic and welfare variables in Nigeria base on the trade elasticities, which fall within the range $0 < \sigma < 1$ for the world price of imports of oil (PWM*)* and $0 < \Omega < 2$ for the world price of exports (PWE*)*. The growth rate of any economy by destination is defined by arbitrary constants (α_{0s}), the accelerators (α_{1s}), and the elasticities (β_{1s}). So our model is calibrated with respect to Government fuel subsidy expenditure (GOVSUE), and World Price of Imports of oil, (PWM), is the elasticity with respect to the level of Government subsidy payment (γ_1) is capacity utilization (u_i) and World Price of Exports of oil (PWE).

5.3 Hypothesised Issues

142.8% fuel subsidy removal in Nigeria combine with the devaluation or depreciation

of the naira would have a complex effect on macroeconomic performance and the level of poverty and may also have multiple implications for the economy. If there is 142.8% fuel subsidy removal (implies PMS will sell at ₦200 per litre*)*, it is hypothesised that household income would decrease, since part of the workers' income paid by Government is paid to subsidy. That is, effect of fuel subsidy or removal may cause large changes also on macro performance and total household disposable income, savings and consumption income could be affected. In other words, it is the believed that, fuel subsidy removal will have a stagflationary effect on the economy: it will slow down rates of growth, increase the domestic price level, reduced the level of domestic investment and better-off the government account and income position.

5.4. Definition of Policy Simulation Experiments

The simulation involves maintaining constantdecrease of subsidy value or increasing the percentage of removal to 142.8% by the Nigerian government and ascertaining the short, the medium and long run distributional effect from 2014/2015 to 2020. This study carried out two experiments of fuel subsidy removal scenarios, including the base experiment of 2014/2015. The "base" in the set serves as comparator.

i. Simulations involves maintaining constant reduction in fuel subsidy rate, and ascertaining the medium and long run distributional effect. That is, stimulate with the removal of subsidy by 142.8% adding to base-run ₦97 per litre, using different elasticity of fuel import (elasticity demand) and ascertaining the short, the medium and long run distributional effect from 2014/2015, 2016, 2017, 2018, 2019 and 2020

Table 2: Fuel Subsidy Reduction

Base Year Subsidy (₦)	Subsidy Reduction (%)	Reduction (₦)	Base Year Price(₦)	Pump Price (₦)	Index	Remark
72.13	0.0	0.0	97	97	Base Year Normalized index Price = 1.00	Zero Subsidy Removal
72.13	142.8	103.00	97	200.00	142.8% over the base year price = 2.428	30.87 Addition to total removal

Source: Author's Computation, 2017

i. With Zero reduction of fuel subsidy. A litre of fuel was sold for ₦97.00
ii. With 142.8% removal of fuel subsidy. A litre of fuel will sells for ₦200.00

Base Year: 2014/2015
Base Year Pump price of fuel = ₦97.00
Base Year: Subsidy = ₦72.13
Base Year Market price of petrol = Pump price + Subsidy + additional value (42.8%) = ₦97.00 + ₦72.13 + ₦30.87 = ₦200.00

Thus, the second simulation experiments add a terms-of-trade shock (deviates from the base-run, 2014/2015). These deviations are dynamic effects from 2016-2020.The normalized prices are *PDD0* = 1, *PDS0* = 1, *PE0* = 1, *PM0* = 1. While, *PX* is a weighted average of prices that are initially normalized, since the model is homogeneous of degree zero in prices, one good must be chosen as the numéraire. The default numéraire is the exchange rate or, equivalently, a price index representing the bundle of imports. Hence *PX0* = 1, *ER0* = 1 (see model equations).

5.5. Data Requirement and Sources

Data were obtained for income, expenditure, trade export supply, import demand, government, investment, balance of payment, among others secondary data for growth and poverty measures for Nigeria is compiled from International Agencies such as the UNDP, World Bank's Economic and Social Database, IMF CD-ROMs, ADB, UNIDO, IFS CD-ROMs, etc., and other relevant sources. Other sources include data from the Nigerian National Bureau of Statistics (NBS), the Central Bank of Nigeria (CBN), Nigeria National Data Bank,

6. Computable General Equilibrium Findings

6.1 Base Scenario and Analysis of Simulation Results

Two fuel subsidy reduction simulations experiments are considered under our scenarios. Base parameter values are simulated from social accounting matrix. The base year period 2014/2015 parameter share is maintained throughout the simulation period for the variables given the rate changes. *The findings from this study tend to confirm a priori expectations* on the effects of fuel subsidy reduction by the Nigerian government on macroeconomic variables and poverty/household welfare in Nigeria. An unexpected decrease in fuel subsidy reduction may have effect on the variables of interest which include the Consumer and Producer Prices for Domestic Supply of Output, Domestic Price of Competitive Imports of Commodity, Composite Price of Output by Activity, Domestic Output (GDP)/aggregated Domestic Demand for Commodity, Savings/Investment, Current Account Balance, and Household income, Household Consumption, Government Income and Government Account Balance.

The results of marginal effects of reduction of fuel subsidy of the policy simulations for all the macroeconomic indicators and household welfare are summarized in Appendixes 1 and 2. The Appendix 1 show the summary of parameters results in percent deviation from base period values of the stated variables changes in the major components, while the appendix 2 show the magnitudes of the parameter yearly growth of the stated variables, The short run effects are capture in 2016, the intermediate effects captured 2017 – 2019, while the long run aggregate effects are capture in 2020. The policy simulations experiments are performed under a flexible exchange rate regime with depreciation of Naira. That is with constant exchange rate fluctuation and falling oil price.

6.2 Macro, Sectoral and Welfare Effects of 142.8% Fuel Subsidy Reduction

With the fuel subsidy simulation scenarios under a 142.8% reduction of fuel subsidy over base period value ₦97.00 of 2014/2015, resulted in a litre of fuel selling for ₦200.00. Implying that ₦103.00 was added to the pump price of fuel per litre. This implies that ₦72.13 added to the pump price of fuel plus an additional ₦30.87 then causing a litre of fuel to be sell for ₦200.00. It is then *ascertained the distributional effects from 2016 to 2020, these for the short run,* intermediate run and long run *are showed in Appendixes 1 and 2.*

The implication of this is that there is no subsidy on fuel price anymore over base period value ₦97.00 of 2014/2015 but tax of ₦6.00 is introduced.

A) Effects on General Price Levels

Appendixes 1 and 2 reports the simulated result which ascertained the distributional effects of the 142.8% reduction of fuel subsidy over base period value ₦97.00 of 2014/2015 on consumer and producer prices for domestic supply of output, domestic price of competitive imports of commodity and composite price of output by activity. Appendix 1 analyses the deviation from the base period and Appendix 2 illustrates the yearly growth overtime. The result shows that accumulated effect of 142.8% reduction of fuel subsidy over base period on the consumer and producer prices for domestic supply of output, domestic price of competitive imports of commodity and composite price of output by activity in Nigeria from a cumulative basis for the period of 2014/2015 to the long run period of 2020 increased by 0.96, 6.08 and 0.72 respectively (see Appendix 1). The greatest accumulated effect of the 142.8% reduction of fuel subsidy on general price level for the long run period impacted mostly on domestic price of competitive imports of commodity.

From Appendix 2, it can be seen that consumer and producer prices for domestic supply of output experienced 0.35 positive growth in the short run and then negative growth in the intermediate and long run (-0.09, -0.05, -0.09 and -0.1 respectively), amounting to accumulated 0.02 yearly growth over the period 2016 till 2020. The result also as reported in Appendix 2 shows that domestic price of competitive imports of commodity experienced constant positive yearly growth in the short run, intermediate and long run. Also, from the same Appendix, it can be seen that composite price of output by activity experienced positive yearly growth in the short run and then negative yearly growth in the intermediate and long run period accumulating to 0.01 yearly growth.

From Appendix 1, the result reveals that in the short run, the fuel subsidy reduction simulation scenarios under a 142.8% of fuel subsidy reduction has a 0.35 distributional impact on Consumer and Producer Prices for Domestic Supply of Output in the short run. The result in the intermediate run reveals distributional impact of 0.26 in 2017, 0.21 in 2018 and 0.12 in 2019. The long run distributional impact shows an increase of 0.02. The accumulated effect over the period of 2014/2015 to 2020 shows an increase of 0.96.

Appendix 1 also reports the simulation result under a 142.8% of fuel subsidy reduction. It can be seen that it has a 0.75 distributional impact on Domestic Price of Competitive Imports of Commodity in Nigeria in the short run, while considering the intermediate run, it has a 1.187 increase in 2017, 1.251 increase in 2018 and 1.375 increase in 2019 being the highest. In the long run of year 2020, the 142.8% fuel subsidy reduction will have a 1.517 distributional impact. The result from this simulation suggests that the 142.8% fuel subsidy reduction is mostly felt on domestic price of competitive imports of commodity in the intermediate and the long run.

Composite Price of Output by Activity from Appendix 1 shows a similar trend of the effect of a 142.8% fuel subsidy reduction. The simulation scenarios show an increase of 0.26 from the 2014/2015 base period to 2016. In the intermediate period, there was an increase of 0.20 in 2017, increase of 0.26 in 2018 and increase of 0.09 in 2019. The long run effect shows an increase of 0.01 in 2020.

B) Effects on External Trade

The simulation scenarios in Appendixes 1 and 2 shows the distributional effects of the 142.8% reduction of fuel subsidy over base period value ₦97.00 of 2014/2015 on imports of commodity, domestic output exported by activity and current account balance. From the exposition, Appendix 1 analyses the deviation from the base period and Appendix 2 illustrates the yearly growth overtime. The deviation from the base period helps to show the distributional effect in which the 142.8% reduction of fuel subsidy has on external trade. Appendix 1 shows the accumulated effect of 142.8% reduction of fuel subsidy over base period on imports of commodity, domestic output exported by activity and current account balance from a cumulative basis for the period of 2014/2015 to the long run period of 2020. The accumulated effect decreased by 28.775 on imports of commodity, -0.546 and 10.107 decrease and increase on domestic output exported by activity and current account balance respectively.

Examining Appendix 2, it is observed that imports of commodity had a growth in the short run, intermediate and long run which are -3,57, -2.118, -0.049, -1.011 and -0.284 respectively amounting to accumulated -7.032 negative yearly growth over the period 2016 till 2020. The result also as reported in Appendix 2 shows that domestic output exported by activity experienced constant positive yearly growth in the short run, intermediate run but negative in the long run; thus the accumulated growth for this period amounted to -2.456. Also, Appendix 2 shows that current account balance experienced positive yearly growth in the short run at 3.718 and then negative yearly growth in the intermediate and long run period accumulating to 0.168.

Appendix 1 reports 142.8% reduction of fuel subsidy over the base period 2014/2015. The result reveals that in the short run, the fuel subsidy reduction simulation scenarios under a 142.8% of fuel subsidy reduction has a -3.57 distributional impact on imports of commodity. The result in the intermediate run reveals distributional impact of –5.688, -5.737 and -6.748 in 2019. The long run distributional impact shows a growth of -7.032.

Appendix 1 reports the simulation result under a 142.8% of fuel subsidy reduction. It can be seen that it has a 0.193 distributional impact on domestic output exported by activity in the short run, while considering the intermediate run; it has a 0.628 increase in 2017, 0.334 increases in 2018 and 0.755 increases in 2019. In the long run of year 2020, the 142.8% fuel subsidy reduction has a -2.456 distributional impact.

Current Account balance from Appendix 1 shows a trend of the effect of a 142.8% fuel subsidy reduction on it. The simulation scenarios show an increase of 3.718 from the 2014/2015 base period to 2016. In the intermediate period, there was an increase of 2.734 in 2017, increase of 2.214 in 2018 and increase of 1.2737 in 2019. The long run effect shows an increase of 0.168 in 2020.

C) Effects on Household Welfare (Measurement of Poverty)

The simulated results of the effect of 142.8% fuel subsidy reduction simulation scenarios on household real income and household consumptionare reported in Appendixes 1and 2. The Appendixes shows the effect of 142.8% reduction of fuel subsidy over base period value ₦97.00 of 2014/2015. Appendix 1 analyses the deviation from the base run period of 29.658 for household real income and 21.519 for household consumption, while Appendix 2 shows the yearly growth overtime. The results shows that the accumulated effects of household real income reduced by 13.008 implying a tremendous increase poverty level and

household consumption decreased by 7.942 from a cumulative basis for the period of 2014/2015 to the long run period of 2020 respectively. The result shows that household real income and household consumption experienced negative yearly growth (see Appendix 1 and 2).

On the Household Real Income, with the fuel subsidy reduction simulation scenarios under a 142.8% of fuel subsidy reduction, the short run distributional impacts show for -0.76 in 2016. The intermediate effect shows -2.06 in 2017, -8.56 in 2018, -13.23 fall in 2019 and (long run distributional effects) -13.01 in 2020 (see Appendixes 1). This shows that 142.8% of fuel subsidy reduction will worsen household welfare in terms of household real income.

Household Consumption also show decreases in the trend analysis in short, intermediate and long run with percentage changes value of -0.54 in 2016 in the short run and -0.89 in 2017, -0.92 and -1.74 decrease in 2019 in the intermediate run and -7.94 decrease in 2020 on the long run.

What emerges from the above results is that the fuel subsidy reductions have tended to reduce/worsen household consumption or welfare and hence increased poverty in both the rural and urban areas among the lowest income earners, by the same percentage. In relative terms, with the reduction in fuel subsidy, the poor households are likely to be more adversely affected as they spend a larger proportion of their income compared to the wealthiest households although the latter spend more in absolute terms on outputs than poor households. The largest effects tend to be borne by the poorest households because the poorest households lack wage indexation during inflations

At the national level, the reduction in consumption volume of the households would increase the number of people living below the poverty line or on the poverty line by the same proportion as the reduction in consumption volume. As the proportion of the poor increases many poor people who were below the poverty line would further fall below the poverty line. Thus, the largest loss would accrue to the households with the lowest expenditure function and not the wealthiest households.

D) Effects on Government Revenue

With the fuel subsidy reduction simulation scenarios under a 142.8% reduction of fuel subsidy **or a litre of fuel been sold for ₦200** over base period value ₦97.00 of 2014/2015, we ascertain the distributional effects from 2016 to 2020, these for the short run, intermediate run and long run are showed in Appendixes 1 and 2 on government revenue.

Appendixes 1 and 2 shows the effect which 142.8% reduction of fuel subsidy or a litre of fuel been sold for ₦200 will have on government revenue. The effect will follow the transmission mechanism on government income and government account balance. The results show that the accumulated effects of government income increased by 5.144 and government account balance increased by 1.713 from a cumulative basis for the period of 2014/2015 to the long run period of 2020 respectively. The yearly growth shows in appendix 2 shows cumulated increase for government income as 1.409 and government account balance as 0.614.

On the Government income, with a litre of fuel been sold for ₦200, the short run distributional impacts show for 0.338 in 2016. The intermediate effect shows 0.68 in 2017, 1.11 in 2018, 1.607 in 2019 and (long run distributional effects) 1.409 in 2020.

Government account balance in short, intermediate and long run with yearly growth value of 0.641 in 2016 in the short run and 0.178 in 2017, 0.091 in 2018, and 0.162 increase in 2019 in the intermediate run and

0.183 increase in 2020 on the long run distributional effects, while the accumulated effect shows 0.14 increase above the base value period of 2014/2015 to 2020.

E) Effects on Growth

The simulation scenarios in Appendixes 1 and 2 shows the distributional effects of the 142.8% reduction of fuel subsidy over base period value ₦97.00 of 2014/2015 on domestic output (GDP)/Domestic Demand for commodity, Supply of composite commodity, Total Savings/Investment Expenditure and Investment Consumption Volume. From the exposition, Appendix 1 analyses the deviation from the base period and Appendix 2 illustrates the yearly growth overtime. The deviation from the base period helps to show the distributional effect in which the 142.8% reduction of fuel subsidy has on growth. Appendix 1 shows the accumulated effect of 142.8% reduction of fuel subsidy over base period on domestic output (GDP)/Domestic Demand for commodity, Supply of composite commodity, Total Savings/Investment Expenditure and Investment Consumption Volume from a cumulative basis for the period of 2014/2015 to the long run period of 2020. The accumulated effect increased by 10.73 on domestic output (GDP)/Domestic Demand for commodity, increased by 10.049 on Supply of composite commodity, increased by 8.763 on Total Savings/Investment Expenditure and 8.708 increases Investment consumption volume.

Examining Appendix 2, it is observed that Domestic output (GDP)/Domestic Demand for commodity had accumulated positive yearly growth over the period 2014/2015 till 2020, Supply of composite commodity had accumulated positive yearly growth over the period 2014/2015 till 2020, Total Savings/Investment Expenditure had accumulated positive yearly growth over the period 2014/2015 till 2020 and Investment Consumption Volume had accumulated positive yearly growth over the period 2014/2015 till 2020.

Appendix 1 reports 142.8% reduction of fuel subsidy over the base period 2014/2015. The result reveals that the fuel subsidy reduction simulation scenarios under a 142.8% of fuel subsidy reduction has a -0.29, -0.64, 4.04, 3.99 and 3.64 distributional impact on Domestic output (GDP)/Domestic Demand for commodity for 2016, 2017, 2018, 2019 and 2020 respectively.

Appendix 1 reports 142.8% reduction of fuel subsidy over the base period 2014/2015. The result reveals that the fuel subsidy reduction simulation scenarios under a 142.8% of fuel subsidy reduction has a 3.678, 2.719, 2.207, 1.276 and 0.169 distributional impact on Supply of composite commodity for 2016, 2017, 2018, 2019 and 2020 respectively.

Appendix 1 reports 142.8% reduction of fuel subsidy over the base period 2014/2015. The result reveals that the fuel subsidy reduction simulation scenarios under a 142.8% of fuel subsidy reduction has a 3.212, 2.371, 1.923, 1.11 and 0.147 distributional impact on Total Savings/Investment Expenditure for 2016, 2017, 2018, 2019 and 2020 respectively.

Appendix 1 reports 142.8% reduction of fuel subsidy over the base period 2014/2015. The result reveals that the fuel subsidy reduction simulation scenarios under a 142.8% of fuel subsidy reduction has a 3.191, 2.356, 1.911, 1.103 and 0.147 distributional impact on Investment Consumption Volume for 2016, 2017, 2018, 2019 and 2020 respectively.

8. Conclusion, Findings and Policy Implication

Appendixes 1 and 2 show the results of marginal effects and yearly growths of 142.8% reduction of fuel subsidy and their corresponding pump prices response of ₦200.00 per/litre. *The study used*

astructuralist CGE method to examine the distributional effects of ₦200 Per/Litre of PMS on macroeconomic variables and household welfare in Nigeria from 2015 to 2020.The results show that increase in PMS price in the country as a result of reduction in fuel subsidy have severe distributional consequences on the Nigerian macroeconomic variables and household welfare.

The findings from this study tend to confirm a priori expectations on the effect of removal of fuel subsidy on macroeconomic variables and poverty/household welfare in the Nigeria. The removal had a stagflationary effect on the economy as it slowed down economic growth and increased the domestic price level. Also, it reduced the level of domestic investment but increased the government account and income position.

The deterioration in the general price is high for 142.8% or ₦200 Per/Litre compared to the based values. The domestic price of competitive imports of commodity rose by 508% above the normalized price index of 100% from 2015 to 2020 for 142.8% %. This might result to hyperinflation. The deterioration in the general price level has greater implications for inflation. The effects might have been due to the depreciation of the Naira

The external trade accumulated effects changes as a result of 142.8% changed in the fuel subsidy. The imports of commodity reduced by 28.775% and domestic output exported by activity also reduced by 0.546% and current account balance increased by 10.107%. The effect of these on imports is transmitted through increased prices of imported intermediates and finished goods, both of which worsen the current account balance. The implication of the worsened terms of trade and current account balance position is the tendency for the external debt of the Nigeria to increase or their external reserves to deplete.

The long run accumulated effect on household real income and consumption show that household experienced further decrease 37.63% and 12.03% for 142.8% respectively. The negative impact of the fuel subsidy removal has invariably been transmitted through increased production cost and commodity prices which tend to decrease household welfare. The findings have the implication of worsening the incidence of poverty in the Nigeria. At the level of each Nigerian, the reduction in income and consumption of the households tends to increase the number of people living below the poverty line

The results of government income and government account balance show that the accumulated effects on government income and account are better off by 142.8% fuel subsidy reduction for the period of 2014/2015 to the long run period of 2020 (see Appendixes 1 and 2). GDP, supply of composite commodity and total savings/investment expenditure experienced more increased with 142.8%. GDP experienced long run accumulated yearly growth of 3.635% with 142.8% fuel subsidy reduction.

8. Policy Responses and Measures

In view of the serious effects of fuel subsidy removal on the Nigerian economy the government needs to determine the appropriate monetary, fiscal and exchange rate policy responses. Measures are also required to moderate inflationary pressures, stimulate savings and investment and improve the current account balance. These will depend on policy possibilities in Nigeria.

(a) Monetary and Fiscal Policy Response

The nature of fiscal and monetary policy response is crucial because the wrong policy response may actually worsen the situation. However, effective policy responses are rather difficult because expansionary policy would exacerbate the inflationary pressures while contractionary policy would exacerbate the contraction in output. Generally, expansionary fiscal or monetary policy increases aggregate demand and inflationary pressures. And if

policy makers use expansionary fiscal or monetary policy to offset the fall in output, prices may rise further and inflation expectations could become endemic. On the other hand, where the monetary authorities tighten monetary policy to contain the inflationary impact, the result may be decreased consumption and investment and a contraction of output further.

In the light of the foregoing, some notable key lesions are as follows:

i. When there is a typical downturn, monetary and fiscal policy can be expansionary without triggering a significant increase in inflation because the fall in demand reduces inflationary expectations.
ii. When the inflation rate is already high and subsidy is rather decrease, a policy of monetary easing, for example, a lowering of interest rates would feed inflation expectations and worsen the inflation situation.
iii. When inflation is low and falling, and subsidy occurs, particularly a transitory one, the government could afford not to worry about inflation and worry instead only about growth and unemployment. In this situation, an easy monetary and fiscal policy option is suggestive even where oil prices are rising.

(b) Price-based Policies versus Subsidies

Subsidies can be provided by a number of different mechanisms which include direct subsidies to users, indirect subsidies through the reduction of taxes on petroleum products, and targeted income subsidies. These, however, tend to put pressure on government revenue and aggravate the budget deficit. Therefore, Nigeria governments may need to turn to targeted assistance as was introduced by Ghana in 2005 when it embarked on eliminating fuel price subsidies. But then, countries would need to properly identify the poor households and develop a delivery mechanism for income transfer and other types of compensation that target low-income households.

References

Asu, Femi (2014), Fuel Subsidy to Reduce by N600bn in BusinessDay's November 19

Asu, Femi. (2013), Nigeria Spends N4.9trn in 7 Years on Fuel Subsidies, Businessday's May 2,

Burniaux, Jean-Marc and Jean Chateau (2010), "An Overview of the OECD ENV-*Linkages Model, OECD Background Paper, OECD, Paris,*

Centre For Public Policy Alternatives (CPPA) (2011), Impact of Fuel Subsidy Removal in Nigeria: A Public Opinion Poll.

Clements, B., J. Hong-Sang and S. Gupta (2003), "Real and Distributive Effects of Petroleum Price Liberalization: The Case of Indonesia." Working Paper WP/03/204, International Monetary Fund, Washington, DC

Dervis, K., Melo, J. de and S. Robinson (1984), "Computable General Equilibrium Models for the Development Policy", The World Bank Washington, D.C

Devarajan, S. and D.S. Go (1993), "The simplest dynamic general equilibrium model of an open economy." Paper presented at the 4th International Computable General Equilibrium Modeling Conference, University of Waterloo, Canada, October 28-30, processed.

Ejiofor A. (2014)**,** Falling Oil Price as Window for Subsidy Removal in This live 28 October

Emeka, U. (2011), "Fuel Subsidies Gulp N3.566t in Six Years"

Esiedesa, O. (2015) Petrol Subsidy Drops to N1.7b daily, *Daily independent*

Ezeigbo C. E. (2013) Fuel Subsidy in Nigeria Highlighting the Facts, in Nigeria Natural

Grosh, M., C. del Nimmo, E. Tesliuc and A. Ouerghi (2008), "*For Protection and Promotion. The Design and Implementation of Effective Safety Net"* Washington, DC: The World Bank.

IMF (2015), Global subsidy IMF PPPRA: IMF Projects $5.3tr Global Subsidy on Fuel

IMF (International Monetary Fund (2001), "*Government Finance Statistics Manual*.

Index Mundi (2016), Country Comparison, By Oil Production in Central Intelligence Agency (CIA) World Fact book .

International Monetary Fund (2014), IFS CD-ROM

Izielen Agbon (2012), IMF and "Fuel Subsidy" Removal in Nigeria, seunfakze.wordpress.com/2012/01/22/imf-and-fuel-subsidy-removal-in-nigeria-by-izielen-agbon

Kachikwu (2015), Nigeria Spent N1trillion on fuel subsidy in Daily Trust, December 15.

OECD (Organisation for Economic Co-operation and Development) (2000), "Environmental Effects of Liberalizing Fossil Fuels Trade: Results from the OECD GREEN Model. Joint Working Party on Trade and Environment, OECD: Paris.

Ogunbodede, E.F,A.O. IlesanmiandF. Olurankinse (2010), "**Petroleum Motor Spirit (PMS) Pricing Crisis and the Nigerian Public Passenger Transportation System** The Social Sciences Volume: 5 Issue: 2 Page No.: 113-121

Okonjo-Iweala Ngozi (2013), Nigeria to Spend $6B on 2013 Fuel Subsidy -

PPPRA (2009) Nigeria spent N 1.185 tn on fuel subsidy in three years in This day, Feb 03

PPPRA(2014) Finally Some Critical Data and Subsidy Payment and Fuel Consumption in Nigeria: nairametrics.com/finally-some-critical-data-and-subsidy-payment-fuel-consumption-in-nigeria-from-pppra

Saunders, M. and K. Schneider, (2000), "Removing Energy Subsidies in Developing and Transition Economies", ABARE Conference Paper, 23rd Annual IAEE International Conference, International Association of Energy Economics, June 7-10, Sydney.

Soni D. (2014) FG to Spend N1 Trillion on Petrol Subsidy in 2015 in Vanguard, Oct 16,

Uzonwanne, M. C; R. U. Ezenekwe and P. C. Iregbenu (2015), Fuel Subsidy Removal and the Nigerian Economy, Australian Journal of Business and Management Research, New South Wales Research Centre Australia (NSWRCA), Pg 15-25

World Bank (2010), "Subsidies in the Energy Sector: An Overview Background Paper for the World Bank Group Energy Sector Strategy

World Bank (2010), Phasing out energy subsidies: a decision tree and evidence from case studies, World Bank Background Paper, World Bank, Washington DC, forthcoming.

Appendix 1: Simulation with 142.8% Reduction of Fuel Subsidy: ₦103.00 over Base Period Value = ₦97.00 of 2014/2015 Macro and household Welfare effects resulted from a Litre of Fuel sells for ₦200.00

Macro and Sectoral Items	Marginal Effects of 142.8% Reduction of Fuel Subsidy						Summary of Parameters Results in Percent Deviation from Base Period Values					
	Summary of Parameters Results						Short run Effect	Inter-mediate Effect	Inter-mediate Effect	Inter-mediate Effect	Long Run Effect	Accumulated Effect
	2014/2015 Base value	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2015-2020
Effects on General Price Levels												
Consumer and Producer Prices for Domestic Supply of Output	1	1.35	1.26	1.21	1.12	1.02	0.35	0.26	0.21	0.12	0.02	0.96
Domestic Price of Competitive Imports of Commodity	1	1.75	2.187	2.251	2.375	2.517	0.75	1.187	1.251	1.375	1.517	6.08
Composite Price of Output by Activity	1	1.26	1.2	1.16	1.09	1.01	0.26	0.2	0.16	0.09	0.01	0.72
Effects on External Trade												
Imports of Commodity	12.096	8.526	6.408	6.359	5.348	5.064	-3.57	-5.688	-5.737	-6.748	-7.032	-28.775
Domestic Output Exported By Activity	6.24	6.433	6.868	6.574	6.995	3.784	0.193	0.628	0.334	0.755	-2.456	-0.546
Current Account Balance	-2.363	1.355	0.371	-0.149	-1.09	-2.195	3.718	2.734	2.214	1.273	0.168	10.107
Effects on Household Welfare												
Household Real Income	29.658	28.896	27.596	21.096	16.426	16.65	-0.76	-2.06	-8.56	-13.23	-13.01	-37.63
Household Consumption	21.519	20.981	20.628	20.601	19.781	13.577	-0.54	-0.89	-0.92	-1.74	-7.94	-12.03
Effects on Government Revenue												
Government Income	3.738	4.076	4.418	4.848	5.345	5.147	0.338	0.68	1.11	1.607	1.409	5.144
Govt. Account Balance	1.874	1.233	1.411	1.502	1.664	1.847	-0.641	-0.463	-0.372	-0.21	-0.027	-1.713
Effect on Growth												
Domestic Output (GDP)/ Domestic Demand for Commodity	19.15	18.861	18.506	23.192	23.136	22.785	-0.29	-0.64	4.04	3.99	3.64	10.73
Supply of Composite Commodity	31.247	34.925	33.966	33.454	32.523	31.416	3.678	2.719	2.207	1.276	0.169	10.049
Total Savings/Investment Expenditure	5.472	8.684	7.843	7.395	6.582	5.619	3.212	2.371	1.923	1.11	0.147	8.763
Investment Consumption Volume	5.436	8.627	7.792	7.347	6.539	5.583	3.191	2.356	1.911	1.103	0.147	8.708

Source: Authors' Computations from Simulated Results of Structuralist Nonlinear Programming CGE (NLPCG). Note: Base Period = 2014-2015; Average fuel price for Base Period = ₦97.00. The Base Year value has a Normalized index Price = 1.00. With constant exchange rate fluctuation and falling oil price.

Appendix 2: Simulation with 142.8% Reduction of Fuel Subsidy: ₦103.00 over Base Period Value = ₦97.00 of 2014/2015
Macro and household Welfare effects resulted from a Litre of Fuel sells for ₦200.00

Marginal Effects of 142.8% Reduction of Fuel Subsidy							Parameters Yearly Growth					
Macro and Sectoral Items	**Summary of Parameters Results**						**Short run**	**Inter-mediate**	**Inter-mediate**	**Inter-mediate**	**Long Run**	**Accumulated**
	2014/ 2015 Base value	**2016**	**2017**	**2018**	**2019**	**2020**	**2016**	**2017**	**2018**	**2020**	**2020**	**2015-2020**
Effects on General Price Levels												
Consumer and Producer Prices for Domestic Supply of Output	1	1.35	1.26	1.21	1.12	1.02	0.35	-0.09	-0.05	-0.09	-0.1	0.02
Domestic Price of Competitive Imports of Commodity	1	1.75	2.187	2.251	2.375	2.517	0.75	0.437	0.064	0.124	0.142	1.517
Composite Price of Output by Activity	1	1.26	1.2	1.16	1.09	1.01	0.26	-0.06	-0.04	-0.07	-0.08	0.01
Effects on External Trade												
Imports of Commodity	12.096	8.526	6.408	6.359	5.348	5.064	-3.57	-2.118	-0.049	-1.011	-0.284	-7.032
Domestic Output Exported By Activity	6.24	6.433	6.868	6.574	6.995	3.784	0.193	0.435	-0.294	0.421	-3.211	-2.456
Current Account Balance	-2.363	1.355	0.371	-0.149	-1.09	-2.195	3.718	-0.984	-0.52	-0.941	-1.105	0.168
Effects on Household Welfare												
Household Real Income	29.658	28.896	27.596	21.096	16.426	16.65	-0.762	-1.3	-6.5	-4.67	0.224	-13.008
Household Consumption	21.519	20.981	20.628	20.601	19.781	13.577	-0.538	-0.353	-0.027	-0.82	-6.204	-7.942
Effects on Government Revenue												
Government Income	3.738	4.076	4.418	4.848	5.345	5.147	0.338	0.342	0.43	0.497	-0.198	1.409
Govt. Account Balance	1.874	1.233	1.411	1.502	1.664	1.847	-0.641	0.178	0.091	0.162	0.183	0.614
Effect on Growth												
Domestic Output (GDP)/ Domestic Demand for Commodity	19.15	18.861	18.506	23.192	23.136	22.785	-0.289	-0.355	4.686	-0.056	-0.351	3.635
Supply of Composite Commodity	31.247	34.925	33.966	33.454	32.523	31.416	3.678	-0.959	-0.512	-0.931	-1.107	0.169
Total Savings/Investment Expenditure	5.472	8.684	7.843	7.395	6.582	5.619	3.212	-0.841	-0.448	-0.813	-0.963	0.147
Investment Consumption Volume	5.436	8.627	7.792	7.347	6.539	5.583	3.191	-0.835	-0.445	-0.808	-0.956	0.147

Source: Authors' Computations from Simulated Results of Structuralist Nonlinear Programming CGE (NLPCG). Note: Base Period = 2014-2015; Average fuel price for Base Period = ₦97.00. The Base Year value has a Normalized index Price = 1.00. With constant exchange rate fluctuation and falling oil price.

Appendix 5: Definition of Variables and Parameters of the Model

Variable Listing

CAPGOV = Government Account Balance
CAPHOSH = Household Savings Rate
CAPWOR = Current Account Balance
CD = Household Consumption Volume
DD = Domestic Demand for Commodity
E = Domestic Output Exported By Activity
ER = Exchange Rate (Domestic per World Unit)
EXSUB0 = Export Subsidy Expenditure
GOVSUE = Government fuel Subsidy Expenditure
GD = Government Consumption Volume
HTAX = Household Direct Tax Revenue
INVD = Investment Consumption Volume
INVEST = Investment Expenditure
M = Imports of Commodity
PDD = Consumer Price for Domestic Supply of Commodity
PDS = Producer Price for Domestic Output of Activity
PE = Domestic Price of Exports by Activity
PM = Domestic Price of Competitive Imports of Commodity
PQ = Domestic Price of Competitive Imports of Commodity
PX = Composite Price of Output by Activity
Q = Supply of Composite Commodity
STAX = Sales Tax Revenue
TARIFF = Tariff Revenue
TE = Export Subsidy Rate
TMS = Import Subsidy Rate
TOTSAV = Total Savings
TS = Sales Tax Rate
TY = Household Income Tax Rate
WALRAS = Slack Variable for Walras's Law
X = Domestic Production by Activity
GDP = Domestic Output Supplied To Domestic Market by Activity
YG = Government Income
YH = Income to Household

Parameter Listing

ac = shift parameter for Armington CES function
at = Shift Parameter for Armington CET function
CAPGOV0 = Government Account Balance
CAPHOSH0 Household Savings Rate
CAPWOR0 = Current Account Balance
CD0 = Household Consumption Volume
DD0 = Domestic Demand for Commodity
Delta = Share Parameter for Armington CES Function
E0 = Domestic Output Exported By Activity
ER0 = Exchange Rate (Domestic per World Unit)
EXSUB0 = Export Subsidy Expenditure
gamma = Share Parameter for Armington CET function

GD0 = Government Consumption Volume
govwor = Transfers From Row To Government
hogovconst = Transfers From Government To Households
howor = Transfers From Row To Households
HTAX0 = Household Direct Tax Revenue
INVD0 = Investment Consumption Volume
INVEST0 = Investment Expenditure
M0 = Imports of Commodity
PDD0 = Consumer Price for Domestic Supply of Commodity
PDS0 = Producer Price for Domestic Output of Activity
PE0 = Domestic Price of Exports by Activity
PM0 = Domestic Price of Competitive Imports of Commodity
PQ0 = Domestic Price of Competitive Imports of Commodity
predelta = Dummy Used To Estimated Delta
Pwe = World Price of Exports of oil
Pwe0 = World Price of Exports of oil
Pwm = World Price of Imports of oil
Pwm0 = World Price of Imports of oil
PX0 = Composite Price of Output by Activity
Q0 = Supply of Composite Commodity
rhoc = Elasticity Parameter for Armington CES Function
rhot = Elasticity Parameter For Output Armington CET Function
STAX0 = Sales Tax Revenue
TARIFF0 = Tariff Revenue
EXSUB0 = Export Subsidy Expenditure
GOVSUE0 = Government fuel Subsidy Rate
TMS = Import Subsidy Rate
TOTSAV0 = Total Savings
TS0 = Sales Tax Rate
TY0 = Household Income Tax Rate
WALRAS0 = Slack Variable for Walras's Law
X0 = Domestic Production by Activity
GDP0 = Domestic Output Supplied To Domestic Market by Activity
YG0 = Government Income
YH0 = Income to Household

Appendix 6: The Specification of Variables as Positive or Free Positive Variables

PDD = Consumer Price for Domestic Supply of Commodity
PDS = Producer Price for Domestic Output of Activity
PE = Domestic Price of Exports by Activity
PM = Domestic Price of Competitive Imports of Commodity
PQ = Domestic Price of Competitive Imports of Commodity
PX = Composite Price of Output by Activity
ER = Exchange Rate (Domestic Per World Unit)
DD = Domestic Demand for Commodity
E = Domestic Output Exported By Activity
M = Imports of Commodity
X = Domestic Production by Activity
GDP = Domestic Output Supplied To Domestic Market by Activity
YH = Income to Household
YG = Government Income
GD = Government Consumption Volume
INVD = Investment Consumption Volume

Free Variables

CD = Household Consumption Volume
Q = Supply of Composite Commodity
CAPWOR = Current Account Balance
CAPGOV = Government Account Balance
TE = Export Subsidy Rate
TMS = Import Subsidy Rate
TS = Sales Tax Rate
TY = Household Income Tax Rate
GOVSUE = Government fuel Subsidy Rate
TARIFF = Tariff Revenue
STAX = Sales Tax Revenue
HTAX = Household Direct Tax Revenue
EXSUB = Export Subsidy Expenditure
CAPHOSH = Household Savings Rate
TOTSAV = Total Savings
INVEST = Investment Expenditure

Appendix 7: Model Blocks

Price Block

PMDEF = Domestic price of competitive imports of commodity
PEDEF = Domestic price of exports by activity
PDSDEF = Producer price for domestic output by activity
PQDEF = Domestic Price of Competitive Imports of Commodity
PXDEF = Composite price of output by activity

Supply Block

CET == Constant elasticity transformation function for domestic production
ESUPPLY== Export supply function (FOC)
ARMINGTON (CES) == Composite commodity aggregation function
COSTMIN == Cost minimization for composite commodity (FOC)

Income Block
YHEQ == Household income
YGEQ == Government income
TOTSAVEQ == Total savings

Expenditure Block
CDEQ == Household commodity consumption
INVESTEQ == Investment expenditure
TARIFFEQ = Tariff Revenue
STAXEQ = Sales tax revenue
HTAXEQ = Household direct tax revenue
EXSUBQ = Export Subsidy Expenditure
GOVSUEEQ = Government fuel subsidy expenditure

Market Clearing Block
QEQUIL = Commodity market equilibrium
DOMEQUIL = Domestic supply and demand equilibrium
CAPWOREQ = Current account balance (foreign trade equilibrium)
CAPGOVEQ = Government account balance (internal balance)
WALRASEQ = Capital account balance