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Ernest Simeon O. Odior [a]

Comparative analysis of the effects of 0, 20, 50, and 66.5% fuel subsidy removals on household wellbeing in Nigeria: A Structuralist CGE Approach

Abstract

This study did a comparative study of the effects of 0, 20, 50 and 66.5% fuel subsidy removals on the wellbeing of household in Nigeria. By 0, 20, 50 and 66.5% fuel subsidy removals, the premium motor spirit (PMS) will sell at ₦97.00, ₦111.43, ₦133.07 and ₦145.00 respectively. Methodologically, the study used a Structuralist Computable General-Equilibrium (SCGE) model to run simulations that indicate the nature of the effects over the period 2015–2020. The comparative empirical findings from the results show that 0, 20, 50 and 66.5% increases in the pump price of fuel in Nigeria have different effects on household real income and household consumption. Specifically, the findings show that, both household real income and household consumption witnessed negative effects. This study recommends that there is need for targeted assistance to the poor by Nigerian government, under the conditions of declined oil price and fuel subsidy removal to enable them to mitigate the adverse consequences. But then, the government need to properly identify the households that are poor and develop a delivery mechanism for transfer of income and include other types of compensation that target the low income households.

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✉ Ernest Simeon O. Odior: odiore@yahoo.com; eodior@unilag.edu.ng

a. Department of Economics, University of Lagos, Nigeria.

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1. Introduction

Fuel subsidies, at their core, fossil-fuel subsidies, which include coal, diesel, gasoline, natural gas, kerosene, electricity and energy, have several aggregate impacts on economies. These economic impacts distort prices and therefore affect consumption and production decisions. Increases in coal, oil, natural gas and petrol prices etc. would have effects on other sectors of the economy; this will affect the production costs, and the prices of other goods and services, particularly energy-intensive ones. A recent International Monetary Fund survey (IMF, 2015) on "Counting the Cost of Energy Subsidies", shows that most of these subsidies problems arises from countries setting energy taxes below levels that fully reflect the environmental damage associated with energy consumption. The International Monetary Fund has revealed that subsidies in energy in 2015, are projected at $5.3 trillion, or 6.5% of global GDP. Despite sharp declines in international energy prices, IMF projects subsidies to remain high (IMF, 2015).

In the view of the Nigerian government, subsidy on premium motor spirit (PMS) constitutes a huge waste of resources that could have been spent more effectively on pro-poor interventions in the economy as fuel subsidy has taken up over a third of the recurrent budget (John et al., 2016), which means that the government has to spend even more to keep domestic prices low and also due to Nigeria's increasing population which result in increased fuel consumption; together these pressures make the cost of fuel subsidy unsustainable as the cost continues to grow exponentially.

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 predicted, according to EIA. With these major buyers of crude oil becoming increasingly self-sufficient, the prices of crude oil in June, 2014, witnessed downward slide, 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. With this scenario, it was expected that the prices will fall below $80 per barrel, a prediction that has forced the Government of Nigerian to benchmark the 2015 budget to $78 per barrel, up from $77.50 in 2014 (Ejiofor, 2014).

Nigeria has an installed production capacity of 445,000 barrels of fuel per day, adequate for surplus export and to meet its domestic needs, this make Nigeria to be the 14th world largest production of crude oil. Yet the

country is a large net importer of gasoline and other petroleum products. As the country's four refineries are in a poor state of disrepair, the country relies on importation for most of its fuel and most often witnessed a drop in importation of refined petroleum products, leading to acute scarcity of the products across the country. Nigeria is expected to spend about N2.2 billion on fuel subsidy with a consumption level of 48 million litre of fuel per day (Emeka, 2011; Izielen, 2012).

With the consumption level of 48 million litre of fuel per day, subsidy on premium motor spirit (PMS) has remained a challenging one for the Nigeria government for the past decades and in recent times; this has dominated public debate. Notwithstanding this debate, the Nigeria government believed that subsidy is to protect the access of poor households to fossil fuels and electricity. This made the Nigeria nongovernment reluctant to remove these subsidies as they claim they are justified on equity grounds, with the problem of corruption and with strong evidence showing that fuel subsidy removal is not beneficial to growth and poverty reduction. Analysts believe that the Nigerian government argument about removal of fuel subsidy could be reversed, meaning that the savings from the budget from subsidy removal would allow for implementation of social support that could be better targeted to poor households.

This research examines these aspects of fuel subsidy and tries to develop new and easy means of understanding the cost and benefit implications on household welfare. Generally, most of the studies carried out on this study 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 effects of the removal of fuel subsidy on household welfare in Nigeria. This study intends to fill this gap.

In view of the stated problems and the justification for this study, this study is set to address the following relevant policy questions: How much gain will the removal of fuel subsidy accrue to household income and consumption volume? While the study overall objective is to analyse the comparative effects of fuel subsidy removal on household income and consumption volume in oil exporting and importing country like Nigeria both on the short and long run period.

After the introductory part in section 1, the rest of the study is organised as follows. Section 2 is the brief review of literature. Section 3 is the computation of fuel subsidy in Nigeria. The data sources and methods of

the study are provided in section 4, while section 5 covers analysis of comparative simulated SCGE results. Section 6 is the discussion of findings and implications, while section 7 is conclusion and policy recommendations

2. Brief Literature Review

The money payment made by government, to keep prices below what they will otherwise be in a free market system refers to subsidy. Subsidy could also be seen as a form of transfer payment and redistribution of income in order to ameliorate the existence of inequity in the economic system.

A very useful and clear explanation on fuel subsidy is given by Coady et al. (2010). In their view, fuel subsidy is the sum of two components or measured as the sum of two components: tax subsidy and pre-tax subsidy. According to this explanation, tax subsidy, represents a lower tax than the "optimal" fuel tax. In a country, it is reasonable to assume that the optimal tax should at least be as large as the consumption tax. While, the notion of optimal fuel tax will or tend to vary across countries and this would depend on revenue requirements of the government as well as the environmental externalities associated with fuel consumption to a large extent.

On the other hand, the difference between the opportunity cost of supplying fuel and the domestic price (excluding any consumption taxes) defines the pre-tax subsidy. For the exporters of oil, opportunity costs constitute the revenue forgone by selling the product in the domestic market (at a lower price) instead of exporting (and therefore selling it at a higher price). Thus for the importers of oil, opportunity costs show the gap between the cost of imports (including the cost of transportation to border plus the distribution and marketing costs) and the domestic price pre-taxes. Opportunity cost at end-user level constitutes border prices plus a mark-up for distribution when fossil fuels are traded internationally, border prices serve as the opportunity cost (Coady et al. 2010)

Following the definition given by OECD (2002) in a study, a subsidy is basically government action that increases the selling price of the producer and or decreases the consumption price of the consumer. In some other definitions, a subsidy can be defined as a reverse tax. In other words, it could be seen as a deliberate attempt by government to support

a consumer and a provider (any chosen economic agent) and applied to any market that involves the selling and buying of products and services.

Clements et al (2003) used a computable general equilibrium (CGE) model to estimate the effect of removal of subsidy on petroleum products in Indonesia. The study ran two scenarios. The Keynesian scenario was used in the first in which real output declined; this led to a fall in the incomes of household. The second was a non-Keynesian scenario that left aggregate output unchanged. In the two scenarios the prices of all goods rose as a result of the removal of subsidy. Their result indicated that the households with higher-income were more affected by the subsidy removal, while, the overall level of poverty in the economy increased, because employment fell among households with the low-income. They recommend that there is the need for targeted support to the poor households if universal subsidies were to be removed or reduced.

Grosh et al (2008) suggested a number of alternative policies that can provide direct assistance to the poor households who would be adversely affected by the removal of subsidy, if subsidies are linked to the price of energy to be phased out. Policies such as social safety nets can take a number of forms. Indirect transfers may include fee waivers for essential services such as transport, education or health, while the direct transfers may include near-cash payments or targeted cash payments. The importance of these policies according to Grosh et al (2008) is their ability to be well-targeted to the poor households; this will result in a lower cost to the government to deliver the same benefits to the households of low income.

Burniaux and Chateau (2010) viewed the economic implications of removing fuel subsidies in non-Organisation for Economic Co-operation and Development (OECD) countries. In line with what is suggested by the theory, if each non-OECD country were to remove its fuel subsidies unilaterally, it would generally bring about gains in welfare. Most regions or most countries report gains in welfare ranging from 0.3% in the rest of the world regional aggregate to more than 4% in the oil-exporting countries. These gains correspond to the improvement of welfare associated with the removal of fuel subsidy. Therefore, from this perspective, the removal of fuel subsidies brings in both economic and environmental benefits

3. Computation of Fuel Subsidy in Nigeria

Based on the information gotten from the website of Petroleum Products Pricing Regulatory Agency (PPPRA, 2014 – this is the agency charged with the responsibility of the regulation and control of domestic fuel consumption), the standardized formula for calculating the final landed cost of petroleum products and petroleum product pricing templates are used. Below is the computation of the fuel subsidy in Nigeria.

According to Ezeigbo (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 in freight 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 trading desk in the Nigerian National Petroleum Corporation (NNPC). Trader's margin yields 100 million dollars per annum 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).

4. Data and Methods

4.1 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, IFS CD-ROMs, etc., and other relevant sources. Other sources include data from the Central Bank of Nigeria (CBN) and the National Bureau of Statistics (NBS).

The model is flexible and can capture the complex realities of the economy of Nigeria. In order to apply the framework to the Nigerian economy, the model was modified to fit the real data and to handle the policy issues and it is calibrated using data for 2014 and the 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: activity accounts, commodity accounts, household accounts, value-added accounts (export duty and sale tax accounts, capital (savings- Investments) accounts), government 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). The entry was normalized to shares of GDP at market prices. The constant elasticity of transformation (CET) and constant elasticity of substitution (CES) and) values used in the calibration of the model were gotten from literatures of past studies (Deverajan et al, 1999).

4. 2 Methodology

4.2.1 Model Specification and Structure

The analysis is based on a structuralist CGE model of a small open economy. This approach have become the main tool used in modern international and developmental macroeconomics and increasingly sought by international organizations around the world. It belongs to the class of new open economy macroeconomic models,

The primary interest of this study is to ascertain the comparative effects of removal of 0, 20, 50 and 66.5% fuel subsidy on household income and 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 exportables and importables.

The model is a non-linear programming (NLP) of 5 blocks and of twenty-eight (28) simultaneous complete equations model, but only the household equations are specified as follows;

Income Equation
YHEQ == Household income Equation
YHEQ: YH =E= (PX*X) + hogovconst + (howor*ER) (1)
Expenditure Equation
CDEQ = Household Consumption Volume Equation
CDEQ: CD *PQ =E= (YH*(1-TY))*(1- CAPHOSH) (2)
HTAXEQ; HTAX =E= (TY*YH) (3)
TOTSAVEQ == Total savings Equation
TOTSAVEQ: TOTSAV =E= (CAPHOSH*(YH*(1-TY))) +
(CAPWOR*ER)+CAPGOV (4)
Market clearing equation
QEQUIL: Q = E = CD + GD + INVD (5)
Related Elasticity Parameters

Elasticity of Export Transformation : rhot = $\rho t = \left(\frac{1}{\Omega}\right)+1$ (7)

Elasticity of Trade Substitution: rhoc = $\rho c = \left(\frac{1}{\sigma}\right)-1$ (6)

where Ω=omega and σ=sigma
Fuel subsidy Variable Initialisation
GOVSUE.L = (TMS.L*pwm*ER.L*DD.L) (8)
pwm = PM0/((1+TMS0)*ER0) (9)
Equation (7) captures the fuel subsidy variable initialization (see Appendixes 5 and 6 for the definition of variables and parameters of the model).

4.2.2 Model Calibration

Thus, whether household income and consumption decrease or increase in response to the removal of fuel subsidy depends on the CES. We analyzed the impact of 0, 20, 50, 66.5 percent fuel subsidy removal effects on household income and consumption volume in Nigeria based on the trade elasticities, which fall within the range of $0 < \Omega < 2$ for the world price of exports (PWE) and $0 < \sigma < 1$ for the world price of imports of oil (PWM). The growth rate of any economy by destination is defined by arbitrary constants (α0s), the accelerators (α1s), and the elasticities (β1s). 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 (γ1) is capacity utilization (ui) and World Price of Exports of oil (PWE).

4.2.3 Definition of Policy Simulation Experiments

The policy analysis examines the comparative effects of different increase in the price of fuel on household income and consumption, if these

variables decline or increases. Because it is hypothesised that household welfare revenue would rise if government continue to subsidise fuel at 0%, since government paid to subsidy. That is, effect of fuel subsidy or removal may cause large changes also on household welfare. It is also the believe that 0% fuel subsidy removal slow down rates of economic growth and have had a stagflationary effect on the economy

The study carried out four comparative scenarios of fuel subsidy removal on the Nigerian economy, including the base experiment of 2014/2015. The "base" in the set serves as comparator. These experiments change the scaling factors on the fuel subsidy removal. These experiments assign values to the world price of fuel import.

The other three (3) simulations involves maintaining constant decrease of subsidy value or increasing the percentage of removal by the Nigerian government and ascertaining the short, the medium and long run distributional effect from 2014/2015 to 2020. Each member of the simulation experiments needed one assignment value.

(i) Stimulate with the base-run ₦97 per litre in 2014/2015, using different elasticity of fuel import (elasticity demand). Allowing 100% no reduction in subsidy removal. That is the base value has an index of 1.00 (see Appendix 1 and 2) and ascertaining the base run distributional effect from the base year 2014/2015, 2016, 2017, 2018, 2019 and 2020.

(ii) The other three simulations involve maintaining constant reduction in fuel subsidy rate, and ascertaining the medium and long run distributional effect. These are: Stimulate with the removal of subsidy by 20%, 50% and 66.5% 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.

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 = ₦97.00 + ₦72.13 = ₦169.13

Table 1. Fuel Subsidy Reduction

Base Year Subsidy (₦)	Subsidy Reduction (%)	Reduction (₦)	Base Year Price(₦)	Pump Price (₦)	Index	Remark
72.13	0.0	0.0	97	97.00	Base Year Normalized index Price = 1.00	Zero Subsidy Removal
72.13	20.0	14.43	97	111.43	20% over the base year price = 1.20	14.43 Reduction from 72.13
72.13	50.0	36.07	97	133.07	50% over the base year price = 1.50	36.07 Reduction from 72.13
72.13	66.5	47.97	97	145.00	66.5% over the base year price = 1.67	47.97 Reduction from 72.13

Source: *Author's Computation, 2017*

(i) With Zero reduction of fuel subsidy. A litre of fuel was sold for ₦97.00

(ii) With 20% reduction of fuel subsidy. A litre of fuel will sells for ₦111.43

(iii) With 50% reduction of fuel subsidy. A litre of fuel will sells for ₦133.07

(iv) With 66.5% reduction of fuel subsidy. A litre of fuel is sells for ₦145.00

With the results from the experiments we are be able to ascertain the relationship between fuel subsidy removal and macroeconomics variables and household welfare (if the fuel subsidy removal has affected household welfare) in Nigeria and the link between fuel subsidy removal and the household welfare.

5. Analysis of Comparative Simulated SCGE Results

Base year parameter values are simulated from social accounting matrix and the share is maintained throughout the simulation period for the variables given the rate changes. Our starting point is a static base simulation which provides a benchmark against which the other scenarios are compared. The base scenarios for capital prices (including the elasticity of world price of crude oil export and world price of fuel import are normalized, at values of one in the base year period 2014/2015. The results of the simulations indicate the net effect on the household welfare.

The findings from this comparative study tend to confirm a priori expectations on the effects of different fuel subsidy reduction by the Nigerian government on household welfare. An unexpected increase in PMS may have effect on the household income and consumption.

The results of marginal effects of reduction of fuel subsidy of the policy simulations for all the household income and consumption are summarized in Appendixes 1 to 4. The Appendixes 1, 2, 3 and 4 show both the summary of parameters results in percent deviation from base period values and magnitudes of the parameter yearly growth of the stated variables. The short run comparative effects are capture in 2016-2018, the intermediate comparative effects captured in 2019, while the long run aggregate comparative 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.

A. Simulation with 0% Reduction of Fuel Subsidy: A Litre of Fuel sells for ₦97.00

Given the fuel subsidy reduction simulation scenarios under a 0% reduction of fuel subsidy over base period value ₦97.00 of 2014/2015, we ascertain the distributional effects from 2016 to 2020, this for the short run, intermediate run and long run. Appendix 1 shows the effect which 0% Reduction of fuel subsidy will have on household real income and household consumption over the base period value ₦97.00 of 2014/2015. The effect will follow the transmission mechanism on household real income and household consumption.

Appendix 1 shows the parameters deviation from the base run period of 29.658 for household real income and 21.519 for household consumption and the yearly growth overtime. The results show that the accumulated effects of household real income reduced by 2.43 and consumption decreased by 1.81 from a cumulative basis for the period of 2014/2015 to the short run 2016 to 2018 and to the long run period of 2020. Implying a reduction in the level of household income and consumption. The result shows that household real income and consumption experienced negative yearly growth. For example, in 2015 with 0% increase of fuel subsidy reduction dropped the base value from 29.658 in 2015 to 29.512 in 2016 and further to 28.806 in 2020.

The simulations show that between 2016 and 2020 the average level of real income fell by 0.146%, 0.346%, 0.45%, 0.637% and 0.852% respectively in 2016 to 2020, under the zero percent and ₦97.00 percent scenarios and under the managed exchange rate regime.

With the fuel subsidy reduction simulation scenarios under 0%, household consumption volume is seen to deteriorate accumulatively by 1.81% in the short run, and it would fall by 0.107% 2016, 0.254% in 2017, 0.332% in 2018, and in the long run it would fall by 0.639% in 2020.

In welfare terms, the poorest households would lose about 0.639%, in the long run, because the real income would be lower. In general, 0% fuel subsidy reduction simulation scenarios will also worsening of household welfare. This affirms apriori expectation as the accumulated effect is more negative on household real income and less on household consumption with the effect been cushioned by savings.

B. Simulation with 20% Reduction of Fuel Subsidy: Litre of Fuel sells for ₦111.13

The fuel subsidy reduction simulation scenarios under a 20% reduction of fuel subsidy over the base period value ₦97.00 of 2014/2015 resulted from a litre of fuel sells for ₦111.43. This suggests that ₦14.43 was removed from fuel subsidy causing an increase to a liter of fuel sells for ₦111.43. We ascertain the distributional effects from 2016 to 2020; this for the short run, intermediate run and long run are shown in Appendix 2.

The first part of Appendix 2 shows the deviation from the base run period for household real income and household consumption, while second part shows the yearly growth overtime. The results show that the accumulated effects of household real income reduced by 4.038 and household consumption decreased by 2.856 from a cumulative basis for the period of 2014/2015 to the long run period of 2020. While the second part shows result shows that household real income and household consumption experienced negative yearly growth.

On the household real income, the short run distributional impacts show for -0.284 in 2016, -0.653 in 2017, -0.81 in 2018 and he intermediate effect shows -1.144 and 2019 and (long run distributional effects) -1.147 in 2020. Household consumption also show decreases in their trend analysis in short, intermediate and long run with percentage changes value of -0.204 in 2016, -0.462 in 2017, -0.588 in 2018 in the short run and intermediate effect shows -0.83 in 2019 and -0.772 decrease in 2020 on the long run.

Compared to the 0% reduction of fuel subsidy, there is a decrease in household real income and household consumption in the short to the long run. This implies that household real income and household consumption may be better off under the zero percent and ₦97.00 percent scenarios and under the managed exchange rate regime than 20% and other successive fuel subsidy reduction.

C. Simulation with 50% Reduction of Fuel Subsidy: Litre of Fuel sells for ₦133.43

Fuel subsidy reduction simulation scenarios under a 50% reduction of fuel subsidy over base period value ₦97.00 of 2014/2015 results in a Litre of fuel selling for ₦133.07. The implication of this is that ₦36.07 was removed from fuel subsidy causing an increase in a litre of fuel selling for ₦133.07. The distributional effects from 2016 to 2020 is ascertained for the short run, intermediate run and long run, as shown in Appendix 2.

The first part of Appendix 3 shows the deviation from the base run period for household real income and household consumption, while the second part shows the yearly growth overtime. The results show that the accumulated effects of household real income reduced by 18.491 and household consumption reduced by 9.126 from a cumulative basis for the period of 2014/2015 to the long run period of 2020. While the second part shows that household real income and household consumption experienced negative yearly growth of 15.039% and 7.762% respectively. This implies a tremendous decrease in household welfare.

On the household real income, the short run percent deviation from base period values are -2.288 in 2016, -3.405 in 2017, -3.469 in 2018, intermediate -4.59 in 2019 and (long run distributional effects) -4.739 in 2020. Household consumption also show decreases in their trend analysis in short, intermediate and long run with percent deviation from base period values of -1.484 in 2016 in the short run and -1.514 in 2017, -1.615 and -1.703 in 2019 in the intermediate run and -2.81 decrease in 2020.

Compared to the 0% and 20% reduction of fuel subsidy, there is reduction in household income and consumption in the short to the long run. This implies that household welfare is worst off with successive fuel subsidy reduction.

D. Simulation with 66.5% Reduction of Fuel Subsidy: Litre of Fuel sells for ₦145.00

Reduction of fuel subsidy by 66.5% over base period value ₦97.00 of 2014/2015 led to a litre of fuel selling for ₦145.00 implying that ₦47.97

was added to the pump price of fuel per litre and the fuel subsidy reduction simulation scenarios, as presented in Appendix 4. The effect of such reduction on household income and consumption is thus examined and compared.

The first part of Appendix 4 shows the deviation from the base run period for household real income and household consumption, while the second part shows the yearly growth overtime. The results show that the accumulated effects of household real income reduced by 26.706 and household consumption decreased by 12.803 from a cumulative basis for the period of 2014/2015 to the long run period of 2020. While the second part shows that household real income and household consumption experienced negative yearly growth.

On the household real income, the short-run distributional impacts are -0.414 in 2016, -0.916 in 2017, -1.491 in 2018, intermediate effect -12.092, in 2019 and (long run distributional effects) -11.793 in 2020. Household consumption also show decreases in their trend analysis in short, intermediate and long run with percentage changes value of -0.301 in 2016 in the short run and -0.665 in 2017, -5.124 and -0.964 decrease in 2019 in the intermediate run and -5.749 decrease in 2020.

Compared to the 0%, 20% and 50% reduction of fuel subsidy, there is reduction in household income and consumption in the short to the long run. This implies that household welfare is worst off with successive fuel subsidy reduction.

6. Discussion of Findings and Implications

This study used a Structuralist CGE methodology to examine the effects of distributional effects of removal of fuel subsidy on household real income and household consumption in Nigeria from 2015 to 2020. The results show that increase in the fuel pump price in the country as a result of reduction in fuel subsidy have negative distributional effect on the household real income and household consumption.

Under the specified fuel subsidy reduction scenarios (0% subsidy reduction with the base-run ₦97 per litre and a litre of fuel sells for ₦97.00), we ascertained the distributional effects from 2016 to 2020, this for the short run, intermediate run, long run and the accumulated effect are shown in Appendix 1. Using the accumulated effect, the simulation results show that the removal of fuel subsidy does lead to decrease in the household real income and household consumption. The results of household real income and household consumption show that the

accumulated effects of household income decreased by 2.43% and household consumption decreased by 1.81% and with parameters yearly growth of -0.852% and -0.639% respectively.

Appendix 2 shows the accumulated effect of 20% reduction of fuel subsidy over base period of 2014/2015 to the long run period of 2020. A litre of fuel will sell for ₦111.43. The simulation results show that the removal of fuel subsidy does lead to a greater decrease in household real income and household consumption compared to 0% non-removal. The results of household real income and household consumption show that the accumulated effects of household income increased by 4.038% and household consumption decreased by 2.856% and with parameters yearly growth of -1.147% and -0.772% respectively

Appendixes 3 and 4 show the accumulated effects of 50% and 66.5% reduction of fuel subsidy over base period of 2014/2015 to the long run period of 2020. A litre of fuel will sell for ₦133.07 for 50% reduction and ₦145.00 for 66.5% reduction. The simulation results show that the removal of fuel subsidy does lead to a greater decrease in household real income and household consumption compared to 0% and 20%. The results show that the accumulated effects on household income and consumption are highest for 66.5% than 0%, 20% and 50% fuel subsidy reduction for the period of 2014/2015 to the long run period of 2020 (see Appendixes 3 and 4). The deterioration effects on household is lowest for the non-removal (0%) than others, both have implications for household income and consumption.

In relation to the findings, it implies that the fuel subsidy reduction and its accumulation effects will affect the poor households more than the households with the highest income share and the income loss would tend to be more pronounced for the households with the lowest income share in both the formal rural and formal urban sectors and informal rural and informal urban sectors. The adverse fuel subsidy reduction tends to increase the absolute numbers of the poor but the increase in the number of the poor would be registered more in the urban areas than the rural areas even though the poverty gap index tends to be higher in the rural areas than urban areas.

In other words, the households with lowest expenditure function or consumption volume, both in the rural and urban areas, tend to be more affected than the households with the higher expenditure function or consumption volume in both the rural and urban sectors. Poverty is at present the worst scourge in Nigeria. That is, increases in consumer prices

reduce the purchasing power of money and the real income of the people and hence worsen the incidence of poverty.

7. Conclusion and Policy Recommendations

According to economic theory, removal of fuel subsidy in form of increased in pump price of petrol decreases household welfare. This study shows that the Nigerian household is very sensitive or very vulnerable to fuel subsidy removal. From the above findings, this study confirms to the apriori expectations. The results of household real income and household consumption show that the accumulated effects on household welfare are better off with 0% (₦97.00) fuel subsidy removal than other higher percentages. These have many implications for the Nigeria household welfare in relation to the findings on household poverty and welfare, because the distributional impacts and implications are notable.

Thus the main goal of social protection in Nigeria should be to reduce poverty and protect vulnerable groups through an effective and sustainable prevention mechanism thereby achieving sustainable social protection. 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.

Nigeria governments may need to turn to targeted assistance as was introduced by Ghana in 2005 when it embarked on eliminating fuel price subsidies. Therefore, there is need to help the poor by Nigerian government, under the conditions of declining oil export prices and fuel subsidy removal to enable them to mitigate adverse consequences. But then, the government 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. For example, the use of cash transfers; this method have been used by Chile and the Philippines to compensate the poor for higher fuel prices. In each of these schemes, effective information dissemination and nation-wide awareness campaigns are indispensable. These can help mitigate the effect of fuel subsidy removal on them while avoiding the problems inherent in generalised subsidies.

Finally, in view of the serious effects of fuel subsidy removal on the Nigerian household, the government also, needs to determine the appropriate exchange rate, fiscal and monetary and policy responses.

Also, and very importantly, there is the need to institute measures to reduce oil dependence, as some other countries have tried to do to improve the non-oil sector considerably. These will depend on policy possibilities in Nigeria.

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Appendix 1. Base Value, 0% Reduction of Fuel Subsidy: ₦0.00 over Base Period Value ₦97.00 of 2014/2015, Household Welfare effects resulted from a Litre of Fuel sells for ₦97.00

Marginal Effects of 0% Reduction of Fuel Subsidy							Summary of Parameters Results in Percent Deviation from Base Period Values					
	Summary of Parameters Results						Short run Effect	Intermediate Effect	Intermediate Effect	Intermediate Effect	Long Run Effect	Accumulated Effect
Effects on Household Welfare	2014/2015 Base value	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2015-2020
1. Household Real lncome	29.658	29.512	29.312	29.208	29.021	28.806	-0.146	-0.346	-0.45	-0.637	-0.852	-2.43
2. Household Consumption	21.519	21.412	21.265	21.187	21.045	20.88	-0.107	-0.254	-0.332	-0.474	-0.639	-1.81

Marginal Effects of 0% Reduction of Fuel Subsidy							Parameters Yearly Growth					
Effects on Household Welfare	Summary of Parameters Results						Short Run GR	Intermediate	Intermediate	Intermediate	Long Run	Accumulated
	2014/2015 Base value	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2015-2020
1. Household Real lncome	29.658	29.512	29.312	29.208	29.021	28.806	-0.146	-0.2	-0.104	-0.187	-0.215	-0.852
2. Household Consumption	21.519	21.412	21.265	21.187	21.045	20.88	-0.107	-0.147	-0.078	-0.142	-0.165	-0.639

Notes: *Source: Authors' Computations from Simulated Results of Structuralist Nonlinear Programming Computable General Equilibrium (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. 20% Reduction of Fuel Subsidy: ₦14.43 over Base Period Value ₦97.00, Household Welfare effects resulted from a Litre of Fuel sells for ₦111.43

Marginal Effects of 20% Reduction of Fuel Subsidy							Summary of Parameters Results in Percent Deviation from Base Period Values					
	Summary of Parameters Results						Short run Effect	Intermediate Effect	Intermediate Effect	Intermediate Effect	Long Run Effect	Accumulated Effect
Effects on Household Welfare	2014/2015 Base value	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2015-2020
1. Household Real lncome	29.658	29.374	29.005	28.848	28.514	28.511	-0.284	-0.653	-0.81	-1.144	-1.147	-4.038
2. Household Consumption	21.519	21.315	21.057	20.931	20.689	20.747	-0.204	-0.462	-0.588	-0.83	-0.772	-2.856
Marginal Effects of 0% Reduction of Fuel Subsidy							Parameters Yearly Growth					
Effects on Household Welfare	Summary of Parameters Results						Short Run GR	Intermediate	Intermediate	Intermediate	Long Run	Accumulated
	2014/2015 Base value	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2015-2020
1. Household Real lncome	29.658	29.374	29.005	28.848	28.514	28.511	-0.284	-0.369	-0.157	-0.334	-0.003	-1.147
2. Household Consumption	21.519	21.315	21.057	20.931	20.689	20.747	-0.204	-0.258	-0.126	-0.242	0.058	-0.772

Notes: *Source: Authors' Computations from Simulated Results of Structuralist Nonlinear Programming Computable General Equilibrium (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 3. 50% Reduction of Fuel Subsidy: ₦14.43 over Base Period Value ₦97.00, Household Welfare effects resulted from a Litre of Fuel sells for ₦133.07

Marginal Effects of 50% Reduction of Fuel Subsidy							Summary of Parameters Results in Percent Deviation from Base Period Values					
	Summary of Parameters Results						Short run Effect	Intermediate Effect	Intermediate Effect	Intermediate Effect	Long Run Effect	Accumulated Effect
Effects on Household Welfare	2014/2015 Base value	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2015-2020
1. Household Real lncome	29.658	27.37	26.253	26.189	25.068	24.919	-2.288	-3.405	-3.469	-4.59	-4.739	-18.491
2. Household Consumption	21.519	20.035	20.005	19.904	19.816	18.709	-1.484	-1.514	-1.615	-1.703	-2.81	-9.126

Marginal Effects of 0% Reduction of Fuel Subsidy							Parameters Yearly Growth					
Effects on Household Welfare	Summary of Parameters Results						Short Run GR	Intermediate	Intermediate	Intermediate	Long Run	Accumulated
	2014/2015 Base value	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2015-2020
1. Household Real lncome	29.658	27.37	26.253	26.189	25.068	24.919	-0.536	-0.606	-0.735	-7.798	-5.364	-15.039
2. Household Consumption	21.519	20.035	20.005	19.904	19.816	18.709	-0.389	-0.44	-0.533	-6.226	-0.174	-7.762

Notes: *Source: Authors' Computations from Simulated Results of Structuralist Nonlinear Programming Computable General Equilibrium (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 4. 66.5% Reduction of Fuel Subsidy: ₦14.43 over Base Period Value ₦97.00, Household Welfare effects resulted from a Litre of Fuel sells for ₦145.00

Marginal Effects of 66.5% Reduction of Fuel Subsidy							Summary of Parameters Results in Percent Deviation from Base Period Values					
	Summary of Parameters Results						Short run Effect	Intermediate Effect	Intermediate Effect	Intermediate Effect	Long Run Effect	Accumulated Effect
Effects on Household Welfare	2014/2015 Base value	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2015-2020
1. Household Real lncome	29.658	29.244	28.742	28.167	17.566	17.865	-0.414	-0.916	-1.491	-12.092	-11.793	-26.706
2. Household Consumption	21.519	21.218	20.854	16.395	20.555	15.77	-0.301	-0.665	-5.124	-0.964	-5.749	-12.803
Marginal Effects of 0% Reduction of Fuel Subsidy							Parameters Yearly Growth					
Effects on Household Welfare	Summary of Parameters Results						Short Run GR	Intermediate	Intermediate	Intermediate	Long Run	Accumulated
	2014/2015 Base value	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2015-2020
1. Household Real lncome	29.658	29.244	28.742	28.167	17.566	17.865	-0.414	-0.502	-0.575	10.601	0.299	-11.793
2. Household Consumption	21.519	21.218	20.854	16.395	20.555	15.77	-0.301	-0.364	-4.459	4.16	-4.785	-5.749

Notes: *Source: Authors' Computations from Simulated Results of Structuralist Nonlinear Programming Computable General Equilibrium (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.*

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Appendix 5. Variables and Parameters of the Model Definition

Variable Listing

CAPGOV = Account Balance of Government
CAPHOSH = Household Savings Rate
CAPWOR = Current Account Balance
CD = Consumption Volume of Household
DD = Domestic Demand for Commodity
E = Domestic Output Exported By Activity
ER = Exchange Rate (Domestic per World Unit)
GD = Government Consumption Volume
GOVSUE = Government fuel Subsidy Expenditure
HTAX = Direct Tax Revenue of Household
INVD = Investment Consumption Volume
PM = Domestic Price of Competitive Imports of Commodity
PQ = Consumer price of composite commodity
PX = Composite Price of Output by Activity
Q = Composite Commodity Supply
QEQUIL = Commodity market equilibrium
TMS = Import Subsidy Rate
TOTSAV = Total Savings
TY = Household Income Tax Rate
X = Domestic Production by Activity
YH = Income to Household

Parameter Listing

CAPGOV0 = Government Account Balance
CAPWOR0 = Current Account Balance
DD0 = Domestic Demand for Commodity
E0 = Domestic Output Exported by Activity
ER0 = Exchange Rate (Domestic per World Unit)
GOVSUE0 = Government fuel Subsidy Rate
hogovconst = Transfers from Government to Households
howor = Transfers From Row To Households
HTAX0 = Household Direct Tax Revenue
PM0 = Domestic Price of Competitive Imports of Commodity
Pwm0 = World Price of Imports of oil
TMS = Import Subsidy Rate
TOTSAV0 = Total Savings
TY0 = Household Income Tax Rate
YH0 = Income to Household

✉ Ernest Simeon O. Odior: odiore@yahoo.com; eodior@unilag.edu.ng
a. Department of Economics, University of Lagos, Nigeria.

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