

Libya

Incidence and Reform Impact Analysis of Food and Energy Subsidies from Households' Perspective

Abdelkrim Araar
Nada Choueiri
Paolo Verme

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EXECUTIVE SUMMARY

The Libyan authorities have announced their intention to eliminate subsidies and replace them with cash transfers. Subsidies cost more than 10 percent of GDP to the government budget in Libya. They are not targeted to the vulnerable population and the extremely low subsidized prices create significant waste (through overconsumption or smuggling) and economic inefficiencies. The cost of energy subsidies in particular dwarfs that of food subsidies partly because they are universal.

To inform the government's subsidy reform plans, this paper provides a distributional analysis of food and energy subsidies and simulates the impact of price increases on household expenditure, on poverty, and on the government's budget. We apply the SUBSIM program to Libya's 2007/8 Household Consumption Survey data to assess the benefit that different population quintiles derive from subsidies; the cost of subsidy reforms (in terms of changes in expenditure and poverty) to the different quintiles; and the gain to the government from increases in prices of subsidized goods. Our analysis focuses on the direct effects of subsidies on households, which constitutes only part of the information needed to develop a good reform plan. More work will be needed to assess the impact of subsidies on productive sectors, as well as the existing social safety nets and mechanisms to distribute cash transfers, among other things.

The Libyan household survey data depict a fairly equal distribution of expenditure, with a Gini coefficient of 30. The benefits from subsidies are therefore more equally distributed across population quintiles in Libya than in other countries in the region. This, and a quota system for food subsidies, ensures that the latter are relatively progressive. However, we estimate that about 35% of government spending on food subsidies does not reach directly Libyan citizen, which in itself would call for reform. Indeed we find that total direct benefits to the Libyan population from food subsidies amounts to 1.3 billion LYD (compared to over 2 billion spent in the government budget in 2012). A similar proportion of “waste” is believed to characterize the energy subsidy program as well.

Subsidy reform would have a relatively bigger adverse impact on the poor than on the rich, and this gap would be significantly wider for food than it would be for energy subsidy reform. Eliminating subsidies would lead to significant prices increases—in the order of 11-fold for rice and flour, 26-fold for bread, and 7- to 8-fold for diesel, gasoline and electricity. Population in the poorest quintile would face a direct expenditure loss of 19 and 24 percent from food and energy subsidy elimination respectively. The corresponding losses to the population in the richest quintile would be 5 and 17 percent.

The poverty impact of subsidy reform would also be significant but could be mitigated through cash transfers. A 30 percent reduction in food (or energy) subsidies would raise extreme poverty (measured at under \$1.25 per day) by 2 (or 2.7) percentage points, from 8½ percent currently, through direct effects on household expenditure. If food (or energy) subsidies were fully eliminated, poverty would rise to 16.6 (or 21.7) percent. A cash transfer of LYD 175 per capita per year to the population in the first quintile would be sufficient to maintain the poverty rate unchanged following an elimination of food subsidies. This would cost the government LYD 340 million a year and would leave a net gain of LYD 943 million to the government budget. In the case of energy subsidies, the corresponding value of annual cash transfers that would be needed to compensate for the increase in poverty (resulting from direct effects on household spending) would be LYD 295 per capita to the bottom quintile (or LYD 245

per capita to the bottom two quintiles). The corresponding annual cost to the government budget would be LYD 571 million and LYD 845 million respectively.

While more analysis is needed to help develop a suitable subsidy reform plan, the results of this paper suggest a number of broad recommendations. The complete elimination of all subsidies in one stroke with no compensation to households could result in a sharp increase in poverty and could affect the middle-class severely.¹ This, in turn, could lead to social unrest. If the government opts for this type of reform, an adequate communication strategy targeted to all stakeholders—something needed for any type of reform—would become even more critical. A less drastic approach would be to reduce subsidies in sequential steps over an extended period of time. Countries such as Tunisia have followed this approach, achieving significant budget savings without social unrest. An alternative option would be to combine the elimination or reduction of subsidies with targeted cash transfers. Compensation could be provided to the bottom 20 or 40 percent of households in the form of coupons or cash transfers. Such reforms could result in significant budget savings and no increases in poverty. However, the difficulty of this approach resides in the correct targeting of households, and specific systems would need to be put in place to ensure such targeting is operationally feasible. If the country does not have in place such effective systems, targeted subsidies may result in substantial waste of resources. It is also advisable to implement reforms one product at a time starting with the products that affect the poor the least, although the authorities may want to weigh in other considerations as well, for example the importance of not delaying reforms where substantial waste is clearly established. Other things equal, this generally implies to start with petroleum products rather than food products and to start with gasoline rather than gas LPG. The report provides all the necessary information to make a choice on priority products based on the importance of each product for different groups of households.

¹ This paper's analysis doesn't take into account new transfers enacted by the GNC over the past months (such as transfers to heads of households and transfers for minors). A complete picture of the impact of subsidy reform on poverty and the middle class will require including these in the assessment, prior to finalizing any reform plans.

I. Introduction

Subsidies have multiple economic drawbacks. Their cost often imposes a heavy burden on government budgets, squeezing essential social or capital expenditure. Although governments seek to protect consumers, particularly the vulnerable ones, through subsidies, often the vulnerable would be better off if government spending on subsidies is rather allocated to more efficient programs that better target the needy. Indeed, in many countries, subsidies (particularly energy subsidies) can be regressive, reinforcing inequality. Subsidies create distortions not only in government budgets but also throughout the economy. They encourage over-consumption and smuggling and, in the case of energy subsidies, they encourage excessive reliance on energy-intensive industries (which leads to resource misallocation and does not necessarily foster job creation) and stifle investment in renewable, cleaner forms of energy.

These considerations are particularly relevant for Libya. The country has maintained a pervasive subsidy system for decades during which the state had been funding up to 93 percent of the value of basic commodities, notably fuel. Subsidies have not been the only source of economic distortions in Libya under Gadhafi's rule. Ad-hoc policies (most prominently property confiscations, for example) have also created distortions that continue to impact Libya's economy today. But subsidies impose a significant and visible cost to the budget—around 10 percent of GDP on average during 2010-2012²—at a time when sizable developmental and social needs require significant resources to put Libya's economy on the right track (Chami et al, 2012; Charap, 2013). They are also, for Libya's policymakers today, an obvious source of waste of resources, with 40 percent of subsidized products believed to be wasted or smuggled, feeding corruptive practices.³ For these reasons, the government announced its intention to replace subsidies with cash transfers and instructed a committee headed by the Ministry of Economy to propose reform options to that effect. The main stated goals of the reform include better targeting of government resources to those that need them most, in addition to improving price signals in the economy, and eliminating waste, corruption and smuggling.

This study helps the authorities assess reform options by providing a distributional analysis of food and energy subsidies and by simulating the impact of price increases on household expenditure, on poverty, and on the government's budget. Using the 2007/8 Household Consumption Survey data, we assess the benefit that different population income groups derive from subsidies; the cost of subsidy reforms (in terms of changes in expenditure and poverty) to the different segments of the population; and the gain to the government from increases in prices of subsidized goods. This information is essential: since the authorities' goals include better targeting of public resources to the most needy, it is important to try to specify the needs of this group of the population, as this study does.

This paper contributes only a few elements to the information set required to put in place subsidy reform; much more work and preparation will be needed for the authorities to prepare a reform agenda. In particular: (a) it would be important to assess, in the context of the existing formal and informal support mechanisms in Libya, whether a new cash transfer system is really needed to compensate for

² This is much higher than neighboring non-oil producers: Morocco's and Tunisia's subsidy bill reached 6.6 percent of GDP and 5 percent of GDP respectively in 2012. But it is dwarfed by Algeria's subsidy costs which were about 16 percent of GDP in 2012 (Verme et al 2014).

³ The 40 percent is quoted in "Study to Replace Subsidies with Cash Transfers" unpublished paper authored by a Libyan inter-ministerial committee tasked to examine the issue of subsidy reform.

subsidy reform and, if so, how best to introduce it in the context of existing social safety nets; (b) actual mechanisms to disburse the transfers might need to be put in place; (c) a strategy for phasing out the transfers may also be needed, particularly if targeting cannot be achieved; and (d) broad consultation needs to be conducted with all sectors affected by the reform to address if need be negative impacts and pave the way through communications for a successful implementation of the reform. These aspects are all beyond the scope of this study but will need to be tackled in due course.

The paper is structured as follows. In the next two sections, an overview of Libya's food and energy subsidy program is presented, and the pros and cons (and challenges) of alternative approaches to subsidy reform are briefly discussed, drawing on other country experiences. An explanation of the methodology adopted in the paper follows. Sections V and VI present the results for food and energy subsidies respectively. Section VII concludes.

II. Libya's Food and Energy Subsidy Program

Libya's ample subsidy program dates back to the early 1970s. It covers a number of food and energy products, as well as public services (water, sanitation, and garbage collection), medicines and animal feed. Food and energy subsidies alone have cost about 9½ billion dinars in 2012 (about 9.2 percent of GDP).⁴ This represents 85 percent of the budget costs from subsidies, with the residual 15 percent incurred from subsidies on the other services and products listed above. This is one of the highest figures in the North-Africa and Middle-Eastern (MENA) region and represents a heavy burden for Libya's new government, as many within (and outside) the country recognize (Zaptia 2013).

Energy and food subsidies in Libya follow different systems but are both very generous. All energy products are universally subsidized, at rates exceeding 85 percent of the products' market value (Table 1).

Table 1: Energy Subsidies in Libya

	Subsidized price (Libyan Dinars per liter)	Market price (Libyan Dinars per liter)	Subsidy (percent of the market price)
Gasoline	0.150	1.072	86
Diesel	0.150	1.110	86
Electricity	0.020	0.156	87
LPG	2.000	20.939	90
Kerosene	0.090	1.089	92

Source: Libyan Authorities and Bank staff calculations. Market prices refer to first quarter 2013.

Food subsidies, similarly large in magnitude, are not universal but rather administered under a system of individual quotas regulated by the Ministry of Economy. Subsidized food products are made available in fixed per-capita quantities at cooperatives throughout the country, except for subsidized flour used to bake bread which is distributed to bakeries directly. Quotas are identical for all individuals, and have remained unchanged for more than a decade. The quantities are very generous and exceed an individual's

⁴ Preliminary data on government spending in 2012 indicated that food, electricity, and other energy subsidies cost respectively 2.1 billion, 1.1 billion and 6.3 billion dinars to the budget.

nutrition needs⁵. As indicated in Table 2, the quantities allowed generate about 4570 calories per person per day—more than double the level recommended by the WHO or the FAO. Initially, 8 food products were made available under this system: flour, wheat, barley, rice, oil, sugar, tea and salt. But the list gradually increased over the years, to include items like pasta, coffee, tomato paste, etc.

Despite some attempts to control the food subsidy system, significant leakages and abuse are believed to occur. Individuals need to be members in a cooperative to be able to shop there. However, individuals are also able to buy these goods on the free market at liberalized prices, so not all Libyans are cooperative members. In particular, most well-off people do not apparently shop at the cooperatives. Nonetheless, while there are no centralized membership records or other mechanisms to control “double-dipping”, it is reported that the total number of cooperative members in the country even exceeds the population size.

There have been attempts at subsidy reform in the past. In the early 2000s, following the removal of international sanctions, Libya embarked on a reform path to modernize and open up its economy (Vandewalle 2011), and cutting subsidies was an important part of that program (Wahby 2005). Despite widespread opposition among the population, the government proceeded with the reform, raising fuel, diesel, and electricity prices in 2005 and completely liberalizing the price of some food products. By 2006, only 4 food products were still subsidized: flour, rice, semolina and pasta. In 2007, the government also eliminated the subsidy on pasta, leaving only 3 food products subsidized, and, in compensation, tried to put in place a transfer system of 4 dinars per capita per month. However, the government was unable to dispense this cash transfer. Still, subsidies remained restricted to the 3 items just listed, until early 2011 when Colonel Gadhafi, in an attempt to quell the revolutionaries’ demands, extended food subsidies back again to 13 items (Table 2).

Table 2: Food Subsidies and Quotas

	Subsidized price (Libyan Dinars per kg*)	Market price (Libyan Dinars per kg*)	Subsidy (percent of the market price)	Quota Enforced (in kilograms* per person per month)					Generated calories (per person per day)
				2008	2009	2010	2011	2012	
Flour for individuals	0.090	1.030	91	3.00	3.00	3.00	3.00	3.00	407
Flour for bakeries	0.037	0.959	96	12.00	12.00	12.00	12.00	12.00	1628
Yeast for bakeries	1.350	5.345	75	not subsidized	not subsidized	not subsidized	0.06	0.06	...
Semolina	0.080	0.911	91	1.00	1.00	1.00	1.00	1.00	137
Rice	0.140	1.559	91	2.50	2.50	2.50	2.50	2.50	347
Sugar	0.250	1.318	81	not subsidized	not subsidized	not subsidized	2.00	2.00	1067
Tea	1.500	5.097	71	not subsidized	not subsidized	not subsidized	0.20	0.20	13
Pasta	0.200	1.394	86	1.50	1.50	1.50	1.50	1.50	206
Vegetable oil	0.600	3.402	82	not subsidized	not subsidized	not subsidized	1.50	1.50	173
Tomato paste	0.600	2.141	72	not subsidized	not subsidized	not subsidized	1.00	1.00	433
Milk for children	7.500	12.250	39	not subsidized	not subsidized	not subsidized	3.20	3.20	...
Milk, condensed	0.975	2.622	63	not subsidized	not subsidized	not subsidized	1.23	1.23	159

* For vegetable oil the unit is liter

Source: Libyan Authorities; FAO (2003); and Bank staff calculations.

⁵The quantities provided within the quota system are not negligible. For example, a family of four is entitled to the following quotas at subsidized prices each month: 8 kg of sugar, 800 gr. of tea, 4 kg of tomato paste, 6 liters of vegetable oil, 10 kg of rice, 12 kg of flour, 4 kg of semolina and 6 kg of pasta. These quantities are not small and can cover well above the total amount of calories necessary for a family of four for a period of one month.

III. Alternative Approaches to Subsidy Reform and Challenges⁶

It is helpful to weigh alternative options when considering subsidy reform. The Libyan authorities have announced the goal to eliminate subsidies and replace them with universal cash transfers, but subsidy reform could also take other forms. It is useful to briefly consider these possibilities to elicit a discussion on what would be the best feasible reform model for Libya. Thinking through the various options and debating their pros and cons can be helpful in building consensus for the chosen reform path and designing it successfully. Looking at alternatives may also be useful since different reform options and different implementation timeframes can be followed for different subsidized products, in the context of one broad strategy.

In general, subsidy reform can have up to three main components: (a) a plan for changing (increasing) the price of the subsidized product; (b) a plan for compensation (if any) to alleviate the impact on segments (or all) of the population; and (c) a plan to communicate the motivation and modalities of the reform to facilitate successful implementation and buy-in. The price change can be gradual, over a number of months or years, or it can be a one-step permanent change. The final price can be fully liberalized, or it could be set according to a clear and transparent formula with a preannounced adjustment timetable. When there are no plans to compensate for price increases, it is advisable that such increases be gradual enough to allow the economy to adjust smoothly, particularly when subsidies are initially extremely large. If compensation is granted, however, then it would be prudent to carefully design it to benefit those in need rather than replicate the inefficiencies of the subsidy system, and in order to minimize budgetary costs. To achieve that, the cash compensation could either be targeted to, say, the bottom 40% of the population only; or, if targeting is not possible, then compensation could be universally dispensed but the amount could be calibrated to fit the needs of the poorest, say, 40 percent, rather than the average population needs. In all cases, the reform needs to be carefully prepared through a well-designed communication strategy, and could usefully be accompanied by efforts to upgrade public services to make rising prices more acceptable to the public.

Country experiences show the importance of tailoring subsidy reform to the country's specific circumstances. A number of countries in Europe and Central Asia have gradually liberalized subsidized prices without any compensation in return, and these reforms were generally successful because the public was well-prepared; and because price increases were gradual, were implemented in the context of reforms that improved governance and delivery of public services, and mostly in the context of existing (or strengthening) social safety nets. In the Middle East, subsidy reforms have often been accompanied by some form of cash compensation scheme⁷, and have also been usually introduced in phases. But it has not always been easy to strike the right balance between budgetary savings and compensation to the population in designing the cash schemes. In Iran, the first major energy exporter to embark on a wide-ranging subsidy reform, universal cash transfers were granted⁸, together with targeted assistance to some

⁶ This section draws mostly on Alleyne et al (2013), Clements et al (2013a and 2013b), Vagliasindi (2012 and 2013) and World Bank (2010).

⁷ In some cases where price increases were not accompanied by cash compensation, explicit policy statements were made towards the goal of improving the targeting of existing social safety nets.

⁸ Initially the plan was to put in place targeted transfers but these proved technically difficult to implement and the government opted for universal transfers instead, declaring the intention to move to targeted transfers in a second phase (Guillaume et al, 2011).

7000 enterprises to help them restructure and cope with higher energy prices, as well as financial support to government entities. This compensation scheme, however, ate up all budgetary savings from higher prices.⁹ The reform was conceived to reduce subsidies to a level of 10% of market prices over a 5-year period, but subsidy reform was put on hold in 2012, two years after the reform started, for a number of reasons including concerns about macroeconomic stability and the large financing needs of cash transfers, in the context of strict economic sanctions that were imposed on Iran at the time.

Different targeting principles have been applied by countries that combined price reforms with cash transfers. A successful reform took place in Indonesia in 2005, for example, when diesel and kerosene prices were substantially increased. Targeted monthly cash transfers to the poorest 35% of the population helped ease the impact of the reform, and the savings to the budget also allowed the government to finance programs in education, rural development, and health. Another reform with targeted compensation is now taking place in Jordan: a wide-ranging subsidy reform program was initiated in late 2012 when all fuel prices were liberalized except for LPG (whose price was increased by 54 percent, nonetheless) and a monthly price adjustment mechanism was restored in January 2013 to prevent the recurrence of subsidies over time. To mitigate the impact, a cash transfer generously targeting about 70% of households was implemented simultaneously with the price increases. The reform was introduced in the context of a strong and clear communication plan that helped moderate public opposition. The next phase of the reform plans to tackle utilities' prices and performance, starting with the electricity company.

Country experiences suggest the following broad lessons from these and other reform episodes. A successful reform is one that is appropriately planned and in detail, with careful sequencing and phasing of price increases; and that is clearly and convincingly explained and debated in public to ensure the population's buy-in. Increased transparency in pricing and improved social safety nets to protect the poor are also essential elements for sustainability and success of the reforms, particularly if they entail large price increases. If there is no efficient structure for social safety nets already in place, then enough time needs to be allocated to putting such a framework in place, for it to be operational at the same time as the price reforms are introduced. In the energy sector, broader structural reforms to improve service delivery and efficiency are essential to the sustainability of subsidy reform.

IV. A Word on the Methodology and Data

This paper uses SUBSIM to provide a distributional analysis of food and energy subsidies (incidence analysis) and a simulation analysis of subsidy reform (impact analysis) for the year 2013 focusing on household and government expenditures. SUBSIM is a simple model that utilizes data on prices and household consumption surveys to evaluate the impact of subsidies and subsidy reform proposals on household spending and the government budget.¹⁰ As such, the approach only provides a partial analysis

⁹ Iran's *Subsidy Reform Act* stipulated that households would receive at least 50% of the budgetary savings resulting from the reform, with another 30% allocated to help Iranian companies cope with the higher prices and the remaining 20% allocated to government entities for the same purpose. However, upon implementation, the share of support going to households exceeded half of budgetary savings, squeezing out the remaining sum available for the productive and government sectors.

¹⁰ For details on the theoretical framework underpinning the model, see Araar and Verme (2012).

of subsidies and cannot cover broader macroeconomic effects, in particular those on productive sectors, which would require a general equilibrium approach that goes beyond the household sector to incorporate other agents in the economy.

The model can distinguish between direct and indirect effects of subsidies (and subsidy reforms) on households and the government budget: direct effects represent the impact of subsidies that fall on a final product, that is a product directly consumed by households, whereas indirect effects represent the impact of subsidies that fall on an intermediate product, that is a product that serves as input to the production process of another product. Direct effects are captured using household expenditure survey data, but indirect effects cannot be measured on the basis of these data alone, they also require data on input-output relationships between products to trace the link from a subsidized intermediate product to final products.

This paper's quantitative estimates only capture the direct effects of subsidies, which we believe isn't a major obstacle for the case of food subsidies. There were no input-output data for Libya with the required level of detail to analyze indirect effects, hence their exclusion. This is not a major problem in the case of food subsidies, since indirect effects are likely negligible: except for flour (and, to a lesser extent, sugar), subsidized food products are not usually inputs to the production processes of other goods.¹¹ Moreover, because food subsidies in Libya are subject to a quota system that limits access to them, the share of subsidized food products that could end up being used in the production of other goods is likely negligible.¹² For example, although sugar can be an input to the production of many processed food products, the quota system in place makes it unlikely that sugar used in food production is actually bought at subsidized prices.¹³ We will therefore assume that indirect effects are relatively small as far as food subsidies are concerned.¹⁴

The treatment of bread in the analysis requires a number of assumptions. We have information on subsidized price and quantities of flour (and yeast) for bakeries, both of which are supposed to be used in making bread, but we have expenditure data for households on bread. Consequently, our analysis needs to be done on bread purchases and we translate the flour subsidy into a bread subsidy as follows. We estimate that 1kg of bread requires 1 kg of flour, and given disparate prices of bread across bakeries in Tripoli we assume that a 100-grammes baguette is sold for 5 Libyan cents. Therefore, the price of a kilogram of bread is 0.5 Libyan dinars. We are therefore able to map the household expenditure on bread into first a quantity of bread (using the 5 Libyan cents per 100-gramme baguette) and then into a quantity of flour, and present these information under the heading “Flour_bread” in the tables below.

¹¹ Anecdotal evidence suggests that because not all households actually take advantage of the quota system for their food purchases, some of the surplus subsidized food ends up being used as cattle feed, or input to the production of sweets in bakeries for the case of flour. However there are no data available to quantify these observations.

¹² A share of subsidized food products is reportedly smuggled and sold illegally in supermarkets, thereby depressing market prices, so some effect from removing subsidies on these products may filter through to market prices, but that effect is likely very small. Also, because of the quota system, we assume no significant impact of subsidized food prices on prices of restaurant meals—otherwise this would have been a main indirect effect to consider in the analysis of food subsidies.

¹³ Except if sugar destined to be sold in cooperatives is smuggled, in which case its price would be higher than subsidized sugar prices but lower than the market price. However, the difference is likely negligible. At any rate, relevant data is not available to factor in such a possibility.

¹⁴ We note here that this paper's analysis does not capture the administrative costs of subsidies, which may be large given the system of quotas administered through cooperatives.

While it is reasonable to assume that indirect effects are small in the case of food products, they are likely to be significant in the case of energy products. This is because energy subsidies in Libya are universal and very large in magnitude, and energy—electricity for power, fuel for transport, etc.—is a non-negligible input in a number of production processes. Subsidies on gasoline, diesel and electricity also benefit enterprises, enabling them to keep their output prices low. This means that households also benefit indirectly from subsidies on inputs used by local enterprises. The effect of increasing energy prices on consumer prices in general is likely large, particularly if producers pass on the associated increases in production costs to the consumers. Because of lack of detailed data (by subsidized energy product) on input-output matrices for the Libyan economy we are not able to estimate these effects in this paper. Similar analyses for neighboring countries like Morocco and Tunisia showed that indirect effects can be as high as direct effects, which could be used as broad benchmark for incorporating indirect effects in analyzing the results for Morocco (Box 1). A word of caution is needed, though. Many features differentiate Libya from Morocco or Tunisia: Libya is an oil producer, where subsidies are now much higher than the level at which they started out in neighboring countries, and the structure of the productive sectors is very different from that of these two neighboring countries.

The analysis is based on the 2007-08 Libyan Household Expenditure Survey (LHES), extrapolated to 2013. This survey is the most recent household expenditure survey administered by the national statistical agency, and the only survey available in Libya today for this type of analysis. To derive results applicable today, these data are projected from 2008 to 2013 using official population estimates for 2013 and IMF estimates for inflation and real GDP growth for the period 2008-2013 (Table 3). All population and expenditure estimates reported henceforth are therefore for the year 2013 at current values.

Table 3: Macroeconomic Statistics

	2007	2008	2009	2010	2011	2012	2013
Gross domestic product (in billions of LYD/constant prices)	44.5	45.7	45.3	47.6	18.1	36.9	44.4
Inflation (average percent change in CPI; base year 2003)	112.0	123.7	126.7	129.8	150.5	159.6	162.8
Population (in millions)	6.0	6.2					6.4

Source: International Monetary Fund, World Economic Outlook Database, April 2013, and Libyan authorities.

The survey data suggest that Libyan households are large and their aggregate consumption is a low share of GDP (Table 4). Libya has a small population, estimated at just below 6.4 million people and about one million households. Aggregate annual household expenditure is estimated at 12.5 billion LYD, implying that annual expenditure per capita is about 1,967 LYD. Households that belong to the bottom two quintiles (households with the lowest 40% expenditure shares of the population) are very large in size, at 9.5 and 7.4 members per household respectively. On average, these household sizes are larger than those in neighboring countries. For example, household size in Morocco is 6.5 for the first quintile and 5.9 for the second quintile, while in Tunisia these figures are 5.8 and 5.0 respectively. Second, aggregate household expenditure is only about 12% of GDP.¹⁵ This is atypical of the North-African region, where surveys indicate that household expenditure is usually around two-thirds of GDP; but it is not totally surprising when we look at comparative data for other oil rich countries such as Qatar, Saudi

¹⁵ Although no data are available, hydrocarbons are believed to constitute about two-thirds of GDP in Libya. This suggests that estimated aggregate expenditure could be about 35 percent of non-oil GDP.

Box 1. Examples of Indirect Effects of Subsidy Reform in Other Countries

This box summarizes the results found in studies that quantified indirect effects of energy subsidy reform in other countries. We focus in particular on studies of subsidy reform in Morocco and Tunisia because they are based on the latest SUBSIM model, the same model used in this paper.¹⁶ SUBSIM makes use of input/output tables to trace the indirect effects of subsidized input price changes on goods produced in the economy. In addition, for illustrative purposes, since Libya's economy differs from Morocco's or Tunisia's by virtue of its heavy reliance on hydrocarbons, we also summarize the results of empirical studies that used different methodologies to gauge the indirect effects of subsidy reform.

These studies find that raising energy prices has a significant impact on the prices of a wide range of consumer goods. In the case of Tunisia and Morocco, the subsidy underlying pre-reform energy prices varied significantly across energy products. A reform plan that would fully eliminate energy subsidies¹⁷ would imply an important increase in energy prices—by, on average, 48.75 percent in Morocco, and 37.7 percent in Tunisia. However, this is much smaller than the 90 percent increase in energy prices required to eliminate energy subsidies in Libya. The resulting impact on non-energy consumer products (which is the driver for indirect effects of higher energy prices on consumers) ranges from zero to about 8 percent for Tunisia and from zero to about 15 percent in Morocco. A simple extrapolation of these results would suggest that eliminating energy subsidies in Libya could cause increases in non-energy consumer prices by up to 20-28 percent.

These indirect effects on consumer prices cause a decline in household spending broadly comparable to the decline due to direct effects. The text table below shows the impact of these indirect price effects on per-capita spending relative to the direct impact of energy price increases. For both Morocco and Tunisia, the indirect effect is much smaller than the direct effect for the upper quintile, and it is highest (relative to the direct effect) for quintiles 2 and 3. In particular, an individual belonging to the most upper quintile would suffer a loss from higher prices of non-energy products he/she consumes that is about 75 percent of the loss suffered from the direct impact of higher energy prices. In other words, the basket of non-energy products consumed by upper quintiles is relatively less energy intensive than its comparator for lower quintiles. On average, however, an individual will suffer a loss in real expenditure from indirect effects of energy price increases that is close to 90 percent of the loss experienced following the increase of energy prices he/she directly consumes.

Other studies that use different methodologies also give some insights. Del Granado and others¹⁸ review the evidence provided by case studies of energy price reform carried out by the IMF and the World Bank between 2005 and 2009 across 20 countries in Africa, Asia, the Middle East and Latin America. Based on the results from these studies, they calculate that a \$0.25 decrease in the per-liter energy subsidy causes in average a 6 percent decline in real income for all population groups, about 56 percent of which is explained by indirect effects. This impact varies widely across countries, ranging from 3.8 percent in South and Central America to 9.6 percent in the Middle East (represented by two countries in the sample, Jordan and Lebanon). They also calculate that indirect effects are about 1.27 times direct effects on average, but with significant variation across countries: the ratio is 0.72 for the Middle East¹⁹, 0.54 for Asia-Pacific countries, but 1.9 for African countries in their sample. This wide range of results underscores the importance of country specific analysis to gauge the size of indirect effects.

Morocco and Tunisia: Indirect Effects on Per-Capita Expenditure from Eliminating Energy Subsidies
In percent of direct effects (SUBSIM based estimation)

	Morocco	Tunisia
Quintile_1	80.02	112.15
Quintile_2	95.81	118.43
Quintile_3	100.63	113.34
Quintile_4	98.33	92.80
Quintile_5	76.33	73.58
Population Average	86.17	88.60

¹⁶ Araar and Verme, 2014. "Indirect Effects of Energy Subsidy Reform in Tunisia and Morocco", unpublished.

¹⁷ The energy products considered in the Morocco and Tunisia studies are gas LPG, gasoline, and diesel.

¹⁸ Del Granado et al, "The Unequal Benefits of Fuel Subsidies: A Review of Evidence for Developing Countries", IMF Working Paper No 10/202, September 2010.

¹⁹ Specifically, the ratio of indirect to direct effects is calculated at 1.18 in Jordan and a much lower 0.4 in Lebanon.

Arabia and Algeria.²⁰ Household final consumption is essentially a small fraction of output as a whole because oil dominates the economy (producing more than two-thirds of GDP) but only a small share of oil proceeds accrues to households via wages and public transfers.

Table 4: Household statistics projected to 2013

	Population (persons)	Number of households	Household size (persons)	Total expenditures (LYD)	Expenditures per capita (LYD)	Expenditures per household (LYD)
Quintile_1	1,936,699	203,399	9.5	1,842,216,192	951	9,057
Quintile_2	1,512,025	203,373	7.4	2,288,316,928	1,513	11,252
Quintile_3	1,264,391	203,346	6.2	2,580,271,872	2,041	12,689
Quintile_4	992,019	203,392	4.9	2,745,245,952	2,767	13,497
Quintile_5	666,346	203,331	3.3	3,077,710,080	4,619	15,136
Total	6,371,480	1,016,842	6.3	12,533,761,024	1,967	12,326

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

In what follows, the incidence and impact analyses are presented separately for food products (Section V) and energy products (Section VI). The analysis is conducted separately because of the different subsidy systems (universal for energy but quota-based for food), which require a different set-up of the SUBSIM model. Also, differences in the relative importance of indirect effects (as noted above) call for a different approach to interpreting the results.

V. Incidence and Impact Analysis for Food Subsidies

Food subsidies have significantly increased in recent years, imposing a toll on the government's budget. Data from Libya's Price Regulation Fund show that the nominal cost of food subsidies has increased from under 175 million LYD in 2001 to over 2 billion LYD in 2012. Over the years, the basket of goods subsidized has seen some variation, from a minimum of 3 to a maximum of 13 products; only flour, semolina, and rice have been consistently subsidized throughout the last decade. At the outbreak of the revolution, all items listed in Table 2 were reintroduced as part of the list of subsidized food products. This led to a significant increase in the cost of food subsidies since the period immediately before the 2011 revolution—from 1.1% of GDP in 2010 to 2% of GDP in 2012 (Table 5). As share of government expenditure, food subsidies also doubled from 2 to 3.8 percent between 2010 and 2012. Flour, sugar, rice, vegetable oil and semolina capture the lion share of the cost of food subsidies to the government.

The distribution of food subsidies

In this section, we show that while food subsidies are relatively progressive, a third of their cost to the government budget is not benefiting households directly. Below, we quantify the size of subsidies received by households at different income levels. The results suggest that food subsidies are relatively progressive in Libya, mostly thanks to the quota system by which they are administered. However, the total cost of food subsidies that reach households is estimated at less than 1.3 billion LYD, equivalent to 65 percent of the budgetary costs for these subsidies incurred by the government in 2012. The difference

²⁰ <http://data.worldbank.org/indicator/NE.CON.PETC.ZS>.

is mostly explained by “leaks” from the subsidy system, including waste from illegal resale of subsidized items outside of the quota system at close-to-market prices. This significant waste would constitute a strong argument for reforming food subsidies.

Table 5: Government Expenditure on Food Subsidies 2001-2012 (Millions LYD)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*	2012*
Wheat	12	99	-31	77	0	0	0	0	0	0	n.a.	n.a.
Flour	124	151	338	527	491	390	467	925	953	703	n.a.	n.a.
Sugar	11	22	39	44	55	54	107	0	0	0	n.a.	n.a.
Rice	8	52	46	104	101	108	97	141	236	187	n.a.	n.a.
Olive and other vegetable oils	-6	5	99	165	120	116	134	0	0	0	n.a.	n.a.
Tea	18	11	15	31	17	41	34	0	0	0	n.a.	n.a.
Tomato paste	9	9	16	0	0	0	0	0	0	0	n.a.	n.a.
Dry yeast	0	1	4	11	10	17	13	0	0	0	n.a.	n.a.
Evaporated milk	-7	3	56	147	0	0	0	0	0	0	n.a.	n.a.
Semolina	0	4	37	48	37	68	43	50	144	58	n.a.	n.a.
Miscellaneous	4	2	6	6	7	7	7	0	0	0	n.a.	n.a.
Pasta	0	0	0	42	0	0	0	0	0	97	n.a.	n.a.
Total	172	357	625	1,202	839	801	902	1,117	1,333	1,046	1,414	2,046
<i>in percent of GDP</i>										1.1	3.3	2.0
<i>in percent of government expenditure</i>										2.0	4.8	3.8

Source: Data provided by Libya’s Price Regulation Fund, obtained from Central Bank of Libya. * Data for 2011-12 are preliminary. For 2001-2010, the breakdown refers to the Price Regulation Fund’s operational balance, a proxy for the cost of subsidies to the government since the Fund is responsible for buying the commodities on the international market and distributing them to the cooperatives. A negative number therefore indicates an operational surplus for that particular commodity and year, which could be due to accumulated inventories from previous years.

Our estimates are an *upper bound* to the benefit that food subsidies convey to the Libyan population. This is because the analysis is based on the assumption that all households purchase the entire amount of quotas they are entitled to.²¹ This may not always be the case as some households may choose not to go to cooperatives to purchase products at subsidized prices—as is in fact reported for a non-negligible share of the population (mostly middle and upper-income tranches) in Libya. However, in the absence of information on the share of households taking advantage of the quota system in their food purchases, it is more conservative to assume that the maximum amount of households take advantage of the benefit available to them so as not to underestimate the impact of any reform on the population.

Households allocate about 9.3 percent (1.2 billion LYD) of their total expenditure to food products that are covered by the quota system, buying them both within the subsidy framework at below-market prices, as well as outside the quota system at market prices (Table 6). About 22.2% of this amount is expenditure on quotas at subsidized prices, while the rest is on the same products bought on the free market. This may seem at odds with the fact that quotas provide generous quantities. However, richer households, as noted earlier, are unlikely to shop at cooperatives (which is necessary to avail themselves of the quotas), opting for better quality and more expensive products, while poorer households may also consume a share of better quality brands not available in the quota system. Indeed for most of these food products, the market may offer several better quality options that may be preferred by the rich and poor alike. For some products, like flour-bread and milk for children, the total expenditure is only on quotas, and there are no purchases of these products at non-subsidized prices. Since bread is sold outside of cooperatives without limit (despite the fact that flour distributed to bakeries for baking bread is limited by estimates of the number of clients serviced by each bakery), the quota system does not seem to be binding in reality for flour used in baking bread.

²¹ We make that assumption when in the survey there is no separate expenditure data for subsidized versus nonsubsidized quantities for a given product.

Table 6: Household Expenditure on Subsidized Food Products (Million LYD)

	Flour	Flour-bread	Semolina	Rice	Sugar	Tea	Pasta	Vegetable Oil	Tomato paste	Milk for children	Milk (concentrated)	Total	Total, in percent of total spending
Quintile_1	11.2	3.6	7.6	18.6	21.3	17.9	33.4	58.0	24.2	4.5	26.5	227.0	12.3
Quintile_2	11.6	3.3	7.9	20.6	23.5	20.2	34.8	60.9	25.8	6.8	29.1	244.5	10.7
Quintile_3	11.8	2.9	7.2	20.2	23.2	20.0	33.3	61.4	26.2	8.3	27.9	242.4	9.4
Quintile_4	11.7	2.4	6.3	20.2	23.3	19.4	32.1	59.1	25.0	9.7	24.3	233.4	8.5
Quintile_5	10.5	1.9	5.1	19.3	21.8	19.1	29.8	55.4	24.2	9.0	23.0	219.0	7.1
Total	56.9	14.1	34.1	98.8	113.1	96.6	163.5	294.8	125.3	38.3	130.8	1,166.2	9.3
of which: share bought at subsidized prices (percent)	15.0	100.0	3.7	15.7	21.7	12.6	11.4	18.0	28.4	99.9	28.3	22.2	2.1

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

As expected, household spending on these food items is a decreasing share of aggregate household spending as we move up the “quintile” scale towards higher-income households. In absolute value, all households spend a broadly similar amount—between 220 and 245 million LYD annually—on food products that are covered by the quota system, but as a share of aggregate household spending this amount declines from 12.3 percent for the lowest quintile to 7.1 percent for the most upper quintile. Nonetheless, the spread between the two extreme quintiles (5.2 percentage points) seems rather small, suggesting low income inequality in Libya.

In terms of quantities, households consume approximately half of the food products via purchases made under the quota system at subsidized prices, while they buy the other half at market prices (Table 7). The first and second quintiles consume products at subsidized prices in higher quantities than the upper quintiles. This is natural given the larger size of households in lower quintiles. The share of products bought via the quota system varies from 30.6% for semolina to 100% for milk for children and flour for bread. Flour and pasta are the most consumed (in kilograms) among subsidized products. This may be due to the fact that these products are basic staples for Libyans and that quotas for these products are larger than those for other products.

Table 7: Quantities of subsidized food products consumed (Kilograms)

	Flour	Flour-bread	Semolina	Rice	Sugar	Tea	Pasta	Vegetable Oil	Tomato paste	Milk for children	Milk (concentrated)
Quintile_1	35.4	96.9	12.8	39.1	38.3	5.1	47.1	37.8	23.5	0.6	16.8
Quintile_2	31.7	89.7	12.6	37.2	37.0	5.4	44.2	35.3	22.3	0.9	17.1
Quintile_3	29.2	77.9	10.9	34.2	33.9	5.1	40.1	33.0	21.0	1.1	15.6
Quintile_4	26.0	64.9	9.0	30.0	30.8	4.7	35.9	29.2	18.5	1.3	13.0
Quintile_5	19.6	51.5	6.7	24.0	25.2	4.3	30.0	24.2	15.9	1.2	11.2
Total	141.9	380.9	52.0	164.3	165.2	24.6	197.4	159.6	101.2	5.1	73.8
of which: share bought at subsidized prices (percent)	66.9	100.0	30.6	67.5	59.3	32.8	47.4	55.5	58.6	100.0	51.5

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

Food subsidies are relatively progressive in Libya. In other words, poorer households spend a much greater share of total expenditure on subsidized food items than richer households. Indeed, while expenditure on food products at subsidized prices (that is purchased under the quota system) represents

just over 2% of total household expenditure (Table 8 and Figure 1) on average, this share is higher for the first (3.6%) and second (2.6%) quintiles, and falls to 1 percent for the fifth quintile. The fact that poorer households are larger in size explains part of this observation. For all quintiles, these shares are very small, explained by the very low subsidized prices, but despite being very low they are not negligible for the poorer households (as suggested by the results on quantities in Table 7 above).

Table 8: Share of spending on subsidized food in total expenditure (percent)

	Flour	Flour-bread	Semolina	Rice	Sugar	Tea	Pasta	Vegetable Oil	Tomato paste	Milk for children	Milk (concentrated)	Total
Quintile_1	0.13	0.19	0.02	0.23	0.37	0.18	0.29	0.82	0.55	0.25	0.57	3.61
Quintile_2	0.09	0.15	0.01	0.16	0.26	0.13	0.20	0.55	0.38	0.30	0.41	2.63
Quintile_3	0.07	0.11	0.01	0.13	0.19	0.10	0.15	0.42	0.28	0.32	0.30	2.08
Quintile_4	0.05	0.09	0.01	0.10	0.15	0.07	0.11	0.31	0.21	0.35	0.21	1.65
Quintile_5	0.03	0.06	0.00	0.06	0.09	0.04	0.07	0.19	0.12	0.29	0.12	1.07
Total	0.07	0.11	0.01	0.12	0.20	0.10	0.15	0.42	0.28	0.31	0.30	2.07

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

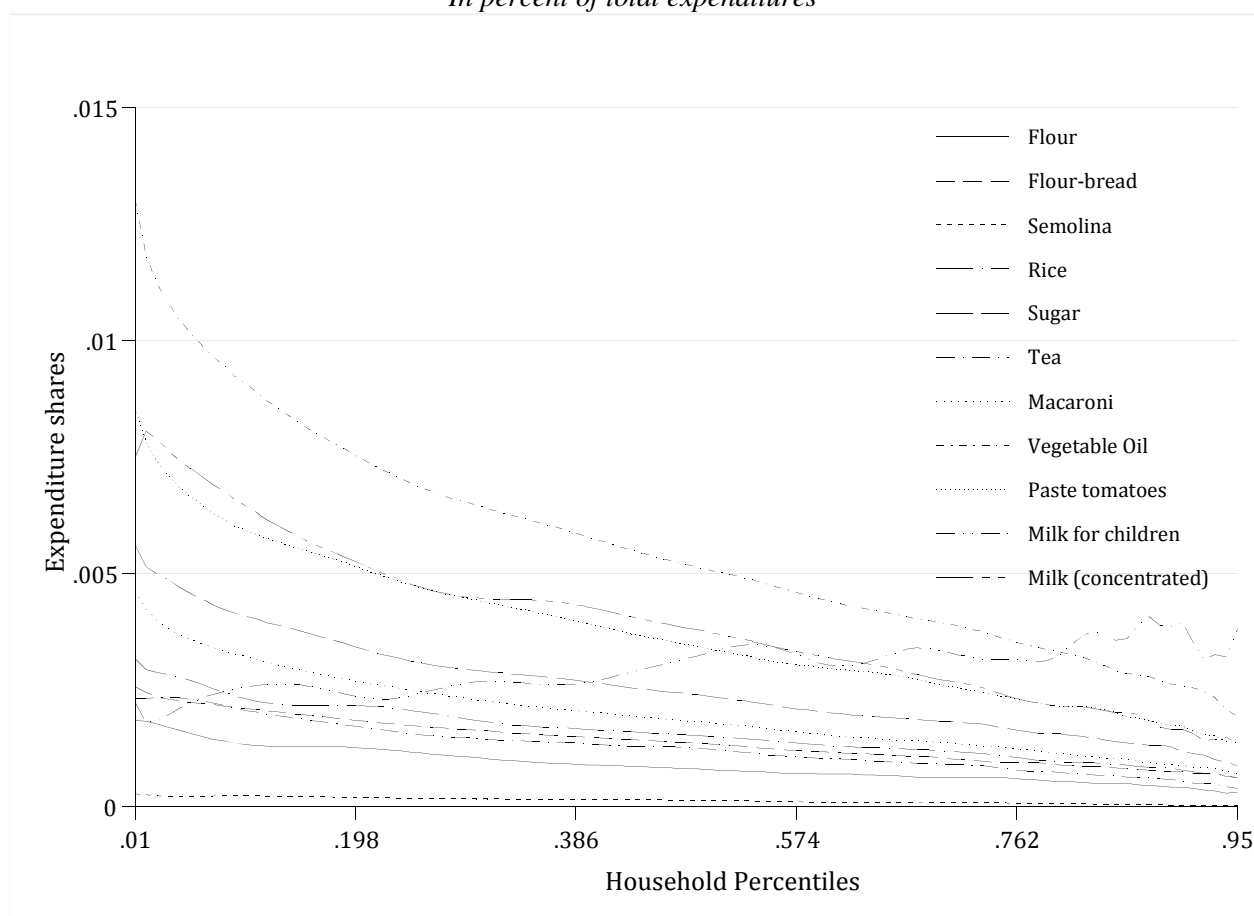
The progressivity of food subsidies is even more clearly apparent when looking at their distribution by population percentiles. This can be seen in Figure 1 which plots the share of expenditure on food products at subsidized prices, relative to total expenditure, by population percentiles. The negative slopes indicate that poorer households devote a larger share of their total spending on food bought under the quota system than richer households (for all products except milk for children.) In other words, food is a larger component of the consumption basket for the poorer households.

The poorest quintiles benefit the most from the monetary value of subsidies (Table 9)—another evidence that food subsidies seem relatively progressive in Libya. This is true for each product with the exception of milk for children. This results sets Libya apart from other countries in the region, where food subsidies tend to be slightly regressive because richer households tend to consume more food overall and because subsidies are universal, unconstrained by a quota system.

We estimate that about 35 percent of government spending on food subsidies is not reaching Libyan households directly. In other words, there could be up to 35 percent of “waste” in the government’s total spending on food subsidies. This estimate rests on the assumption that households purchase first all the quotas of food products to which they are entitled, at subsidized prices, before going to the market for additional quantities of that product. Based on this assumption, we estimate that the monetary value of food subsidies received by households in 2013 was 1.3 billion LYD (Table 9). This estimate is much lower than the total cost to the government budget from food subsidies, which we estimate at 2 billion LYD.²² We interpret the difference between the government budget data and the estimates derived from the household survey in this paper as representing the waste from the subsidy system, including waste from illegal resale of subsidized items outside of the quota system at close-to-market prices.

²² Government spending on food subsidies was 1.4 billion and 2.0 billion LYD in 2011 and 2012 respectively. The 2013 budget allocated 1.5 billion LYD to food subsidies. Actual spending data is not yet available.

Figure 1: Household Expenditure on Food Bought at Subsidized Prices
In percent of total expenditures



Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

Table 9: Value of food subsidies received by households (Million LYD)

	Flour	Flour-bread	Semolina	Rice	Sugar	Tea	Pasta	Vegetable Oil	Tomato Paste	Milk for children	Milk (concentrated)	Total
Quintile_1	25.2	89.4	4.1	42.3	29.2	8.2	32.3	70.7	26.1	2.9	17.6	348.0
Quintile_2	21.1	82.7	3.5	37.4	25.3	7.2	26.9	59.3	22.1	4.3	15.8	305.6
Quintile_3	18.3	71.9	2.7	33.1	21.4	6.1	22.6	50.9	18.7	5.2	13.1	264.1
Quintile_4	15.1	59.8	1.9	26.5	17.4	4.6	17.9	40.2	14.7	6.1	9.7	213.8
Quintile_5	9.6	47.5	1.0	18.1	11.3	3.0	12.0	27.1	9.9	5.7	6.4	151.6
Total	89.3	351.2	13.2	157.4	104.6	29.1	111.7	248.3	91.4	24.2	62.6	1,283.0

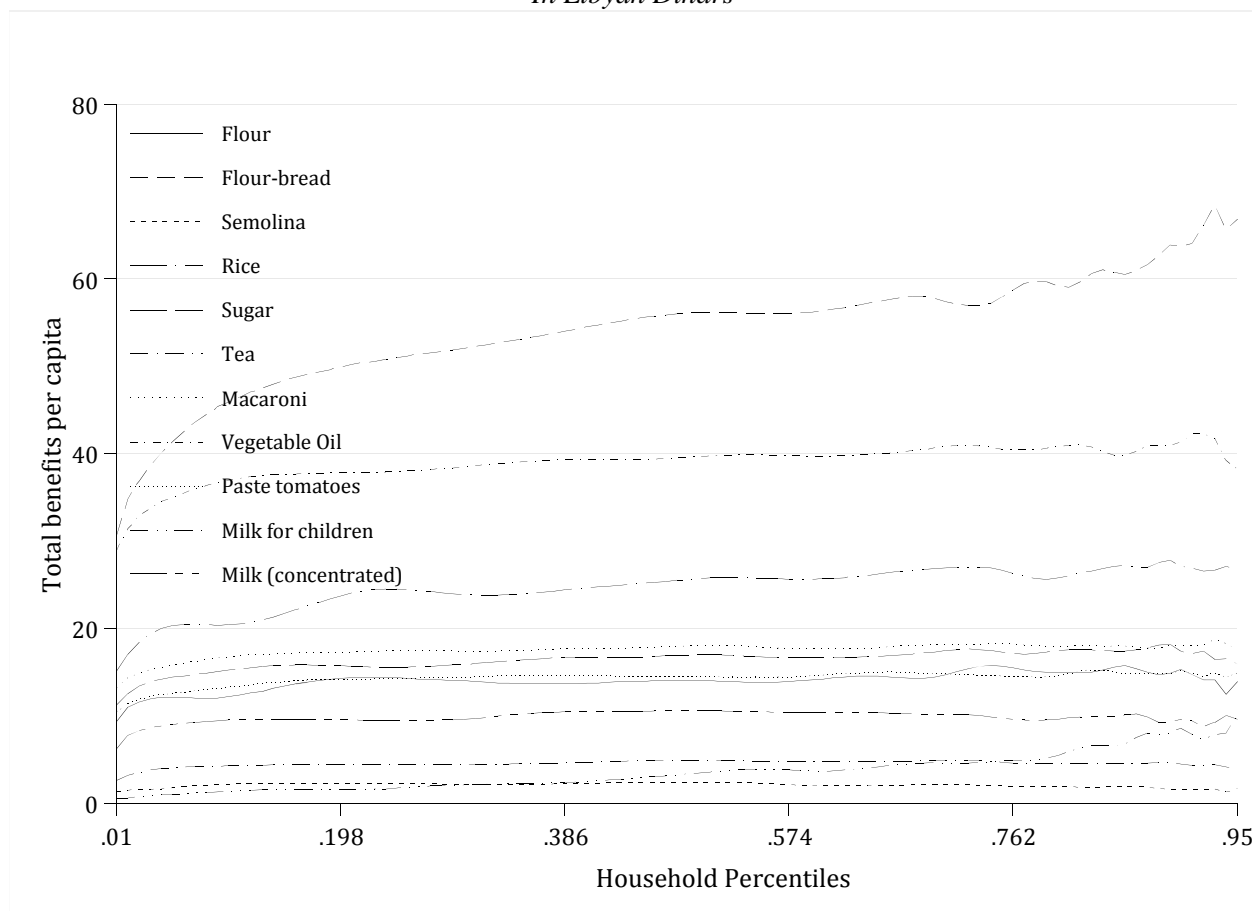
Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

The per-capita data suggest that subsidies benefit all people broadly equally, with the exception of flour used for bread and milk for children.²³ Figure 2 plots the total monetary value of food subsidies

²³ Household sizes are different across quintiles, as noted earlier, with poorer households also being the largest. It is therefore useful to also look at per-capita estimates in addition to per-household estimates to assess whether or not food subsidies are progressive.

per capita on the y-axis and the population percentiles on the x-axis. The curves are flat, indicating everyone across the spectrum of the population derives the same monetary value from food subsidies. Again, this results is not surprising given that the quota system is established on a per-capita basis, allocating the same quantity of food at subsidized prices to every individual regardless of the income bracket.

Figure 2: Per-Capita Benefits from Subsidies by Food Product
In Libyan Dinars



Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

Simulation of food subsidy reforms

This section shows that food subsidy reform would have a bigger negative impact on the poor than the rich. Below we simulate the impact of two alternative subsidy reform scenarios on household welfare and on government revenue. Consistently with the finding that food subsidies are relatively progressive (see above section), the results show that reducing or removing price subsidies would hurt the poor the most. If food subsidies were completely eliminated, for example, the poorest quintile would incur an annual loss of 348 million LYD whereas the annual cost to the richest quintile would be 152 million LYD (equivalent to 44% of the loss of the poorest quintile). As a result, and in the absence of any compensation scheme, the poverty rate would jump from 14 to 24 percent of the population and inequality would increase.

We perform simulations of one-step reform for all food subsidies. We consider the following eleven products which were subsidized in 2013: flour, flour-bread, semolina, rice, sugar, tea, pasta, vegetable oil, tomato paste, milk for children and concentrated milk. Expenditure on each of these items is reported in the 2007/08 household survey, which enables us to include them all in the analysis. Two scenarios are considered: 1) a 30 percent decrease in the subsidy for each product and 2) the total elimination of all subsidies. Although the authorities are reportedly considering total elimination of subsidies (hence our scenario 2), we also provide a less drastic reform scenario for illustrative purposes. Note that a 30% decrease in the subsidy on each product in that illustrative scenario would result in a different price increase for each product. Table 10 reports the current subsidized price for each product under the quota regime, the unit subsidy, the price after a 30% reduction in subsidy (Final price, scenario 1) and the price after the elimination of all subsidies (Final price, scenario 2). This last price is equivalent to the market reference price that we consider for each product.²⁴

Eliminating all food subsidies (scenario 2) would result in exceptionally high price increases. The price of flour used in making bread would need to increase by almost 26 times to match the market price, and prices of flour, semolina and rice would need to increase more than 11 times. Even in the case of the product whose price is currently the closest to the market price (milk for children), a 60 percent increase would be needed to match the market price—a significant price increase.

Table 10: Two Reform Scenarios

	Current Subsidized Price (LYD/kg)	Subsidy (in percent of market price)	Final price (Scenario 1) (LYD/kg)	Final price (Scenario 2) (LYD/kg)	Ratio of Market Price (S2) to subsidized price
Flour	0.090	91.3	0.372	1.030	11.4
Flour for bread	0.037	96.1	0.314	0.959	25.9
Semolina	0.080	91.2	0.329	0.911	11.4
Rice	0.140	91.0	0.566	1.559	11.1
Sugar	0.250	81.0	0.570	1.318	5.3
Tea	1.500	70.6	2.579	5.097	3.4
Pasta	0.200	85.7	0.558	1.394	7.0
Vegetable oil	0.600	82.4	1.441	3.402	5.7
Tomato paste	0.600	72.0	1.062	2.141	3.6
Milk for children	7.500	38.8	8.925	12.250	1.6
Milk condensated	0.975	62.8	1.469	2.622	2.7

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

These price increases would affect the poor in greater proportion than the rich. The total monetary impact of a complete removal of subsidies (scenario 2) on households would be equivalent in magnitude to the total estimated monetary value of subsidies received by households, namely 1.3 billion LYD

²⁴ Market prices were obtained from the authorities (Ministry of Economy) dated for the first quarter of 2013.

(Table 11). The total impact of a 30% reduction in subsidies (scenario 1) is estimated at 385 million LYD. The impact would be regressive in that poorer households would be affected more than richer households, as indicated by the greater loss in per-capita spending for lower quintiles (Table 12). This is to be expected since food subsidies were shown to benefit the poor in greater proportion. For example, with an elimination of subsidies the first quintile (the poorest 20% of the population) would bear a cost of 348 million LYD, equal to 27.1% of the total cost for households. And at 18.9 percent, the decline in per-capita spending of the lowest quintile if food subsidies were eliminated is nearly 4 times that of the highest quintile (4.9 percent). This would be a disproportionate cost for poorer households.

Table 11: Aggregate Monetary Impact of Subsidy Reform on Expenditure—Scenario 2
Million LYD

	Flour	Flour-bread	Semolina	Rice	Sugar	Tea	Pasta	Vegetable Oil	Tomato Paste	Milk for children	Milk (concentrated)	Total
Quintile_1	-25.2	-89.4	-4.1	-42.3	-29.2	-8.2	-32.3	-70.7	-26.1	-2.9	-17.6	-348.0
Quintile_2	-21.1	-82.7	-3.5	-37.4	-25.3	-7.2	-26.9	-59.3	-22.1	-4.3	-15.8	-305.6
Quintile_3	-18.3	-71.9	-2.7	-33.1	-21.4	-6.1	-22.6	-50.9	-18.7	-5.2	-13.1	-264.1
Quintile_4	-15.1	-59.8	-1.9	-26.5	-17.4	-4.6	-17.9	-40.2	-14.7	-6.1	-9.7	-213.8
Quintile_5	-9.6	-47.5	-1.0	-18.1	-11.3	-3.0	-12.0	-27.1	-9.9	-5.7	-6.4	-151.6
Total	-89.3	-351.2	-13.2	-157.4	-104.6	-29.1	-111.7	-248.3	-91.4	-24.2	-62.6	-1,283.0
NB: Total \$1	-26.8	-105.4	-4.0	-47.2	-31.4	-8.7	-33.5	-74.5	-27.4	-7.3	-18.8	-384.9

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

Table 12: Per-capita Monetary Impact of Subsidy Reform—Scenario 2
In percent of per-capita expenditure

	Flour	Flour-bread	Semolina	Rice	Sugar	Tea	Pasta	Vegetable Oil	Tomato Paste	Milk for children	Milk (concentrated)	Total
Quintile_1	-1.4	-4.9	-0.2	-2.3	-1.6	-0.4	-1.8	-3.8	-1.4	-0.2	-1.0	-18.9
Quintile_2	-0.9	-3.6	-0.2	-1.6	-1.1	-0.3	-1.2	-2.6	-1.0	-0.2	-0.7	-13.4
Quintile_3	-0.7	-2.8	-0.1	-1.3	-0.8	-0.2	-0.9	-2.0	-0.7	-0.2	-0.5	-10.2
Quintile_4	-0.5	-2.2	-0.1	-1.0	-0.6	-0.2	-0.7	-1.5	-0.5	-0.2	-0.4	-7.8
Quintile_5	-0.3	-1.5	-0.0	-0.6	-0.4	-0.1	-0.4	-0.9	-0.3	-0.2	-0.2	-4.9

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

Reducing food price subsidies would reduce government expenditure through two channels. The direct impact on government expenditure from the removal of subsidies would be equivalent to the total impact on household welfare, namely 1.3 billion LYD—equivalent to 2.8% of government expenditure (Table 13, last two lines).²⁵ However, under a partial reduction of subsidies (30% in the case of scenario 1), the direct impact on government expenditure would be greater than the impact on household welfare (Table 13, upper 6 lines). Under scenario 1, the former would amount to 660 million LYD, compared to 385 million LYD for the impact on household welfare (Table 11). This difference is explained by the fact that - when subsidies are not totally removed - we have two potential causes for lower government expenditure, the first resulting from higher subsidized prices (which is equivalent in size to the impact on household welfare) and the second resulting from lower quantities consumed by households at these

²⁵ Estimates of the budgetary impact of alternative reform scenarios do not take into account savings from lower administrative costs of managing the subsidy program and from leakages of the subsidy program (e.g. smuggling).

higher subsidized prices. If subsidies were totally eliminated, this second effect would disappear given that no quantities would be sold at a subsidized price.

Table 13: Impact of Subsidy Reform (Scenario 1) on the Government Budget (Million LYD)

	Flour	Flour-bread	Semolina	Rice	Sugar	Tea	Pasta	Vegetable Oil	Tomato Paste	Milk for children	Milk (concentrated)	Total
Quintile_1	13.7	56.4	2.2	22.8	13.2	3.3	15.7	32.7	10.7	1.0	6.7	178.4
Quintile_2	11.4	52.2	1.9	20.2	11.5	2.9	13.1	27.4	9.0	1.4	6.0	157.1
Quintile_3	9.9	45.4	1.5	17.9	9.7	2.5	11.0	23.5	7.7	1.8	5.0	135.7
Quintile_4	8.2	37.8	1.0	14.3	7.9	1.9	8.7	18.6	6.0	2.1	3.7	110.0
Quintile_5	5.2	30.0	0.6	9.8	5.1	1.2	5.8	12.5	4.0	1.9	2.4	78.6
Total (S1)	48.5	221.7	7.2	84.9	47.4	11.8	54.2	114.6	37.5	8.1	23.9	659.8
NB: Total, S2	89.3	351.2	13.2	157.4	104.6	29.1	111.7	248.3	91.4	24.2	62.6	1,283.0
NB: Total, S2, % gov exp	0.2	0.9	0	0.4	0.2	0.1	0.2	0.5	0.2	0	0.1	2.8

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

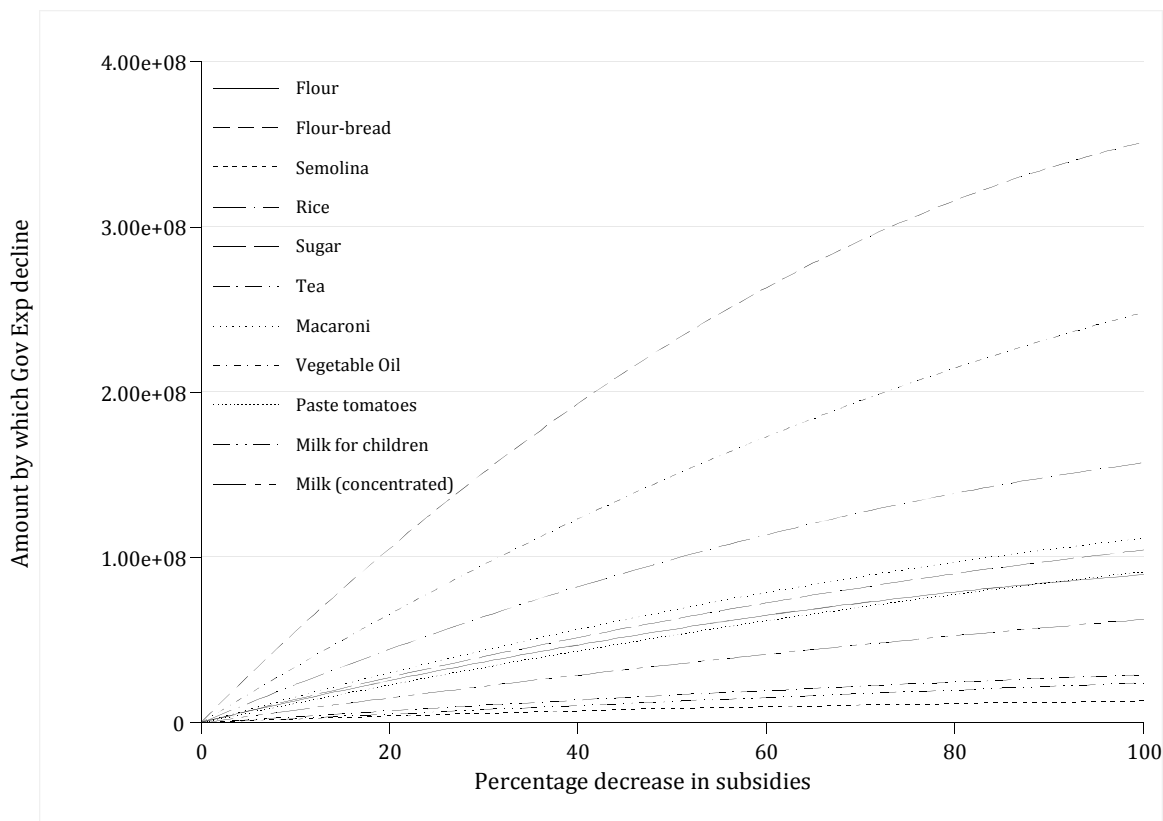
Should a gradual approach to reform be considered, measuring the government budgetary impact may help with the decision regarding the sequencing by product and by size of subsidy reduction. Figure 3 traces, for each product, the impact of a reduction in price subsidy (shown in percent on the x axis) on government expenditure in absolute value (measured in LYD on the y-axis). That impact would differ across products because of different quantities consumed and different price changes associated with a specific subsidy reduction. The fastest decline in government expenditure would result from reforming first the subsidy on flour used in bread production, and then that on vegetable oil. We note that the curves are not linear, implying decreasing marginal returns in terms of lower government expenditure should prices increase.

Removing subsidies on food products would have a significant negative impact on poverty (Table 14). We estimate poverty in Libya based on both the universal poverty line (\$1.25 per day)²⁶ and on an estimated national poverty line (966.26 LYD per person per year).²⁷ Under the former benchmark, poverty is estimated at about 8½ percent of the population. If food subsidies were eliminated, poverty would rise by 8 percentage points, to 16½ percent. The effect would be much smaller (an increase of 2 percentage points) in case of a 30% reduction of subsidies (scenario 1). Flour used in bread, rice, and vegetable oil would be the products whose price increases would contribute the most to a rise in poverty. Along with greater poverty, inequality would rise, from 30.2% to 33.2% in case of a complete elimination of food subsidies. This is consistent with the finding that food subsidies are pro-poor. It is interesting to note that inequality in Libya is very low: at 30.2 percent, the Gini coefficient has possibly the lowest value in the MENA region. For example, the latest Gini coefficient for Morocco estimated in 2007 was above 40%; that for Egypt, where inequality is believed to be very low, was around 32% in 2011.

²⁶ We convert \$1.25 to Libyan dinars using 2009 PPP exchange rate data (1 LYD = 0.74 \$PPP; latest available data) and inflation for the period 2009-13. We find the equivalent universal poverty line for 2013 to be 821.42 LYD per person per year.

²⁷ To estimate the national poverty line, we use the 2003 poverty line—which was estimated at 593.6 LYD by staff of Libya's Office of Statistics but was not necessarily endorsed officially—and CPI inflation between 2003 and 2013. This national poverty line estimate corresponds to 2.65 LYD per day, or about \$2 at the actual exchange rate. The national poverty line estimate represents 49% of the average per-capita expenditure of households (1,967 LYD).

Figure 3: Magnitude of Decline in Government Expenditure under Reform Scenario 2
In Libyan Dinars



Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

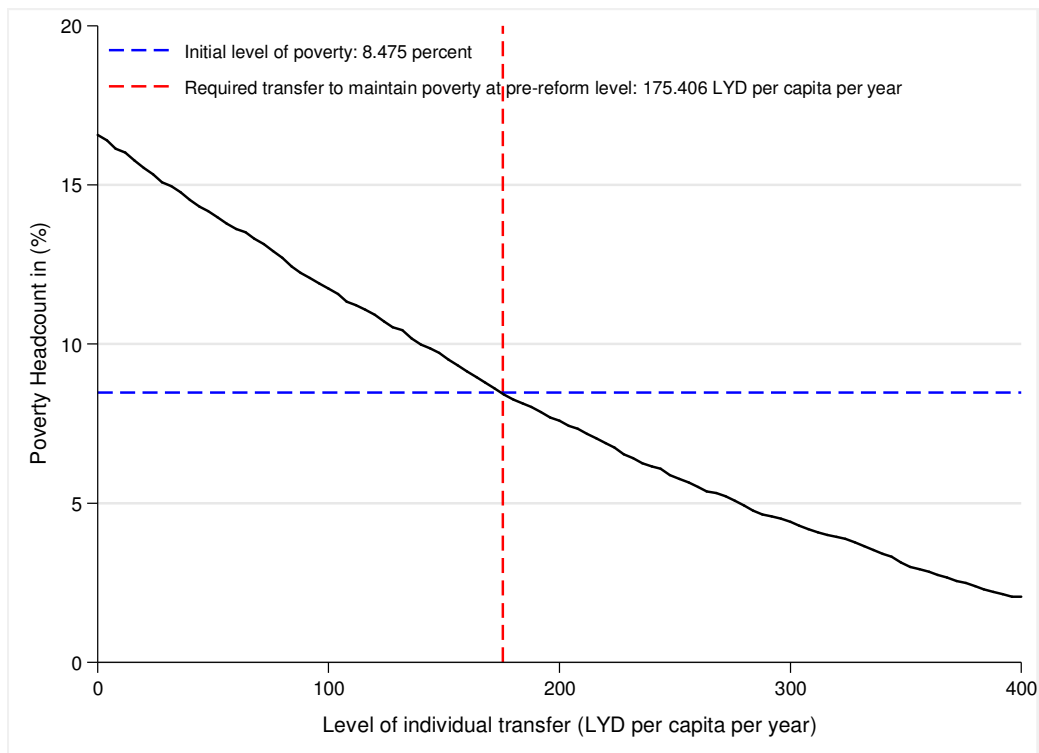
A cash transfer of LYD 175 per capita per year targeted to the first quintile would be sufficient to restore poverty to the pre-reform level of 8½ percent under the scenario of full subsidy elimination (Figure 4). An increase in poverty to 16½ percent under that scenario implies that poverty remains concentrated in the bottom quintile following the price reform. Therefore, targeting that share of the population would be sufficient to maintain poverty unchanged at the pre-reform level. This targeted transfer system would cost the government LYD340 million per year. Given that savings from the price increases would amount to LYD 1.3 billion as calculated above, the net gains to the budget from full subsidy elimination *and* cash compensation to the population in the first quintile of LYD 175 per capita would be LYD 943 million. In case targeting the first quintile is not possible, extending that level of transfer to the entire population would raise the budgetary cost to LYD 1.1 billion per year. In this case, total net gains to the budget from subsidy reform *and* cash transfers would be much lower, at LYD 165 million per year.

Table 14: Poverty Impact of Subsidy Reform

	Scenario 1				Scenario 2			
	Poverty level (percent)	The change in poverty	Standard error	P-Value	Poverty level (percent)	The change in poverty	Standard error	P-Value
Pre reform*	8.475	.	.	.	8.475	.	.	.
Flour	8.622	0.147	0.040	0.000	8.934	0.459	0.068	0.000
Flour-bread	8.907	0.432	0.063	0.000	10.106	1.630	0.118	0.000
Semolina	8.504	0.029	0.018	0.101	8.546	0.071	0.028	0.011
Rice	8.730	0.255	0.051	0.000	9.226	0.751	0.084	0.000
Sugar	8.586	0.111	0.033	0.001	8.927	0.452	0.066	0.000
Tea	8.527	0.052	0.020	0.010	8.620	0.145	0.036	0.000
Pasta	8.638	0.163	0.040	0.000	9.031	0.556	0.073	0.000
Vegetable Oil	8.770	0.295	0.051	0.000	9.835	1.360	0.110	0.000
Tomato paste	8.613	0.138	0.036	0.000	8.873	0.398	0.059	0.000
Milk for children	8.478	0.003	0.003	0.317	8.507	0.032	0.017	0.059
Milk (con-centrated)	8.566	0.090	0.029	0.002	8.755	0.280	0.051	0.000
Post reform*	10.498	2.023	0.134	0.000	16.585	8.110	0.250	0.000
<i>Memo: Poverty Impact of Reform based on national poverty line measurement:</i>								
Pre reform	14.440	.	.	.	14.440	.	.	.
Post reform	17.255	2.815	0.151	0.000	24.024	9.584	0.261	0.000

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

Figure 4: Poverty Impact of Cash Transfers to First Quintile under Food Subsidy Reform S2



Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

The impact of subsidy reform on quantities consumed would also be significant (Table 15). It is useful to look at this impact because it gives an idea of the changes required in production and imports of food products bought via the quota system and also to better understand the impact on government revenues discussed above. When compared to the initial quantities consumed under the quotas, changes would vary from -13.7% for milk for children to -62.3% for flour for bread. The impacts are also quite flat across quintiles although the impact on the first quintile would be lower for all products.²⁸

Table 15: Impact of Subsidy Reform (Scenario 2) on Quantities Consumed Per-Capita (in kg/liters*)

	Flour	Flour-bread	Semolina	Rice	Sugar	Tea	Pasta	Vegetable Oil	Tomato Paste	Milk for children	Milk (concentrated)
Quintile_1	-7.19	-31.19	-1.31	-7.92	-5.55	-0.36	-6.16	-5.29	-2.78	-0.04	-1.42
Quintile_2	-7.69	-36.99	-1.45	-8.97	-6.14	-0.41	-6.58	-5.68	-3.00	-0.08	-1.63
Quintile_3	-7.98	-38.42	-1.33	-9.49	-6.23	-0.41	-6.62	-5.84	-3.05	-0.12	-1.61
Quintile_4	-8.37	-40.76	-1.19	-9.69	-6.44	-0.40	-6.67	-5.87	-3.04	-0.18	-1.52
Quintile_5	-7.98	-48.18	-0.97	-9.85	-6.26	-0.38	-6.66	-5.89	-3.04	-0.25	-1.50
Initial Quantity	14.91	59.78	2.49	17.41	15.37	1.27	14.68	13.91	9.31	0.80	5.97
Avg Impact (S1)	-5.17	-28.30	-0.86	-5.96	-3.37	-0.19	-3.89	-3.21	-1.47	-0.04	-0.69
Avg Impact (S2)	-7.73	-37.27	-1.29	-8.96	-6.04	-0.39	-6.48	-5.64	-2.95	-0.11	-1.53
Change (% S2)	-51.87	-62.34	-51.80	-51.47	-39.27	-30.72	-44.15	-40.58	-31.73	-13.69	-25.68
<i>*In kilograms for all products except, for vegetable oil, in liters.</i>											

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

VI. Incidence and Impact Analysis for Energy Subsidies

Unlike food subsidies, energy subsidies in Libya are universal, and therefore bring greater benefits to households. There is no quota system for energy subsidies: all consumers, households and businesses alike, benefit from subsidized prices on any quantity consumed. Therefore, the benefits to households from energy subsidies are multiples of those derived from food subsidies—households in the lowest quintile derive 2½ times more monetary benefit from energy than food subsidies, and that ratio increases gradually to 6½ times for the upper quintile.

Our analysis covers five energy products: gasoline, diesel, electricity, gas GPL and kerosene. Gasoline is the main energy product used in the road transport sector for individuals –both in private cars and in taxis (there are no other means of public transportation). Diesel is mainly consumed by businesses (for transportation) and by the electricity generation company. Electricity and Gas GPL are almost

²⁸ These results are entirely dependent on the choice we made regarding the point elasticity at market price and the shape of the demand curve. Other assumptions would lead to different results and these findings should be taken with caution. Note, however, that the final results on household welfare reported earlier are not affected by the choice of elasticity and demand curve as these estimates depend only on the initial expenditure and the price change (relative changes in quantities consumed of subsidized and non-subsidized products do not affect the overall welfare effects given that we consider a hard budget constraint).

universally consumed. Half of the kerosene sold on the market goes to the air transport sector, while the rest is likely used by lower income households as a substitute for electricity, but no data are available to corroborate the latter hypothesis.

The distribution of energy subsidies

This section shows that gasoline and electricity capture the bulk of energy consumption and, together with other energy products, are more heavily consumed by the rich. Gasoline and electricity take up more than 90% of household energy consumption and, correspondingly, the same share of government spending on subsidies. Moreover, subsidies for these two products are clearly regressive in absolute terms, as are other energy product subsidies: an individual in the upper quintile benefits about 3.5 times more from subsidies on electricity and gasoline than an individual in the bottom quintile (that ratio is 2.8 and 2.7 for Diesel and LPG respectively).

To recall, our analysis focuses on the direct distributional effects of energy subsidies. We find that households' direct benefits from energy subsidies are close to 2.5 billion LYD, which only represents about a third of total cost to the budget from energy subsidies. If we assume that indirect benefits compare in magnitude to these direct benefits, then total benefits captured by the Libyan population from energy subsidies could be close to 5 billion dinars, with the residual budgetary spending on energy subsidies (about 2.5 billion dinars) representing waste (for example from smuggling).²⁹

Given their extremely low subsidized prices, energy products capture a very small share of household expenditure—about 3 percent of total, equivalent to 370 million LYD (Table 16). Gasoline and electricity represent the lion share while expenditure on kerosene is very low. The share of household spending on energy products is slightly higher for poorer households (3.6%) relatively to richer households (2.5%). The share of expenditure on gas GPL shows the largest difference across quintiles (Table 17), suggesting that it is used more intensively by poorer households.

Table 16: Household Expenditure on Energy Products (Million LYD)

	Gasoline	Diesel	Electricity	GAZ_GPL	Kerosene	Total	Total, in percent of total spending
Quintile_1	28.9	0.7	29.9	5.7	0.3	65.4	3.6
Quintile_2	34.9	0.7	34.0	5.9	0.5	76.0	3.3
Quintile_3	36.1	0.6	34.2	5.7	0.5	77.1	3.0
Quintile_4	36.2	0.6	33.1	5.5	0.6	76.0	2.8
Quintile_5	33.6	0.7	35.8	5.2	0.6	75.9	2.5
Total	169.6	3.3	167.1	28.0	2.5	370.5	3.0

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

Compared to other countries in the North-Africa region, the share of expenditure on energy products is more homogeneous across quintiles. This corroborates the result we found in analyzing food subsidies, namely that income distribution in Libya is comparatively more flat, with lower

²⁹ The budget data we work with do not include administrative costs associated with the subsidy system.

inequality, compared to the North-Africa region's other countries. Particularly striking is the distribution of gasoline and diesel expenditure. The poorest quintile of households spends on gasoline 85% of what the richest quintile spends and on diesel a higher amount than the richest quintile. Indeed, data from the household survey on car ownership confirm that most households in Libya own at least one car and that the share of non-owners, 25.8 percent, (Table 18, first column) is rather homogeneously distributed across quintiles. This finding, which is atypical for countries at similar levels of per-capita income, is explained by the cost of gasoline and diesel being so low that it seems almost irrelevant for households' decision to own/operate cars, which seem therefore widely available in Libya.³⁰

Table 17: Share of Energy Expenditure in Total Household Expenditure
(In percent)

	Gasoline	Diesel	Electricity	GAZ_GPL	Kerosene	Total
Quintile_1	1.57	0.04	1.62	0.31	0.01	3.55
Quintile_2	1.53	0.03	1.49	0.26	0.02	3.32
Quintile_3	1.40	0.02	1.33	0.22	0.02	2.99
Quintile_4	1.32	0.02	1.21	0.20	0.02	2.77
Quintile_5	1.09	0.02	1.16	0.17	0.02	2.47
Total	1.35	0.03	1.33	0.22	0.02	2.96

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

Table 18: Percentage of Households that Own Cars (by quintile and number of cars)

	0	1	2	3	4	5	Total
Quintile_1	6.25	12.17	1.32	0.17	0.08	0	20
Quintile_2	4.64	13.54	1.51	0.29	0.03	0	20
Quintile_3	4.87	13.62	1.26	0.21	0.04	0	20
Quintile_4	4.69	13.86	1.16	0.24	0.04	0.01	20
Quintile_5	5.35	13.63	0.83	0.16	0.03	0	20
Total	25.8	66.81	6.09	1.06	0.22	0.01	100

Source: 2007-08 Household Survey; and authors' calculations. The columns correspond to the number of cars that can be owned by a household (ranges from 0 to 5).

Highly subsidized prices have unsurprisingly led to excessive consumption of energy products in Libya. The household survey data imply that households consume an estimated 1.13 billion liters of gasoline per year, equivalent to about 177 liters per capita (Table 19).³¹ To put that in context, we have extracted comparable data from the World Bank database on energy consumption for Libya and other countries in 2010.³² These data suggest that per capita gasoline consumption in Libya in 2010 was 281 liters (far greater than the household survey data imply) which is also much higher than per-capita consumption in Italy (225 liters) or France (159 liters) for that year, and far higher than the world average (187 liters). Per-capita gasoline consumption in Algeria, another oil producer, is reported at 96 liters in

³⁰ Anecdotal evidence suggests that the stock of cars in Libya is quite old, many low-income people drive run-down cars and keep doing so given cheap gasoline and no alternative transportation means.

³¹ The authorities budget for 4.47 billion liters of gasoline to be sold on the market in Libya in 2013.

³² Source: <http://data.worldbank.org>. The data were converted from Kg to liters on the basis that 1 liter of petrol weighs 0.711 kg.

the Bank's database. These statistics all point towards significant gasoline overconsumption in Libya. The same conclusion holds when comparing electricity consumption in Libya to that of other countries.

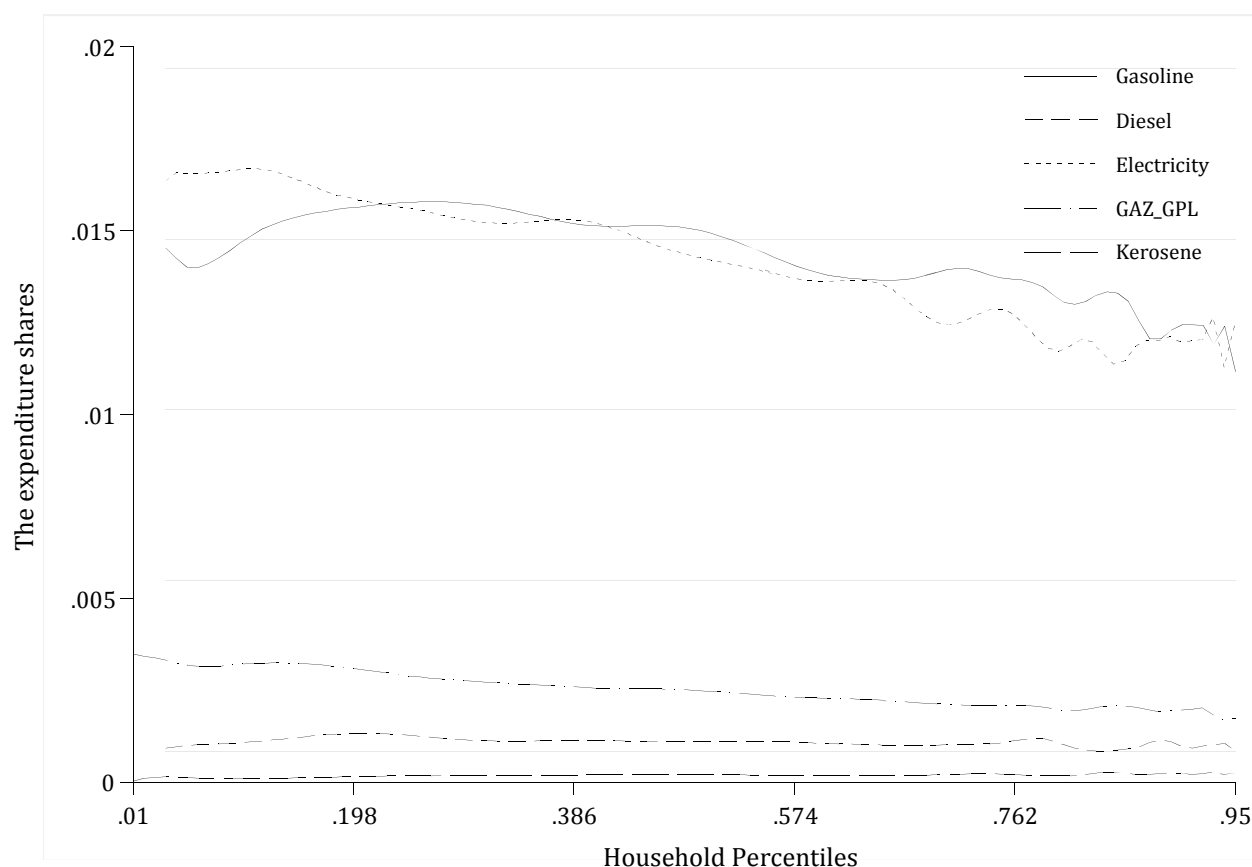
Table 19: Household Consumption of Energy Products
(in millions of indicated units)

	Gasoline (liter)	Diesel (liter)	Electricity (kWh)	GAZ_GPL (bottle 15 kg)	Kerosene (liter)
Quintile_1	192.39	4.78	1496.16	2.83	2.96
Quintile_2	232.92	4.95	1700.90	2.93	5.17
Quintile_3	240.56	3.71	1710.95	2.85	5.68
Quintile_4	241.18	3.95	1654.91	2.77	6.66
Quintile_5	223.74	4.67	1791.30	2.62	6.93
Total	1130.79	22.06	8354.21	14.00	27.40

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

Figure 5 below confirms that energy products represent a greater share of total expenditure for the poor than for the rich. This is shown by the negative slopes of some of the curves depicted in the figure.

Figure 5: Household Spending on Energy Products
As a share of total household expenditure



Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

This is not perceptible for diesel and kerosene partly because these products are consumed in very small quantities but also because these products follow a different pattern across quintiles. The share of kerosene expenditure in total expenditure in particular is very flat across quintiles.

Households derive substantial benefits from energy subsidies. We estimate the total value of direct energy subsidies received by households at 2.5 billion LYD (Table 20)— 6.7 times higher than total household expenditure on these products. About 1 billion LYD of this total derive from gasoline and 1.1 billion LYD from electricity. This underscores the significant share of subsidy incorporated in energy prices in Libya: on average, the government should increase energy prices by 670% to reach market levels and eliminate subsidies (more on this below).

Table 20: Monetary value of Energy Subsidies to Households (Million LYD)

	Gasoline	Diesel	Electricity	GAZ_GPL	Kerosene	Total
Quintile_1	177.38	4.59	203.48	53.64	2.96	442.04
Quintile_2	214.75	4.75	231.32	55.44	5.16	511.43
Quintile_3	221.80	3.56	232.69	54.05	5.68	517.78
Quintile_4	222.37	3.79	225.07	52.51	6.65	510.39
Quintile_5	206.29	4.48	243.62	49.53	6.92	510.84
Total	1042.59	21.18	1136.17	265.17	27.38	2492.48

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

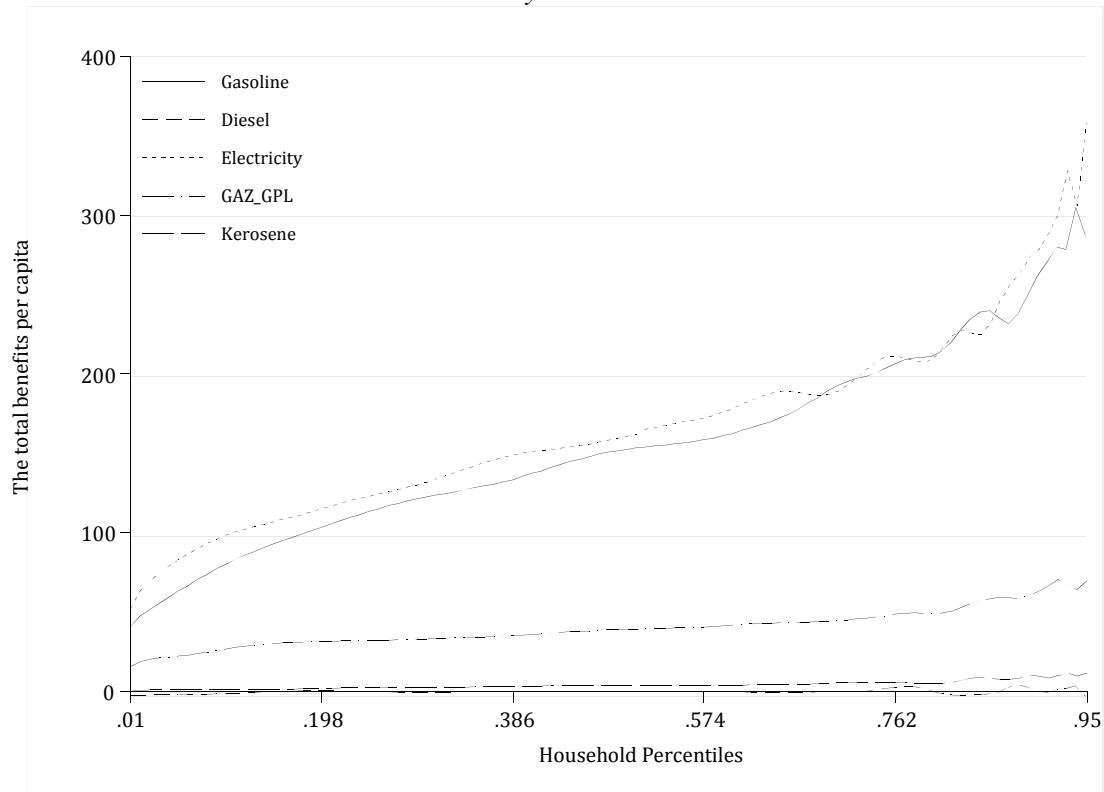
These estimated benefits are much lower than estimates of the value of energy subsidies reported in the government budget data. The difference can be explained by a number of factors. First, we could not estimate indirect effects which are certainly very large in Libya.³³ Second, there are many practical legal and illegal arrangements that households may use to provision and stock on fuels (including smuggling), which may distort estimations; however it is not possible to correct for these factors with simple assumptions. Therefore, despite their very high values, we should note that the above estimates on the incidence of subsidies are lower bound.³⁴

Energy subsidies in Libya are regressive (in absolute value), or pro-rich. This can be more clearly seen when looking at the distributional analysis on a per-capita basis. Indeed, the per-household data mask the fact that poorer households are larger in size so that comparable benefits (that is, comparable monetary values accruing from subsidies) across households mean that on a per-capita basis the lower income brackets are less well-off. Figure 6 shows per-capita subsidies (y-axis) across population percentiles (x-axis) for each subsidized energy product. All curves are positively sloped which indicates that richer households receive higher amounts of subsidies per capita. The regressive feature of energy subsidies is less pronounced for the cases of kerosene and diesel, consistent with the proposition that these products are consumed more intensively by the poorer population. This feature is most pronounced for gasoline and electricity, the two products whose subsidies generate the biggest cost to the government budget.

³³ To recall, indirect effects refer to the benefits households receive through lower prices of commodities which in turn benefit from low cost of subsidized energy input prices. Therefore, these show up as subsidy costs in the fiscal accounts, and as lower input costs for businesses, but do not show up in household expenditure directly.

³⁴ In our extrapolations of the 2008 household survey data to the year 2013, we rely on GDP and inflation data alone, which may miss structural changes. But we have no reason to suggest that this biases the results downward.

Figure 6: Per Capita Benefits Accruing From Subsidies on Energy Products
In Libyan Dinars



Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

Simulations of energy subsidy reforms

Energy subsidy reform would have a significant direct impact on households. Consistent with the fact that gasoline and electricity are the main energy products consumed by households, we find that reducing subsidies on these two items would have a far larger impact on household real income and poverty, as well as on the government budget, than reducing subsidies on other energy products. Presumably, the impact on productive sectors would also be large. Given the considerable magnitudes involved (both for necessary price adjustments to remove subsidies and impact on household/producers' welfare) a gradual approach to subsidy reform (spread over a number of years) would be called for even if a cash compensation scheme is put in place.

As in the case of food subsidies, we simulate a one-step reform under two scenarios: 1) a 30% cut in subsidies for each product and 2) a 100% decrease (total elimination) of subsidies. Recall that a 30% cut in subsidies would result in a different price increase for each product since price levels vary across products. Table 21 reports for all energy products considered the initial subsidized price, the unit subsidy, the price following a 30% reduction in subsidy (Final price, scenario 1) and the price after the elimination of all subsidies (Final price, scenario 2). This last price is equivalent to the market reference price that we consider for each product.

The elimination of subsidies (scenario 2) would lead to exceptionally large price increases. The price of kerosene would need to rise 12.1 times to match the market price; that of gas GPL would need to rise

by a factor of 10.5; and those of gasoline, diesel and electricity would need to rise by more than seven times. The product whose price is currently the “closest” to market price (gasoline) would still undergo a price increase of 7.15 times to match the market price. These are the largest gaps observed between subsidized and market prices in the North-Africa region and represent a real challenge for reform.

Table 21: Energy Subsidy Reform: Two Scenarios

Prices are in LYD per liter

	Current Subsidized Unit Price	Subsidy (percent of market price)	Final price (Scenario1)	Final price (Scenario 2)	Ratio of Market Price (\$2) to Subsidized Price
Gasoline	0.15	86.01	0.4266	1.0720	7.15
Diesel	0.15	86.49	0.4380	1.1100	7.40
Electricity	0.02	87.18	0.0608	0.1560	7.80
Gas gpl	2.00	90.45	7.6817	20.9390	10.47
Kerosene	0.09	91.74	0.3897	1.0890	12.10

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

Households would lose one fifth of their purchasing power should energy subsidies be eliminated, with the rich losing more in absolute terms but the poor losing more as a share of their income. The direct cost of a complete elimination of subsidies to households is estimated at 2.5 billion LYD (Table 22), equivalent to the total amount of direct subsidies received by households. This is a very large sum, representing 20% of total household expenditure. A 30 percent reduction in subsidies on each product would cost households 0.75 billion LYD. These costs would be rather evenly distributed across quintiles with the exception of the first quintile which would bear a much lower cost than the rest. Interestingly, the quintile that would bear the greatest cost is the third quintile. In per capita terms, removing subsidies would cost more to the upper quintiles in nominal terms, as expected given the result that energy subsidies are regressive. Nonetheless, because energy expenditure represents a higher share of total expenditure for the poor, the per-capita loss of the lower quintiles represents a larger share of their total per-capita spending (Table 23) –but the difference is not as stark as we found it to be in the case of food subsidy reform (Table 12).

Table 22: Monetary Impact (Direct Effect) of Subsidy Reform on Households

In Millions of LYD; Reform Scenario 1

	Gasoline	Diesel	Electricity	GAZ_GPL	Kerosene	Total
Quintile_1	-53.2	-1.4	-61.0	-16.1	-0.9	-132.6
Quintile_2	-64.4	-1.4	-69.4	-16.6	-1.5	-153.4
Quintile_3	-66.5	-1.1	-69.8	-16.2	-1.7	-155.3
Quintile_4	-66.7	-1.1	-67.5	-15.8	-2.0	-153.1
Quintile_5	-61.9	-1.3	-73.1	-14.9	-2.1	-153.3
Total	-312.8	-6.4	-340.9	-79.6	-8.2	-747.7
NB: Total (\$2)	-1042.6	-21.2	-1136.2	-265.2	-27.4	-2492.5

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

Table 23: Per-capita Monetary Impact (Direct Effect) of Subsidy Reform on Households
In percent of total per-capita expenditure; Reform Scenario 2

	Gasoline	Diesel	Electricity	GAZ_GPL	Kerosene	Total
Quintile_1	-9.6	-0.2	-11.0	-2.9	-0.2	-24.0
Quintile_2	-9.4	-0.2	-10.1	-2.4	-0.2	-22.3
Quintile_3	-8.6	-0.1	-9.0	-2.1	-0.2	-20.1
Quintile_4	-8.1	-0.1	-8.2	-1.9	-0.2	-18.6
Quintile_5	-6.7	-0.1	-7.9	-1.6	-0.2	-16.6

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

The government would save close to 4 percent of its total expenditure should energy subsidies be eliminated. Eliminating all energy subsidies would create direct savings of 2.5 billion LYD to the government budget—the same amount as the total direct value of subsidies to households. This would amount to approximately 3.9% of government expenditure (Table 24). The removal of gasoline subsidies alone could create direct savings of 1.6% of government expenditure and the removal of subsidies on electricity about 1.8%. A 30 percent reduction in subsidies on all products (scenario 1) would create 1.22 billion LYD in direct savings to the government budget which is more than one third of the decline in spending under the 100% reduction scenario (scenario 2). As already explained for the case of food subsidies, this is because with a partial reduction in subsidies we have two sources of reduced government spending, the first resulting from higher subsidized prices and the second resulting from lower quantities consumed by households at these higher prices. If subsidies were totally eliminated, this second effect would disappear given that no quantities would be sold at a subsidized price.

Table 24: Magnitude of Reduction in Government Expenditure Following Subsidy Reform (S1)
In Libyan Dinars

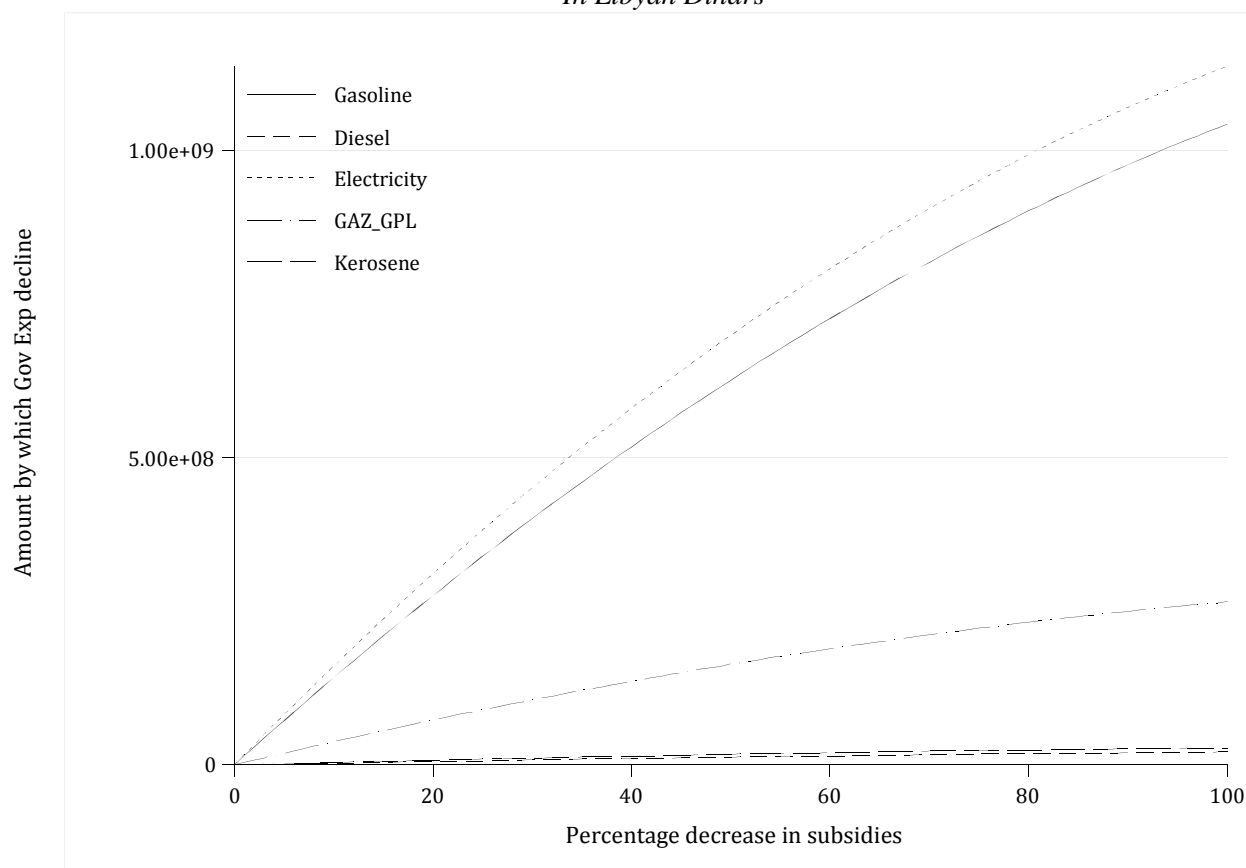
	Gasoline	Diesel	Electricity	GAZ_GPL	Kerosene	Total
Quintile_1	84,273,296	2,197,311	101,441,672	27,876,292	1,586,568	217,375,136
Quintile_2	102,026,952	2,275,849	115,323,712	28,815,506	2,771,826	251,213,840
Quintile_3	105,374,184	1,707,626	116,004,728	28,093,556	3,047,044	254,227,136
Quintile_4	105,644,264	1,817,591	112,205,056	27,292,528	3,569,895	250,529,328
Quintile_5	98,004,456	2,147,338	121,453,008	25,742,580	3,716,235	251,063,616
Total	495,323,136	10,145,714	566,428,160	137,820,464	14,691,567	1,224,409,088
NB: Total S2	1,042,587,904	21,175,252	1,136,173,056	265,173,264	27,375,106	2,492,484,608
NB: Total S2 in percent of gov expenditure	1.61	0.03	1.76	0.41	0.04	3.86

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

Reforming gasoline and electricity prices would bring the greatest savings to the government budget. Figure 7 illustrates, for each energy product, the direct impact on government expenditure (measured on the y-axis in LYD) that a percentage reduction in subsidy (x-axis) would generate. The values that correspond to 30% and 100% reductions are the same as those reported under the two scenarios in the table above. For all products, government expenditures are a decreasing function of subsidy reduction. The marginal returns to reducing subsidies would diminish as prices get closer to

market levels, because fewer and fewer quantities would be bought at subsidized prices given fixed household expenditure levels.

Figure 7: Magnitude of Decline in Government Spending Following Reform Scenario 2
In Libyan Dinars



Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

Energy subsidy reform could have a substantial impact on poverty. A 30% reduction in subsidies, assuming unchanged consumption patterns, would increase poverty (measured by the international line of \$1.25 per day) by 2.7 percentage points, from 8.5% to 11.2% (Table 25). The increase in poverty following a total elimination of subsidies would be significantly higher, at 13.2 percentage points, resulting in a post-reform poverty rate of 21.7%. These magnitudes are commensurate with the magnitude of price adjustments that would be needed under either reform scenario. The products that would explain most of the rise in poverty under the two scenarios are gasoline (+4 percentage points) and electricity (+5¼ percentage points). The rise in poverty would also be accompanied under scenario 2 by a rise in inequality, estimated at 3.2 percentage points. These estimates are among the highest when compared with those for other countries in the region such as Morocco, Tunisia, Egypt or Jordan, in part because of the higher level of subsidies in Libya compared to these countries.

Table 25: Impact of Energy Subsidy Reform on Poverty
Poverty measured in percent of total population

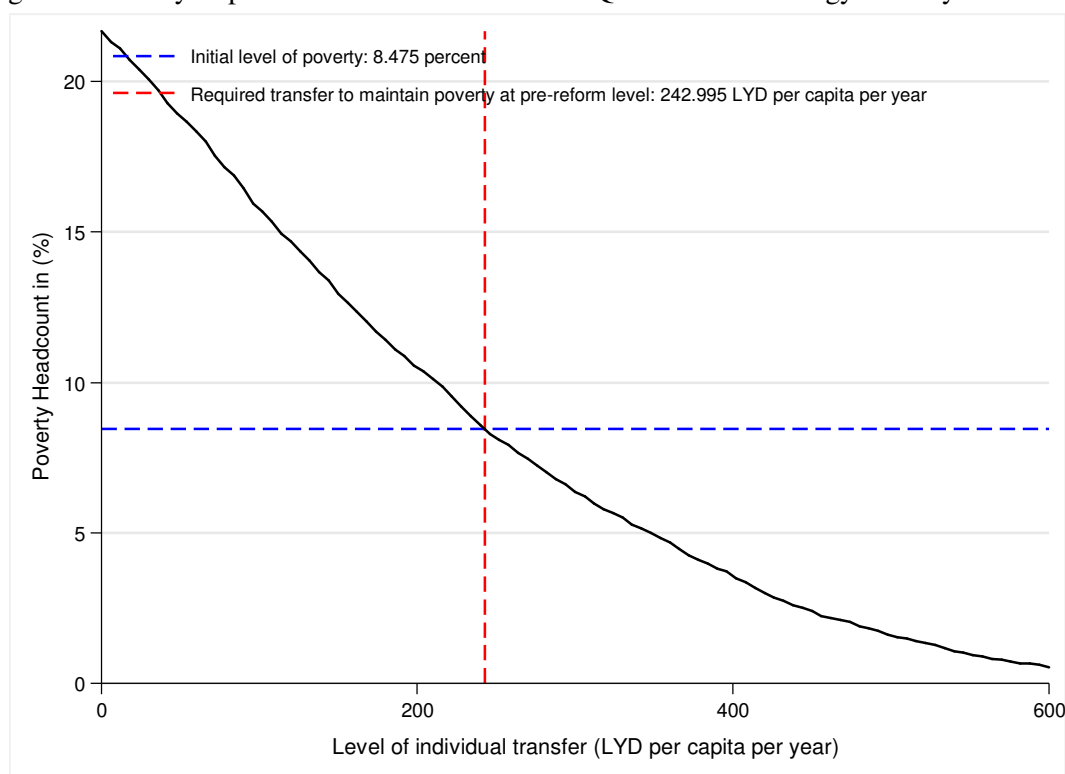
	Scenario 1				Scenario 2			
	Poverty level (percent)	Change in poverty	Standard error	P-Value	Poverty level (percent)	Change in poverty	Standard error	P-Value
Pre reform	8.475	.	.	.	8.48	.	.	.
Gasoline	9.31	0.83	0.09	0.00	12.49	4.01	0.18	0.00
Diesel	8.51	0.03	0.02	0.07	8.59	0.12	0.03	0.00
Electricity	9.69	1.21	0.10	0.00	13.73	5.25	0.20	0.00
GAZ_GPL	8.67	0.20	0.04	0.00	9.32	0.84	0.08	0.00
Kerosene	8.50	0.03	0.02	0.12	8.53	0.06	0.02	0.02
Post reform	11.16	2.68	0.15	0.00	21.67	13.20	0.30	0.00
<i>Memo: Poverty Impact of Reform based on national poverty line measurement:</i>								
Pre reform	14.440	.	.	.	14.440	.	.	.
Post reform	18.160	3.720	0.170	0.000	30.444	16.004	0.311	0.000

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

A number of factors can help attenuate the above negative impact of energy subsidy reform. A gradual and sequenced approach to energy subsidy reform, across products and across time, would help make room for simultaneously working on improving public service delivery, so that households and productive sectors are able to gradually adjust to the new economic realities. Besides, the poverty impact of energy subsidy reform measured above is purely monetary, and thus does not take into consideration inevitable substitution patterns that would result when a reform is introduced; these substitutions would be greatly facilitated if the reform were gradual and accompanied by complementary measures to provide other options for citizens in terms of services (such as more efficient electricity production or the introduction of public transportation networks).

The impact of subsidy reform could also be attenuated through cash transfers. A transfer of LYD 295 per capita per year targeted to the first quintile would be sufficient to restore poverty to the pre-reform level of 8½ percent under the scenario of full subsidy elimination (Figure 8). This targeted transfer system would cost the government LYD 571 million per year. Alternatively, because poverty would jump over 20% if all energy subsidies are eliminated, the government may decide to target the transfers to the first two quintiles. The per-capita amount required to bring poverty back to 8½ percent in this case would be LYD 245, costing the government LYD 845 million per year. Yet another possibility to restore poverty to the 8½ percent level would be a universal transfer of LYD 243 per capita per year, costing the government LYD 1.5 billion annually. Given that direct savings from the price increases would amount to LYD 2.5 billion (Table 24), the net gains to the budget from full subsidy elimination *and* cash compensation to the population in the first quintile of LYD 295 per capita would be LYD 1.9 billion. In case targeting the first quintile is not possible, extending a transfer of LYD 243 per person per year to the entire population—sufficient to maintain poverty at 8½ percent—would reduce the net gains to the budget from subsidy reform *and* cash transfers to LYD 944 million per year.

Figure 8: Poverty Impact of Cash Transfers to First Quintile under Energy Subsidy Reform S2



Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

Table 26: Impact of Energy Subsidy Reform (Scenario 1) on Quantities Consumed

	Gasoline (liters)	Diesel (liters)	Electricity (kWh)	GAZ_GPL (Bottle 15 kg)	Kerosene (liters)
Quintile_1	-48,122,316	-1,222,470	-424,353,696	-888,996	-1,000,547
Quintile_2	-58,260,132	-1,266,165	-482,425,472	-918,948	-1,748,013
Quintile_3	-60,171,492	-950,035	-485,274,272	-895,925	-1,921,575
Quintile_4	-60,325,716	-1,011,214	-469,379,392	-870,380	-2,251,304
Quintile_5	-55,963,180	-1,194,668	-508,065,728	-820,951	-2,343,591
Total	-282,842,848	-5,644,551	-2,369,498,624	-4,395,200	-9,265,030
NB: Total S2	-454,212,448	-9,002,348	-3,843,167,744	-6,572,784	-14,432,063
NB: Total S2 (in percent of total quantities)	-40.17%	-40.81%	-46.00%	-46.94%	-52.67%

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

Energy price increases would also be expected to reduce consumption (Table 26).³⁵ Based on our assumptions, a 30 percent reduction in energy subsidies would reduce the quantities of energy products

³⁵ These results are entirely dependent on the choice we made regarding the point elasticity at market price and the shape of the demand curve. Underlying our analysis are demand curves that depict the same elasticity for all households but differ in elasticity across products, with the difference depending on the gap between market price

consumed by 46% for electricity, 52.7% for kerosene, and 40 percent for gasoline and diesel. The estimated impact on quantities would also vary across quintiles. For kerosene, for example, the impact would be greater for richer households, but for other products such as diesel and gas GPL the impact would be the greatest for the second quintile.

VII. Summary and Conclusions

This paper provided a food and energy subsidy incidence analysis as well as impact analysis for two alternative reform scenarios. The results provide useful information for each subsidized good (impact on household welfare and on poverty) that should guide the authorities in considering alternative reform proposals.³⁶ Below we review quickly the key results and discuss the main issues that could usefully be addressed in the authorities' reform plans.

Food subsidies save households some 10% of annual expenditure and eliminating them would have a significant effect on poverty. Table 27 summarizes the results of the food subsidy analysis. Household expenditure loss would reach 3% under scenario 1 and 10.2% under scenario 2. Expenditure on food purchased under the quota system would rise from 2% to 5.3% of total household expenditure under scenario 1 and to 13.7% under scenario 2, as the incidence of subsidies would drop from 10.2% in the pre-reform scenario to 7.4% under scenario 1 and zero under scenario 2. Subsidy reform would reduce government spending by about 1% under scenario 1 and 2% under scenario 2 (but additional savings from lower administrative costs and less waste/smuggling would also materialize). The poverty impact would be particularly stark: depending on the definition used, poverty would rise from 8.5% (or 14.4%) to 10.5% (or 17.3%) under scenario 1 and to 16.6% (or 24%) under scenario 2. Inequality would also rise.

Table 27: Summary of Aggregate Results for the Case of Food Subsidies

	Pre-reform	Scenario 1: 30% reduction in subsidies	Scenario 2: elimination of subsidies
Total real household expenditure (billion LYD)	12.53	12.15	11.25
Household expenditure loss in real terms (% of pre-reform)	...	-3.1	-10.2
Expenditure on subsidized products (billion LYD)	0.26	0.64	1.54
Incidence of expenditure on subsidized products (% total exp)	2.1	5.3	13.7
Total subsidies (billion LYD)	1.28	0.90	0.00
Incidence of subsidies (% tot exp)	10.2	7.4	0.0
Change in government spending following reform (billion LYD) *	...	-0.66	-1.28
Savings to the government following reform (% government expenditure) *	...	1.0	2.0
Poverty headcount (%): International poverty line (\$1.25 per capita per day)	8.5	10.5	16.6
Poverty headcount (%): National poverty line (966.26 LYD per person per yr)	14.4	17.3	24.0
Inequality (%)	30.2	31.0	33.2

* These estimates exclude savings from reduced waste, smuggling and administrative costs.

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

and subsidized price. For energy products, we assumed a point elasticity of -0.5 at the free market price. This estimate and a linear demand curve function are then used to estimate the point elasticity at the subsidized price.

³⁶ If the authorities decide to consider other scenarios for subsidy reduction on any product it would be relatively quick to generate corresponding results using the tools that underpin this paper.

While food subsidies are relatively progressive, the “waste” they create (about 35% of government spending on food subsidies) would support the authorities’ decision to replace them with cash transfers. This paper’s analysis can provide guidance for the size of cash transfers that would compensate for food subsidy reform. One can look for guidance in the estimates of the per-capita monetary value of subsidies received by the various quintiles of the population (Table 28). For example, under a scenario of full subsidy elimination, should the authorities wish to maintain the poverty rate constant at 8½ percent, they could allocate a per capita transfer of LYD 175 per year targeted to the population in the first quintile. If the objective is rather to compensate the population falling in the first quintile for the totality of their loss, the transfer could be LYD 180 per capita, again granted only to the population in that group. And if the objective is to compensate the average member of the population (a way to address in part the needs of the middle class in a compensation scheme) then cash transfers could amount to, for example, 201 LYD per year per person, which is the average monetary value that a Libyan person derives from food subsidies today. Table 29 summarizes the fiscal cost of these alternative cash transfer scenarios.

Table 28: Per-capita Monetary Value of Food Subsidies (in LYD per year)

	Flour	Flour-bread	Semolina	Rice	Sugar	Tea	Pasta	Vegetable Oil	Tomato Paste	Milk for children	Milk (concentrated)	Total
Quintile_1	13.03	46.14	2.10	21.84	15.08	4.21	16.66	36.53	13.48	1.48	9.11	179.66
Quintile_2	13.94	54.70	2.32	24.74	16.70	4.77	17.79	39.22	14.59	2.85	10.45	202.08
Quintile_3	14.46	56.83	2.14	26.16	16.94	4.82	17.90	40.29	14.80	4.15	10.36	208.84
Quintile_4	15.17	60.28	1.91	26.72	17.51	4.66	18.04	40.52	14.79	6.16	9.74	215.49
Quintile_5	14.46	71.26	1.55	27.14	17.02	4.48	18.01	40.67	14.78	8.53	9.62	227.54
Total	14.01	55.12	2.07	24.70	16.42	4.56	17.53	38.97	14.35	3.80	9.83	201.36
<i>Note: Per capita annual cash transfer that will maintain poverty at 8.5% in case of reform scenario 2 ==></i>												175.41

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

Table 29: Budget Costs of Alternative Cash Transfer Scenarios Accompanying Food Subsidy Reform (In million LYD)

	Assumed Transfer Amount (in Libyan dinars per capita per year)					
	<i>Universal (non-targeted) transfers</i>			<i>Transfers targeting only the bottom quintile</i>		
	LYD 175	LYD 180	LYD 201	LYD 175	LYD 180	LYD 201
Quintile_1	338.9	348.6	389.3	338.9	348.6	389.3
Quintile_2	264.6	272.2	303.9	0	0	0
Quintile_3	221.3	227.6	254.1	0	0	0
Quintile_4	173.6	178.6	199.4	0	0	0
Quintile_5	116.6	119.9	133.9	0	0	0
Total	1,115.0	1,146.9	1,280.7	338.9	348.6	389.3

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

The above examples dealt with eliminating all subsidies in one step but, alternatively, the authorities may decide to sequence the reform over products and over time. Price liberalization could start with items that are likely to have a small impact on households such as semolina and milk for children³⁷ and move onto bigger ticket items over time. This approach may be easily followed in Libya

³⁷ A caveat to our analysis is that it does not take into consideration the nutritional consequences of food subsidy reform. Such an analysis may be needed before arriving at a view on how small is the impact on households particularly if the reform is not accompanied by cash transfers.

since it was implemented in the past—as noted in section II, between 2007 and 2010 only 3 food items were subsidized, flour rice and semolina. Yet another possibility, given the generous calorific content of the quotas, could be to start reducing the quantities of all food items under the quota system gradually before eliminating subsidies altogether at a later point in time.³⁸

Energy subsidies save households about 26% of annual expenditure and their elimination would also significantly impact poverty. Table 30 summarizes the aggregate results for analysis of energy subsidies. Household expenditure loss would reach 6% under scenario 1 and 25.9% under scenario 2. These magnitudes are much larger than the ones seen in the case of food subsidies, given the much larger subsidized component underpinning energy prices in Libya today, compared to that in food prices. Expenditure on subsidized energy products would increase from 3% of total household expenditure before the reform to 9.5% under scenario 1 and a staggering 39% under scenario 2. Subsidy reform would reduce government spending by about 1.9% under scenario 1 and 3.9% under scenario 2 (but this would be a partial impact on the government budget since factors like indirect effects and effects on productive sectors are not incorporated in the analysis, nor are other factors like smuggling). The impact on poverty would be very high with a rise in poverty from 8½ percent under the international poverty line (or 14.4% under the national line) to 11.2 percent (or 18.2%) under scenario 1 and to 21.7% (or 30.4%) under scenario 2. This rise in poverty would also be accompanied by a rise in inequality of 3.2 percentage points. These are partial estimates however, since substitution effects are likely to lower the total impact on households.

Table 30: Summary of Aggregate Results for the Case of Energy Subsidies

	Pre-reform	Scenario 1: 30% reduction in subsidies	Scenario 2: elimination of subsidies
Total real household expenditure (billion LYD)	12.53	11.79	9.29
Household expenditure loss in real terms (% of pre-reform)	...	-6.0	-19.9
Expenditure on subsidized products (billion LYD)	0.37	1.12	3.61
Incidence of expenditure on subsidized products (% total exp)	3.00	9.5	38.9
Total subsidies (billion LYD)	2.49	1.74	0.00
Incidence of subsidies (% tot exp)	19.9	14.8	0.0
Change in government spending following reform (billion LYD) *	...	-1.22	-2.49
Savings to the government following reform (% government expenditure) *	...	1.9	3.9
Poverty headcount (%): International poverty line (\$1.25 per capita per day)	8.5	11.2	21.7
Poverty headcount (%): National poverty line (966.26 LYD per person per yr)	14.4	18.2	30.4
Inequality (%)	30.2	30.8	33.4
* These estimates exclude savings from reduced waste, smuggling and administrative costs. They also exclude savings from reduced subsidies to producers (which are the source of indirect effects on consumers).			

Source: Libyan Household Consumption Survey 2007/8; Libyan authorities; and Bank staff calculations.

³⁸ Indeed, as already mentioned, the current basket of subsidized products provides more than twice the amount of adult calories intake as recommended by the WHO or FAO. If we consider that the majority of household members in poor households composed of 6-7 individuals are children, this suggests that the amount of calories allocated within the quota system is anywhere between two and three times the calories needed. This would justify a reduction in quotas based on the level of individual calorific needs—quotas could be cut by half, for example. This would be equivalent to reducing food subsidies by half, which would save more than 1% of government spending.

Clearly, energy subsidy reform would have a huge impact on the Libyan economy, which calls for gradualism. Full liberalization would imply price increases by between 7 and 10 times the existing prices, in a context where alternatives (such as more efficient production processes for electricity, or public means of transportation) are not available. It would therefore seem imperative that the reform be planned in stages, with a product by product approach, gradually liberalizing product after product over a number of years, and along with significant improvements in service delivery in related areas (electricity, transport, etc.). The latter would help improve efficiency, contributing to lower energy consumption. For the electricity sector in particular, the authorities seem to be rightly considering to first improve performance at all levels—production, distribution and collection—at the same time as (if not before) embarking on reducing electricity price subsidies to the consumer.

It is also important to consider the effect of energy reforms on producers. If the authorities wish to introduce a cash compensation scheme to accompany eventual energy price reforms, the results in this paper could guide the decision on amounts to grant households, but further analysis would be needed to assess the impact of price increases on producers and decide whether a compensation scheme would be needed for them as well.

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Appendix—SUBSIM Basic Formulae

This annex provides a brief introduction to the basic formulae used by SUBSIM. The first version of SUBSIM (SUBSIM 1.0) was accompanied by a full paper: Araar, A. and Verme, P. (2012) Reforming Subsidies: A Toolkit for Policy Simulations, World Bank Policy Research Working Paper No. 6148. The paper includes a general section on subsidies simulations, a section on the economic theory behind SUBSIM and the SUBSIM 1.0 users' guide. The sections below integrate and update the theoretical part of the paper for SUBSIM 2.0.

Changes in welfare

Let w =welfare measure; e =expenditure; p =price, the subscript 1 representing the subsidized product and the subscript 2 representing the bundle of all other consumed products. The change in welfare due to an increase in the price of product 1 (reduction in subsidies) can be estimated as:

$$\Delta w = -e_1 dp_1$$

where dp represents the relative price change ($\Delta p_1/p_1$). This is the most popular method to estimate changes in welfare subject to changes in prices and is the same approach proposed by Coady et al. (2006) among others.

Note that this formula applies with any behavioral response on the part of households including changes in quantities consumed of the subsidized products or substitution of the subsidized product with consumption of other products. This means that the use of elasticities in SUBSIM does not affect the estimation of the impact of subsidies reforms on household welfare. Households can reorganize consumption as they wish but the impact on total household welfare will not change.

In the case of multiple pricing of the product considered (for example electricity with different tariffs for different quantities consumed) the formula for the changes in household welfare is as follows:

$$\Delta w_h = - \sum_{b=1}^B e_{1,h,b} dp_{1,b}$$

where b represents the blocks and h households. The sum across households represents the total change in welfare.

SUBSIM 2 also allows to model household behavior using a Cobb-Douglas function. In the case of multiple pricing of the product considered the formula is as follows:

$$\Delta w = e_{1,h} \left(\frac{1}{\prod_{m=1}^M \varphi_{m,h}^{\alpha_{m,h}}} - 1 \right)$$

Where $\varphi_{m,h}$ is the average weighted post reform price (the post reform price in the linear case) of household h for the good m and $\alpha_{m,h}$ is the expenditure share of household h for the good m .

The marginal approach is the most common method and it is usually accurate for small or moderate price increases. For very large price increases, the marginal approach tends to overestimate the welfare impact and it is better to use the Cobb-Douglas approach.

Changes in quantities

Estimates of changes in quantities in the consumption of the subsidized product are useful to have an idea on the impact of the subsidy reforms on quantities consumed and, by consequence, on production of subsidized goods. They are also essential to estimate the impact of reforms on government revenues given that the government reduces expenditure on subsidies when households reduce consumption of subsidized products. Estimates on changes in quantities, in turn, require knowledge of the demand function and the price-quantity elasticity of the subsidized product.

SUBSIM assumes a linear demand function and allows for imputing elasticities. The basic formula for the estimation of changes in quantities of the subsidized product is

$$\Delta q_1 = q_1 dp_1 \varepsilon_1$$

where the own price elasticity ε_1 is typically negative and between 0 and -1. Note that we are assuming that all households behave equally so that the total impact on quantities is just the sum of the changes in quantities consumed across all households.

Elasticity

The formula for the estimation of changes in quantities consumed uses the own-price uncompensated elasticity. One of the main difficulties in subsidies simulations is to specify the value of this elasticity correctly. There are at least three major difficulties.

The first difficulty is that it is very hard to estimate elasticities when products are subsidized. When prices are subsidized and especially when only one price is applied nationally and on all quantities, it is not possible to estimate the own-price elasticity cross-section with a model based on household data (there is no price variation). Sometime, the subsidized price changes over time and one may have available several household consumption surveys that cover the period when price changes occurred. However, this is rare and it is very difficult to isolate the impact of the price change in the subsidized product from other

effects on expenditure over time. Therefore, subsidies analysts can rarely estimate elasticities for the country of interest.

The second difficulty relates to the use of known elasticities from the literature and other countries. Sometimes, it is possible to derive elasticity parameters from the specific literature on products. For example, the own-price elasticity for gasoline is quite well known and has been estimated widely worldwide and the user could simply use estimations made for similar countries to the country of interest. However, known elasticities are typically estimated at free market prices and they are point elasticities that apply to prices that are not subsidized. The point elasticities at subsidized prices may be very different and cannot be assumed to be the same. Therefore, it is very difficult for subsidies analysts to simply “borrow” elasticities from elsewhere.

The third difficulty is that the formula presented in the previous section is designed for small changes in prices (marginal changes) and does not function well for large price changes. When the product between changes in prices and elasticity ($dp_1 \varepsilon_1$) is greater than 1, the post-reform quantity can become negative using this formula. Unlike other simulations of price changes, changes in subsidized prices can be very large, especially when governments want to remove subsidies altogether. In these cases, it is not unusual to have price increases of several folds so that dp_1 can be very large. Therefore, subsidies analysts cannot simply use standard parameters for elasticities like -0.3 or -0.5 but have to consider more specifically the relation between subsidized and unsubsidized prices before specifying elasticities.

To overcome these problems, SUBSIM has three main solutions. The first solution is that, by design, SUBSIM does not allow quantities to become negative ($-Q_0$) because the post-reform quantity has a lower bound of zero. However, one should be aware that when results on quantities in the Excel output file show zero values, it is most likely that the specified elasticities are too large. Subsidized products are usually essential consumption items and it is unlikely that households stop consuming these products altogether if the price increases. It is more likely that our specification of elasticity is incorrect.

The second solution is to use the value of elasticity at unsubsidized prices from another country and derive from this elasticity the correct elasticity to use for the subsidized price. When the subsidized price is several folds lower than the unsubsidized price, this means that the subsidized price is extremely low. But if this price is extremely low and quantity is initially high, we should expect the own-price elasticity to be very low. If prices increase a little around the subsidized price, consumers will tend to reduce quantities by very small amounts. On the contrary, if the subsidized price is very close to the unsubsidized price then it is more likely that increases in prices will lead to large decreases in quantities and that the elasticity will be large. Hence, either the elasticity ε_1 is large or the relative change in price dp_1 is large but they should not be both large at the same time. As a rule of thumb, if the new price is three times the current price and the known elasticity at unsubsidized prices is (say) -0.3, then the elasticity to use in the formula may be around a third of that value, say 0.1.

With the assumption of a straight linear demand function, it is also possible to calculate precisely the initial elasticity (the elasticity at the subsidized price) using the final elasticity (the elasticity at the unsubsidized price). The formula is as follows:

$$\varepsilon_1 = \frac{\left(\frac{1}{\left(\frac{\varepsilon'_1(p'_1 - p_1)}{p'_1} \right)^{-1}} \right)}{(p'_1 - p_1)} p_1$$

The third (and perhaps the most sensible) solution is to run SUBSIM with different assumptions about the elasticity and compare results. In this case, it is useful to use zero as a lower bound and the expected value of elasticity at the unsubsidized price as an upper value. This is what we would recommend especially when price increases are very large.

Changes in government budget balance

Having discussed elasticities and changes in quantities, we can now estimate changes in government budget balance (resulting from changes in expenditure). We may face two cases, one where we know the unit subsidy and one where we don't know the unit subsidy in advance. If we know the unit subsidy, the formula is as follows:

$$\Delta r = \sum_{h=1}^H e_{k,h} dp_k (1 - \varepsilon_k (s_k - dp_k))$$

where s_k is the unit subsidy for product k . If we don't know the unit subsidy in advance, we can then approximate the change in government budget balance with the change in producers' profits as follows:

$$\Delta r = \sum_{h=1}^H -e_{k,h} dp_k (1 + \varepsilon_k (1 + dp_k))$$

SUBSIM will use one or the other formula depending on whether users specify unit subsidies or not in the Tab "Items".