Impacts of Removing Refined Oil Import Subsidies in Nigeria on Poverty

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Abstract

The crude oil sector in Nigeria contributes substantially to the economy; however, these benefits are being compromised by significant subsidies on refined oil imports. The refined oil subsidy is paid primarily on imported fuel because domestic refineries cannot satisfy the national demand at current prices. Low fuel prices are considered an important benefit to the Nigerian people, where more than half the population lives in poverty in this oil rich country. The costs of these subsidies have been rising in recent years, due to volatile refined oil prices and the cost of corruption. Previous governments have attempted to remove the subsidy without success. Removing the fuel subsidy, therefore, remains one of the most intricate socio-economic policy issues in Nigeria. In this paper, we use an economy-wide framework to identify the impact of removing the fuel subsidy on the Nigerian economy. Policy alternatives that target certain households and promote domestic production of refined oil are discussed. The results show that accompanying a subsidy reduction with a transfer of income to poor households alleviate some of the negative impacts on households.

Keywords: Nigeria, fuel subsidy, poverty, income distribution, economy-wide framework.

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1 Introduction

Nigeria is the most populous country in Africa with a 2011 population of 162.5 million. It possesses 28 percent of African proven oil reserves, second after Libya, and it is the top producer of African crude oil, producing 24 percent of 2010 African oil production equaling 2.4 million barrels per day (bpd) (UN, 2011; BP, 2011). Figure 1 shows that crude oil production in Nigeria during the last decade ranged between 2.1 to 2.5 million bpd (measured at the left vertical axis) and its share in African production ranged between 21 percent and 29 percent. At the same time, Nigeria's share in world production remained almost constant around three percent. Nigeria ranks among the top 12 world producers of oil in 2011 (BP, 2012). The production of the top twenty world oil producers, in 2011 and their share of world production are shown in Appendix 1.

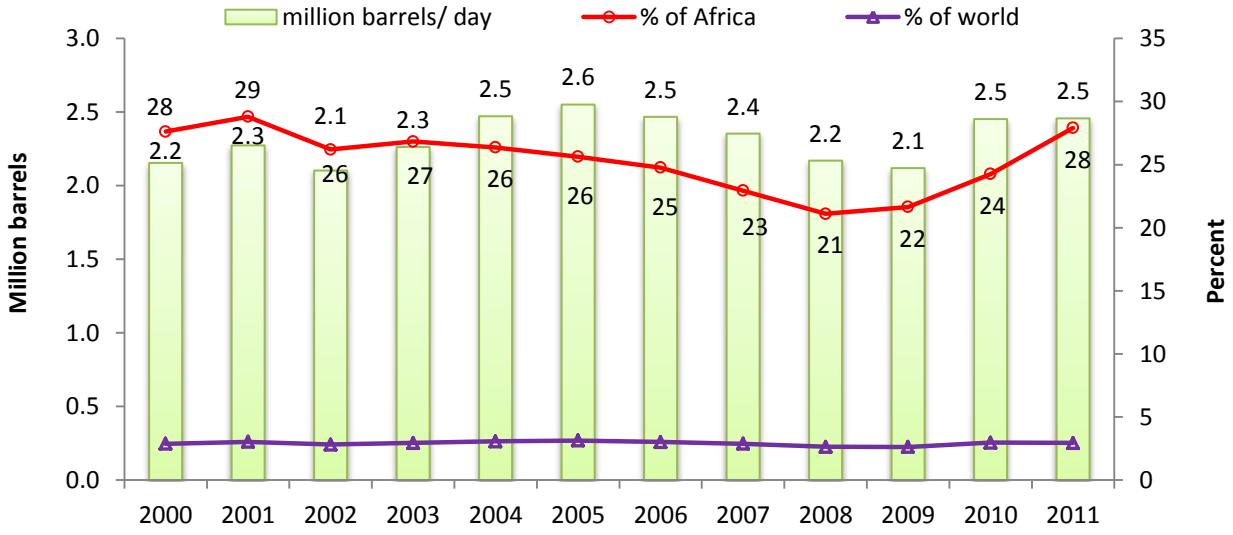

Figure 1: Oil production in Nigeria (million barrel/day, 2000 - 2011)*.

Source BP (2012).

* Shares are measured at the right vertical axis and oil production is measured at the left vertical axis.

Over the last four decades, crude oil has become Nigeria's top export commodity. The share of oil in Nigerian exports peaked at 97 percent in 1984 and has not been less than 90 percent since, while its share in gross domestic product (GDP) has ranged between 25 percent and 30 percent in recent years (NBS, 2010). Between 1970 and 2005, crude oil sales contributed about 75 percent of government revenue and 96 percent of Nigerian foreign exchange earnings (Adenikinju, 2009).

Despite being Africa's largest oil producer, Nigeria still relies heavily on imported refined oil. Its four refineries Port Harcourt I and II, Warri and Kaduna have a combined capacity of around 445 thousand bpd, which covers 63 percent of domestic demand.[2] However, these refineries are running far below their capacity due to operational failures, poor maintenance, sabotage on crude oil pipelines feeding refineries, theft, and fire (EIA, 2012; Businessday, 2013). In 2009 and part of 2010, particularly low refinery runs forced the country to import about 85 percent of its refined oil needs. Other estimates show the domestic refineries to satisfy a maximum of 25 percent of domestic consumption (Rice, 2012).

With the proclaimed objective to alleviate high levels of poverty, the Nigerian government subsidizes private consumption of imported refined fuels to maintain a stabilized price at the consumer pump. The dollar value of the subsidy increases with increasing refined oil prices or increased import volumes. Rising world fuel prices have caused this subsidy to increase significantly over recent years; damaging the country's fiscal health (Rice, 2012; BBC 2012a, 2012b). The Nigerian Petroleum Products Pricing Regulatory Agency (PPPRA) determines the daily and monthly subsidy rates as follows: the subsidy is determined daily and monthly by PPPRA based on the gap between the expected price of imported fuel, including margins, and the pre-established, regulated, domestic price[3].

Though the subsidy helps the poor, by keeping Nigerian prices lower than world prices, the biggest beneficiaries have been importing companies and local wholesalers (The Economist, 2011) that smuggle some of the subsidized fuel into neighboring countries and sell it at higher prices (The Economist, 2012). Illegal trade is not well recorded in official trade statistics, which makes it difficult to analyze. According to the BBC (2012a, b), however, the Nigerian government paid the subsidy on 59 million liters of fuel a day in 2011, although domestic consumption in Nigeria was approximately 35 million liters a day. Thus, fuel importers were paid hundreds of millions of US dollars to import fuel that was never delivered to the Nigerian people.

Nigeria is not a special case regarding its refined fuel subsidies. The World Bank (2009) shows that subsidies on electricity and petroleum products in the Middle East and North Africa

[2] According to Businessday (2013), the domestic refineries were operating at an average of 24% of their capacity in 2009 and 2010 and covered only 15% domestic demand.

[3] The PPPRA follows the import parity principle in its price determination, which includes: a) landing cost of products; b) margins for the marketers, dealers, and transporters; c) jetty-depot through-put; d) other charges and taxes.

(MENA) region have contributed to energy-use inefficiency. The Bank notes that subsidies are meant to share the countries' natural-resource wealth with its citizens, especially the poor. However, fuel subsidies have proven to disproportionally benefit wealthier citizens that consume relatively larger amounts of refined fuel to power their autos and homes. Therefore, the study states that: "untargeted energy subsidies reduce the amount of money that can be spent on programs that really benefit the poor. They also encourage investors and firms to invest in activities that would be unprofitable if energy were not subsidized" (World Bank, 2009).

For the past 30 years, governments have attempted to remove the fuel subsidy due to the damaging fiscal impact (Adenikinju, 2009). From a political economy perspective, subsidy removal is difficult because it impacts a broad spectrum of Nigerian households. Despite the majority of the subsidies benefiting wealthier households, lower and less volatile fuel prices are popular to all population segments.

For these reasons, attempts to remove the subsidy have always generated opposition from consumers. Moreover, there is the presumption that any price increase will fuel inflation and reduce economic welfare (Adenikinju, 2009). Nonetheless, the subsidy on imported refined oil was abolished on January 1, 2012 under the justification that corruption had greatly swelled the cost of providing cheap fuel (Rice, 2012). This led the price to rise by more than double. Nigerians took to streets, led by the trade union and civil society. After more than two weeks of strikes, the government introduced a new subsidy that lowered the price from 140 to 97 Naira per liter. Although a new subsidy was introduced, the refined oil price has remained more than 50 percent higher than 65 Naira per liter, its price before the first attempt at removing the subsidy.

The MENA region has also experienced rioting as a result of reduced fuel subsidies without, complimentary, compensatory measures for affected groups (World Bank, 2009). The World Bank has suggested some of the social unrest may be avoided by implementing social protection programs to protect poor households from steep increases and volatile energy prices (World Bank, 2009).

2 Objectives and Research Questions

The objective of this study is to assess the implications of cutting Nigerian fuel subsidies on poor household's income and consumption providing support to the policy-making process.

We do this in an economy-wide framework by simulating two cuts to the fuel subsidy:

1) Complete removal of the subsidies on imported refined oil, and

2) Partial removal of subsidies so that fuel prices do not increase more than 10 percent of the baseline price of fuel.

The study also analyzes alternative policies that, in addition to the subsidy removal or reduction, would mitigate the impact on the domestic economy and poor households. For example:

- What are the implications of introducing a government transfer scheme targeting poor households?
- To what extent would the domestic Nigerian refineries be able to replace imported refined oil, should the subsidy be made on the domestic refined oil and what impact would that have on the domestic economy?

We present our results focusing on several key aspects of the Nigerian economy, including: GDP, government revenue, household incomes and consumption.

3 Methodology

In this study, we use a global applied general equilibrium model linking the Nigerian economy to the rest of the world. The newly developed MyGTAP Model by Walmsley and Minor (2012), is an extension to the standard GTAP model (Hertel, 1997) that eliminates the single regional household and the related distribution parameters and replace them by linking private and government expenditures directly to income sources. Furthermore, the single private household is replaced with multiple households allowing us to analyze distributional impacts and to implement policy scenarios that target particular households. The new model specification also allows for a focused treatment of government income and expenditures, which allows us to track the effects of the subsidy removal on government budget deficits.

Apart from the multiple households and improved government specification, MyGTAP augments the standard GTAP model by including inter-regional transfers, such as remittances and foreign capital incomes.

According to the modified structure of the model, the new government account collects income from taxes and foreign aid and spends it as government purchases, transfers to households, foreign aid (out) and subsidies. The difference between government income and expenditure is then either a deficit or savings (Figure 2).

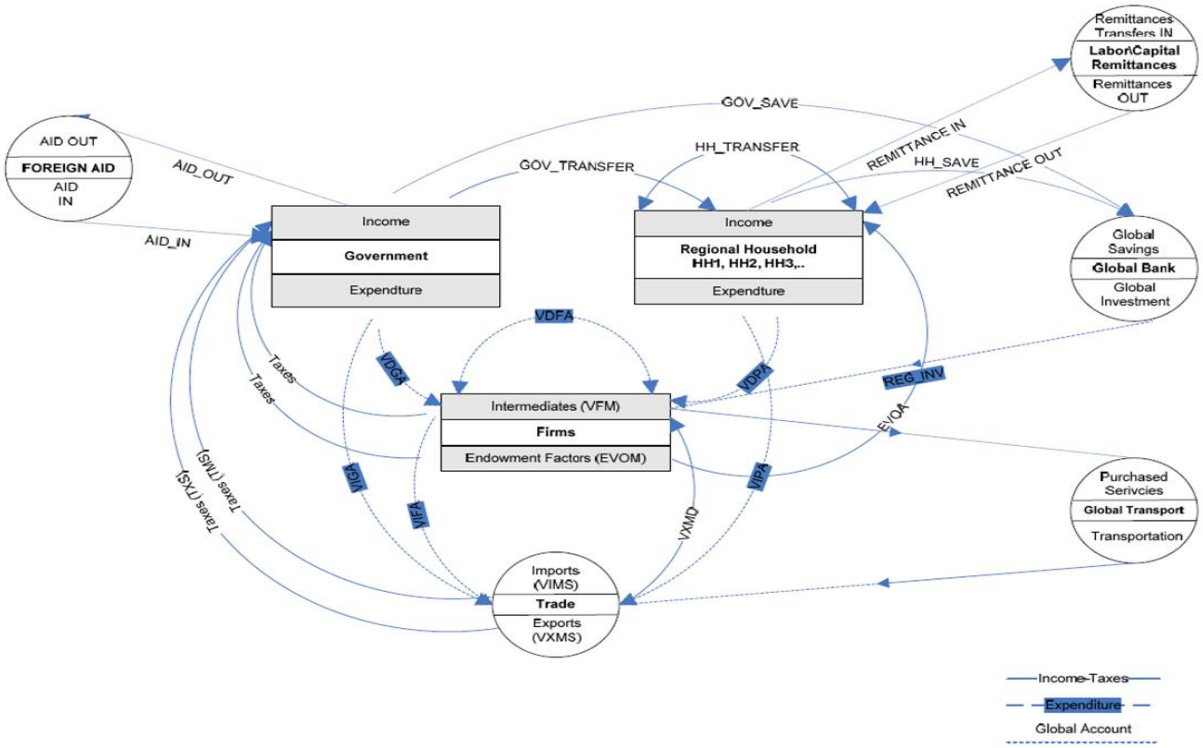

Figure 2: Income and Expenditure Flows in MyGTAP Model.

Source: Walmsley and Minor (2012).

Income sources for private households on the other hand are a function of returns to factor endowments (land, labor and capital), net foreign labor remittances and net foreign capital rents, transfers from the government and transfers from other households. The household income is spent on consumption and savings (Figure 2).

To use the MyGTAP model within the context of this paper, we modified the GTAP data base by breaking down the regional household into multiple households based on a data tool documented in Minor and Walmsley (2012). The breakdown of households was based on the latest available Nigerian Social Accounting Matrix (SAM) for the year 2006 (Nwafor et al., 2010). The SAM provides detailed information on 12 household groups, classified by geographical zones, and rural and urban categories. The implementation of multiple households is particularly useful for our study, as we aim at assessing the implications of different subsidy scenarios that are combined with a discriminatory transfer scheme targeting lower income Nigerian households. A complimentary policy permits the reduction in the refined oil subsidy while compensating poor

households to reduce the impacts of higher fuel prices.[4] Despite the lack of households' accounts that are differentiated by income (e.g. income quintiles) in the SAM, it was possible to bring such information about by calculating savings rates of the different household groups and employing some basic assumptions about savings rates, wealth and income (Appendix 4).

The SAM structure allows us to study the effects of the subsidy removal scenarios on other sectors of the economy as it distinguishes 62 sectors and commodities, of which more than half are agricultural. The SAM has a separate sector for refined oil, a sector for crude petroleum and natural gas and an aggregated sector for other mining (Nwafor et al., 2010).

4 Data Adjustments and Mapping

4.1 Data Aggregation

In light of the data provided in the SAM of Nwafor *et al*. (2010), the database applied in this study aggregates the 129 regions of the GTAP 8a data base into 13 regions as shown in Table 1.

Table 1: Regional Aggregation of GTAP 8a Database

No.	Code	Description
1	Japan	Japan
2	China	China
3	USA	United States of America
4	EU_25	European Union 25
5	MENA	Middle East and North Africa
6	Ghana	Ghana
7	CotedIvoire	Cote d'Ivoire
8	Nigeria	Nigeria
9	Cameroon	Cameroon
10	SouthAfrica	South Africa
11	RWestAfrica	Rest of Western Africa
12	RestofSSA	Rest of Sub-Saharan Africa
13	RestofWorld	Rest of World

Our regional aggregation emphasizes countries neighboring Nigeria and includes countries that are involved in the oil trade with Nigeria such as the United States (USA), major non-oil trading partners, such as China, Japan and South Africa, and aggregated regions MENA, European Union (EU), sub-Saharan Africa (SSA) and the rest of West Africa, and the rest of the world.

[4] Additional technical details on the model features, applied closure and experiment variables are provided in Appendix 5.

The 57 GTAP sectors are aggregated into 21 sectors according to their importance to the Nigerian economy either by production, consumption, or trade. Another factor considered is the connectivity between non-energy sectors with the energy sectors. The detailed mapping between the sectors of the Nigerian 2006 SAM and GTAP sectors is shown in Appendix 2, while the mapping between the aggregated 21 sectors and the GTAP 8 sectors is shown in Appendix 3.

The MyGTAP data module is applied to split the single private household into 12 households to conduct a detailed analysis of the effects to household income distribution and expenditures. The data and weights required are obtained from the disaggregated SAM accounts.[5] Accordingly, the newly aggregated 21 sectors are mapped to the corresponding sectors in the SAM, while land and natural resources on the one hand and skilled and unskilled labor on the other of the GTAP 8 data base are aggregated together to coincide with the three production factors of the SAM. These reconciliations between the production sectors and factor endowments of the SAM and the GTAP 8 data base are needed for tracking income by factors endowments accruing from the different activities (sectors) of the SAM and for generating the corresponding shares to be used in MyGTAP.

In order to allocate factor income across households, factor ownership weights are calculated by household. That is, a mapping between the factors of production, their dollar income, and the ownership of factors by households is created, thereby determining households' budgets by their factor incomes. Net foreign remittances for capital and labor are then added to factor income to get the households budget[6]. Households' expenditure weights for each commodity's share in household expenditure are calculated along with household savings. Government income is calculated from tax revenues and net foreign aid payments.

4.2 Nigeria Specific Adjustments

As mentioned earlier, the subsidy on imported refined oil is determined on a daily and monthly basis by the PPPRA. Calculating an annual weighted average of monthly subsidies, we find that the subsidy rate that is reflected in the GTAP version 8a database is incorrect. We, therefore, employ the Altertax tool (Malcolm, 1998) to correct the subsidy rate contained in the GTAP 8a database. The Altertax approach runs a simulation where tax rates are set to their desired value and the updated post-simulation database is saved for subsequent policy experiments. A special

[5] Only the Nigerian data is modified, but it has to add up to the totals in the GTAP Data Base. The data for all other regions remain the same.

[6] Household factor incomes are calculated net of depreciation.

closure and special parameter file are applied to ensure that the rate-changing simulation has the least possible effect on other cost and sales shares. This closure fixes real regional trade balances, whilst the parameter settings amount to Cobb-Douglas everywhere, which keeps budget shares fixed.

The applied PPPRA subsidy during the second half of 2012 was 33.0 percent. All the imported refined oil in Nigeria consumed by private households, government and firms, is subject to this rate. Therefore, the Altertax simulation is applied to the imported refined oil tax rates corresponding to each of agents in Nigeria: firms (tfm); government (tgm), and private households (tpm)[7]. Each of these taxes implies a wedge between the composite import price pim(i,r) and the respective consumption prices for each agent (referred to in the GTAP model as pfm[i,r], ppm[i,s] and pgm[i,r]).

Once the data has been fixed to correctly represent the subsidy we change the closure of the model for all other simulations. A model closure that fixes the government real savings is applied for all simulations so that the subsidy removal is not translated into increased government savings. To put this another way, changes in the fuel subsidy are accompanied by equal changes in government expenditures on goods, or transfers to households. This is a stylized assumption that helps us interpret the results, which is also realistic because it refers to policies that are meant to relocate government spending rather that changing it. The closure is shown in Appendix 5.

5 Simulation Scenarios

Four scenarios are assumed relevant to the policy debate in Nigeria, these are the following:

Scenario 1 (full-removal): the complete removal of the government subsidy on imported refined oil, which amounts to 33.0 percent.

Scenario 2 (half-removal): the complete removal of the subsidy of January 2012 resulted in higher fuel prices and riots in Nigeria. Prices never returned to their full subsidy levels, but a price increase was eventually accepted, with a reduced subsidy. Accordingly, this scenario assumes reducing the subsidy to a level that increases the market price of refined oil in Nigeria to

[7] We refer to the lower case parameters in GTAP, tfm, tgm, and tpm as tax rates, where, in fact, these parameters represent changes to the "power" of taxes, a technical definition, which can easily be translated into tax rates. So, we use tax "rates" and "power" of taxes interchangeably, recognizing they are numerically different.

no more than 10 percent above the full subsidy level; this is equivalent to reducing the subsidy by half.

Scenario 3 (half-removal + local-subsidy): applying the same subsidy reduction as in Scenario 2, while introducing an equivalent dollar level subsidy on domestically produced refined oil with the objective of promoting domestic refineries. The resulting subsidy rate is shown in Table 2.

Scenario 4 (half-removal + transfer): applying the same subsidy reduction as in Scenario 2, while transferring revenue from the government to the six lower income households. The targeted household groups are the six rural household groups which are selected due to a) their saving rates, given by the SAM (Nwafor *et al.,* 2010) and shown in Appendix 4, being substantially below those of urban households and b) their poverty headcount ratio in 2012 (NBS, 2012) being substantially above those of urban households. These targeted payments are introduced in the model as transfers from the government to households relative to government income (realtrng).

Table 2, shows the policy variables that are used in the four scenarios and compares their pre and post simulation values. The applied subsidy rates are those of December 2012, which are determined by the PPPRA, while the transfers from government to the selected household groups are only included in the fourth scenario.

Table 2: Subsidy Rates (%) and Transfers to Households (US$ million) for the 4 Scenarios

Scenario	Description	Subsidy on refined oil (fuel) consumption		Government transfers to poor households
		Imported	Domestic production	
Base	Base	33.0%	--	--
Scenario 1	Full removal of subsidy on imports	00.0%	--	--
Scenario 2	50% removal of subsidy on imports	16.5%	--	--
Scenario 3	50% removal of subsidy on imports and paying subsidy on domestic	16.5%	Transfer of subsidy to local production	--
Scenario 4	50% removal of subsidy on imports and providing transfers to households	16.5%	--	Transfer of subsidy to poor households

6 Results

This section starts with a discussion of the effects on the prices of refined oil in Nigeria, followed by the impacts on output and consumption. Finally, macroeconomic and welfare impacts are discussed.

6.1 Prices

Figure 3 shows the percentage changes in the prices of refined oil due to the four scenarios. Full-removal (Scenario 1) causes the highest change in prices as it removes the subsidies on imported refined oil without applying any compensation mechanism. After the complete removal of the subsidy in January 2012, the refined oil price increased from 65 Naira per liter to 140 Naira per liter (Economist, 2012). Complete removal of the subsidy did not continue for long, with the Nigerian government reinstating a fuel subsidy to maintain a market price of 97 Naira per liter shortly thereafter.

In all four scenarios, the subsidy on refined oil is reduced or removed and the market price of imported refined oil increases as a result. Imported refined oil represents nearly 80.0 percent of apparent consumption in Nigeria. Local Nigerian consumption switches to the now more competitive, but still limited, local refined oil production. Domestic production prices of refined oil in Nigeria, therefore, rise substantially (between nine and 19 percent) except in the Scenario 3, where a subsidy on domestic refined oil is simulated and the market price for domestic production falls.

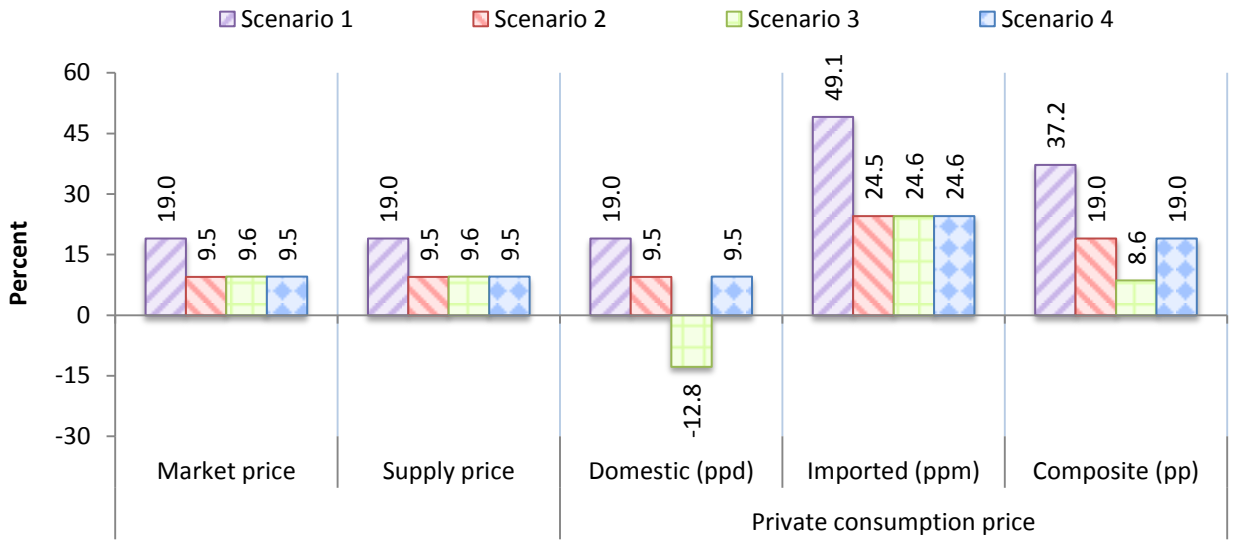

Figure 3: Changes in the Prices of Refined Oil (%).

The remaining three scenarios, which remove half the refined oil subsidy, have similar impacts on market and supply prices, but are lower in magnitude than the full-removal (Scenario 1) because they all reduce the subsidy by the same amount, targeting a maximum market price change of 10 percent, as intended. The private consumption price (labeled pp in the chart) for the composite (imported and domestic) commodity would increase by 19 percent due to Scenario 2 (half removal of the subsidy with no other domestic intervention) and Scenario 4 (half removal of the subsidy with a transfer to the poor households).

A subsidy to local- refineries (labeled Scenario 3) equal to the subsidy removed on fuel imports, increases the private consumption price by 8.6 percent, less than the other scenarios because it includes a subsidy on domestic refined oil. This leads the price of the domestic refined oil to decrease by 12.8 percent, and the market price of the imported refined oil to increase by 24.6 percent. Hence, the composite domestic price increases by only 8.6 percent.

Figure 4 shows the percentage changes in the market price of refined oil compared to the market prices of transport-communication[8] and electricity, all major users of refined oil in Nigeria as determined by the cost structure of firms reported in the GTAP database. Refined oil represents 31.7 percent and 23.7 percent of production costs of transport-communication and electricity in

[8] Transportation and communications services are grouped in one sector according to our sector aggregation (Appendix 3).

the database, underscoring the importance of refined oil to these sectors. Similarly, these two sectors consume the majority of intermediate refined oil in Nigeria comprising 66.7 percent and 11.0 percent of intermediate consumption of refined oil in Nigeria. In addition, the refined oil sector itself uses 20.0 percent of the intermediate consumption of refined oil and the three sectors together consume 98.0 percent of total intermediate use according to the GTAP v8a database.

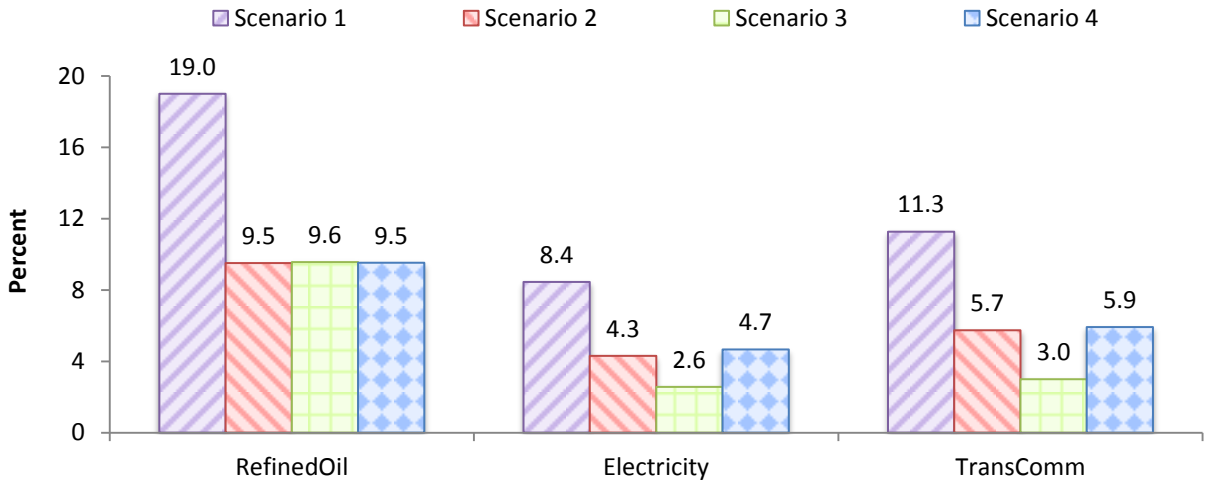

Figure 4: Market Prices of Refined Oil, Electricity and Transports-communication (%).

Recalling that Scenario 1 (full removal of the subsidy) resulted in refined oil's price increasing 19.0 percent, it is not surprising that the prices of transport, communication and electricity increase by 11.3 percent and 8.4 percent, respectively. Thus, the impacts of the price increase on refined oil will not be limited to direct impacts on final consumers, but will also impact the cost of transportation, communication and electricity indirectly impacting consumers. Therefore, it might further aggravate the situation of poor people across the country. The baseline data from Nwafor *et al*. (2010) shows that non-poor urban households consume more of the three commodities relative to rural households. The average shares of refined oil, electricity and transport-communication in the urban households' base consumption expenditure are 1.2, 3.9 and 4.3 percent respectively, while for the rural households these are 0.7, 3.0 and 2.1 percent respectively. This implies that urban households would be more affected by increasing refined oil prices and price increases would have a less significant direct impact on Nigerian households relative to the indirect impact through increasing prices of electricity and transport-communication because the latter two commodities have higher shares in their consumption budget relative to refined oil.

These price increases are lower under the other Scenarios 2, 3, and 4 where only half of the subsidy is removed.

6.2 Domestic demand

The percentage changes in the quantities of refined oil demanded by households are shown in Figure 5. Private demand for domestic refined oil increases while it decreases for imported refined oil. The decrease of private demand for imported refined oil drives the results of the composite, total, private demand. Also, all scenarios lead to a reduction in imported refined oil. Total demand for imported refined oil (for intermediate and final use) in the country declines by 15.7, 9.2, 13.6 and 8.7 percent for Scenarios 1-4, respectively.

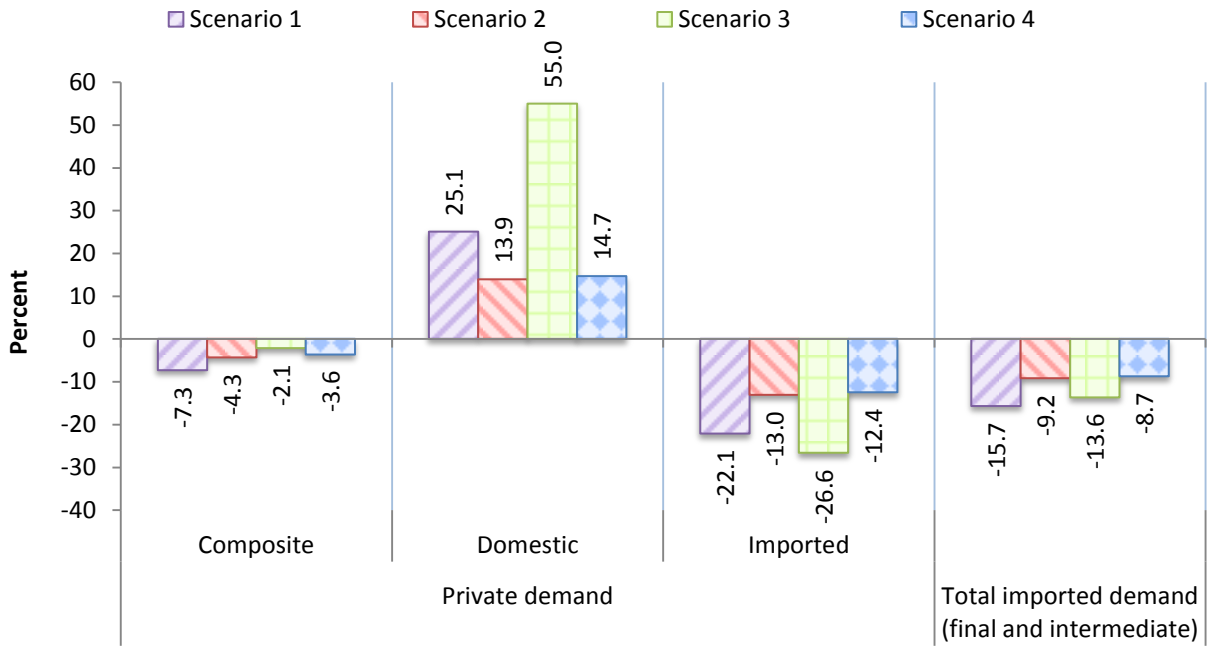

Figure 5: Private and Total Import Demand for Refined Oil in Nigeria (%).

Scenario 3 (half subsidy with local subsidy on domestic production) would lead to the greatest reduction in use of imported refined oil (-26.6 percent) and the highest growth in the use of domestically refined oil (55.5 percent) compared to the other scenarios. Under all scenarios, the total demand for composite refined oil is declining by between -7.3 percent (Scenario 1) and -2.1 percent (Scenario 3).

The impact of the four scenarios on intermediate demand for refined oil is shown in Figure 6. Transport-communication and electricity intermediate demand for refined oil, which together constitutes 78.0 percent of intermediate refined oil, would decrease in the four scenarios (see composite demand). Domestically refined oil would increase its use of both domestically refined

oil and imported refined oil. As will be seen in the following sections, output of domestically produced refined oil increases.

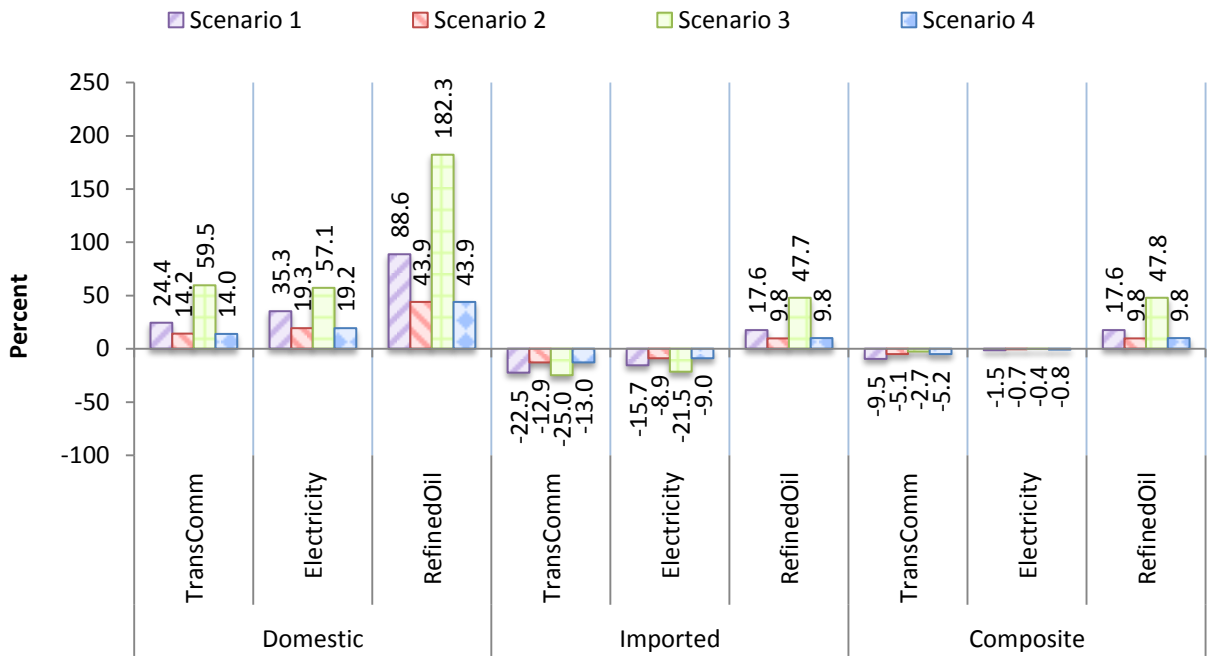

Figure 6: Refined Oil Intermediate Demand by Major Users (%).

6.3 Production

Higher refined oil prices in all scenarios (Figure 3) lead to increased output of refined oil (Figure 7). Domestic production increased most (47.3 percent) under the Scenario 3, where the subsidy on imported refined oil would be reduced and complemented by an equivalent subsidy on domestically produced refined oil. Under the Scenario 1 (full subsidy removal), domestic output increases by 16.9 percent. Under Scenario 4 (half removal of the subsidy and transfers to poor households), the impact on production would be similar to Scenario 2, which does not include the transfers to households. The impact of the transfers to poor households has minimal impact on domestic production.

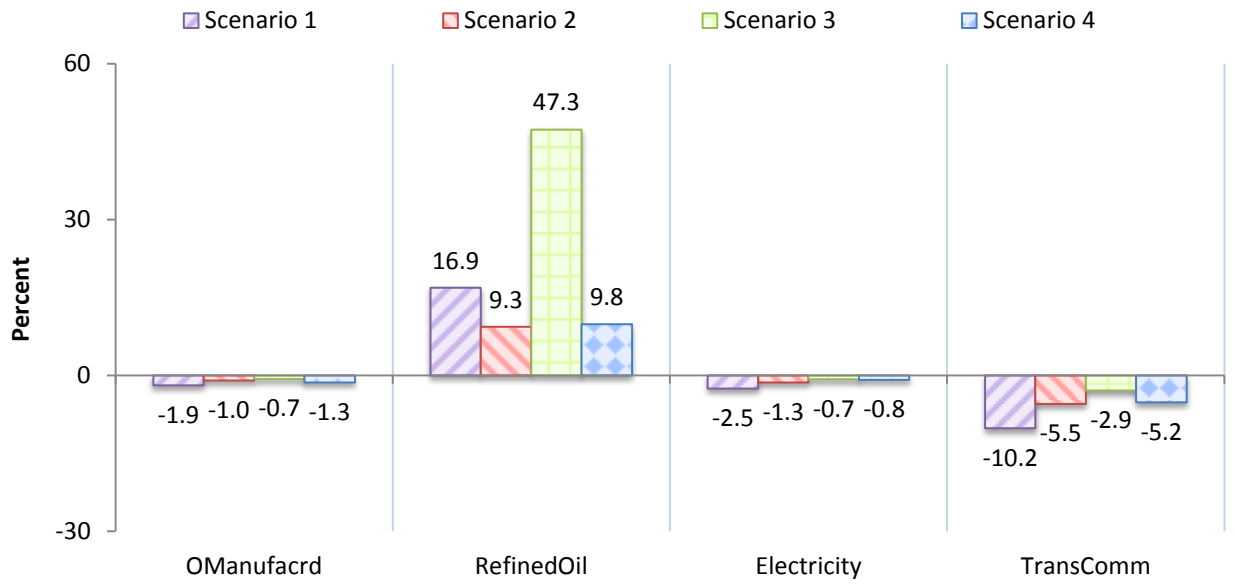

Figure 7: Changes in the Output of the Major Users of Refined Oil (%).

Increasing refined oil prices under all four scenarios causes the output of transport-communication, electricity, and other manufacturing to decline. The impact on transport-communication is highest due to the higher share of fuel in its cost structure representing 31.7 percent compared to 23.7 percent for electricity, the next most intensive user of refined oil.

6.4 GDP and Trade

6.4.1 GDP

Real GDP increases in all four scenarios (Figure 8). Real GDP (GDP quantity index in Figure 8) increases the greatest under Scenario 1 (0.18 percent) which completely removes the distortion (import subsidy) on the refined oil sector and improves overall economic efficiency. Scenarios 2 through 4 have similar impacts on real GDP which vary from 0.13 percent increase in Scenario 2 to 0.10 percent in Scenario 3. Domestic prices in scenarios 1 through 3 rise modestly by 0.11 to 0.19 percent. Scenario 4, in contrast, sees a noticeable increase in domestic prices relative to the three prior scenarios. In Scenario 4, the reduced oil subsidy is transferred to poor rural households and domestic prices rise by 0.51 percent. Domestic prices increasing strongest under Scenario 4 is due to the transfer of money from the government to poor rural households which have a higher expenditure share on domestic goods than the government itself or local producers (Scenario 3). In the prior three cases, our closure assumes that any reduction in the subsidy increases disposable government income and that this increase in government income is entirely spent by the Nigerian government, in the same proportions as in the baseline data. The baseline data for Nigeria reveal that imported machinery and transport equipment comprise nearly 40

percent of the Nigerian government's consumption and, more generally, imports make up over 70 percent of Nigerian government consumption. In contrast, domestically produced goods, such as fresh fruits and vegetables, comprise over 85 percent of poor rural household's consumption. The rise in domestic demand causes land and labor prices in Nigeria to rise relative to the prior three scenarios and contributes to an overall rise in prices in Nigerian economy seen in the GDP price index presented here. Scenario 4 does best from income redistribution prospective to be elaborated on later in section 6.5.

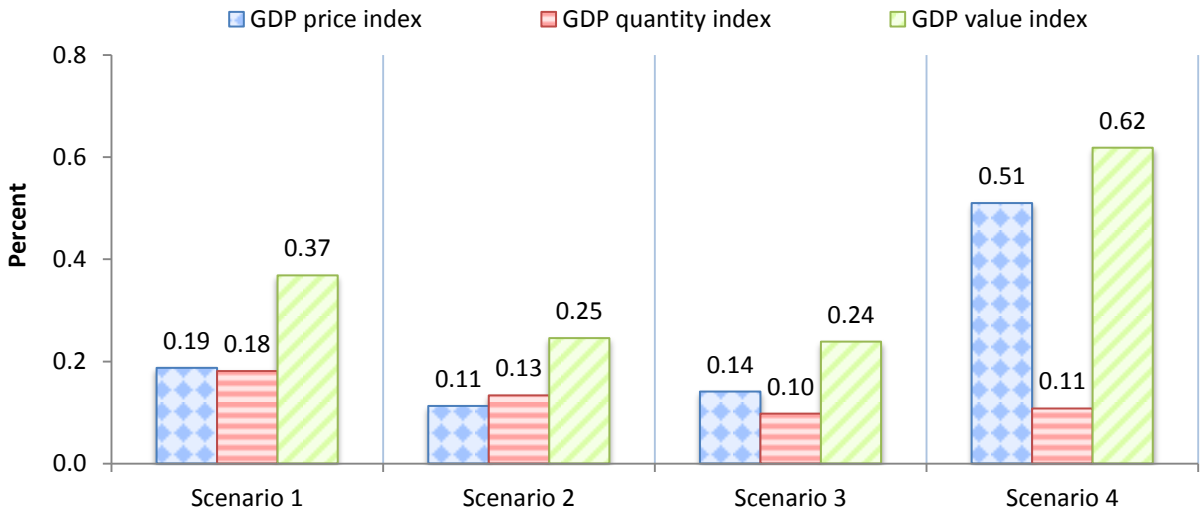

Figure 8: Changes in GDP Indices (%).

By studying the changes of the detailed GDP composition from the expenditure side, results show that real government expenditure increases by 18.5, 10.2, 5.7 and 4.9 percent under the four scenarios, respectively, which is driven by the increases in government income by 7.3, 4.1, 2.3 and 2.0 percent. Government income increases are due to the reduced outlays on refined oil subsidies. However, these changes, despite being much greater than those in private consumption, generate smaller changes at the GDP level as the government expenditure share in the base data GDP is only 4.8 percent. The increasing government income under Scenarios 3 and 4 despite the redistribution of the refined oil subsidy to poor households is explained by increases in the government revenue from taxes on intermediate input usage and private consumption. Additional technical details on the applied closure and experiment variables are provided in Appendix 5.

6.4.2 Trade

Refined oil imports constitute 14.6 percent of Nigerian import value (GTAP v8a database). The four scenarios reduce it by 15.7, 9.2, 13.6 and 8.7 percent, respectively. The greatest reductions are in Scenarios 1 and 3 because the former removes the subsidy on refined oil imports entirely and the latter subsidizes domestic refined oil production and reduces the subsidies on imports by 50 percent. This, among other changes, results in total imports increasing by 0.4 and 0.2 percent under scenario 1 and 2, respectively. Meanwhile, imports decrease by 0.9 and 0.2 percent under Scenarios 3 and 4, respectively (Figure 9).

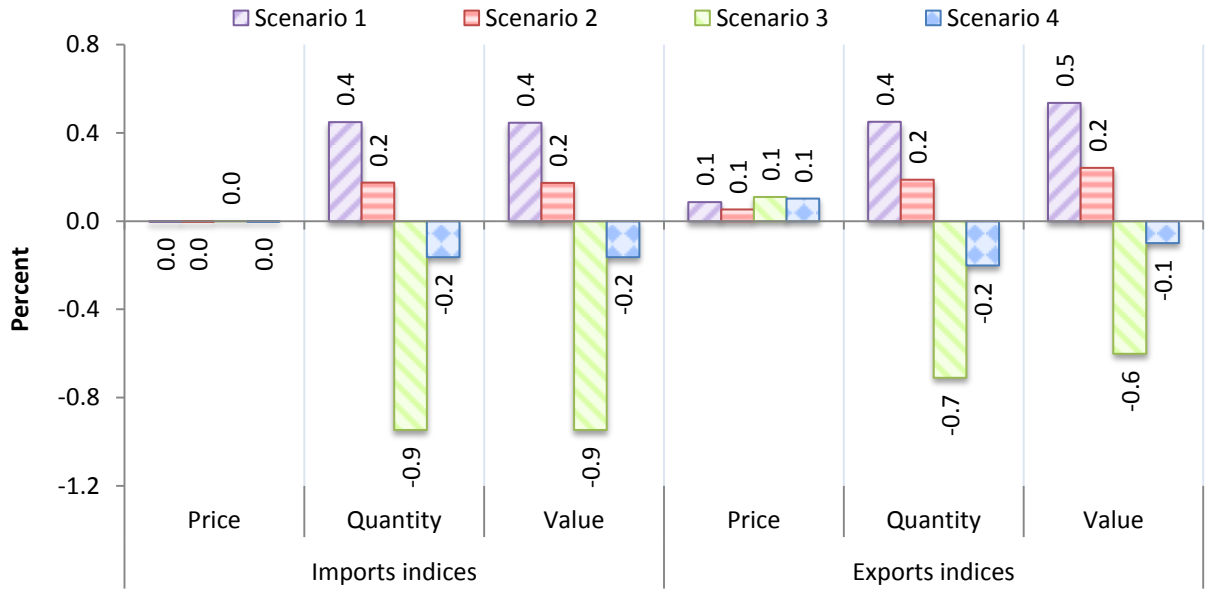

Figure 9: Change in Trade Indices (%).

The increase in the real imports under Scenarios 1 and 2 are mainly driven by increases in the quantities imported of other manufactures, which represent about 40.0 percent of imports and increase by 2.3 and 1.3 percent respectively under the two scenarios (not shown). Imports of transport-communication increase by 12.6 and 6.4 percent, other services increases by 13.3 and 7.4 percent and transport equipment by 11.2 and 6.2 percent, respectively. The increases caused by the Scenario 3 and 4 on these major imported commodities are smaller to outweigh the reductions in the imports of other sectors. Hence, they lead total imports to decline. Import price indices show no changes, while those of exports slightly increase under the four scenarios.

The overall country's change in the balance of trade under the four scenarios is positive which is consistent with scenarios that involve reductions in an import subsidy.

6.5 The impact on Households

Changes in real household income, which is calculated from the MyGTAP model by adjusting changes in nominal households' income for a price index for private consumption expenditure in Nigeria is shown in Figure 10. The simulation results indicate that real income decreases in Scenario 1, 2 and 3 for all households. In Scenario 4, which includes a government transfer to households, real income increases for Rural-South South, Rural-South East and Rural-South West and it decreases at relatively lower levels for Rural-North Central, Rural-North East and Rural-North West compared to the first three scenarios, which indicate that it maintains the best policy for poor households in Nigeria among the four simulated policies. Under the first three scenarios, real household income declines due to the decreases in factor returns (wages and profits) as total output declines by 3.3, 1.9 and 0.8 percent, respectively.

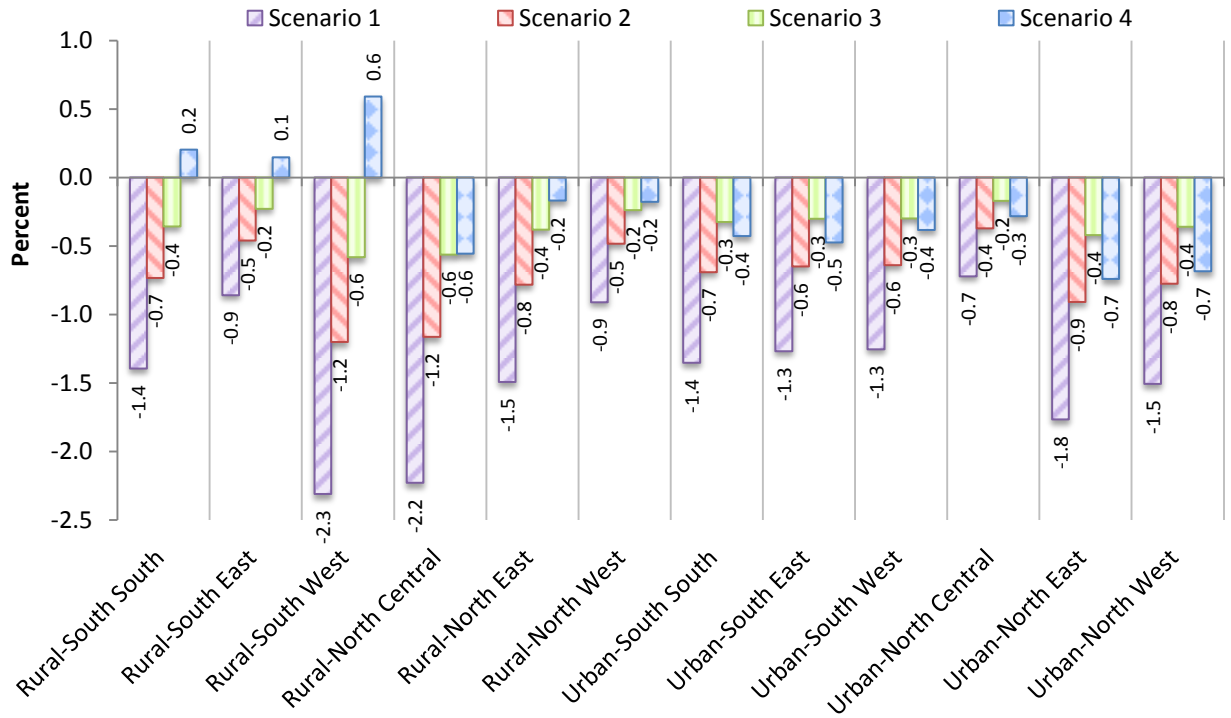

Figure 10: Change in real households' income in Nigeria (%).

Source: Authors' calculation from MyGTAP model.

Scenario 1 eliminates government spending on refined oil import subsidies, but it reduces the real income of all household groups due to the resulting higher price of refined oil.

The changes in the sources of household income show all households benefit from a government transfers in Scenario 4 with the share of transfers in their income increasing by an average of 1.1 percent for rural households, while there was no change in transfers to urban households (Figure 11). The share of income from endowments, on the other hand, is found to decrease for rural households by an average of 0.6 percent, while it increases for urban households by an average of 0.3 percent (not shown). The increase in factor returns for urban households is due to the increasing returns to land and natural-resources in all scenarios and the relatively high share of this factor in urban income. In Scenario 4, nominal wages remain relatively constant, while they decease in scenarios 1 -3, further contributing to the relatively large increase in nominal income for rural households under Scenario 4.

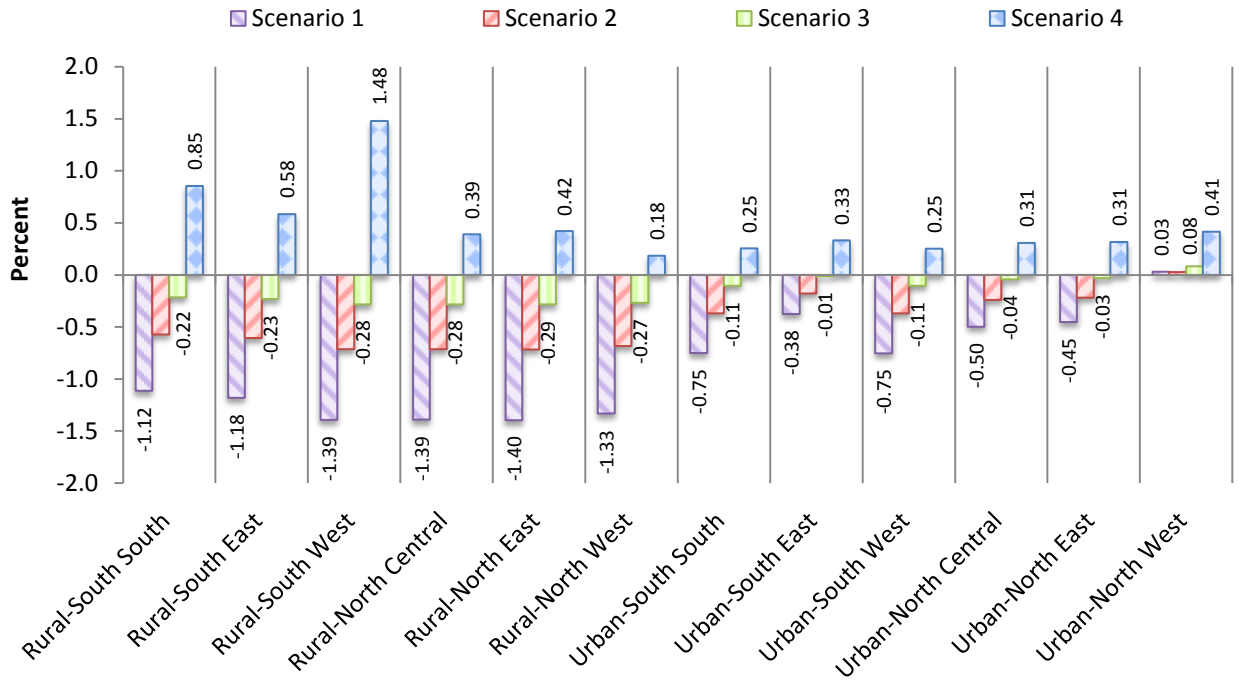

Figure 11: Changes in nominal Nigerian household incomes (2007 base data).

The effects of prices on real household income can be ascertained by disentangling the impact of income from that of price. Figure 11 shows nominal changes in households' income (net of depreciation). Nominal household income decreases due to Scenario 1, 2 and 3 for almost all households, while it increases for all households in Scenario 4, the scenario including a government transfer to rural poor households. Considering the price effects as indicated by percentage changes in the price index for private consumption expenditure under the four scenarios, results show Scenario 4 to cause an average percentage change in price index of 0.65

percent compared to 0.23 percent, 0.13 and 0.13 percent in Scenario 1, 2 and 3, respectively for rural households.[9] This implies that as households nominal income increases in Scenario 4; price inflation makes the impact less positive, and even reverses the benefits of rising nominal incomes for nine out of twelve household groups.

7 Summary and Conclusions

Nigeria is Africa's top producer and exporter of crude oil. Crude oil constitutes about 90 percent of Nigeria's exports, nearly one third of its GDP and about 75 percent of government revenue. Despite the significance of oil exports in the economy, the Nigerian economy is heavily burdened by subsidies on refined oil imports, which constitute more than 80 percent of domestic demand of refined oil because domestic refineries are unable to meet domestic demand. The subsidy on refined oil imports is proclaimed to alleviate poverty; but a large part of this subsidy accrues to importers and wholesalers and involves corruption and inefficiencies. It is likely that beneficiaries invest in lobbying for the maintenance of import subsidy, legally and illegally, which would constitute economic losses to the economy as a whole, and presents a barrier to advancing good governance.

Recent efforts to remove the import subsidy on refined oil have met with mixed success. Refined oil subsidy continue to be a large share of government spending, increases with rising imports and continue to destabilize the country's fiscal health. Low fuel prices are considered the only benefit of the subsidy to the people of Nigeria, where more than half its population is living under poverty in this rich oil country.

In this paper we use MyGTAP model, which is an economy wide framework to identify the impacts of several fuel subsidy reduction scenarios, together with complementary policies to alleviate the impacts of their removal on the economy. The scenarios range from the complete removal of the subsidy (Scenario 1) to offering policy alternatives that promote domestic production of refined oil (Scenario 3) and transfers to poor households (Scenario 4).

Removal of the subsidy, without accompanying it with other policy interventions, will be harmful to private households, but result in substantial increases in government revenues. Similar conclusions are found should the subsidy be only partially reduced such that domestic prices do not rise by more than 10 percent. Impacts on private household income are less averse, but less

[9] Changes in the price index for private consumption expenditure for urban households are 0.84, 0.45, 0.28 and 0.81 percent under Scenario 1, 2, 3 and Scenario 4.

so, under our third scenario that simulates, in addition to reducing the subsidy on imports, a subsidy for domestically produced refined oil.

The channels by which poor and non-poor households are affected differ. Non-poor households are impacted to a greater extent through their direct purchases of refined oil. Poor households are impacted thorough their consumption of products and services which use refined oil. In the case of a subsidy reduction or elimination, prices of refined oil would increase, negatively affecting many sectors in the economy, especially those heavily dependent on refined oil such as transportation and electricity, which will see their prices rise. Higher prices for energy intensive goods and services negatively affect poor households, whose share of these goods is higher than non-poor households, who directly consume relatively more refined oil.

This study suggests that accompanying a subsidy reduction with a transfer of government income to poor households will not only promote pro-poor growth, but will alleviate some of the negative impacts on all households (Scenario 4). It increases the GDP, improves the government budget by reducing subsidy outlays and it modestly improves the countries balance of trade. Moreover, Scenario 4 promotes domestic production of refined oil to substitute for imports motivated by higher domestic prices.

The benefits of Scenario 4 will have to be considered against the likely costs of the transfer policy. In the case of Scenario 4, the case of partial reduction of the subsidy and a transfer of income to poor households, reductions in corruption costs from the subsidy reduction will have to be weighed against inefficiencies and corruption from implementing a transfer scheme. It is not known what the ultimate outcome would be, but our results suggest, if corruption costs can be kept low, the transfer scheme would be beneficial to the poor and to Nigeria[10]. Greater information on the quantities of refined oil that the government pays for and never reaches the consumer is a pre-requisite for better analysis in this area.

An extension of this work, which we have not considered as an alternative policy approach, is the coupling of reduced refined oil subsidies with use efficiency subsidies, such as fuel efficient autos, trucks and generators (World Bank, 2009). The use of energy efficient goods would reduce the need for future subsidies. Weighed against this would be the cost of the subsidies themselves. More information is required on the efficiency "gap" between current Nigerian infrastructure and the modern, energy efficient devices which would replace them.

[10] We note that without eliminating the subsidy, many of the lobbying and informal payments will remain. However, the reduced subsidy will reduce the benefits of smuggling refined oil, since the margins will be lower for smugglers, due to the reduced subsidy.

Finally, the model applied in this study, namely MyGTAP could be accounted for as a helpful development that allows for the incorporation of distributional aspects in the global modeling framework of GTAP, which as this study shows, provides more information for policy makers in terms of what the effects of a policy will be at the household level.

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9 Appendices

Appendix 1: Oil Production of the Top 20 World Producers in 2011

No.	Producers	Production (thousand barrels/ day)	% of world's production
1	Saudi Arabia	11160.61	13.35
2	Russian Federation	10280.33	12.30
3	US	7841.26	9.38
4	Iran	4321.10	5.17
5	China	4089.66	4.89
6	Canada	3521.60	4.21
7	United Arab Emirates	3322.05	3.97
8	Mexico	2937.78	3.52
9	Kuwait	2865.43	3.43
10	Iraq	2798.11	3.35
11	Venezuela	2720.30	3.25
12	Nigeria	2457.36	2.94
13	Brazil	2192.91	2.62
14	Norway	2039.32	2.44
15	Kazakhstan	1840.68	2.20
16	Angola	1746.44	2.09
17	Algeria	1728.56	2.07
18	Qatar	1722.59	2.06
19	United Kingdom	1099.73	1.32
20	Indonesia	941.75	1.13
	Total top 20	71627.56	85.70
	Total World	83575.68	100.00

Source: BP (2012).

Appendix 2: The Mapping between the 2006' Nigerian SAM and GTAP Sectors

Nigerian 2006's SAM			**GTAP Database version 8**		
No.	**Code**	**Description**	**No.**	**Code**	**Description**
1	crice	Rice	1	pdr	Paddy rice
2	cwhet	Wheat	2	wht	Wheat
3	cmaze	Maize	3	gro	Cereal grains nec
4	csorg	Sorghum			
5	cmilt	Millet			
6	ccass	Cassava	4	v_f	Vegetables, fruit, nuts
7	cyams	Yams			
8	ccyam	Cocoyam			
9	cpota	Irish potato			
10	cspot	Sweet potato			
11	cplan	Banana and plantain			
16	cveg	Vegetables			
17	cfrt	Fruits			
18	ccoco	Cocoa			
24	cnuts	Nuts			
25	ccash	Cashew			
13	cgnut	Groundnuts	5	osd	Oil seeds

Nigerian 2006's SAM			GTAP Database version 8		
No.	**Code**	**Description**	**No.**	**Code**	**Description**
14	csoys	Soybeans			
15	cosed	Beniseed			
21	cpalm	Oil palm			
22	csuga	Sugar and sugar cane	6	c_b	Sugar cane, sugar beet
			24	sgr	Sugar
20	ccott	Cotton	7	pfb	Plant-based fibers
12	cbean	Beans	8	ocr	Crops nec
19	ccoff	Coffee			
23	ctoba	Unprocessed tobacco			
26	crube	Rubber			
27	cocrp	Other crops not specified			
28	ccatl	Cattle	9	ctl	Cattle, sheep, goats, horses
29	cgshp	Live goats and sheep			
30	cpoul	Live poultry	10	oap	Animal products nec
37	ceggs	Eggs			
31	coliv	Other live animals			
38	cmilk	Milk and dairy products	11	rmk	Raw milk
			22	mil	Dairy products
Zero sector			12	wol	Wool, silk-worm cocoons
33	cfore	Forestry	13	frs	Forestry
32	cfish	Fish and fish meat	14	fsh	Fishing
Zero sector			15	coa	Coal
47	ccoil	Crude petroleum and natural gas	16	oil	Oil
			17	gas	Gas
49	comin	Other mining	18	omn	Minerals nec
34	cbeef	Beef	19	cmt	Meat: cattle, sheep, goats, horse
35	cgsmt	Goat and sheep meat			
39	comet	Other livestock meat	20	omt	Meat products nec
36	cpmet	Poultry meat			
41	cofod	Processed food products (excluding beverages)	21	vol	Vegetable oils and fats
			23	pcr	Processed rice
			25	ofd	Food products nec
40	cbevg	Beverages and tobacco products	26	b_t	Beverages and tobacco products
42	ctext	Textiles and leather products	27	tex	Textiles
			28	wap	Wearing apparel
			29	lea	Leather products
43	cwood	Wood, wood products, furniture	30	lum	Wood products
46	cfert	Fertilizer	33	crp	Chemical, rubber, plastic products
45	comfc	Other manufactured products	31	ppp	Paper products, publishing
			34	nmm	Mineral products nec
			35	i_s	Ferrous metals
			36	nfm	Metals nec
			37	fmp	Metal products
			38	mvh	Motor vehicles and parts
			40	ele	Electronic equipment
			41	ome	Machinery and equipment nec
			42	omf	Manufactures nec
48	croil	Refined oil	32	p_c	Petroleum, coal products

Nigerian 2006's SAM			GTAP Database version 8		
No.	**Code**	**Description**	**No.**	**Code**	**Description**
44	cemfc	Transportation and other equipment	39	otn	Transport equipment nec
51	cutil	Electricity and water	43	ely	Electricity
			45	wtr	Water
Zero sector			44	gdt	Gas manufacture, distribution
50	ccons	Building and construction	46	cns	Construction
54	ctrad	Wholesale and retail trade	47	trd	Trade
55	chotl	Hotel and restaurants			
52	crtra	Road transport	48	otp	Transport nec
53	cotra	Other transportation	49	wtp	Sea transport
			50	atp	Air transport
56	ccomm	Telecommunications, Post, broadcasting	51	cmn	Communication
57	cbser	Financial institutions, Insurance, Business service	52	ofi	Financial services nec
			53	isr	Insurance
58	crest	Real estate	54	obs	Business services nec
62	coser	Private nonprofit organizations, Other services	55	ros	Recreation and other services
59	ceduc	Education	56	osg	PubAdmin/Defence/Health/ Education
60	cheal	Health			
61	cpser	Public administration			
Zero sector			57	dwe	Dwellings

Appendix 3: Mapping between the Aggregated 21 Sectors and GTAP 57 Sectors

No.	New code	Sector description	Comprising old sectors
1	PaddyRice	Paddy rice	Paddy rice
2	Wheat	Wheat	Wheat
3	OCereals	Other cereal grains	Cereal grains nec.
4	VegsFruits	Vegetables, fruit and nuts	Vegetables, fruit, nuts.
5	ProcdFood	Processed food, oilseeds, rice and beverages	Oil seeds; Vegetable oils and fats; Processed rice; Food products nec; Beverages and tobacco products.
6	Sugar	Sugar cane and sugar beet	Sugar cane, sugar beet; Sugar.
7	Cotton	Plant-based fibers, Cotton	Plant-based fibers.
8	OCropsFrst	Other crops including forestry	Crops nec; Forestry.
9	Livestock	Cattle, sheep, goats and horses	Cattle, sheep, goats, horses
10	OAnimalPrd	Animal products including dairy and milk	Animal products nec; Raw milk; Wool, silk-worm cocoons; Dairy products
11	OMining	Coal and other minerals	Coal; Minerals nec.
12	CrOilGas	Crude Oil and Gas	Oil; Gas
13	MeatFisch	Meat products including Fishing	Fishing; Meat: cattle, sheep, goats, horse; Meat products nec.
14	TxWaLeWd	Textile, wearing apparel, leather and wood	Textiles; Wearing apparel; Leather products; Wood products
15	OManufacrd	Other manufactured goods	Paper products, publishing; Chemical, rubber, plastic prods; Mineral products nec; Ferrous metals; Metals nec; Metal products; Motor

No.	New code	Sector description	Comprising old sectors
			vehicles and parts; Electronic equipment; Machinery and equipment nec; Manufactures nec.
16	RefinedOil	Petroleum, coal products	Petroleum, coal products
17	TransEquip	Other transport equipment	Transport equipment nec.
18	Electricity	Electricity	Electricity
19	TrdFinBusIns	Trade, financial and business services	Trade; Financial services nec; Insurance; Business services nec.
20	TransComm	Transport and communications	Transport nec; Sea transport; Air transport; Communication
21	OServices	Other services	Gas manufacture, distribution; Water; Construction; Recreation and other services; Public Administration/ Defense/ Health/Education; Dwellings.

Appendix 4: Saving Rates by Household in Nigeria (saving relative to income %)

Households	Savings (Naira million)	Total income (Naira million)	Saving rate (%)
Urban-South South	695822.95	1790481.85	38.86
Urban-South East	249401.78	816022.30	30.56
Urban-North East	214541.53	819950.99	26.17
Urban-South West	663199.60	2682111.46	24.73
Urban-North West	487853.53	2185462.47	22.32
Urban-North Central	170032.10	870073.51	19.54
Rural-North East	17934.37	1042484.57	1.72
Rural-North Central	12510.03	1068908.03	1.17
Rural-North West	16897.87	1534777.07	1.10
Rural-South West	3357.66	475533.43	0.71
Rural-South South	4695.77	1004127.35	0.47
Rural-South East	3533.05	1163266.56	0.30
Total	2539780.24	15453199.58	16.44

Sources: Nwafor et al. (2010); Authors' Calculation.

Appendix 5: Technical Appendix on the Model, Closure and Experiments

Features of MyGTAP:

MyGTAP has several new characteristics that are helpful in the multiregional context of the standard GTAP model. These features include 1) more flexibility in the treatment of government savings and spending. This is achieved by removing the regional household of the standard GTAP model and replacing it with a separate government and private household; 2) the inclusion of transfers between government and households and among household groups, remittances and foreign capital incomes; 3) allowing the assessment of a policy impact on different household groups and production factors within an economy of interest (e.g. Nigeria), should additional data such as a SAM be available (Minor and Walmsley, 2012b?); and 4) allowing the allocation of private household expenditure across commodities using either the Constant Difference Elasticity (CDE) or Linear expenditure system (LES) specifications depending on the studied situation (Minor and Walmsley, 2012).

The applied closure:

A closure that fixes the government saving is applied for all scenarios so that the subsidy removal does not translate in increasing government savings. The intention behind this assumption is to make the Nigerian households in general and poor households in particular less vulnerable to the negative consequences of the subsidy removal. The detailed applied closure is shown hereafter:

```
! A closure for MyGTAP that fix government savings (qgsave)
exogenous
   poph
   qoh_s
   pfactwld
   psaveslack profitslack incomeslack endwslack
   cgdslack tradslack
   gincomeslack hincomeslack
   ams atm atf ats atd
   aosec aoreg avasec avareg
   afcom afsec afreg afecom afesec afereg
   aoall afall afeall
   dppriv dpgov dpgsave dphsave dphsave_all
   to tp tm tms tx txs tpdh tpmh toh
   atall avaall tf tfd tfm tgd tgm tpd tpm
   emplh empl
   sremoh sremih remavo
   sfyoh sfyih fyavo
   saidout saidin aidavo
```

```
    realTRNH realTRNG
    s_sub ;
Rest Endogenous ;
swap qgsave("Nigeria")=dpgsave("Nigeria");
```

Experiments' variables:

Four scenarios are simulated in the paper. Full-removal and Half-removal are concerned only with the subsidy on imported refined oil, where the first removes it and the second reduces it by half. Accordingly, the shocked variables in these scenarios are: (1) tax on imported refined oil purchased by all sectors in Nigeria (tfm); (2) tax on imported refined oil purchased by the government in Nigeria (tgm"); and (3) tax on imported refined oil purchased by private households in Nigeria (tpm).

Local-subsidy includes, besides the partial removal of subsidy of Half-removal, paying subsidies to the domestically produced refined oil. Therefore, the experiment includes the following variables as well: (1) tax on domestically produced refined oil purchased by all sectors in Nigeria (tfm); (2) tax on domestically produced refined oil purchased by the government in Nigeria (tgm"); and (3) tax on domestically produced refined oil purchased by private households in Nigeria (tpm).

HHs-transfer includes besides the partial removal of subsidy of Half-removal, paying transfers from the government to the lower tier of household groups, namely, the six household groups that have low saving rates based on Nwafor et al., (2010) as follows: (1) Rural-North East, (2) Rural-North West, (3) Rural-North Central, (4) Rural-South South, (5) Rural-South East, and (6) Rural-South West. Accordingly, the experiments' variables of these scenarios include besides the subsidy the change in transfers from government to households relative to government income (realtrng).