

AIAE RESEARCH PAPER 2

Does Subsidy Removal Hurt the Poor?

Evidence from Computable General Equilibrium Analysis



AFRICAN INSTITUTE FOR APPLIED ECONOMICS

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*Evidence from Computable General Equilibrium Analysis*¹

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Eric Eboh
Series Editor

Abstract

The study examines the effects of the removal of petroleum subsidies on poverty in Nigeria. In recent years, government has increased the prices of petroleum products many times. However it was unknown if these price increases would lead to higher poverty levels. It was also unknown what the relative effects would be on different socioeconomic groups. Previous efforts to assess the economic impacts of the increases have been limited by the little attention paid to poverty effects. This gives ambiguous results as to its poverty impacts.

The study employed a Computable General Equilibrium Micro-simulation Analysis to assess the impacts on poverty. This enabled explicit poverty assessments to be carried out by incorporating information on households from a national household survey. The study also explored the possible role fiscal policy can play in managing the effects of the subsidy removal. Finally the study adds to existing knowledge by assessing the impacts of selective removal of petroleum subsidies by disaggregating the refined petroleum products sub-sector.

Subsidy removal, without spending of the associated savings, would increase the national poverty level. This is due to the consequent rise in inputs' costs which is higher than the rise in selling prices of most firms and farms. The key sectors which experience increased nominal output are the refined petroleum products, which provide income for an extremely low number of households. The government's fiscal policy stance following subsidy removal is important in determining the poverty effects. The inflation resulting from subsidy removal can be considerably reduced with a conservative fiscal policy response. A highly expansionary policy of spending all savings from subsidy removal will favour rural and disfavours urban households. This is because urban households earn most of their incomes from inputs-intensive sectors while rural households do not. An expansionary policy fuels inflation and worsens urban income while it improves rural income as output prices rise generally. An increase in transfers to households reduces the poverty effects. A non-inflationary expansionary policy which increases transfers to households would have the least poverty effect.

1.0 Introduction

The study examines an aspect of Nigeria's energy policy that can have appreciable effects on its poverty alleviation drive: the pricing and subsidising of petroleum products. Nigeria is rich but its people are poor (World Bank, 1996). This irony has made it imperative to assess the poverty implications of the government's activities. A greater urgency should be brought into this issue as the population of poor people is almost steadily growing: between 1980 and 2004 the percentage of poor people (living below the poverty line) doubled from 27% (18 million) to 58% (73 million) of the population. Poverty is caused and affected by microeconomic, macroeconomic as well as socio-cultural factors. The study assessed the possible impact of petroleum products pricing and subsidising which has been the focus of much controversy with regard to poverty dynamics in Nigeria.

Inefficiency in the production and distribution of petroleum products and fiscal pressure on the government caused the Federal Government to announce that the acceptable price range for petroleum products will be reviewed periodically with strong consideration given to the financial and economic environment. The knowledge that petroleum product prices in Nigeria are relatively low compared to prices in surrounding countries has also encouraged calls for their review. The last reviews occurred in 2005 with prices of key petroleum products increased. The increases in prices are achieved by removing the subsidies on both imported petroleum products as well as those produced in the country.

By doing this the twin problems of inefficiency in the sub sector and fiscal pressure are to be attended to. Subsidy removal will bring prices to an efficient level as well as make the sub sector more attractive to private local and foreign investors. Evidence from around the world has shown that government owned enterprises are not as efficient as privately owned and controlled enterprises. This has informed the view that government would do well to restrict its role to that of providing an enabling environment for the private sector operators to function. The gradual removal of subsidies is a step amongst many aimed at deregulating the sub-sector (PPPRA, 2003). Moreover the level of investment in the sector is inadequate as the 4 refineries in the country are overage and are able to produce only about 50% of their installed capacity and meet only about 40% of the daily 30 million litres domestic demand for refined petroleum products. Thus there is a need to stimulate investment in the sector. Also, the opportunity cost of

subsidising the products is substantial as the same funds can be channelled towards productive investments with long term benefits and used to avoid the government's persistent budget deficits. The expected benefits of subsidy removal are increase in government revenue and investment and output in the sub sector as well as a possible reduction of fiscal deficits and their inflationary effects.

These expectations, in as much as they are beneficial, are welcome, as any policy to improve one or more sectors of the economy is needed as Nigerians have been experiencing declining average well being i.e. poverty measures. These envisaged benefits are sectoral and macroeconomic in nature. In a similar way previous studies on petroleum pricing in Nigeria focused on the macroeconomic effects .However, the failure of the top-down approach has questioned the expected transmission of macroeconomic benefits to the household level and consequently their eventual effect on household poverty. Macroeconomic benefits therefore do not automatically lead to reductions in the poverty level. While macroeconomic indicators look good, the poverty level may be moving in the opposite direction.

Presently, it is important to assess developments from a perspective of their macroeconomic as well as poverty impacts. The millennium development goals have been endorsed by Nigeria and globally .These goals have poverty reduction as their focus. Moreover, with Nigeria's recent and, hopefully, final freedom from Military rule there is a social need for the present government to deliver "democracy dividends" in the country's newly-inaugurated 4th republic. For the majority of the citizenry this translates into an expectation of tangible improvements in visible welfare indices for example the affordability of basic products and necessities. The implementation of such a 'gradual deregulation' of the petroleum sub sector therefore brings up certain issues pertinent to the country's drive towards growth with poverty reduction: Can we sufficiently monitor the impacts of this chosen pattern of efficiency-through-deregulation? Can we follow paths that minimise possible adverse effects? With cautious optimism the preceding questions can be answered in the affirmative. Certain pertinent questions arise from the above issues:

1. In spite of the possible positive macroeconomic effects, will the increases lead to higher poverty rates? What role will these increases play in the dynamics of poverty in Nigeria? Which socioeconomic groups and sectors will be most affected? Unless this is known, it is plausible that as gradual subsidy removal is achieved other unanticipated adverse socio-economic effects will follow. A strategic economy wide view of the subsidy removal is needed.

2. The price changes may lead to inflation, reduce sectoral labour income and sectoral growth (in some sectors) and reduce national growth. (Adenikinju, 2000; Choucri and Lahiri, 1984). If they lead to inflation there will be a need for monetary management authorities to anticipate this. However, can policies such as government expenditure level and composition control be used to anticipate any adverse effects of the increases? By varying the composition of expenditure, government can carefully aim at using the increased total revenue arising from the subsidy removal to target expenditure compositions which can best counter negative effects in particular and poverty in general. This will go a long way in carrying out the increases in ways that minimize or avoid the adverse effects.

These questions have to be answered in order to design a price deregulation process that, though well-intended, has a negative net-effect in real terms on the welfare of the majority of Nigerians. This can be done by anticipating both the positive and negative impacts, so that the former are consolidated, and the later countered, with appropriate policy. These issues were addressed in the study. Previous studies concerning Nigeria's petroleum pricing focused on the macroeconomic/sectoral effects of the price increases and paid less attention to the poverty impacts.

The study is distinguished in the following ways: First, because it is a microsimulation analysis, it focuses on the poverty impacts by carefully incorporating information on households' income heterogeneity into the analysis. The key existing study on this issue, Adenikinju (2000), is limited by the employment of one household in the analysis. This entails strong assumptions about the intra-household distribution of income (Decaluwe et al, 1999a and b, Cockburn, 2001). Second, the processed crude oil products sector is more disaggregated to separate Kerosene, Premium motor spirit ('fuel') and diesel. By disaggregating the refined petroleum products sector to separately show the three products, it is possible to run simulations where the prices increase individually as the subsidy is removed. In this way the impacts of the price increases are noted separately. This gives more information and allows for more flexibility in decision-making. Finally, it analyses the relationship between different unique compositions of government expenditure and the poverty level in the country. This report describes the work done in the study. Section 2 discussed key features of the petroleum subsidy in Nigeria. Section 3 explains the transmission channels involved in the analysis. The methodology used is discussed in section 4 while section 5 discusses the results of the policy experiments. Finally, section 6 concludes the report. The Appendix contains further technical details of the analysis.

2.0 Petroleum Subsidy in Nigeria

Two types of subsidy are referred to in the literature: explicit and implicit subsidy. Explicit subsidy is used in the normal sense in which subsidy is used: it is the difference between production cost and selling price. Implicit subsidy on the other hand is the type of subsidy that is observed in the exploitation of wasting assets such as crude oil. It refers to the difference between the opportunity cost of a wasting asset and the present selling price. Actually this is what is usually meant when subsidy of oil products is involved (Adenikinju, 2000; IMF, 2003). Implicit subsidy is important because of the implications for efficiency. For pricing in the sub sector to be efficient, prices should be equal to the Marginal Opportunity Cost (MOC). For the petroleum sub sector, this is the border or international price of the product (Adenikinju, 2001; Hossain, 2003). This is necessary so as to compensate future generations for the irreversible extraction of the product so that a foundation for continued growth even when the petroleum resources are exhausted is laid for future generations.

In Nigeria, both types of subsidies apply. The four refineries in the country produce about 13 million litres of refined petroleum products daily. However, daily domestic consumption is 30 million litres. The government imports the shortfall of 17 million litres so as to meet daily demand. The government does not sell the imported products at their full landed cost as it subsidizes them. In June 2003 the government stated that for each litre of petroleum products, N12 is spent as subsidy. This implies an explicit subsidy of N74 Billion or about 1.42% of GDP. Of course changes in the international price of petroleum products and the exchange rate cause the landed cost of the products to fluctuate.

The domestic prices of petroleum products in the country are much lower than what obtains in the neighbouring countries. This has led to a thriving smuggling business. This difference is partly because the crude oil for producing products for domestic consumption is sold to the local refineries at a lower price per barrel. This therefore brings down the cost of production. In 1993, for example, the export price of a barrel of crude oil was \$15, but the local refineries bought it for \$1. In 2002, exported crude oil was sold at \$25 per barrel, while crude oil barrels for local refining were sold at \$18 to the local refineries. The other reason prices in Nigeria are much lower when compared those in neighbouring countries is the subsidisation of imports. The end result is that there is an implicit subsidy on petroleum products which is the difference between border prices

and domestic prices. As at 1992, the prices of petroleum products in Neighbouring countries were at least 700% of those in Nigeria (Adenikinju, 2000). Hossain (2003) calculates the 2002 implicit subsidy to be N94billion or 1.8% of GDP. As at 2003, the domestic prices of refined petroleum products in Nigeria were still much lower than obtained in neighbouring countries. As at 2003 Fuel, Diesel and Kerosene were being domestically sold at 80% of the importation cost i.e. 'border price' (Authors' calculation). Domestically produced products were also sold at the same price thus giving rise to an explicit subsidy on imported products and implicit subsidy on domestically produced goods. In the year 2003, the explicit subsidy alone amounted to 2% of GDP. Adding implicit subsidy to this would raise the percentage to about 3.5% of GDP.

3.0 Petroleum Prices Poverty Linkages

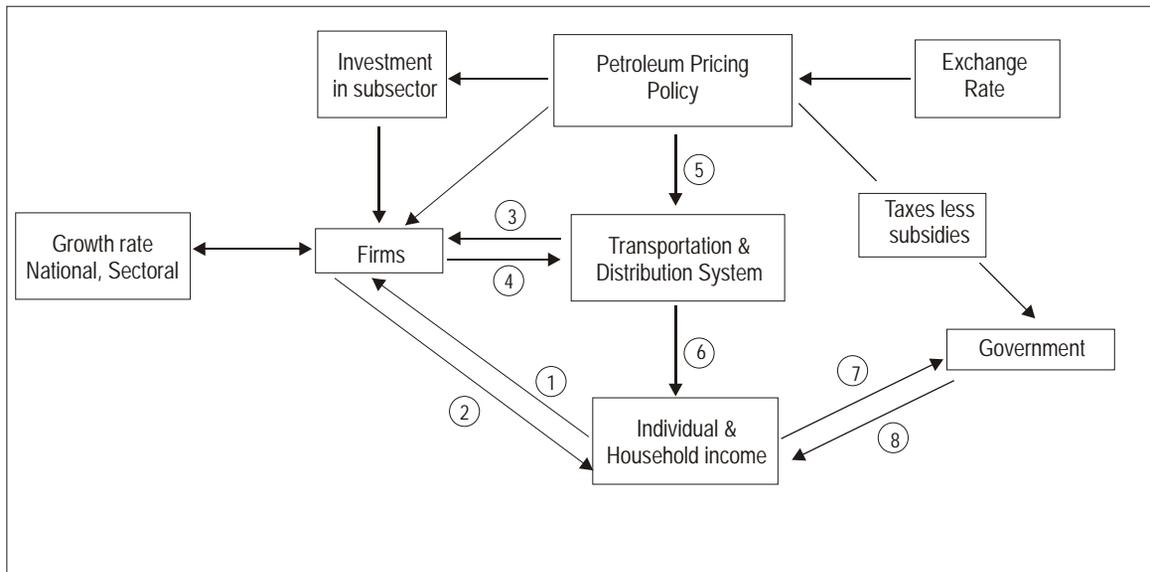


Figure 1: Petroleum Prices Poverty Linkages

Key:

1. Household consumption (of petroleum and other products)
2. Income (profit and wages) and employment
3. Intermediate goods
4. Finished goods
5. Impact on transportation cost
6. Finished goods for household consumption
7. Income taxes
8. Government spending (expansionary/neutral/contractary) on infrastructure, transfers etc

Three major channels account for the effects of petroleum prices on poverty: (1) Impacts on firms (2) Impact on and off the distribution and transport system and (3) Impact on government income and expenditure. Firms are affected in three ways: firms' energy bill increases for those that rely heavily on petroleum powered generators for energy; the cost of intermediate inputs increase as a result of increased cost of transportation of individuals and goods; and increases in private investment in the sub sector are expected as it becomes more attractive. The impact on energy bills may be strong as, according to World Bank (2002), a sizeable number of firms depend on petroleum powered generating sets for their energy supply as electricity supply is grossly inadequate and/or unreliable.

The first two effects on the firm translate into higher cost of doing business which will affect the cost of intermediate and finished goods. This increase in the cost of doing business will also affect the output level and profitability of firms as they operate within their budget constraint. In addition to private generating sets, the National Electric Power Authority (NEPA) also depends on petroleum products to carry out some of its operations so electric energy bills may also be affected. Adenikinju (2000) and Choucri and Lahiri (1984) report increases in the prices of almost all products as a result of petroleum price increases. This is linked to the first 2 effects on firms. Finally, the effects on the different firms' behaviour, causes changes in the growth rate of the different sectors and GDP. The impact on growth rate is discussed below.

The second pathway through which the change in prices will affect households is the transportation and distribution network. This network is powered by petroleum products and consequently it has strong inter-sectoral linkages with the sub sector (Adenikinju, 2000; World Bank, 1993) .The existence of a strong linkage is supported by the findings of both Adenikinju (2000) and Choucri and Lahiri (1984): following a subsidy reduction, the highest increases in prices are in the energy sector followed by the transport sector. As a result of this linkage, increases in the prices of the petroleum products lead to increases in passenger and goods transportation costs. Ultimately, the increase in transportation costs results in further increases in the cost of intermediate and finished goods, and this is coupled with increases attributable to the cost of energy.

The third pathway through which the change in prices affects the household is through their impact on government revenue and expenditure. Subsidy removal increases government revenue and therefore possible government expenditure. However subsidy removal also leads

to lower revenue because of the slow down in growth rate which the increase in prices will cause. It has been noted that the increases lead to a slow down in growth of national income (Abel and Bernake, 1992; Adenikinju (2000); Choucri and Lahiri, 1984). Adenikinju (2000) reports a fall in real GDP due to a reduction in economic activities. This is related to limits imposed on firms by their budget constraints. Abel and Bernanke report that increases in energy prices in the US due to external oil price shocks, led to reduced energy consumption and reduced output at given levels of capital and labour. Generally, as growth of national income is affected government tax revenue will also be affected due to changes in the tax base. On the expenditure side, government spending on transfers etc can be increased due to greater revenue availability and this ultimately improves household welfare. If this is done without substantially increasing government expenditure it will have the advantage of not putting further pressure on aggregate demand and causing possible demand pull inflation.

Through these three pathways, the ripple effects of the price increases reach households. What will be the effect of these rising prices? The answer is analogous to those of events that take place after trade liberalisation: the direct effect of trade liberalisation (subsidy removal) will be to change prices. The effect of a single small price change on household welfare therefore depends on whether the household is a net supplier or net demander of the good or service in question. A price rise for something you sell makes you better off; a price rise for something you buy makes you worse off. More precisely, the effect of a small price change on household welfare is proportional to the ratio of its net supply position to its total expenditure (McCulloch, 2001). In other words “variations in the prices of energy products will affect resource allocation and equity in the economy. This will work through its effects on production, prices and demand for energy and non-energy products” Adenikinju (2000). Although the pricing in the sector will be more efficient, the poor will pay more for energy and other products that use energy as an input. This has a negative impact as the poor are net-consumers and not net-producers of the petroleum products.

Households are affected by the effects on their income and consumption. The slow down in national and sectoral growth will affect both labour income and capitalist income and therefore total household income. This occurs through changes in the incomes of firms which cause changes in household and individual income (profits and wages) and consumption. Income poverty may therefore change as a result of the price changes if incomes change to levels below or above the poverty line. Similarly, consumption poverty may change as the size of household

consumption changes. Choucri and Lahiri (1984) report a decrease in total consumption as a result of the increases. Consumption would likely fall if sectoral prices rise. It is possible that notable changes in consumption of both petroleum and non-petroleum products will be made due to a rise in the prices of goods the household consumes. This may go as far as pushing consumption below the consumption poverty line. This may be the case even when income is still above the income poverty line.

Government spending can have a positive impact on individuals and households through transfers and indirectly through investment expenditure which improve the earning ability of individuals in the long run. Also, a neutral fiscal policy is positive in the sense that government spending does not contribute to demand pull inflation. A reduction or absence of fiscal deficit will have the opposite effect of reducing prices. To this extent it keeps real income at a higher level. The exchange rate and international price of petroleum products play a role as they can widen the gap between border and domestic prices as well as increase the cost of importation. However they are treated as constants so as to allow a focus on the impacts of the domestic price increases.

4.0 METHODOLOGY

4.1 Introduction

A Modified version of the IFPRI model (Lofgren et al, 2002) was used for the analysis. A 2003 Social Accounting Matrix was built for the study. We examined 3 key shocks only: (1) Explicit and Implicit Subsidy removal (2) Changes in government expenditure level and (3) Reallocation of government expenditure. The model has 8 sectors as shown as follows:

1. A-Kerosene
2. A-Fuel (Premium motor spirit or 'petrol')
3. A-Diesel
4. A-Manufacturing (other)
5. A-Agriculture (other)
6. A-Firewood
7. A-Services
8. A-Oil and other mining

Actual rather than representative households are used in the analysis. This makes the analysis a micro simulation analysis. By working with a large number of actual households (rather than representative average- households), we carry out a micro simulation exercise which is more reliable as it accounts for within (socioeconomic) group variations/distribution of income. Poverty was measured using the poverty line of the Nigerian Living Standards Survey (NLSS). A full description of the IFPRI model is found in Lofgren et al (2002) and the specification of the version employed is found in the appendix. We describe main features of this version further below.

4.2 The Social Accounting Matrix and Household Data

The Social Accounting Matrix (SAM) was built with 2003 as the base year. An unbalanced proto SAM was built and then balanced with the GAMS entropy code (Robinson and McDonald, 2005). Key features of the SAM as well as the entropy code are shown in table D1 in the appendix. One interesting feature of the data is the presence of 2 explicit subsidies. Explicit subsidy is the difference between full official unsubsidised cost of importation and the actual subsidised cost of importation. We discovered that the officially stated subsidies do not fully

account for the difference between the actual cost of importation and the market price of the products. We then assumed that the remaining difference between the official unsubsidised cost of importation and the actual cost of importation was due to a world price higher than that officially quoted. The first subsidy is the difference between the officially calculated unsubsidised importation cost and the subsidised importation cost. The second subsidy is the difference between the officially calculated unsubsidised importation cost and the actual cost of importation.

Actual (subsidized) cost of importation = Full CIF cost - 1st subsidy - 2nd subsidy.

Removing the second subsidy alone brings the importation cost to the level documented by the government based on the world price. Thus, the second subsidy measures how much government 'subsidises' the importation of fuel from expensive sources- higher than the prevailing and documented world price. The removal of both brings the cost to what prevailed in the domestic market. The combined cost of the subsidies is consistent with government estimates of the expenditure on fuel importation. The structure of the SAM is shown as follows:

Table 1: Aggregate SAM

	Activities	Commodities	Factors	Households	Firms	Government	Taxes	Import Subsidy	Savings-Investment	Rest of the World	Total
Activities		8312201									8312201
Commodities	1365872			3548381		1765906			1077946	3933480	11691585
Factors	6947820										6947820
Households			3395629	16955	750611	84601				30000	4277796
Firms			1827044			590240				191865	2609149
Government			1480096				1308573				2788669
Taxes	-1491	330474		118754	857940	2896					1308573
Import Subsidy		-147630				147630					0
Savings-Investment				593706	1000598	-9241				-507117	1077946
Rest of the World		3196540	245051			206637					3648228
Total	8312201	11691585	6947820	4277796	2609149	2788669	1308573		1077946	3648228	

After balancing the SAM we proceeded to reconcile the individual households in the household survey with the figures in the SAM. After data cleaning, 16,291 households were used for the analysis. Specifically we reconciled household incomes in the survey with household incomes in the SAM. Household incomes in the survey were first re-aggregated into the categories in the SAM and Model. Unlike Robinson and Robilliard (2001), we choose not to allow error margins on the SAM aggregates so that the reconciliation process reproduced the SAM aggregates exactly. This made it unnecessary to rebalance the SAM after household data reconciliation. In the reconciliation process, we adjusted both household weights and incomes with a minimization objective. First, weights were readjusted to meet national levels. This was necessary as the data cleaning process eliminated some households and reduced the total weight of households. In the first stage of the reconciliation, we put a constraint on total urban and rural weights so that they equal the national levels from the household survey. Second, the readjusted weights were then used as inputs in the income re-estimation equations.

To ensure that the poverty profile was reproduced by the reconciliation, we put moment constraints on per capita household income. The Federal Office of Statistics measures the poverty level using the household per capita expenditure. The constraints used in the reconciliation were obtained from the per capita expenditures in the household survey. Mean and variance constraints were put on the incomes. To ensure a better result, we calculated the variance around the poverty line in the household survey and then imposed this in the reconciliation process. The reconciliation process ensured that the heterogeneity of household incomes by source was maintained and at the same time the total weights of urban and rural households were accurate. It also ensured that the data on household incomes in the survey was consistent with the SAM.

4.3 Main Features of the Model

Production

Output is modelled using the Leontiff production function which aggregates value added and intermediate inputs. There are 5 production factors: agricultural capital, non-agricultural capital, agricultural labour, non-agricultural labour and land. Capital in each sector is fixed while labour is mobile across sectors. Land is fixed. Agricultural capital has a share of less than 10% of its sectoral value added. CES functions are used to aggregate factors into value added.

Subsidy

Explicit and implicit subsidies are captured in the model. Domestic consumption of petroleum products is met through importation and domestic production. Prices of imported products are subsidized up to the explicit Subsidy rate, ESR, so that final sales price of imported products are a fraction of the full cost of importation. The ESR is the ratio of the explicit subsidy to the border value of imported products. The border price equalizer (BPE) is the increase in price of domestically produced petroleum products necessary to remove implicit subsidies. It is a factor which is used to multiply the domestic price and equates it to the border price. The BPE and ESR are exogenous variables and serve to keep the market price of domestic production as well as imports equal and fixed- as they are in Nigeria. The explicit subsidy is part of government expenditure. When the BPE is non-zero it raises the final domestic sales price to the border level and removes the implicit subsidy. At base level the BPE is set to zero. As the domestic prices of the products increase, the profit level in the sub sector increases and government revenue through taxes increase as well.

Investment and Savings

As the model is static investment does not increase capital stock. Household and firms savings rates are adjusted by an endogenous adjustment factor so as to equate total savings with investment. Government savings is determined by its revenue less expenditure. Foreign savings is exogenous. The equality of savings and investment is thus achieved through the endogenous adjustment factor and changes in government savings.

In most experiments government savings was fixed but for E4 and E5 it was endogenous while government expenditure was fixed. The idea was to allow a surplus consistent with the fixed (E4) and reduced (E5) non-subsidy expenditure level to occur (see below)

Households and Poverty

There are 8 households in the model.

1. HUA : Urban Agricultural
2. HUM : Urban Manufacturing
3. HUO : Urban Oil
4. HUS : Urban Services
5. HRA : Rural Agricultural
6. HRM : Rural Manufacturing
7. HRO : Rural Oil
8. HRS : Rural Services

In the household survey, information exists on the classification of households according to these major sectors therefore they were used. Household income is made up of factor incomes and transfers from other households, the government and the rest of the world. In the model we distribute labour incomes according to observations from the survey.

Table 2: Labour Income Distribution

	LA-AG, A-AG	LA-AG, A-FIRE	LA-NAG, A-KERO	LA-NAG, A-FUEL	LA-NAG, A-DIESEL	LA-NAG, A-MANF	LA-NAG, A-SER	LA-NAG, A-OIL	LAND, A-AG
HUA	0.20	0.20	0.00	0.00	0.00	0.13	0.33	0.00	0.13
HUM	0.03	0.03	1.00	0.62	0.76	0.61	0.06	0.00	0.02
HUO	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.77	0.02
HUS	0.03	0.03	0.00	0.00	0.00	0.13	0.40	0.00	0.02
HRA	0.50	0.50	0.00	0.00	0.00	0.03	0.10	0.00	0.57
HRM	0.07	0.07	0.00	0.38	0.24	0.05	0.01	0.00	0.08
HRO	0.07	0.07	0.00	0.00	0.00	0.00	0.00	0.23	0.08
HRS	0.07	0.07	0.00	0.00	0.00	0.03	0.11	0.00	0.08
	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

The table above describes household labour income distribution by sector. The first cell indicates that 20% of agricultural labour income in the agric sector is earned by HUA households. Incomes from the agricultural sector accrue mainly to agricultural households while those from the service sector accrue mainly to HUS households etc. Capital income is distributed such it mostly goes to urban households in the non- agric sectors. Based on the poverty profile these households are richer and more likely to own capital. Households consume all products excepting oil and other mining. Household consumption is modelled with the Linear Expenditure System. Households pay income tax to the government.

For poverty analysis we worked with 16,291 households. We employ a new Microsim-representative household approach (MS-RH). To overcome the limitation of the representative household approach in Agenor et al[2003] and Lofgren et al (2001) we adjust factor incomes rather than total incomes. Rather than adjust total income by the change in total income from the model, we adjust factor incomes in the survey by the changes observed in the model. This uses the information on the heterogeneity of household income sources and thus allows intra-household income distribution to vary after a shock. The poverty line is the one used by the Federal Office of Statistics in 2003/2004. Basically the process is as follows:

1. Sort the reconciled household data on 16,291 households according to the 8 groups above
2. Use the DAD software and reconciled household data to calculate base poverty levels.
3. Run the model and obtain percentage increases of each (real) income source as well as total income for each of the 8 households
4. Adjust the incomes in the household data according to the percentages and sum to obtain the new total income (HHINC1)
5. Adjust the base total income in the data set according to the percentage change in total income from the model to obtain the second new total income (HHINC2).
6. Generate per capita income by dividing by household size
7. Use the DAD software to calculate the poverty level using the new per capita income and new weights from the reconciliation.

HHINC1 above represents the normal representative household approach which ignores the heterogeneity in household incomes. By computing HHINC2 we allow household incomes to vary according to each household's initial factor endowments. This is akin to what happens when all households are introduced directly into the model with varying initial factor endowments. It achieves the same objective in a less time consuming way.

External Trade

4 products are not exported: kerosene, diesel, fuel and firewood. All products are imported. Domestic consumption specification is based on the armington hypothesis. The exchange rate is an exogenous variable in the model. Output of tradeable sectors is allocated to export and domestic markets via a CET function.

Government

Government revenue is made up of import taxes, income taxes and other indirect taxes. The government also receives a share of the profits from firms which represents earnings from the oil sector. Government spends on commodities, transfers to households, payment to firms, explicit subsidies and payments to the rest of the world. Government commodity expenditure is treated as consumption expenditure. In the base year government savings is negative. It should be noted that the government has persistently experienced budget deficits since independence.

Equilibrium Conditions

The demand for labour = supply of labour

Demand for each composite good = supply of each

Demand for exports = supply of exports

Total investment = savings

Key Exogenous Variables

1. Government expenditure
2. Government savings
3. Explicit Subsidy rate
4. Border price equalizer

4.4 Policy Experiments

3 Major policy scenarios are analysed: subsidy removal, changes in government (non-subsidy) expenditure level and reallocation of revenue increase arising from subsidy removal.

Increase the level of Government non-subsidy expenditure

- [E1] Maintaining a budget deficit at base year level - using increased revenue from subsidy removal to increase government expenditure on commodities only. Subsidies on all 3 products are removed.

- [E1i] Maintaining a budget deficit at base year level - using increased revenue from subsidy removal to increase government expenditure on commodities only. Subsidies only diesel and fuel are removed.
- [1ii] Maintaining a budget deficit at base year level - using increased revenue from subsidy removal to increase government expenditure on commodities only. Only on fuel Subsidies are removed.
- [1ii] Maintaining a budget deficit at base year level - using increased revenue from subsidy removal to increase government expenditure on commodities only. Only diesel subsidies are removed.
- [E2] Eliminating deficit and maintaining a balanced budget spending some of the savings on commodities only; government savings is fixed to zero. Subsidies on all 3 products are removed.
- [E3A] Eliminating deficit and maintaining a surplus budget spending some of the savings on commodities only. Subsidies on all 3 products are removed.
- [E3Ai] Eliminating deficit and maintaining a surplus budget (larger than [3A] above) spending some of the savings on commodities only. Subsidies on all 3 products are removed.
- [E3Aii] Eliminating deficit and maintaining a surplus budget (larger than [3Ai] above) spending some of the savings on commodities only. Subsidies on all 3 products are removed.

Further Changes in Expenditure Composition

- [E3B] Experiment 3A but expenditure on commodities and transfers to both households is increased.
- [E3C] Experiment 3A but only expenditure on transfers to both households is increased. Expenditure on commodities is unchanged.

[E3D] Experiment 3A but only expenditure on transfers to rural households is increased. Expenditure on commodities and transfers to urban households is unchanged.

[E3E] Experiment 3A but only expenditure on transfers to rural households is increased. Expenditure on commodities and transfers to urban households is unchanged. The subsidy on kerosene is not removed

Constant non-subsidy expenditure Level

[E4] Surplus budget- no savings from the subsidy removal is spent. Expenditure on non subsidy items remains the same. Subsidies on all 3 products are removed. We shall refer to this as the conservative response to subsidy removal.

Decrease in non-subsidy Government Expenditure

[E5] Surplus budget-no savings from the subsidy removal is spent. Expenditure on non subsidy items is reduced by 5%. Subsidies on all 3 products are removed.

To assess the use of government expenditure level (and therefore deficit level) in countering possible negative effects, experiments E1, E2-E3Aii and E4-E5 are compared: the difference between them is the level of government expenditure and deficit. Experiments E3B-E3D are carried out to assess the effects of government expenditure composition. As such the difference between them is what government does with the savings from subsidy removal. Experiments 1i-1iii and E3E were carried out to ascertain the impacts of selectively removing subsidies. The key interest was to ascertain: whether subsidy removal will (1) increase the national poverty level and (2) have substantially different effects on different households thus leading to some being more affected than others and; if different government expenditure compositions and levels will have different impacts on poverty and to note which have the greatest positive impacts. The competing government expenditure categories are commodities, transfers to rural households and transfers to urban households. As most poor people live in the rural areas, transfers to the rural areas will have more effect on the poor than otherwise. As we ran different simulations using different government expenditure compositions the impacts on poverty were noted.

5.0 Results

5.1 Impacts on Production

The increase in refined petroleum prices leads to an expansion in the nominal output of these sectors such that they expand the most. In all experiments, the volume of output/quantity demanded of these products declined due price increases. However the increase in prices led to an increase in nominal output. The impact on the other sectors depends on government's fiscal policy and the resulting price level. With increased expenditure on non subsidy items an increase in the price level occurs and the output of the agriculture sectors expands more than the service and other sectors. With no increase or with a decrease in expenditure level the output of the service sector expands more than the agric sectors. Moreover we observe that with little spending of government savings (experiments E3Ai and E4) the largest increases in output prices occurs in the refined petroleum sectors followed by the service sector.

Table 3: Effects on output

	change in gross output value							
	A-KERO	A-FUEL	A-DIESEL	A-MANF	A-AG	A-SER	A-FIRE	A-OIL
E1	29.954	31.0844	28.3285	1.4087	19.1948	11.4849	17.355	-0.4126
E1i	3.9639	30.6184	28.2097	1.2351	16.9456	10.4311	15.2977	-0.3208
E1ii	3.0819	30.4171	-0.4392	0.9899	13.4071	8.2752	12.363	-0.261
E1iii	0.8682	0.1713	28.7493	0.2221	3.5131	2.0825	2.9979	-0.0539
E2	29.6405	30.8857	28.3127	1.6258	17.9555	11.1229	16.275	-0.4011
E3A	28.1475	29.9313	28.2328	2.6638	12.0164	9.3934	11.0563	-0.3475
E3Ai	24.6467	27.6378	28.0121	5.1257	-2.1586	5.2976	-1.6836	-0.2286
E3Aii	26.1534	28.6347	28.1129	4.0613	3.9852	7.0673	3.8872	-0.2786
E3B	27.4566	29.4898	28.1932	3.1543	9.1794	8.5749	8.5408	-0.323
E3C	24.2316	27.326	27.9824	5.3614	-3.3546	4.9183	-2.7938	-0.2165
E3D	22.8732	26.0399	27.8811	5.6824	-3.3799	4.5202	-3.0033	-0.1874
E3E	-0.1615	26.6218	26.774	-0.2683	2.5117	3.9933	1.7131	0.0347
E4	23.045	26.5612	27.8953	6.2654	-8.7618	3.4047	-7.754	-0.1776
E5	19.0434	23.7919	27.5576	9.1492	-25.5844	-1.3766	-23.6052	-0.0604

This is expected as the transport sector which is part of the service sector depends heavily on these products. Choucri and Lahiri (1984) observed this in their study of energy price increases in Egypt. However when government spends a lot of the savings from subsidy removal (experiments E1 and E2) the increase in agric prices is higher than that of service sector prices. Typically in Nigeria increases in the price of most goods and services after petroleum price increases are observed. What the above observations show is that this can come from 2 sources: the increase in petroleum prices and the increase in government expenditure which follows it. Overall, an expansionary policy after subsidy removal for all products (experiments E1 and E2) would lead to an increase in nominal output of all sectors excepting the oil sector. While the key selling price of the oil sector (the world price of oil exports) remains constant, the cost of inputs increases and domestic demand by petroleum refining sectors declines. The net effect is a slight decrease in the value of output in the sector. This indicates that an increase in sales in favour the export market did not fully compensate for the domestic loss of demand. However, the decrease in sales was not substantial a maximum reduction of 0.4% in all experiments.

A conservative policy of no spending of savings (experiment E4) led to an increase in nominal output of only the refined petroleum sectors, manufacturing and service sector. This demonstrates that the increase in government's effective demand allowed increases in the nominal output of the other sectors.

The increase in intermediate inputs costs leads to a reduction in GDP in all cases. Even when there is no change in the Consumer Price Index (experiment 3Ai) GDP reduces. This indicates that there was a general increase in the price of inputs. This is expected as all sectors use the service sector and the refined petroleum products in different degrees. Thus production costs are directly affected through the later and indirectly through the former.

5.2 Price Level

The price level, CPI, increases the most when the base level government deficit is maintained and expenditure on commodities is increased (experiment E1). With elimination of the deficit and the maintenance of a surplus the price level falls (experiment E2). When no savings from subsidy removal is spent total government expenditure falls and leads to a deflation (experiment E4). With a further cut in government expenditure the deflation is higher (experiment E5). These

observations indicate that high increases in price level do not have to follow increases in petroleum prices. What is important in this case is the fiscal policy stance of the government after subsidies are removed. However, as we shall see below, the government's stance and its consequences have distributional implications. Comparing experiments 1i-1iii it is clear that the key driver of the inflationary impacts is the fuel sector. This can be understood as fuel is 13% of aggregate intermediate inputs while kerosene and diesel are .1% and 7.5% respectively. Similarly, Fuel is 3.3% of total domestic demand while kerosene and diesel are .5% and 1.3% respectively.

5.3 Impact on Factor Incomes

Increase in government non-subsidy expenditure after subsidy removal would favour agric factor incomes and disfavour non-agric factor incomes. Non-agric sectors are comparatively inputs-intensive. Agric sectors in contrast are not inputs intensive.

Subsidy removal with slight and non-inflationary increase in expenditure (experiment 3Ai) reduces most factor incomes as production costs increase is not fully compensated by increase in effective demand. However, agriculture factor incomes are worse hit as their prices do not increase while production costs increase.

Table 4: Effects on factor Incomes

	Change in average nominal factor income				
	LA-AG	LA-NAG	Land	CAP-AG	CAP-NAG
E1	19.80	1.50	19.82	19.82	2.31
E1i	17.46	1.07	17.47	17.47	1.44
E1ii	13.79	1.02	13.79	13.79	1.33
E1iii	3.65	0.01	3.65	3.65	0.04
E2	18.51	1.45	18.52	18.52	2.08
E3A	12.31	1.20	12.32	12.32	0.96
E3Ai	-2.48	0.65	-2.48	-2.48	-1.70
E3Aii	3.93	0.88	3.94	3.94	-0.55
E3B	9.35	1.09	9.36	9.36	0.43
E3C	-3.73	0.60	-3.73	-3.73	-1.95
E3D	-3.75	0.46	-3.76	-3.76	-2.34
E3E	2.41	-0.59	2.42	2.42	-3.58
E4	-9.37	0.42	-9.38	-9.38	-2.92
E5	-26.93	-0.11	-26.95	-26.95	-6.02

A larger increase in government expenditure (experiments E1 and E2) stimulates the economy so that effective demand increases and gross output in most sectors increases compared to the conservative scenario (E3Ai) above. In this case the agriculture factor incomes rise faster as they are less inputs intensive. Though increased government expenditure creates demand it also leads to inflation which increases the cost of inputs.

Unchanged or decreased government expenditure (experiments E4 and E5) has similar effects as with a slight and non-inflationary increase in expenditure (experiment E3Ai). In all cases the value added in the refined petroleum sectors increase substantially. This makes these sectors more attractive to investors.

Table 5: Effects on Poverty and National Variables

Experiment	Percentage Change in P0						Change in total real household income	Change in CPI	Growth rate	Budget Balance (Billions of Naira)
	RH			MS-RH						
	All	Urban	Rural	All	Urban	Rural				
E1	-1.13	7.19	-2.64	-1.13	7.19	-2.35	-0.49	15.03	-0.31	-9.24
E1i	-1.35	6.54	-2.50	-1.13	6.54	-2.20	-0.35	13.05	-0.27	-9.24
E1ii	-0.90	5.23	-1.76	-0.68	5.23	-1.62	-0.35	10.45	-0.22	-9.24
E1iii	-0.23	2.61	-2.06	-0.45	1.96	-0.59	0.00	2.59	-0.07	-9.24
E2	-1.13	6.54	-2.50	-0.90	6.54	-3.08	-0.50	14.16	-0.31	0.00
E3A	-0.68	4.58	-1.62	-0.23	4.58	-0.88	-0.59	9.97	-0.33	44.29
E3Ai	0.68	0.00	1.17	0.68	-0.65	1.32	-0.84	-0.02	-0.39	150.00
E3Aii	0.23	0.65	0.29	0.45	1.96	0.29	-0.72	4.31	-0.36	104.00
E3B	-0.23	3.27	-0.73	0.00	3.27	-0.44	-0.52	7.97	-0.35	44.29
E3C	1.35	0.00	1.76	0.23	-1.96	0.88	0.22	-0.87	-0.39	44.29
E3D	3.39	13.07	1.76	0.68	12.42	-1.17	-0.33	-0.89	-0.41	44.29
E3E	1.35	9.15	0.00	-0.23	9.15	-1.62	-0.03	2.75	-0.35	44.29
E4	1.81	-5.23	3.23	2.26	-1.31	3.08	-0.99	-4.68	-0.41	199.00
E5	4.51	-12.42	7.78	4.29	-11.11	7.34	-1.49	-16.54	-0.46	325.00

Table 6: Summary of experiments

Experiment	Details
E1	Remove all subsidies. Spend all sub savings on commodities only; maintain deficit at base level
E1i	Remove diesel and Fuel subsidy. Spend all subsidy savings on commodities only; maintain deficit at base level
E1ii	Remove Fuel subsidy. Spend all subsidy savings on commodities only; maintain deficit at base level
E1iii	Remove diesel subsidy. Spend all subsidy savings on commodities only; maintain deficit at base level
E2	Remove all subsidies ; Spend all sub savings on commodities only; balanced budget
E3A	Spend a little less savings on commodities only;surplus
E3Ai	Spend a lot less savings on commodities only, surplus; zero inflation
E3Aii	Spend a lot less savings on commodities only;surplus; 4% inflation
E3B	Spend a little less savings on commodities and transfers, surplus
E3C	Spend a little less savings on transfers to both urban and rural households only
E3D	Spend a little less savings on transfers to rural households only
E3E	Spend a little less savings on transfers to rural households only and leave kerosene subsidy
E4	Do not spend any of the subsidy savings
E5	Do not spend any of the subsidy savings and spend less of other funds; reduce expenditure on commodities

5.4 Impact on Poverty

RH above represents results based on the standard representative household method of calculating poverty impacts. MS-RH represents those from the Microsim-representative household approach. Urban households earn most of their incomes from the non-agric sectors while rural households earn most of theirs from the agric sectors. In line with the discussions above, an expansionary policy therefore favours the average rural households and disfavors the average urban household. A conservative policy (E4) does the opposite.

The poverty implications of channelling subsidy savings to households depend on the inflationary impacts of government policy. Comparing E3A and E3B above, which are identical excepting for the increase in transfers in the latter, we observe that the increase in transfers did not lead to lower national poverty levels. In the urban areas the increase in transfers was beneficial as it led to a decrease in poverty compared to experiment E3A. The opposite happened in the rural areas. The key to this is the decrease in price level that accompanied the increase in transfers. This implies that spending on transfers as well as commodities (rather than on commodities alone as in E3A) is less inflationary. Unfortunately rural households experience higher incomes in a more inflationary environment- while urban households experience the opposite. This pattern is further confirmed by experiment E3C where only expenditure on transfers is increased. This leads to a deflationary situation which comparatively favours urban households and disfavours rural households.

Making transfers to rural households alone has a positive effect on them in spite of the fall in price level. This implies that the size of the real increase in transfers was higher than the decrease in real agric sector income due to lower price level. Spending all savings on rural households reduces rural poverty but causes national poverty to be higher compared to when both households receive transfers. Comparing E1 and E1ii we observe that leaving the kerosene subsidy has no impact on national poverty. However we observe that this allows households to consume more of the product than subsidy removal on all products would. Table 5 summarizes the poverty impacts as well other impacts. From the results, it is clear that a non inflationary fiscal policy response which targets rural/poor households would have the best poverty effect. In such a policy urban households would benefit more from transfers as they are worse hit. Of course, doing this would only serve to maintain the base urban-rural poverty rates before subsidy removal.

In most experiments the RH and MS-RH approach give the same direction of results for national poverty level. In one case, E3E the results move in opposite directions. Looking at the urban and rural household results it is clear that there can be noticeable differences in the results of the 2 procedures the urban results for E4, for example, demonstrate this. Given these observations it appears necessary to take into account the heterogeneity of household incomes in conducting an analysis of this kind. It would be interesting to further examine the factors that determine when the 2 procedures give the same result as they often give the same result and sometime give appreciably different results. Comparing the changes in the real total household income

with the MS-RH results demonstrates the weakness of employing one household in this kind of analysis: in some experiments, the 2 measures give opposing results on the welfare impacts.

6.0 Conclusion

Subsidy removal, without spending of the associated savings, would increase the national poverty level. This is due to the consequent rise in inputs' costs which is higher than the rise in selling prices of most firms and farms. The key sectors which experience increased nominal output are the refined petroleum products, which provide income for an extremely low number of households. The government's fiscal policy stance following subsidy removal is important in determining the poverty effects. The inflation resulting from subsidy removal can be considerably reduced with a conservative fiscal policy response. A highly expansionary policy of spending all savings from subsidy removal tends to favour rural and disfavours urban households. This is because urban households earn most of their incomes from inputs-intensive sectors while rural households do not. An expansionary policy fuels inflation and worsens urban income while it improves rural income, as output prices rise, generally. An increase in transfers to households reduces the poverty effects. A non-inflationary expansionary policy which increases transfers to households would have the least poverty effect.

There are noticeable benefits from incorporating information on the heterogeneity of household income sources. It is interesting to note that in some experiments the normal representative approach gives the same results as the MS-RH approach while in others it does not. This deserves further examination.

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