Benefit Incidence of Fuel Subsidies in Madagascar and Recommendations for Child-Friendly Reallocation

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Benefit Incidence of Fuel Subsidies in Madagascar and Recommendations for Child-Friendly Reallocation

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Summary

Fuel subsidies lead to environmental damage through inefficiencies in energy use, they are a burden for public budget and moreover they are regressive, benefitting the already better off households. Despite, these negative qualities, energy subsidies are still implemented throughout the World. Post-tax energy subsidies in the World are estimated to be 5.3 trillion USD while fuel subsidies alone, are estimated to be 1.5 trillion USD, making up 1.8 percent of the global GDP in 2015. Although fuel subsidies are regressive, fuel subsidy reforms impact the poor the hardest. Previous experience with fuel subsidy reforms around the World show that, poverty increases as a result of fuel subsidy removal if it is not mitigated with redistribution efforts like cash transfers. In Madagascar, the government decided to eliminate fuel subsidies gradually in June 2014. Yet, price control mechanism has not been dropped yet. Given the sharp fall in international oil prices in the last year, a window of opportunity has opened for Madagascar and countries alike to adopt a liberalized pricing system and abolish fuel subsidies.

Using ENSOMD 2012 dataset, we show that in Madagascar, fuel subsidies are highly regressive. Gasoline and diesel consumption is very rare in the households in the bottom 60 percent while kerosene is commonly consumed by households from all income groups. We find that poor households are affected the least if kerosene price remain unchanged. Nevertheless, different price increase scenarios including a change in the price of kerosene do not increase poverty by more than 1 percentage points. Instead reallocating the gains from the fuel subsidy reform to children aged 0-4 or 0-14 uniformly is found to decrease poverty rates between 2.4 to 4.6 percentage points.

Keywords: Fuel subsidies, impact of fuel subsidy reform, Madagascar.
JEL Classification Numbers: H20, H22, H23
Acknowledgments

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1. Introduction
High levels of energy subsidies in the World lead to fiscal losses and environmental damages. Energy subsidies (i) damage the environment, (ii) lead to large fiscal costs for the public purse as well as vulnerability to price volatilities in energy products (iii) discourage investments for efficient uses of energy and (iv) are shown to be regressive, hence benefitting the better off instead of the poor (Coady et al, 2015). Despite, their negative outcomes, energy subsidies are currently estimated to be high in the World. Due to inefficient pricing – e.g. without taking into account necessary environmental and consumption taxes - post-tax energy subsidies in the World is estimated as 5.3 trillion USD. Fuel subsidies alone, are estimated to be 1.5 trillion USD, making up 1.8 percent of the global GDP in 2015.

Many developing countries, in need of a larger fiscal space, following the price increases of fuel products in the last decade implemented fuel subsidy reforms. While developed countries already have very low post-tax subsidies if not none, developing countries also started reforming their fuel subsidies in the recent years due to the pressure of high international oil prices create on public budget. According to a list by the International Energy Agency (IEA), 27 countries implemented reforms in energy prices in 2014 including a wide range of countries such as Angola, Ghana, India, Indonesia and Yemen (IEA, 2014).

Fuel subsidies are regressive, benefitting the households that are already better off. It is estimated that the top quintile captures 6 times more than the bottom quintile in subsidies (Del Granado, Coady and Gillingham, 2010). In Africa, for instance, it was estimated that 7.8 percent of the fuel subsidies accrue to the households in the bottom quintile, while this amount is as high as 44.2 percent for the households in the top quintile (Del Granado, Coady and Gillingham, 2010).

Yet, fuel subsidy reforms impact the poor the hardest. Country experiences show that, poverty increases as a result of fuel subsidy removal if it is not mitigated with redistribution efforts like cash transfers. In Ghana, it was estimated that removal of fuel subsidies would result in a 2.1 percentage point decline in the annual budget of the households in the bottom quintile and poverty rate would increase by 1.5 percentage points (Cooke et al, 2014). On the other hand, expanding the coverage of cash transfers to 150,000 additional households was estimated to reverse the poverty impact of the price hikes. In Tunisia, the proposed fuel price hikes together with increases in electricity prices are estimated to increase poverty by 2.69 percentage points (Cuesta et al, 2015). The poverty impact was found to be mitigated with a universal transfer of the total gains. In Indonesia, it was estimated that without the mitigating cash transfers, fuel price hikes would increase the poverty rate from 16.66 percent to 22.05 percent.

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1 See Clements et al (2013), for post-tax fuel subsidies calculated for each country in the World and see GIZ (2014) for maps of countries implementing fuel taxes and fuel subsidies. According to Clements et al (2013), among the advanced countries Luxembourg is the country with the highest level of post-tax fuel subsidies, in the amount of 3.56 percent of its GDP in 2011. Luxembourg is followed by the United States with 2.42 percent.
whereas, poverty rate actually dropped to 16.58 percent following the price hikes in fuel products coupled with mitigating cash transfers to the poor (Beaton and Lontoh, 2010).

This paper focuses on fuel subsidies in Madagascar, showing who benefits from them and impact of possible price changes on the households. In Madagascar, the government decided to eliminate fuel subsidies gradually in June 2014 (IMF, 2014a). Yet, price control mechanism has not been dropped yet. Given the sharp fall in international oil prices in the last year, a window of opportunity has opened for countries like Madagascar to adopt a liberalized pricing system and abolish fuel subsidies.

The paper first gives background information on Madagascar in terms of poverty and access to services followed by fuel prices and subsidies. Part 3 describes the data at hand and the methodology adopted for the analysis. Part 4 presents the analysis results, by first giving descriptive statistics on households such as average household size, number of children, total household consumption and fuel consumption levels and the part continues with the benefit incidence of fuel subsidies and ends with outlining the possible impact of fuel price hikes by showing the simulation results. Part 5 gives a short summary of the international experience on fuel price hikes and poverty mitigating efforts, followed by simulations showing the impact of possible reallocation scenarios. Part 6 concludes.

2. Background

Poverty in Madagascar

Figure 1 Poverty increased in Madagascar in the last two decades as opposed to an overall decrease in Sub-Saharan Africa (Poverty headcount ratio at 1.90$ a day)

Madagascar is a low income country in Sub-Saharan Africa with a predominantly young and rural population. In 2014, of the 23.6 million people living in the country, 65.5 percent were living in rural areas and 42.0 percent were below age 15.

At the macro level, Madagascar experiences frequent shocks that disrupt the well-being of the population such as periodic cyclones, droughts, floods as well as economic and political crisis (Auffret, 2014). Recently, between 2009-2013, Madagascar has been through a major political crisis which led to an economic crisis, hampering growth and increasing
poverty levels in the country. World Bank (2014a) estimates that the poverty rate in Madagascar would have been 13 percentage points lower if the political crisis did not take place.

**Poverty in Madagascar is extremely high and shows an upward trend as opposed to the regional trends (See Figure 1).** In 2010, 81.8 percent of the population were living below the 1.90$ a day poverty line as opposed to 46.1 percent in Sub-Saharan Africa region, on average. While poverty trends were in parallel with Sub-Saharan Africa between 1993 and 1999, from 2001 on, poverty rates started to diverge and poverty in Madagascar continued to increase from then on. As a matter of fact, Madagascar is the poorest country in the region (See Figure 2). Taking the latest poverty rates reported between 2006 and 2012 in the region, Madagascar stands out as the country with the highest poverty headcount ratio in the region, making it one of the poorest countries in the World as well.

**Figure 2** Madagascar is the poorest country in the region, in recent years
(_Poverty headcount ratio at 1.90$ a day_)

**Source:** World Bank, World Development Indicators

**Figure 3** Households with children are more likely to be poor
(_% of population living in a household below the poverty line_)

Households with children are more likely to be poor in the country. While poverty rate is already very high in Madagascar, households with children are even poorer. In 2012, 71.5 percent of the population were living below the national poverty line as opposed to 75.5 percent of the population living in households with children aged 0-14 (See Figure 3). Furthermore, poverty rate is even higher when there are younger children in the household. Poverty rate reaches 80.7 percent for the population living in a household with children aged 0-4 year old. The trend is similar with the households living in extreme poverty. Population living in households with...
children and especially with children aged 0-4 are more likely to be living in extreme poverty.

People of Madagascar are not only income poor but they also lack access to basic education, health and infrastructure services. Access to these services is below regional averages in the country (See Figure 4). As of 2012, 69.4 percent of the primary school age children were enrolled in primary school in Madagascar as opposed to 77.4 percent in the Sub-Saharan Africa region.\(^2\) Regarding health outcomes, 44.3 percent of the births are attended by skilled health staff and 64 percent of children 12-23 months old are vaccinated against measles, while these rates are 48.8 and 72.7 percent respectively in the region. Access to an improved water source, an improved sanitation facility and access to electricity is very low in the country as well. Almost half of the population do not have access to an improved water source in Madagascar while the situation is even direr with respect to access to an improved sanitation facility with only 12 percent of the population having access. Access to electricity is similarly low in the country with 15.5 percent as opposed to 35.3 percent in the region on average. Apart from already low access rates, significant disparities exist in access to services by income level of the household and the region the household is located in (INSTAT, 2014).

**Figure 4 Access to basic services in Madagascar is below the average levels in Sub-Saharan Africa**

<table>
<thead>
<tr>
<th>Education</th>
<th>Health</th>
<th>Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>School enrolment, primary (% net)</td>
<td>Births attended by skilled health staff (% of total)</td>
<td>Improved water source (% of population with access)</td>
</tr>
<tr>
<td>69.4</td>
<td>44.3</td>
<td>51.5</td>
</tr>
<tr>
<td>77.4</td>
<td>48.8</td>
<td>67.6</td>
</tr>
<tr>
<td>64.0</td>
<td>62.7</td>
<td>12.0</td>
</tr>
<tr>
<td>72.7</td>
<td>29.7</td>
<td>29.7</td>
</tr>
<tr>
<td></td>
<td>35.3</td>
<td>15.4</td>
</tr>
</tbody>
</table>

Source: World Bank, World Development Indicators. *(For Madagascar’s net enrolment rate, the source is INSTAT (2014).)*

Note: Net enrolment rate is for year 2012 for Madagascar and for year 2013 for Sub-Saharan Africa; births attended by skilled health staff is for year 2013 for Madagascar, for year 2011 for Sub-Saharan Africa; measles immunization rate is for year 2014 both for Madagascar and Sub-Saharan Africa; access to an improved water source and access to an improved sanitation facility are for 2015 for both of them; and access to electricity is for year 2010 both for Madagascar and Sub-Saharan Africa.

\(^2\) Source for net primary school enrolment rate for Madagascar is INSTAT (2014), while the rate for Sub-Saharan Africa is World Development Indicators of World Bank.
Fuel prices and subsidies in Madagascar

In Madagascar fuel prices have been regulated and they are below cost-recovery levels. In 1999, pre-liberalization period of the market started with setting up a technical regulatory body and preparing the strategies before full-liberalization (OMH, 2015). In 2004, the fuel market was fully liberalized and remained so until fuel prices started to rise rapidly in 2008 in the international market (IMF, 2014b). In 2011, following the price increases in fuel products in the international market, government froze prices at the pump (IMF, 2014a). From then on, prices at the pump remained below cost recovery levels and the suppliers are compensated by taking the price difference between the price at the pump and the cost-recovery price.

Prices at the pump did not change significantly in the last 5 years. While in Ariary terms the prices at the pump increased between February 2010 and August 2015, in USD terms they decreased slightly due to the depreciation of Ariary against USD (See Figure 5). Since the prices at the pump are controlled by the government neither the significant international price increases nor the decreases are reflected well on the prices at the pump. A significant increase in international fuel prices took place between February 2010 and April 2011, when crude oil price increased by 43.4 percent in the international market. In contrast, prices at the pump in Madagascar increased only by 12.1, 13.9 and 16.9 percent in USD respectively for gasoline, diesel and kerosene in the same time period. In fact, the price increase at the pump was largely due to the appreciation of Ariary against USD at the time. In Ariary terms, prices at the pump actually increased by only 3.0, 4.6 and 7.4 percent respectively. Until mid-2014, international prices and prices at the pump in Madagascar remained largely stable. Between June 2014 and August 2015 there were two price hikes for the fuel products in Madagascar. However prices at the pump fell in USD terms due to the depreciation of Ariary against USD. In the same time period, starting from mid-2014, international prices started their sharp fall as well, creating the highest difference observed in the last five years between the prices at the pump in Madagascar and international prices.

Figure 5 Prices at the pump in Madagascar in Ariary and in USD versus international spot prices of the fuel products

Source: For monthly fuel prices at the pump data is obtained from OMH’s website at http://www.omh.mg/codes/prix%20mensuel.php. For the exchange rate, data is obtained from Central Bank of Madagascar from http://www.banque-centrale.mg/index.php. Lastly the source for spot prices is the U.S. Energy Information Administration http://www.eia.gov/duav/pet/pet_pri_spt_s1_d.htm
As of June 2014, prices at the pump were below targeted price levels in the country. Prices at the pump for gasoline, diesel and kerosene are below 10.1 percent, 22.7 percent and 11.3 percent their targeted cost-recovery levels. As can be seen in Figure 6, prices at the pump are lower than target prices due to the lower than necessary taxes. While both gasoline and diesel had positive taxes, kerosene effectively had a negative tax meaning it had a subsidy at the pump. If the targeted prices became effective, gasoline will be the most heavily taxed fuel product while kerosene, a fuel product used widely in the country by people from all income levels will be taxed the least.

**Figure 6 Prices at the pump are lower than target prices due to low taxes**  
*(USD/lt in June 2014)*

![Chart showing price differences at the pump vs target prices for gasoline, diesel, and kerosene.](chart)

*Source: OMH (Office Malagache des Hyrocarbures). Values were reported in Ariary in OMH website and converted into USD using June 2014 Ariary/USD monthly exchange rate.*

Although the government decided in June 2014 to eliminate fuel subsidies with gradual price increases, a sharp fall in crude oil prices starting in July 2014 resulted in a natural grow in the fiscal space. In June 2014, Madagascar government decided to eliminate fuel subsidies by gradually increasing prices of fuel products every three months (IMF, 2014a). Starting in July 2014, price of crude oil started to decrease in the international markets as well. Hence, following the government’s decision in June 2014 and possibly due to the sharp fall in the fuel product prices at the international market there have only been two price hikes in Madagascar after June 2014. Even with the price hikes, prices at the pump remained below the targeted levels. However given the sharp fall in crude oil price -59.5 percent decline in August 2015 from the price level in July 2014- the fiscal space increased naturally without further need for price increases.

Madagascar charges gasoline close to the median rate in Sub-Saharan Africa while it charges diesel less than the median rate compared to other countries in Sub-
Saharan Africa (See Figure 7). The price of gasoline at the pump for year 2014 was slightly below the median rate for the region while it was almost the same as the World average but below the OECD average. Comparatively, price of diesel at the pump was lower than the median rate for Sub-Saharan Africa and also below the World and the OECD averages.

Figure 7 Prices at the pump for gasoline and diesel in Madagascar are close to the World averages but lower than the OECD averages (USD/lt in 2014)

Source: World Bank, World Development Indicators

Like most of the Sub-Saharan African oil importer countries, Madagascar does not have pre-tax subsidies while it has post-tax subsidies for fuel products. According to the calculations by IMF (2013), Madagascar had a pre-tax subsidy in the amount of -1.3 percent of its GDP in year 2012, meaning that it is taxing the fuel products.\(^3\) Post-tax subsidy on the other hand is calculated as 0.7 percent of its GDP, pointing to the fact that current taxes are below the levels they are supposed to be. This is similar to the general trend in Sub-Saharan Africa where few countries have pre-tax subsidies while the majority have post-tax fuel subsidies (See Figure 8).

\(^3\) Fuel subsidies can be in two forms; a pre-tax subsidy occurs when prices at the pump are below the supply and distribution costs while a post-tax subsidy occurs when taxes are below their efficient level (Clements, 2013).
3. Data and Methodology

Data

In the analysis, we made use of Madagascar Millennium Development Goals National Monitoring Survey (ENSOMD) 2012. ENSOMD was conducted from September 2011 to August 2013 with the primary aim of monitoring Madagascar’s progress in achieving
MDG targets. Final dataset covers 16,920 households and it is representative at the national, urban/rural, and regional level.

The survey collects information to monitor all 7 MDG targets (except the last one on financial resource mobilization). In this respect, households responded to questions on a range of topics including household expenditures, durables, education and health outcomes. Overall, ENSOMD is composed of four questionnaires: a household questionnaire, an anthropometry questionnaire to record children’s anthropometric outcomes, a woman questionnaire for the women in reproductive age (15-49) living in the household and a man questionnaire for men aged 15-59 living in the household.

Methodology

The analysis in the paper is composed of four main topics in order to determine the benefit incidence of fuel subsidies and the impact of a price increase on households’ welfare as well as the impact of subsidy reallocation options. The main topics are: (i) the level of fuel consumption of the households and how the consumption changes by consumption quintile, (ii) the level of the fuel subsidies accruing to the households in each consumption quintile, (iii) a simulation showing the impact of price increases and (iv) a simulation showing the impact of reallocating fuel subsidies.

In order to determine the level of fuel subsidy, a price-gap approach is employed in the analysis. In the price-gap approach the difference between the prices at the pump and an international comparative price is taken and this difference gives the subsidy level. The price gap-approach is employed in many international comparative studies such as IMF (2013) and Clements (2013). Price-gap approach can be used to calculate both pre-tax and post-tax subsidies. While for the pre-tax subsidy efficient taxes are not taken into account, post-tax subsidy calculations assumes an efficient tax rate for each country. In this respect, the price-gap taken in this study is the gap between the prices at the pump and the target prices as published by the regulatory body of the fuel market in Madagascar, Office Malagache des Hydrocarbures (OMH).\(^4\)

As evidenced by the difference between the prices at the pump and the target prices, Madagascar effectively employs a post-tax subsidy for the fuel products gasoline, diesel and kerosene. According to the publication by the OMH (lastly updated on June 2014) prices at the pump for gasoline, diesel and kerosene are below their targeted price levels by 10.1, 21.7 11.3 percent respectively (See Table 1). While the prices at the pump takes into account transport and distribution costs in addition to a tax, the tax is not at the targeted level for all three fuel products (gasoline, diesel, kerosene).

In order to calculate the total subsidy level in the economy, we used the price increase necessary to reach these target prices assuming that the taxes determined for the targeted prices are the efficient tax rates. This calculation also requires the assumption that households’ fuel consumption will not change with price changes, which might

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\(^4\) Fuel subsidies can be in two forms; a pre-tax subsidy occurs when prices at the pump are below the supply and distribution costs while a post-tax subsidy occurs when taxes are below their efficient level (Clements, 2013).

\(^5\) Latest report available is for June 2014 in http://www.omh.mg/codes/simh2014.php
be true in the short-run but might probably change in the medium to long-run. Hence total subsidy is calculated using the equation below:

\[ \text{Total subsidy} = (\text{Price at the pump in June 2014}) \times (\text{Necessary increase to reach the targeted prices (\%)}) \times (\text{Total annual amount of fuel consumed by the households (in liters)}) \]

**Table 1 Prices at the pump and prices estimated after the targeted price increase (in USD/lt)**

<table>
<thead>
<tr>
<th></th>
<th>Gasoline</th>
<th>Diesel</th>
<th>Kerosene</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price at the pump in June 2014 (USD/lt)</td>
<td>1.51</td>
<td>1.21</td>
<td>1.00</td>
</tr>
<tr>
<td>Target price in June 2014 (USD/lt)</td>
<td>1.66</td>
<td>1.48</td>
<td>1.11</td>
</tr>
<tr>
<td>Price increase (%)</td>
<td>10.11%</td>
<td>21.68%</td>
<td>11.25%</td>
</tr>
</tbody>
</table>

*Source: OMH (Office Malagache des Hydrocarbures). Values were reported in Avriry in OMH website and converted into USD using June 2014 Avriry/USD monthly exchange rate obtained from Central Bank of Madagascar at [http://www.banque-centrale.mg/index.php](http://www.banque-centrale.mg/index.php)*

### 4. Analysis Results

#### 4.1 Household Characteristics

Table 2 summarizes the characteristics of the households in Madagascar for each per capita consumption quintile. On average, households in the bottom quintiles are more crowded and average number of children living in poorer households is higher as well. Average number of children aged 0-14 living in the households in the bottom quintile is 4.5 as opposed to only 1.5 living in the households in the top quintile.

**Level of annual per capita consumption is low in Madagascar along with widespread poverty.** Household annual per capita consumption is 8 times higher on average for the households in the top quintile compared to the households in the bottom quintile. While average per capita consumption is 210.1 USD in the country, for the households in the bottom quintile per capita consumption is only 62.3 USD as opposed to 503.2 USD for the households in the top quintile. In addition, given that the national poverty line is at 227.5 USD, all the households in the bottom 60 percent and more than half of the households in quintile 4 are below the national poverty line.

**Overall, ownership of assets consuming fuel products is extremely low and especially low among the households in the bottom 60 percent.** Of the households in Madagascar only 1.5 percent own a car, 1.8 percent own a motorcycle and 0.3 percent own a tractor. While ownership of this type of assets is almost non-existent for the households in the bottom 60 percent, households in the top quintile have the highest ownership rate. Of the households in the top quintile 6.5 percent own a car, 7.2 percent own a motorcycle and 1 percent own a tractor.

**Kerosene is widely consumed by the population as primary source for lighting.** In Madagascar, electricity is the main source of lighting for only 20 percent of the households. While this rate reaches 24.8 percent for the households in quintile 4 and 58.1 percent for the
households in the top quintile, it is lower than 10 percent for the households in the bottom 3 quintiles. In contrast, kerosene is used as the main source of lighting for 70.4 percent of the households in the country with more than 80 percent of the households in the bottom three quintiles reporting using kerosene as the primary lighting source (See Table 2).

Although kerosene is used widely for lighting, it is rarely used as a fuel source for cooking. In Madagascar the majority of the households (95.3 percent) use either wood or charcoal for cooking purposes. Kerosene has never been reported as the primary source of fuel for cooking and only reported by 1 household in the ENSOMD dataset as a secondary source of cooking. Hence a change in the price of kerosene cannot affect households’ choices of fuel for cooking.

Table 2 Averages for each per capita consumption quintile

<table>
<thead>
<tr>
<th></th>
<th>Q1 (Bottom)</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Household size and number of children</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household size</td>
<td>7.4</td>
<td>6.3</td>
<td>5.6</td>
<td>4.9</td>
<td>4.1</td>
<td>5.7</td>
</tr>
<tr>
<td>Number of children</td>
<td>4.5</td>
<td>3.5</td>
<td>2.9</td>
<td>2.2</td>
<td>1.5</td>
<td>2.9</td>
</tr>
<tr>
<td>Number of children 0 to 4</td>
<td>1.5</td>
<td>1.1</td>
<td>0.9</td>
<td>0.7</td>
<td>0.5</td>
<td>1.0</td>
</tr>
<tr>
<td>Number of children 5 to 14</td>
<td>2.9</td>
<td>2.3</td>
<td>1.9</td>
<td>1.5</td>
<td>1.1</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>Household consumption</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per capita consumption (in USD)</td>
<td>62.3</td>
<td>108.4</td>
<td>153.1</td>
<td>223.8</td>
<td>503.2</td>
<td>210.1</td>
</tr>
<tr>
<td>Total household consumption (in USD)</td>
<td>392.8</td>
<td>577.3</td>
<td>703.1</td>
<td>904.6</td>
<td>1728.8</td>
<td>861.2</td>
</tr>
<tr>
<td>Poverty rate at national poverty line (%)</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>57.5</td>
<td>0.0</td>
<td>71.5</td>
</tr>
<tr>
<td><strong>Durables (%)</strong></td>
<td></td>
<td></td>
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<tr>
<td>Car Ownership</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>0.7</td>
<td>6.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Motorcycle Ownership</td>
<td>0.2</td>
<td>0.1</td>
<td>0.7</td>
<td>1.0</td>
<td>7.2</td>
<td>1.8</td>
</tr>
<tr>
<td>Tractor Ownership</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.4</td>
<td>1.0</td>
<td>0.3</td>
</tr>
<tr>
<td><strong>Main source of lighting (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main source of lighting: Kerosene</td>
<td>88.5</td>
<td>83.9</td>
<td>80.0</td>
<td>64.7</td>
<td>35.0</td>
<td>70.4</td>
</tr>
<tr>
<td>Main source of lighting: Electricity</td>
<td>2.4</td>
<td>5.5</td>
<td>9.5</td>
<td>24.8</td>
<td>58.1</td>
<td>20.0</td>
</tr>
<tr>
<td><strong>Main source of fuel for cooking (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main source of fuel for cooking: Wood</td>
<td>89.1</td>
<td>84.9</td>
<td>77.0</td>
<td>63.0</td>
<td>32.6</td>
<td>69.3</td>
</tr>
<tr>
<td>Main source of fuel for cooking: Charcoal</td>
<td>6.1</td>
<td>10.8</td>
<td>18.2</td>
<td>32.7</td>
<td>62.1</td>
<td>26.0</td>
</tr>
<tr>
<td>Main source of fuel for cooking: Other</td>
<td>4.8</td>
<td>4.3</td>
<td>4.8</td>
<td>4.3</td>
<td>5.3</td>
<td>4.7</td>
</tr>
</tbody>
</table>

Source: Author’s calculations using ENSOMD dataset

4.2 Fuel Consumption of the Households and Benefit Incidence of Fuel Subsidies

Fuel consumption for the households in the bottom 4 quintiles is very low and the primary fuel consumed by the poor is kerosene (See Figure 9). Per capita fuel consumption (in liters) is the highest for the households in the top quintile, on average. Gasoline and diesel are mainly consumed by the households in the top quintile. On average, per capita
gasoline consumption is 0.01 liters annually for the households in the bottom quintile as opposed to 6.17 liters for the households in the top quintile. Similarly, diesel consumption is almost nonexistent for the households in the bottom quintile with annual per capita consumption of 0.004 liters while households in the top quintile consume the highest with 5.18 liters per capita annually. While gasoline and diesel consumption are negligible for the households in the bottom 4 quintiles, kerosene consumption is significant. Yet, the highest amount of per capita kerosene consumption is observed again for the households in the top quintile with 6.93 liters per year.

**Figure 9 Fuel consumption in Madagascar**

a. Average annual per capita fuel consumption is significantly higher in the top quintile  
(Average annual per capita fuel consumption (in liters))

![Graph showing fuel consumption](image)

b. Yet, average share of fuel consumption in household budget is as high as top quintile for the bottom quintile due to kerosene consumption  
(Average share of fuel consumption in households’ annual budget (%))

![Graph showing fuel consumption percentage](image)

*Source: Author’s calculations using ENSOMD dataset*

**Figure 10 Total level of annual subsidy**  
is 80.1 million USD, while 53.3 million of it is received by the households in the top quintile  
(Amount of annual fuel subsidy received by households in each quintile (in million USD))

![Graph showing subsidy level](image)
Although per capita fuel consumed is lower for poorer households, the share of fuel consumption in total household budget is as high as the share in household budget for the households in the top quintile (See Figure 9). This is mainly because of kerosene consumption. While per capita kerosene consumption is lower for the households in the bottom quintile compared to the top quintile, average share in budget is actually higher. For the households in the bottom quintile kerosene consumption on average makes up 3.26 percent of the total household budget as opposed to 0.96 percent for the households in the top quintile. While the share of gasoline and diesel consumption is negligible in overall household budget for the households in the bottom 4 quintiles, it is 1.20 and 0.80 percent on average for the households in the top quintile.

Given the consumption dynamics of the households for fuel products, not surprisingly the majority of the fuel subsidies accrue to the households in the top per capita consumption quintile. Total subsidies are estimated as 80.1 million USD using the price gap between the pump prices and target prices for gasoline, diesel and kerosene. 53.3 million USD of this subsidy is received by the households in the top quintile, making 66.5 percent of the total amount of fuel subsidies. In contrast, only 5.1 million USD, or approximately the tenth of what is received by the richest, is received by the households in the bottom quintile.

Compared to other fuel subsidies, kerosene subsidy is distributed more equally. While the households in the top quintile continue to receive a higher amount of the kerosene subsidy with 31.7 percent of the total kerosene subsidy accruing to them, households in the bottom quintile receive 15 percent of the kerosene subsidy. 55.7 percent of the total kerosene subsidy actually accrues to the households in the bottom 60 percent.

4.3 Impact of Price Increases to Target Levels

In this part the household budget and poverty impact of price increases to target levels is investigated. 4 different basic scenarios are run to see the impact of fuel price increases on poverty headcount ratio, poverty gap, public budget and household budget. These are:

- Scenario 1. All prices increase
- Scenario 2. All prices increase but the price of gasoline
- Scenario 3. All prices increase but the price of diesel
- Scenario 4. All prices increase but the price of kerosene

In these scenarios as an indirect impact transport prices are assumed to increase through diesel price increases as well. The pass-through is assumed to be 50%. A possible change in food prices and inflation are not accounted for.

Results show that poverty headcount ratio is not affected by more than 1 percentage points for all four scenarios while the smallest impact occurs in Scenario 4 where kerosene prices are left unchanged (See Table 3). Given that gasoline is consumed mainly by the richest households, not raising its price do not change the poverty
headcount ratio compared to the baseline scenario where all prices increase. Not raising diesel prices affect poor households through increases in the transport prices. Hence in the scenario where diesel prices left unchanged poverty headcount ratio is slightly lower compared to the baseline scenario where all prices increase. In comparison, poverty headcount ratio increases only by 0.02 percentage points compared to the benchmark case of stable prices when price of kerosene remains unchanged. This is not surprising given that kerosene is used as the main source of lighting for the majority of the poor households and a price change in kerosene directly affects them. Hence, not changing the price of kerosene while increasing the prices of gasoline and diesel distorts the budget of the poor households the least.

While Scenario 4 where kerosene price is left unchanged increases the poverty headcount ratio the least, this scenario also brings the smallest amount of increase to the public budget. In the baseline scenario where all prices increase, public budget increases by 80.1 million USD assuming that the consumption levels of households would not change with the price increases. Since kerosene is the most widely used fuel, not raising its price along with price hikes on gasoline and diesel brings 47.2 million USD to the public budget while in the scenarios where kerosene price is also raised along with gasoline or diesel, public budget increases by 60.9 and 52.2 million USD respectively.

Table 3 Poverty rate and increase in public budget following the price increase scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Poverty headcount ratio (at national poverty line)</th>
<th>Poverty gap (at national poverty line)</th>
<th>Poverty headcount ratio (at national extreme poverty line)</th>
<th>Poverty gap (at national extreme poverty line)</th>
<th>Increase in public budget (in million USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>At current level of prices</td>
<td>71.51</td>
<td>32.77</td>
<td>52.72</td>
<td>19.81</td>
<td></td>
</tr>
<tr>
<td>Sc. 1 All prices increase</td>
<td>71.61</td>
<td>32.87</td>
<td>52.85</td>
<td>19.90</td>
<td>80.1</td>
</tr>
<tr>
<td>Sc. 2 All but gasoline</td>
<td>71.61</td>
<td>32.87</td>
<td>52.85</td>
<td>19.90</td>
<td>60.9</td>
</tr>
<tr>
<td>Sc. 3 All but diesel</td>
<td>71.58</td>
<td>32.85</td>
<td>52.82</td>
<td>19.89</td>
<td>52.2</td>
</tr>
<tr>
<td>Sc. 4 All but kerosene</td>
<td>71.53</td>
<td>32.80</td>
<td>52.74</td>
<td>19.82</td>
<td>47.2</td>
</tr>
</tbody>
</table>

Source: Author’s calculations using ENSOMD dataset

Household budget is also affected the least, in scenario 4 where kerosene price is left unchanged (See Figure 11). Not surprisingly, compared to other scenarios keeping the price of the kerosene the same, decreases the household budget the least on average for households in all per capita income quintiles except the top quintile. In the scenario where all
prices increase, household budget decreases by 0.37 percentage points for the households in the bottom quintile while the impact is only 0.03 percentage points in scenario 4.

**Figure 11** Household budget is affected the least for the households in bottom 4 quintiles if kerosene prices remain unchanged (% of decrease in total household budget)

Source: Author’s calculations using ENSOMD dataset

5. International comparisons on fuel subsidies and Reallocation Options

5.1 Fuel Subsidy reforms from around the World and Mitigating Efforts

**Sub-Saharan Africa**

Several countries in Sub-Saharan Africa implemented reforms to decrease or abolish fuel subsidies in the last decade. Angola, Gabon, Ghana, Mozambique, Niger and Nigeria are among these countries in the region.

Most of these countries also employed mitigating measures to alleviate the poverty impact resulting from increases in fuel prices. Expanding the public transportation network or subsidizing it is a commonly applied measure and was implemented in Gabon, Ghana, Niger and Nigeria (Del Granado, Coady and Gillingham, 2010). Increased fiscal space is also used to finance programs in health care, education or improvement of infrastructure as well. For instance in Gabon and Ghana, school enrolment fees were waived following the fuel price hikes (Del Granado, Coady and Gillingham, 2010). In addition, cash transfer programs to the poor are expanded in scope or in the transfer amount in countries Gabon, Mozambique and Nigeria (Del Granado, Coady and Gillingham 2010, and IMF, 2013).
Nigeria is the country which implemented a large program specifically designed to allocate the benefits obtained from decreasing fuel subsidies. This kind of a program was seen necessary especially after the massive social unrest following the fuel price hikes in the country (World Bank, 2014b). Hence, following the fuel subsidy reform in 2012, Subsidy Reinvestment and Empowerment Program (SURE-P) was introduced (IMF, 2013). SURE-P included measures to boost economic growth and alleviate poverty. In this respect, for the alleviation of poverty, the program focuses on projects of urban mass transit, vocational training, public works and maternal and child health. Under maternal and child health arm of the program conditional cash transfers are provided for pregnant mothers in addition to supply side measures. Employment of midwives, community health care workers and village health workers and improving the infrastructure of the primary health care centers are among these measures (World Bank, 2014b).

Cash transfer programs that are properly targeted is a good mechanism to curb the negative impacts of the fuel price hikes on the poor. In this respect, in Ghana, Cooke et al (2014) suggests expanding the current cash transfer program to the poor to alleviate the increase in poverty as a result of the fuel price hikes. In Ghana, the cash transfer program LEAP is found to be the most progressive social program benefitting the poor with 57 percent of its subsidies reaching the poor compared to only 2.3 percent of fuel subsidies reaching the poor (Cooke et al, 2014).

Other parts of the World
Many countries from around the World implemented subsidy reforms in the last years. These include Egypt, Iran, Jordan, Morocco, Sudan, Tunisia and Yemen in the Middle East and North Africa region and Indonesia, and Malaysia from East Asia. Accompanying the reforms these countries generally implement mitigating efforts targeted for the poor.

Implementing cash transfer programmes was commonly seen among these countries. Iran, Jordan, Indonesia and Malaysia all implemented cash transfer programmes accompanying the fuel price hikes. In Iran, following the increases in fuel products of 2 to 9 fold in 2010, a uniform cash allocation programme was adopted (Lindebjerg, Peng and Yeboah, 2015). As a result, Iranians started to receive 45 USD per person per month to their bank accounts requiring only that they apply to receive the transfer (Lindebjerg, Peng and Yeboah, 2015). The reform led to decreases in poverty and inequality while inflation increased as a result of large cash transfers (Salehi-Isfahani 2014). Jordan introduced a cash transfer programme following the fuel price hikes in 2012 as well. But different than Iran, Jordan’s programme targeted the households with a head earning less than a targeted amount. The program provided cash transfers to approximately two-thirds of Jordanian households and actually ended up over-compensating the households due to paying more than the savings gained from the subsidy reform (Araar et al, 2013). Indonesia adopted a cash transfer programme directly targeting the poor to compensate for the negative effects of the fuel price hikes (Lindebjerg, Peng and Yeboah, 2015). With this program 15.5 million households received 30 USD every 3 months for a year. In total, 2.3 billion USD was distributed to households, making up 25 percent of the gains from subsidy reduction. Following the price hikes in 2013, Malaysia increased the cash
transfers in magnitude and extended the cash allocations to cover lower-middle income households as well (Bridel and Lontoh, 2014).

Apart from cash transfer programmes, grants to schools, health insurance for the poor and affordable housing schemes were adopted as well in some countries as mitigation efforts. Indonesia, adopted other programmes such as Health Insurance for the Poor Programme, School Operational Assistance Programme (BOS) and Rural Infrastructure Support Project (Beaton and Lontoh, 2010). Affordable housing programmes were implemented in Tunisia and Malaysia (Cuesta et al, 2015, and Bridel and Lontoh, 2014).

5.2 Fuel Subsidy Reallocation Options for Madagascar

In Madagascar, children are concentrated in bottom quintiles (See Figure 12). 25.2 percent of all children live in households in the bottom quintile as opposed to 13.8 percent of the children living in the households in the top quintile. Similarly a higher share of the people living in households in bottom quintiles are children of age 0-14. 59.4 percent of the people living in households in the bottom quintile are below the age of 15 while this share is 32.7 percent for the people living in households in the top quintile. In this respect any uniformly targeted child subsidy will have more progressive targeting than fuel subsidies, since children are already concentrated more in poorer households.

Figure 12 Children are concentrated in bottom quintiles

a. Children are concentrated more in the bottom 60% (% of all children)

b. A higher share of the bottom quintiles are children (% of each quintile)

In order to see the impact of a uniform child subsidy on poverty, we tried two basic reallocation scenarios. We used previous price change scenarios and allocated the gain
in the public budget in each one to (i) children of ages 0-14 and (ii) children of ages 0-4. Hence the fuel price increases are coupled with child subsidies without any specific targeting other than children’s age.

**Table 4 Annual subsidy per child in each price increase and subsidy scenario**

<table>
<thead>
<tr>
<th>Price increase scenario</th>
<th>Subsidy scenario</th>
<th>Annual subsidy per child (in USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sc. 1 All prices increase</td>
<td>Subsidy to all children 0-14</td>
<td>8.2</td>
</tr>
<tr>
<td>Sc. 2 All but gasoline</td>
<td>Subsidy to all children 0-4</td>
<td>23.7</td>
</tr>
<tr>
<td>Sc. 3 All but diesel</td>
<td>Subsidy to all children 0-14</td>
<td>6.2</td>
</tr>
<tr>
<td>Sc. 4 All but kerosene</td>
<td>Subsidy to all children 0-14</td>
<td>18.0</td>
</tr>
<tr>
<td></td>
<td>Subsidy to all children 0-4</td>
<td>5.3</td>
</tr>
<tr>
<td></td>
<td>Subsidy to all children 0-14</td>
<td>15.5</td>
</tr>
<tr>
<td></td>
<td>Subsidy to all children 0-14</td>
<td>4.8</td>
</tr>
</tbody>
</table>

*Source: Author’s calculations using ENSOMD dataset*

Subsidy per child is the highest and the poverty headcount ratio is the lowest in the scenario where prices of all fuel products increase at the same time (See Table 4 and Figure 13). The highest subsidy per child is 8.2 USD for 0-14 year olds and 23.7 USD for 0-4 year olds when all prices increase. Reallocaing the gains from these price increases leads to the lowest level of poverty rates compared to other scenarios. When the subsidy is allocated to children 0-4 year old, poverty headcount ratio drops to 66.9 percent and when it is allocated to 0-14 year olds it drops to 67.1 percent from an initial level of 71.5 percent.

**Figure 13 Poverty rate is the lowest when all of the gain from fuel subsidy is distributed to children**

* (Poverty headcount ratio at national poverty line (%))
Along with the fuel subsidy removal plan, Madagascar government already has plans as mitigating measures as well. According to IMF (2014), as mitigating policies, government is planning to implement targeted public transport subsidies for urban areas, an expansion of the cash-for-work program for the rural areas, extending the program on cash transfers conditional on school participation and expanding the school kits program to a larger number of regions.

Social protection programmes in education are in need of resources in Madagascar. As a result of the recent economic crisis, budgets of social protection programmes in education were cut severely. Approximately two-thirds of the teachers are hired and paid by local parents’ associations in Madagascar, creating a burden on households’ budget (Auffret, 2014). For the school year 2009/10, 70 percent of these salaries were subsidized by the government in cooperation with the Catalytic Fund but this subsidy scheme was discontinued in the following year due to the budget cuts. Similarly, distribution of free school kits was discontinued in 2010/11 school year (Auffret, 2014). Hence a reallocation of fuel subsidy gains could solve the budgetary problems in these programmes.

Yet, for these subsidies to be progressive, more effort is needed to increase the enrolment rates of the poor children. Our calculations using ENSOMD 2012 dataset shows that, percent of children aged 5-14 registered in school decreases for the households in the bottom per capita consumption quintiles. While 81.6 percent of the children aged 5-14 living in households in the top quintile are registered to school, this rate goes down to 46.4 percent for the children living in households in the bottom quintile. Hence subsidy reallocation programmes targeting increasing the enrolment rates of the poor children could be influential as well.

6. Conclusion

In Madagascar, fuel subsidies are highly regressive. Gasoline and diesel consumption is very rare in the households in the bottom 60 percent while kerosene is commonly consumed by households from all income groups. Given that they are the main consumers of gasoline and diesel, 66.5 percent of the total amount of subsidies accrues to the households in the top quintile. In contrast only a tenth of the subsidy received by the top quintile is received by the households in the bottom quintile.

Poor households are affected the least if kerosene price remain unchanged. Kerosene is used as the primary lighting source for the majority of the poor households, and hence they are directly affected by a price change in it. On the other hand, gasoline and diesel are mainly consumed by households in the top quintile and price changes in these products do not affect poor households as significantly as a price change in kerosene (However since diesel is also used
in public transport, hence price increases in diesel also have an indirect impact). In this respect, the impact on the poor can be minimized when kerosene prices are kept stable. While it is a lower bound estimate, different price increase scenarios do not increase poverty by more than 1 percentage points. The highest increase in public budget is obtained when all prices increase while the lowest is obtained when kerosene price remains stable.

**Reallocating the gains from the fuel subsidy reform to children uniformly decreases poverty rates significantly.** Children are concentrated more heavily in the households in the bottom 60 percent, making any uniform subsidy distribution targeting children naturally ending up progressive. Simulation results show that reallocating subsidy gains to children aged 0-4 decreases the poverty most when the prices of all fuel products increase. Poverty headcount ratio drops down to 66.9 percent up from a current rate of 71.5 percent. These simulations point to the result that in fact abolishing the subsidies on kerosene and reallocating the gains to children ends up being more progressive than keeping kerosene subsidies (Yet, it must be noted that the administrative costs of such a subsidy has not been taken into account in these simulations, neither the possible changes in food prices or the inflation).

**The government should take advantage of the currently low international fuel prices to make the necessary reforms.** In the last year, starting from June 2014, international fuel prices plummeted significantly. In August 2015, the price per barrel of crude oil was less than half of the price in June 2014. While this is currently great news for the public budget, to decrease the sensitivity to future price volatilities, the government should consider loosening the price control mechanism and going back to the liberalized prices period as it was in the period between 2004-2008.
References


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Sdralevich, Mr Carlo A., Miss Randa Sab, Mr Younes Zouhar, and Giorgia Albertin. 2014. Subsidy reform in the Middle East and North Africa: Recent progress and challenges ahead. Washington, DC: IMF.


Technical Annex

In this technical annex, the variables used in the analysis and the calculations will be described in detail. For the analysis we used ENSOMD 2012 dataset. STATA software has been used for the data analysis.

All the consumption variables were converted into USD values using June 2014 exchange rate 2354.71 Ariary/USD, obtained from Central Bank of Madagascar http://www.banque-centrale.mg/index.php. We used this rate specifically, since the fuel prices we use belong to June 2014, as this was the date for the last report published on pricing structure of fuel products on OMH’s website.

The fuel prices for June 2014 are 3560, 2860 and 2355 Ariary for gasoline, diesel and kerosene respectively, as obtained from OMH’s website. These prices are converted into USD using June 2014 exchange rate.

For all the calculations household weights are used. As household weight we used the variable popW.

Total Consumption and Fuel Consumption

The main datafile is MdgTables.dta and it was merged with other variables from other datasets when necessary. The consumption aggregate and per capita consumption variables were already calculated in this dataset that we received from UNICEF.

- Variable name for consumption aggregate: consoAggregate
- Variable name for per capita consumption: consopc

While per capita consumption quintiles were also already calculated in the dataset, in the Readme file that was sent over with the data files some problems were mentioned. Hence instead of using the already calculated variable, we recalculated per capita consumption quintiles using consopc and the code below:

```
xtile quintile_new=consopc[w=popW], n(5)
```

For fuel consumption, data is obtained from the data file DepensesB.dta.

We kept the variables that have the codes in qms15bg00 of gasoline, diesel and kerosene.

- Gasoline is coded as 92 (essence)
- Diesel is coded as 94 (gazole)
- Kerosene is coded as 95 (petrole)

We calculated annual consumption using the answers to questions on monthly expenses. The question on the amount of liters consumed is “Quelle est la quantité achetée de cet ..[ARTICLE].. en moyenne par mois ?” corresponding to the variable qms15bg07 and the question on the amount of money spent per month is “Combien avez-vous dépensé en moyenne par mois pour cet ..[ARTICLE]..?”. corresponding to the variable qms15bg06. These values are multiplied with 12 in order to come up with the annual values.
In order to calculate per capita values we divided these values with HHSIZE variable which was also already calculated in the dataset MdgTables.dta.

**Other variables**

Transportation costs are obtained from the dataset DepensesC.dta. Public transportation (Frais de transport public (Voyages)) is coded as 126 in the variable qms15cq00. In order to calculate yearly expenses we used the question on expenses that have been made in the last month and multiplied it with 12. The question asks “Combien avez-vous dépensé au total pour .../[ARTICLE/ DÉPENSE]... les 30 derniers jours?” and corresponds to the variable qms15cq03.

Number of children is calculated using Demographie.dta dataset. This dataset includes information on the ages of the household members. We calculated the number of children in the household for children aged 0-14, 0-4 and 5-14. The variable that captures age is qms01q06.

Information on household durables is obtained from Durables.dta. This dataset includes information on ownership of cars, motorcycles and tractors which we were interested in. For a car, variable qms09q00 was coded as 161, for a motorcycle it is coded as 162 and for a tractor it is coded as 173. If the household also reported that it has this asset then variable qms09q01 is coded as 1 (Yes). This variable corresponds to the question “Le ménage possède-t-il [ARTICLE] ?” in the questionnaire.

Information on the primary source of lighting and primary source of cooking fuel were obtained from the dataset Habitation.dta. The relevant variables are qms06q24_1, qms06q24_2 and qms06q37 for primary fuel source for cooking, secondary fuel source for cooking and source for lighting respectively. The question for lighting is “Quelle est la principale source d'éclairage pour votre logement ?” and the question for cooking fuel is “Quels sont les deux principaux combustibles utilises?”.

Number of children registered to school is calculated using the information on Education.dta. We made use of the question “Est-ce que (NOM) était inscrit à l'école pour l'année scolaire 2011-2012 ?” corresponding to the variable qms03aq09 to find the number of registered children in the household. Since this dataset does not include ages, we first merged the age data and then counted only the children aged 5-14.

Education expenses are also obtained from the same dataset. These expenses correspond to the variables qms03bq02-qms03bq13 in the dataset and annual expenses for each individual. Names of each education expense are “Droits de scolarité”, “Cotisations FRAM”, “Assurance (PASCOMA)”, “Frais de scolarité ou écolages”, “Uniformes scolaires”, “Linges de sports”, “Livres”, “Fournitures scolaires”, “Transport pour l'école”, “Nourriture”, “Autres Dépenses” and “Quel est le montant global non ventilé des dépenses scolaires pour (NOM) pour l'année scolaire 2011-2012 ?” if questions 2-12 are unfilled.

Health expenses are obtained from DépensesC.dta. For the health expenses qms15cq00 is coded as 97-105. The names of these expenses are “Médicaments traditionnels”, “Médicaments
pharmaceutiques”, “Appareils et matériels thérapeutiques”, “Frais de consultation des praticiens modernes”, “Frais d’analyse médicale”, “Frais de consultation des guérisseurs”, “Frais de transports”, “Frais d’hospitalisation”, “Autres dépenses de santé”. In order to come up with annual household expense we multiply the value on qns15cq03 with 12 for each of these items and added them together to come up with the annual household health expenditure.

**Benefit incidence**

Per capita subsidies are calculated by multiplying per capita fuel consumption (in liters) with prices of fuel as reported by OMH on June 2014 and then multiplied by the necessary price increase. In other words this is equal to multiplying the fuel consumed with the price gap. For example, for gasoline prices the code is as follows:

```
  gen pcbenefit_gasoline=mGasoline_pcQ_annual*0.1011*Gasoline_OMHprice
```

Total subsidy accruing to each quintile is calculated by multiplying total household consumption with the price gap and then the household weight, this amount is then summed up for all households in each quintile.

```
  gen hhbenefit_gasoline=(mGasoline_Q_annual*0.1011*Gasoline_OMHprice*popW)/1000000
```

**Impact of price increases**

For each price increase scenario, the subsidy per person is subtracted from per capita consumption level. When there is a price increase in diesel prices, transport costs per capita were assumed to increase by half of the increase in diesel prices. The calculation for the first scenario when all prices increase is as follows:

```
  gen pcexp_new_a=consopc-(mKerosene_pcQ_annual*0.1125*Kerosene_OMHprice)-
     (mGasoline_pcQ_annual*0.1011*Gasoline_OMHprice)-
     (mDiesel_pcQ_annual*0.2168*Diesel_OMHprice)-(Transport_pcCost_annual*0.5*0.2168)
  replace pcexp_new_a=0 if pcexp_new_a<0
```

**Reallocation scenarios**

Subsidy per child is calculated by dividing the total subsidy to total number of children. Then new per capita expenditures are calculated by first subtracting the fuel subsidy and then adding the child subsidy. The equation is as follows for the first scenario where all prices increase and child subsidy is distributed to all children aged 0-14:

```
  gen pcexp_new_c=consopc-(mKerosene_pcQ_annual*0.1125*Kerosene_OMHprice)-
     (mGasoline_pcQ_annual*0.1011*Gasoline_OMHprice)-
     (mDiesel_pcQ_annual*0.2168*Diesel_OMHprice)-(Transport_pcCost_annual*0.5*0.2168)
  replace pcexp_new_c= pcexp_new_c + (subsidy_child*num_child) if num_child!=0
  replace pcexp_new_c=0 if pcexp_new_c<0
```