



IMF Working Paper

The Unequal Benefits of Fuel Subsidies: A Review of Evidence for Developing Countries

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Abstract

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This paper reviews evidence on the impact of fuel subsidy reform on household welfare in developing countries. On average, the burden of subsidy reform is neutrally distributed across income groups; a \$0.25 decrease in the per liter subsidy results in a 6 percent decrease in income for all groups. More than half of this impact arises from the indirect impact on prices of other goods and services consumed by households. Fuel subsidies are a costly approach to protecting the poor due to substantial benefit leakage to higher income groups. In absolute terms, the top income quintile captures six times more in subsidies than the bottom. Issues that need to be addressed when undertaking subsidy reform are also discussed, including the need for a new approach to fuel pricing in many countries.

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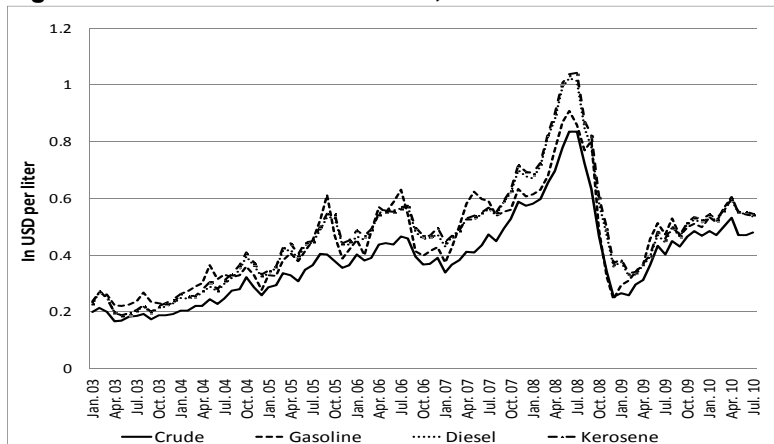
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I. INTRODUCTION

International fuel prices² have shown considerable volatility in recent years. Between end-2003 and mid-2008, nominal international fuel prices increased more than fourfold, with most of the increase occurring during 2007 and the first half of 2008 (Figure 1). However, many governments in developing countries were reluctant to fully pass through these price increases to domestic consumers, resulting in substantial fiscal costs.³

After a sharp decline in international prices in the second half of 2008, prices have increased substantially, renewing concerns about the

Figure 1. International Fuel Prices, 2003–2010



Source: US Energy Information Administration

fiscal risk associated with less than full pass-through of these increases to domestic prices. The unwillingness of many governments to fully pass through international fuel price increases to domestic consumers reflects concerns about the adverse impact of higher prices on household real incomes. Of particular concern is the impact on lower-income households who are least able to absorb the welfare cost of higher prices. For this reason, evidence on the magnitude of the welfare impact of fuel price increases, and how it is distributed across income groups, is a crucial input into policy decisions regarding how best to protect households from higher fuel prices.

This paper reviews evidence from country studies that estimate the welfare impact of fuel price increases on households. In doing so, it extends the cross-country evidence reviewed in Coady and others (2006) to a larger number of countries. Most of the country studies reviewed were conducted by staff at the IMF and followed a comparable methodology. This review is intended to promote a wider dissemination of the results from these studies and to facilitate policy advice on fuel pricing in countries where such studies have not been undertaken.

A brief overview of fuel pricing policies in the sample of countries included in the review is provided in Section II. Section III presents a brief outline of the methodology used in the

² The terms “petroleum product” and “fuel” are used interchangeably throughout the paper.

³ See Coady and others (2010) for a more extensive discussion of the magnitude of these fiscal costs, and Gupta and others (2003) for a discussion of fuel pricing policy in oil exporting countries. IEA (2009) provides a discussion of the potential environmental benefits from reforming fossil fuel pricing policies.

studies. Section IV reviews the empirical findings of the country studies. Section V discusses issues that arise when reforming fuel subsidies. Section VI summarizes the main findings of the review.

II. COUNTRY CASE STUDIES

The review covers estimates of welfare impacts for twenty countries from Africa, Asia, the Middle East, and Latin America. All of the studies were undertaken between 2005 and 2009; 16 country case studies were undertaken by the IMF, and two studies by the World Bank provided data for the 4 additional countries.⁴ However, since the magnitude of the price increases evaluated differed across the country studies, their results are not directly comparable. An important contribution of this review, therefore, is the recalculation of welfare impacts based on a common fuel price increase. To facilitate ease of interpretation and comparison across countries and fuel products, this study evaluates the welfare impact of increasing retail prices of fuel products by \$0.25 per liter.⁵ The welfare impact of any specific price increase can be easily calculated by scaling accordingly.

Many countries in these regions increased domestic retail prices substantially between 2003 and mid-2008 (Appendix Table 1). The median price increase across all regions was \$0.56, but this varied widely from \$0.02 in the Middle East to \$0.66 in Africa. These price increases reflect a combination of the pass through of increases in international fuel prices to domestic prices, as well as decreases in existing fuel subsidies or increases in existing low fuel taxes. For example, the relatively high price increases in the sample countries from the Middle East and from Asia and the Pacific occurred in the context of fuel subsidy reforms in these countries while high price increases in Africa (Mozambique, Madagascar, and Senegal) reflected increases in taxes. As one would expect, reflecting a commitment to high pass-through of international prices, on average countries with high initial domestic prices were also the countries that increased domestic prices the most (Figure 2).

However, even these large price increases were in many cases insufficient to fully pass through increases in international prices (Appendix Table 1). The pass-through ratio, defined as the ratio of the change in retail prices to the change in import costs (both in domestic currency), varied substantially across regions (Figure 3). In all regions, the median pass-through was less than 100 percent, signifying that the absolute change in the domestic price was less than the absolute change in the import cost in more than half of the countries in each region. The median pass-through was lowest in the Middle East and highest in Africa. In four of the sample countries, the average pass-through exceeded 100 percent (El Salvador,

⁴ The studies by the World Bank are Adriamihaja and Vecchi (2007), and Bacon, Bhattacharya, and Kojima (2010).

⁵ To put the magnitude of this price increase in perspective, between end-2003 and mid-2008 international fuel prices increased by about \$0.8 per liter (Figure 1). Between end-2006 and mid-2008, a period of sharply rising prices, fuel prices increased by around \$0.5 per liter.

Madagascar, Mozambique, and Senegal), while it was less than 50 percent in five countries (Gabon, Bolivia, Peru, India, and Indonesia). Within regions there is also substantial variation. For example, in Africa, in both Madagascar and Senegal the large pass-through led to an increase in average fuel taxes over the period, while in the Republic of Congo and Ghana low pass-through transformed taxes into subsidies.

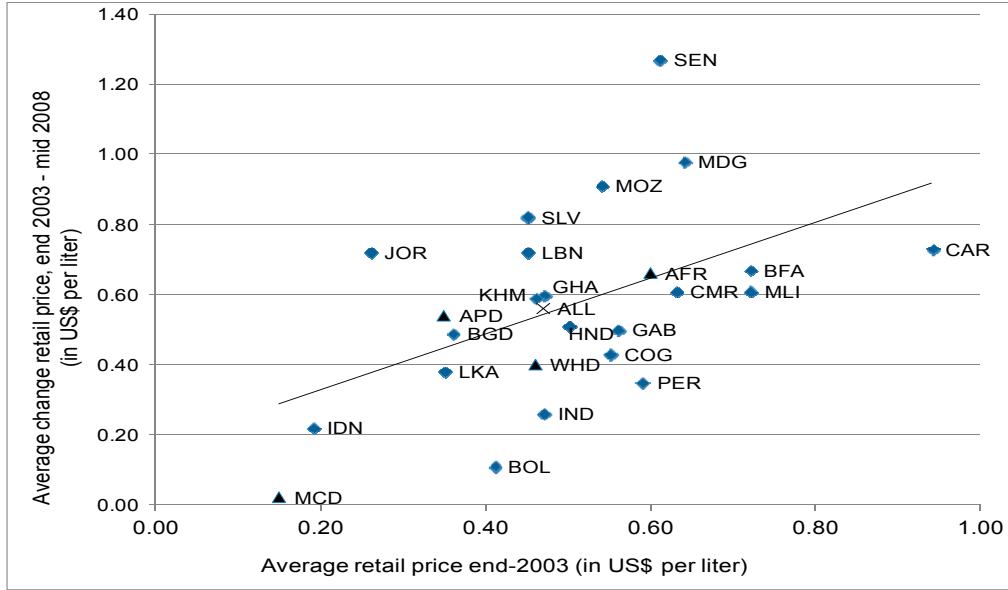
III. METHODOLOGY

The impact of increasing domestic fuel prices on the welfare of households arises through two channels.⁶ First, there is a *direct impact* on households faced with higher prices for fuels consumed for cooking, heating, lighting, and private transport. Second, there is an *indirect impact* through higher prices for other goods and services consumed by households as higher fuel costs are reflected in increased production costs and consumer prices. The magnitude of these impacts will depend on the importance of cooking, lighting, heating, and private transport costs in total household consumption, as well as on the fuel intensity of other goods and services. The distribution of the impacts across different income groups will depend on the relative importance of these factors across income groups. For example, if the consumption baskets of higher-income groups are relatively more fuel intensive than for lower-income groups, then the impact on the former will be greater than on the latter.

Evaluating the direct impact requires data on household expenditures on fuels for cooking, heating, lighting, and transport. Many countries have household survey data that contain information on consumption patterns, with detailed information on fuel consumption. These data can be used to calculate the budget share for each fuel product for each household, i.e., total household expenditure on each fuel product divided by total household consumption. All of the studies in the review use such data to calculate the direct impact of fuel price increases on households. The budget share for a given fuel (i.e., the ratio of fuel expenditure to total household consumption) provides an estimate of the welfare impact of a doubling of the fuel price absent any demand response. For example, if the budget share for gasoline is 0.05 (i.e., the household allocates 5 percent of its total consumption budget to gasoline) then a doubling of the price of gasoline will result in a decrease in welfare for the household equivalent to a 5 percent decrease in real income. In this review, the welfare impact of a common \$0.25 per liter increase in the price of fuel products is calculated by scaling budget shares, which capture the welfare impact of a doubling of existing prices, accordingly to reflect different initial retail prices across countries (Appendix Table 2).

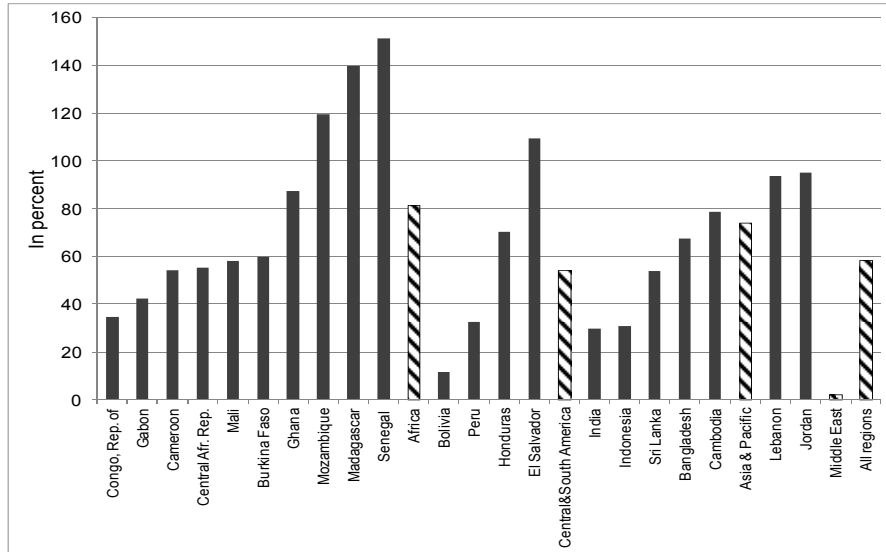
⁶ In developing countries, gasoline is typically used for private household transport and in smaller private business vehicles, diesel is used mostly in larger private and public transport vehicles, and kerosene is used by households for lighting and cooking, especially those without access to electricity.

Figure 2. Retail Price Increases Between End-2003 and Mid-2008 in Sample Countries



Sources: OECD, U.S. EIA, and Coady and others (2010).
 Note: Averages are consumption-weighted averages for gasoline, diesel, and kerosene. See Appendix Table 1 for product-specific data. Regional averages are indicated with a triangular marker.

Figure 3. Pass-Through Between End-2003 and Mid-2008 in Sample Countries



Sources: OECD, U.S. EIA, and Coady and others (2010).
 Note: Regional pass-through is the median for the region, and levels are consumption weighted averages of pass-through for gasoline, diesel, and kerosene. See Appendix Table 1 for product-specific data.

Since this estimate of the direct welfare impact implicitly assumes that households do not reduce the impact by substituting away from fuel, it is often interpreted as either an estimate of the short-run impact (i.e., before households can adjust fuel consumption) or as an upper bound on the long-run estimate. None of the studies reviewed attempts to adjust for such substitution. The impact of such an adjustment would depend not only on the pattern of price increases across different fuel products (capturing changes in relative fuel prices and the resulting inter-fuel substitution) but also on the change in the relative price of fuel and non-fuel consumption. The latter reflects the fact that non-food prices are also affected by higher fuel prices.

Most of the country studies evaluated the indirect impact of higher fuel prices by estimating the impact on the prices of other goods and services, which essentially requires a model of price shifting. The model used in these studies, which is presented elsewhere in Coady and others (2006) and Coady and Newhouse (2006), assumes that increases in fuel costs are fully passed forward onto the domestic prices of goods and services. Estimating these price increases requires information on the production structure of the economy, e.g., an input-output table describing the share of different inputs in the production cost structure.

The approach used to estimate the indirect impact on prices of other goods and services implicitly assumes that goods are non-traded, that domestic production technologies exhibit constant returns to scale, and that demand is completely price inelastic. The non-traded assumption is less problematic in the present context since much of the indirect impact of fuel price increases comes from the higher cost of domestic transport for distributing goods and services within a country, and this component of all goods and services is inherently non-traded. But the assumption of demand inelasticity means that estimates should again be interpreted as short-term impacts or upper-bounds on long-term impacts.⁷

Once the impact of higher domestic fuel prices on the prices of other goods and services is estimated, this is multiplied by the household budget share for each of these consumption categories (taken from a household survey) to get the welfare impact of each price change. These welfare impacts are then aggregated to estimate the total indirect welfare impact of fuel price increases for each household. The total impact of fuel price increases is then calculated as the sum of the direct and indirect impacts.

The distribution of the impact across households in different parts of the income distribution is estimated by calculating the average impact for households in different income groups. Consistent with most studies of poverty and inequality, households are allocated to welfare quintiles based on a measure of consumption per capita or per adult equivalent (i.e., consumption adjusted for different needs reflecting different household demographics). The

⁷ For an analysis of fuel subsidy reform that allows for demand responses within a general equilibrium framework, see Clements, Jung, and Gupta (2007).

distribution of the welfare impact from a price increase is classified as progressive if the percentage welfare loss increases with household consumption. Therefore, a progressive (regressive) distribution of the welfare loss means that the share of higher income groups in the aggregate welfare loss is greater (less) than their share in aggregate consumption.

Whether or not lower fuel prices are seen as an effective approach to protecting the welfare of low-income households will depend on the share of the total benefit from low fuel prices that accrues to lower-income households. Good targeting requires that a high proportion of benefits accrue to lower-income households. If a substantial proportion of benefits leak to higher income households then it is likely that more effective approaches to social protection are possible.

Some additional caveats should be borne in mind when interpreting the pattern of energy consumption and welfare impacts across countries and welfare groups. First, although in all cases the underlying welfare measure is per capita consumption of the household, the comprehensiveness of the total consumption measures used may vary. For this reason, we do not emphasize the difference in the level of budget shares for the various fuels across countries, and focus more on the pattern across different fuels and household income groups. However, the consumption measures used always coincided with the welfare measures used by each country to calculate poverty and inequality statistics. Second, not all fuel products were covered in all studies, either reflecting the focus of the study or availability of data in the household survey. But in most countries the main fuel products were covered.

IV. WELFARE IMPACTS OF FUEL PRICE INCREASES

The total (direct plus indirect) impact of a \$0.25 per liter increase in fuel prices is substantial. On average, such an increase in fuel prices results in a 5.9 percent decline in household real incomes, with the impact ranging from 3.8 percent in South and Central America to 9.6 percent in the Middle East (Table 1). Although, on average, the indirect impact accounts for over a half of the total impact, its share differs substantially across regions. Whereas the indirect effect is over 60 percent of the total impact in Africa and South and Central America, it is less than 45 percent in Asia and the Middle East. However, in all cases it is a sizeable component of the total impact, reflecting the fact that a high proportion of total fuel consumption is for intermediate use. Therefore, it is important for any evaluation of the welfare impact of fuel price changes to incorporate this indirect effect.

The composition of the direct effect also differs across regions. For example, the relative importance of kerosene in Africa reflects the low level of household access to electricity.⁸

⁸ Electricity is included in the direct effect here, since in many countries it is based on thermal fuel, especially diesel.

Kerosene is much less important in the Middle East due to more extensive access to electricity. It is also important to recognize that low household access to certain fuels can mean that the estimates in Table 1 for each fuel may substantially underestimate the impact on households with access. For example, if only half of households have access to electricity, then the impact on electricity users will be double that presented in the table. In practice, this issue is especially important for electricity and LPG; Table 2 provides an illustration of this from the studies for Burkina Faso and El Salvador.

Table 1. Direct and Indirect Welfare Impacts of Fuel Price Increases
(In percent of total household consumption)

	Direct by Product				Direct	Indirect	Total
	Gasoline	Kerosene	LPG	Electricity			
Africa (average)	0.2	1.2	0.2	0.4	2.0	3.8	5.7
Cameroon	0.2	1.4	0.1	0.5	2.3	1.3	3.7
Gabon	0.2	0.3	0.5	1.2	2.2	3.5	5.6
Central African Republic	0.0	0.6	0.0	0.0	0.7	2.8	3.5
Senegal	0.1	0.3	0.3	0.4	1.0	1.1	2.1
Ghana	0.6	5.0	0.1	...	5.6	11.7	17.3
Mali	0.4	0.9	...	0.3	1.5	1.4	2.9
Congo, Republic of	0.0	0.9	0.0	0.3	1.3	7.7	9.0
Burkina Faso	0.5	0.6	0.0	0.2	1.3	0.7	2.0
Madagascar	0.0	0.8	...	0.2	1.0	...	...
South & Central America (average)	0.2	0.2	0.3	0.8	1.4	2.4	3.8
Bolivia	0.3	...	0.5	...	0.7	2.9	3.6
Peru	0.1	0.1	0.3	0.5	0.9	0.7	1.7
El Salvador	0.2	0.1	0.3	1.1	1.7	...	...
Honduras	0.1	0.4	0.2	0.7	1.4	3.5	5.0
Asia and Pacific (average)	0.3	1.6	0.3	1.7	3.9	2.1	5.9
Bangladesh	0.1	0.9	0.1	0.7	1.7	1.5	3.2
Sri Lanka	0.2	1.0	0.3	1.1	2.7	2.6	5.3
Cambodia	.	0.3	0.4	1.5	2.2	...	...
India	0.2	1.8	0.4	1.1	3.6	...	...
Indonesia	0.7	4.1	0.2	3.8	8.8	...	...
Middle East & Central Asia (average)	1.4	0.7	1.0	2.7	5.8	4.2	9.6
Jordan	0.9	0.7	1.1	3.0	5.7	6.3	12.1
Lebanon	1.9	...	0.8	2.4	5.1	2.0	7.1
All regions (average)	0.3	1.1	0.3	1.1	2.8	3.3	6.2
Only countries with indirect effect	0.4	1.0	0.3	0.9	2.6	3.3	5.9

Source: Based on data available in country studies.

Note: The indirect effect arises predominantly from changes in the price of diesel, which is used mainly as an intermediate product in transport and other sectors. Welfare impacts relate to a \$0.25 per liter increase in the price of fuel products. [...] indicates information not available in the country study.

Table 2. Electricity and LPG Consumption Patterns

(In percent)

	Access Rate	Share in Total Consumption	
		All Households	Households with Access
Burkina Faso			
Electricity	10.0	0.4	4.4
LPG	5.2	0.1	2.1
El Salvador			
Electricity	87.8	2.7	3.0
LPG	67.8	0.8	1.1

Source: Authors' calculations based on household survey data.

Note: Access rate is the share of households with positive expenditures in the specific energy product.

The indirect impact on households depends on the fuel intensity of their consumption. Table 3 presents data on the average budget share of food, non-food (excluding direct fuel consumption), and transport (including household use of private and public transport services). The indirect effect is calculated as a budget-share weighted average of price changes across these consumption categories. On average, the slightly lower budget share for non-food compared to food is offset by the greater fuel intensity of non-food, as reflected in its higher price effect. As a result, on average, higher non-food prices account for just over 50 percent of the indirect impact on households and higher food prices for nearly 40 percent. Although transport services absorb, on average, only 3.3 percent of household budgets, the relatively large price effect (reflecting the relatively high energy intensity of these services) means that it accounts for nearly 10 percent of the indirect impact.

The total, direct and indirect welfare impacts are approximately distributionally neutral with the percentage decrease in welfare being very similar across income groups. (Table 4; Appendix Table 3 disaggregates across regions). However, in the case of the direct effect, this hides substantial variation across products. Whereas the impacts for gasoline and electricity are strongly progressive, the kerosene impact is strongly regressive. The distribution of the impact of LPG seems to differ across regions. Clearly the lowest income household will obviously have more substantial difficulties absorbing such a large welfare loss given their low initial level of consumption.

Table 3. Composition of Indirect Impact
(In percent of total household consumption)

Region/Country	Budget Share			Price Effect			Indirect Impact		
	Food	Non Food	Transport	Food	Non Food	Transport	Food	Non Food	Transport
Cameroon	44.5	49.6	5.9	0.01	0.01	0.06	0.4	0.6	0.3
Gabon	48.8	47.7	3.5	0.04	0.03	0.03	1.8	1.5	0.1
Central African Republic	47.1	48.5	0.9	0.02	0.03	0.14	1.1	1.6	0.1
Senegal	49.3	47.4	3.0	0.00	0.02	0.00	0.2	0.8	0.0
Ghana	45.2	47.4	3.2	0.12	0.10	0.47	5.2	4.9	1.5
Mali	45.6	53.5	0.9	0.01	0.01	0.12	0.6	0.7	0.1
Congo, Republic of	41.4	47.7	10.9	0.02	0.12	0.09	1.0	5.7	1.0
Burkina Faso	57.0	42.3	0.7	0.01	0.01	0.07	0.3	0.3	0.1
Peru	51.2	47.1	1.8	0.01	0.01	0.03	0.4	0.3	0.0
Jordan	41.0	59.0	...	0.06	0.06	...	2.6	3.8	...
Bangladesh	65.7	30.5	2.7	0.02	0.01	0.07	1.0	0.3	0.2
Sri Lanka	56.1	38.1	2.5	0.03	0.02	0.10	1.8	0.6	0.2
All countries (average)	49.4	46.6	3.3	0.03	0.04	0.11	1.4	1.8	0.3
Share in total effect/impact	...	...	...	16.9	20.8	62.3	39.6	50.6	9.9

Source: Authors' calculations based on country reviews.

Note: The price effect is the proportionate increase in prices resulting from a \$0.25 per liter increase in fuel prices. The indirect impact is the product of budget shares and the price impact. [...] indicates information not available in the country study.

Table 4. Composition of Total Impact by Consumption Quintile
(In percent of total household consumption)

	Consumption Quintiles					All households
	Bottom	2	3	4	Top	
Total Impact	6.4	6.2	6.2	6.3	6.4	6.2
Direct Impact	2.8	2.7	2.7	2.8	2.9	2.8
Gasoline	0.1	0.2	0.3	0.4	0.7	0.3
Kerosene	1.7	1.3	1.2	1.0	0.6	1.1
LPG	0.3	0.3	0.3	0.3	0.4	0.3
Electricity	0.8	0.9	1.0	1.1	1.2	1.1
Indirect Impact	3.6	3.5	3.5	3.5	3.5	3.3

Source: Authors' computations based on country reviews.

Note: Impacts are averages of percentage impacts across all country studies based on a \$0.25 per liter increase in fuel prices.

Since the distribution of the total impact of fuel price increases is approximately neutral, maintaining low fuel prices results in a badly targeted subsidy. This reflects the substantial leakage of benefits to higher income groups. Table 5 presents the shares of the total benefits from subsidized fuel prices captured by each income group (Appendix Table 4 disaggregates by region). On average, the top income quintile receives about six times more in subsidies than the bottom quintile. The concentration of subsidy benefits in the hands of the top income groups is even more pronounced in the case of gasoline and LPG, where the top income quintile receives 20 and 14 times that of the bottom quintile, respectively. Although the poorest households receive a much higher share of kerosene subsidies than for other fuel subsidies, there is still substantial leakage of kerosene subsidies to higher income groups.

Table 5. Distribution of Subsidy Benefits by Consumption Quintile
(In percent)

	Consumption Quintiles					
	Bottom	2	3	4	Top	All households
Total Impact	7.1	11.4	16.2	22.5	42.8	100.0
Total Direct Impact	7.1	10.7	14.0	19.9	47.6	100.0
Gasoline	3.0	5.7	9.7	19.4	61.3	100.0
Kerosene	19.0	19.7	20.6	20.1	20.6	100.0
LPG	3.8	7.6	12.6	20.8	53.8	100.0
Indirect Impact	7.3	11.7	16.3	22.6	42.0	100.0

Source: Authors' computations based on country reviews.

Note: Impacts are averages across all country studies.

In the case of electricity, the ability to vary tariff levels according to consumption levels can be used to mitigate the impact of price increases on poor households. The tariff schedule for electricity typically has a lower “lifeline tariff” for electricity consumption below some specified monthly electricity consumption. However, this approach to protecting low-income households is often less effective than believed. Table 6 presents an illustration from El Salvador. Nearly 13 percent of all households are not connected to the electricity grid, and this number rises to nearly 32 percent for the bottom income quintile.⁹ In addition, a substantial proportion of low-income households has consumption above the lifeline threshold, possibly due to larger family sizes. Therefore, a large proportion of poor households does not benefit from lower lifeline tariffs, either because they do not consume electricity or they consume above the lifeline threshold. Also, to the extent that lifeline subsidies are financed through higher tariffs for larger electricity consumers, poor households that consume large amounts of electricity will actually lose out as a result.

Table 6. Electricity Consumption Patterns in El Salvador
(In percent)

	Consumption Quintiles					
	Bottom	2	3	4	Top	All households
Budget Shares Electricity						
All households	2.3	2.7	3.1	3.1	2.3	2.7
Households with positive consumption	3.3	3.1	3.4	3.2	2.3	3.0
Consumption Pattern (In percent of households in each quintile)						
No Consumption	31.5	13.8	9.0	5.9	2.5	12.6
Consumption between 1 and 49 kWh	27.2	30.3	18.4	13.9	10.9	20.1
Consumption between 50 and 99 kWh	30.6	35.2	37.8	32.3	22.8	31.8
Consumption more than 99 kWh	10.8	20.7	34.7	47.8	63.9	35.6

Source: Authors' computations based on country studies.

⁹ Access to electricity tends to be substantially lower in Africa and Asia.

V. REFORMING FUEL SUBSIDIES: EXPERIENCE AND POLICY OPTIONS

The substantial leakage of subsidy benefits to the top income groups means that universal fuel subsidies are an extremely costly approach to protecting the welfare of poor households. For example, if we take the poorest 20 percent of households to be our target “poor” group, the cost to the budget of transferring one dollar to this group via gasoline subsidies is around 33 dollars (i.e., \$1/0.03). This reflects the fact that over 97 out of every 100 dollars of gasoline subsidy “leaks” to the top four quintiles. Even for kerosene, this cost-benefit ratio is around 5 dollars (i.e., \$1/0.19).

Such high leakage of subsidy benefits means that there is likely to be a high return to developing more effective ways of protecting the real incomes of poor households. For example, if 15 out of every 100 dollars allocated to a safety net program is absorbed by administrative costs and 80 percent of the remaining 85 dollars in beneficiary transfers reaches the poor (or 68 percent of the total budget), then the cost-benefit ratio for such a program is 1.5 dollars (i.e., \$1/0.68), which is substantially lower even than for kerosene subsidies. In addition, the extent of protection that can be given to the poor via kerosene subsidies without severely disrupting fuel markets is very limited. Relatively low kerosene prices result in substitution of kerosene for diesel (legally or illegally) and often lead to shortages for rural households and smuggling to neighboring countries with higher prices.

However, since eliminating fuel subsidies can still have a sizeable adverse impact on poor households, reform strategies should include measures to mitigate this impact.¹⁰ Where an effective social safety net exists, expanding the budget for these programs can address concerns for poverty while containing the fiscal cost. For countries that do not have access to effective safety net programs, a more gradual reform approach is desirable if fiscal conditions allow. This could involve maintaining kerosene subsidies over the short term and using existing programs that can be expanded quickly, possibly with some improvements in targeting effectiveness (for instance, school meals, reduced education and health user fees, subsidized mass urban transport, cash transfers to vulnerable groups, or subsidies for consumption of water and electricity below a specified threshold). Similarly, other public expenditures, such as education and health expenditures, as well as infrastructure expenditures such as roads and electrification schemes, could be expanded. Box 1 presents a range of mitigating measures introduced by some countries that have undertaken fuel subsidy reforms since 2005.

Increasing retail prices to reduce fuel subsidies is always a politically sensitive issue. However, an effective public information campaign can increase public support for price

¹⁰ See Gupta and others (2000) and Coady and others (2010, Section IV) for further discussion.

increases by informing the potential beneficiaries (consumers and taxpayers) about the drawbacks of existing subsidies and the benefits of reform. This could include the following:

- *Highlight the fact that subsidies provide incentives for inefficiently high levels of fuel consumption and that the associated fiscal costs can be detrimental to growth and poverty reduction.* Eliminating subsidies will encourage more efficient energy consumption and thus reduce the impact of future international price increases on the economy. In addition, subsidy reform will contribute to fiscal sustainability and economic growth, which are crucial for sustained poverty reduction. A growing economy will also enhance households' capacity to absorb price shocks for key commodities and can be the most effective approach to mitigating the adverse impact of general price increases.
- *Highlight the fact that retail price changes reflect fluctuations in international prices.* All importing countries face price fluctuations and need to adjust to this reality. As indicated above, passing through higher international prices to domestic prices provides the appropriate incentive to consumers to reduce fuel consumption and thus mitigate the adverse impact on the economy as a whole.
- *Educate the population about the importance of fuel tax revenues in financing priority public expenditures.* This should highlight the importance of revenues for financing a range of high priority public expenditures such as improvements in education, health, and physical infrastructure. During times of relatively high price increases, it is important to clearly identify the decreases in other priority expenditures that would have to be made if subsidies increase. It is also essential to transparently record subsidies on-budget to ensure that they have to compete with these other sectors for available financing.
- *Highlight the fact that higher income groups benefit the most from fuel subsidies and that neighboring countries with higher prices are often substantial beneficiaries through cross-border smuggling.* The evidence presented above clearly shows that most of the benefit from lower fuel prices goes to higher income groups. When relevant, governments should also highlight that subsidies promote smuggling, shortages, black market activities, and corruption.

Avoiding the recurrence of fuel subsidies requires a new approach to fuel pricing in many countries. In countries with fuel subsidies, the government typically controls domestic prices. This creates the impression that price changes reflect government policy, rather than international factors, with political pressure to avoid passing through increases in international prices but to pass through decreases.

Box 1. Mitigating Measures—Country Experience

Gabon increased gasoline and diesel prices by 26 percent in March 2007.

- National Social Guarantee Fund cash payments to the poor were resumed, while conducting a new and improved census of lower-income households.
- Assistance to single mothers via the existing program in the Ministry for the Family was increased, as was funding for microcredit program targeting disadvantaged women in rural areas.
- Households with monthly electricity and water bills of less than the expenditure thresholds for subscribers who already received the social rates were eligible for free electricity and water up to a limited quantity.
- School enrollment fees were waived for pupils enrolled in public schools and school text books given free of charge to all primary school pupils.
- PRSP investments related to the expansion of rural health services, electrification, and drinking water supply were accelerated.
- The mass public transport network in Libreville was expanded (27 buses).

Ghana increased domestic fuel prices by 50 percent in February 2005.

- Fees for attending primary and junior-secondary school were eliminated.
- Extra funds were made available for primary health care programs concentrated in the poorest areas through the existing Community Health Compound Scheme.
- Investment in the provision of mass urban transport was expanded and expedited.
- Extra funds were made available to expand a rural electrification scheme.

Mozambique increased fuel prices by 38 percent in 2008.

- Budgetary allocations to a range of social protection programs were increased substantially (Direct Social Support, Social benefits Through Work, Income Generation and Community Development)
- The level of cash benefits received by beneficiaries of the Food Subsidy Program was increased, with the minimum benefit increasing from 70 MT to 100 MT and the maximum benefit from 140 MT to 300 MT
- The number of branches of the National Institute for Social protection was increased from 19 to 30 to facilitate an expansion of the program

Indonesia increased domestic fuel prices in both March and October 2005 (more than doubling prices) and again in May 2008 (prices of fuel products were increased by 25–33 percent).

- A temporary cash transfer program to 19 million poor families, with targeting relying on existing databases, was implemented in 2005 to mitigate the impact of fuel price increases. A similar cash transfer accompanied the fuel price increases in 2008 for a period of seven months.
- Some budgetary savings from reducing subsidies were reallocated to existing education, health and infrastructure programs that benefit low- and middle-income households.
- The subsidies on kerosene are being reduced in conjunction with a program to increase the use of LPG as an alternative fuel source.

Jordan initiated a gradual reduction of fuel subsidies in 2005, culminating in full price liberalization in February 2008 when fuel prices were increased by 33–76 percent.

- The minimum wage was increased, and low-paid government employees received higher wage increases than other employees.
- A one-time bonus was given to low-income government employees and pensioners.
- An electricity lifeline tariff was maintained at current low levels—electricity access is almost universal.
- Cash transfers were provided to other low-income households whose head is a non-government worker or pensioner.
- The government announced a plan to increase funding to the National Aid Fund as part of a program to improve the design and implementation of this national safety net program with World Bank assistance.

The first best approach to petroleum pricing is to implement a fully liberalized regime, accompanied by appropriate regulation to ensure competition. As an interim measure, however, governments can adopt automatic pricing mechanisms. But the adoption of an automatic mechanism in itself is not a panacea. Many countries have abandoned such mechanisms, or abandoned subsidy reform programs, in times of sharp increases in international prices. For example, Ghana adopted an automatic mechanism in January 2002 only to abandon it in January 2003. The increasing fiscal cost of incomplete pass-through led to the reinstatement of the mechanism in February 2005, but it was again abandoned in early 2008 when international prices increased sharply, and domestic prices remained fixed from May to November 2008. Similarly, Indonesia began a subsidy reform in 2005 with the intention of eliminating subsidies and fully passing through increases in international prices. However, this policy had been abandoned by the end of 2007. So both governments that control prices and those with automatic pricing mechanisms have struggled to fully pass through prices during periods of sharp increases in international prices. Consistent with this, median pass-through exceeded 100 percent at the end of 2006 but decreased substantially thereafter (Appendix Table 5).

The fragility of automatic price adjustment mechanisms often reflects the reluctance of governments to fully pass through sharp international price increases that they believe may be temporary. If such price increases are persistent, this “wait and see” approach can result in escalating subsidies, and substantial increases in domestic fuel prices are eventually required. Since the public is likely to be more concerned about large price increases, reform becomes more difficult and subsidies become entrenched. However, to make automatic pricing adjustments more attractive, smoothing mechanisms can be incorporated. These smoothing rules can: (i) reduce the magnitude of retail price changes compared to full pass-through, (ii) ensure full pass-through of price changes over the medium term, and (iii) avoid long periods of fixed prices that eventually necessitate large retail price increases if international price increases turn out to be persistent.¹¹

VI. CONCLUDING REMARKS

The paper reviews recent empirical evidence on the impact of increases in fuel prices on households. On average, a \$0.25 per liter increase in fuel prices is found to decrease household real incomes by about 5.9 percent. This means that the large increases in international fuel prices that occurred between 2003 and mid-2008 would, if fully passed through, have had a very large adverse impact on household welfare. On average, over half of this impact arises from the indirect impact of higher fuel prices on the prices of other goods and services consumed by households.

¹¹ See Federico, Daniel, and Bingham (2001) for a more detailed discussion of smoothing mechanisms.

The distribution of the total, direct, and indirect welfare impact are approximately neutral, with the welfare loss being similar across income groups. However, in the case of the direct impact, this hides substantial differences across fuel products, with the impact of gasoline and electricity price increases being progressive and of kerosene price increases being regressive. But clearly low income groups incur a substantial welfare loss, which they will find more difficult to absorb given their low initial consumption levels. However, the benefits of maintaining low prices are captured mostly by higher income groups, reflecting their large share in total income and consumption. This makes fuel subsidies a very inefficient policy instrument for protecting poor households from fuel price increases. Subsidy reform programs may therefore need to introduce supporting measures to mitigate the adverse impact of higher prices on poor households. Where an effective safety net does not exist, a more gradual reform may be warranted if fiscal conditions allow, while governments develop the existing safety net.

Transparently recording subsidies in the budget and running a public information campaign to identify the shortcomings of subsidies can help to gain public support for subsidy reform. This campaign should emphasize that high-income households capture most of the subsidy and that the subsidy crowds out higher priority public expenditures for education, health, and physical infrastructure, which are crucial for growth and poverty reduction.

Avoiding a recurrence of subsidies requires a new approach to pricing which removes governments from direct control of fuel prices. While the first-best approach is to fully liberalize pricing, adopting an automatic fuel pricing mechanism can provide a useful interim step while governments develop their capacity to regulate fuel markets to ensure competitive pricing practices. This approach can also include a smoothing mechanism to avoid sharp increases in prices, which can often create substantial political pressure to reintroduce subsidies.

Appendix Table 1. Fuel Price Increases, Pass-Through, and Tax Levels by Country

	Pass-through, end-2003 to mid-2008 (in percent)				Average tax rate (in US\$ per liter)		Fiscal cost (in percent of GDP)	Retail price increase, end-2003 to mid-2008					
	Gasoline	Diesel	Kerosene	Average	end-2003	mid-2008		(in US\$ per liter)				(in percent change)	
								Gasoline	Diesel	Kerosene	Average	Average	With full pass-through
Africa	89	85	79	82	0.17	0.18	1.0	0.65	0.73	0.68	0.66	91	126
Burkina Faso	49	66	60	60	0.28	0.19	1.1	0.64	0.72	0.60	0.67	45	74
Cameroon	58	51	55	54	0.20	0.09	1.1	0.64	0.61	0.52	0.61	42	78
Central African Rep.	52	59	51	55	0.50	0.47	0.4	0.74	0.80	0.59	0.73	30	55
Congo, Rep. of	50	38	14	35	0.12	-0.20	2.2	0.57	0.45	0.26	0.43	30	93
Gabon	64	46	10	42	0.33	0.06	2.2	0.65	0.54	0.21	0.50	37	92
Ghana	92	86	79	87	0.04	-0.12	3.0	0.56	0.63	0.57	0.60	191	220
Madagascar	161	146	101	140	0.20	0.42	-2.5	0.97	1.09	0.75	0.98	247	184
Mali	76	55	43	58	0.29	0.14	1.7	0.72	0.61	0.49	0.61	42	75
Mozambique	154	114	106	120	0.11	0.25	-0.9	1.04	0.90	0.83	0.91	177	151
Senegal	139	154	...	151	0.17	0.74	-2.0	1.08	1.30	...	1.27	125	101
Central & South America	53	54	30	54	0.07	-0.08	0.9	0.37	0.70	0.42	0.40	52	170
Bolivia	11	12	...	12	0.18	-0.48	11.4	0.10	0.12	...	0.11	20	173
El Salvador	106	112	...	109	0.02	0.09	-0.5	0.71	0.90	...	0.82	186	169
Honduras	53	87	30	70	0.07	-0.16	3.4	0.32	0.68	0.21	0.51	124	170
Peru	30	33	49	33	0.16	-0.26	2.6	0.32	0.35	0.47	0.35	34	103
Asia & the Pacific	81	71	57	74	-0.03	-0.19	0.1	0.70	0.56	0.48	0.54	138	181
Bangladesh	106	62	67	68	-0.08	-0.36	1.5	0.67	0.46	0.51	0.49	183	280
Cambodia	112	69	73	79	0.03	-0.15	2.4	0.76	0.54	0.57	0.59	134	177
India	36	37	2	30	0.05	-0.47	4.4	0.29	0.31	0.03	0.26	42	184
Indonesia	34	34	17	31	-0.24	-0.77	4.3	0.21	0.26	0.14	0.22	140	513
Sri Lanka	81	47	46	54	-0.08	-0.46	3.5	0.50	0.34	0.35	0.38	138	273
Middle East	11	8	6	2	-0.08	-0.76	5.4	0.09	0.02	0.04	0.02	25	503
Jordan	83	101	101	95	-0.18	-0.20	-1.0	0.56	0.80	0.80	0.72	330	337
Lebanon	57	124	115	94	0.02	0.01	0.2	0.38	0.98	0.91	0.72	210	194
All regions	64	69	55	58	0.06	-0.06	0.9	0.60	0.76	0.60	0.56	90	173

Source: Dataset provided by Coady and others (2010).

Note: Average pass-through and price increases are weighted by fuel consumption shares. Regional observations are group medians based on larger country samples: Africa (43 countries), Central and South America (31 countries), Asia and the Pacific (15 countries), Middle East (12 countries).[...] indicates information not available.

Appendix Table 2. Adjustment Factor by Fuel Product

	Gasoline	Kerosene	Diesel	LPG
Cameroon	0.40	0.92	0.48	0.44
Gabon	0.29	0.59	0.38	0.34
Central African Republic	0.24	0.45	0.27	0.26
Senegal	0.25	0.28	0.28	0.27
Ghana	0.96	1.42	1.02	0.99
Mali	0.36	0.59	0.58	0.47
Congo	0.30	0.49	0.45	0.37
Burkina Faso	0.29	0.57	0.40	0.35
Madagascar	0.27	0.42	0.32	0.30
Bolivia	0.54	0.71	0.52	0.53
Peru	0.27	0.27	0.27	0.27
El Salvador	0.38	...	0.41	0.39
Honduras	0.36	0.53	0.47	0.42
Bangladesh	0.54	0.86	0.86	0.70
Sri Lanka	0.33	0.95	0.88	0.61
Cambodia	0.40	0.62	0.55	0.47
India	0.28	1.23	0.46	0.37
Indonesia	0.69	1.79	1.12	0.90
Jordan	0.53	1.25	1.29	0.91
Lebanon	0.35	0.67	0.72	0.54

Source: Authors' calculations based on country studies and data available from Coady and others (2010).

Note: Factor adjustments indicate how fuel product budget shares need to be adjusted to calculate the impact of a \$0.25 per liter increase in fuel prices. Values less than one indicate that a doubling of fuel prices would result in a greater than \$0.25 per liter price increase. The factor for LPG is a weighted average of those for gasoline and diesel. [...] indicates information not available in the country study.

Appendix Table 3. Distribution of Impacts by Region

	Consumption Quintiles					All Households
	Bottom	2	3	4	Top	
Africa						
Total Impact	5.8	5.6	5.5	5.6	6.0	5.7
Total Direct Impact	2.1	1.6	1.5	1.3	1.4	2.0
Gasoline	0.1	0.1	0.1	0.2	0.6	0.2
Kerosene	1.9	1.4	1.2	0.9	0.6	1.2
LPG	0.1	0.1	0.1	0.2	0.2	0.2
Electricity	0.2	0.3	0.3	0.4	0.6	0.4
Indirect Impact	3.5	3.7	3.7	3.9	4.0	3.8
South & Central America						
Total Impact	3.7	3.6	3.8	4.0	3.9	3.7
Total Direct Impact	0.5	0.6	0.6	0.6	0.7	1.4
Gasoline	0.0	0.1	0.1	0.2	0.4	0.2
Kerosene	0.4	0.3	0.1	0.1	0.0	0.2
LPG	0.2	0.3	0.4	0.4	0.3	0.3
Electricity	0.4	0.6	0.8	0.9	0.9	0.8
Indirect Impact	2.7	2.4	2.4	2.4	2.3	2.4
Asia and Pacific						
Total Impact	5.5	5.9	6.2	6.5	6.3	5.9
Total Direct Impact	2.2	2.1	2.1	2.2	2.1	3.8
Gasoline	0.0	0.1	0.2	0.3	0.6	0.3
Kerosene	2.2	2.0	1.9	1.7	1.0	1.6
LPG	0.0	0.0	0.1	0.3	0.6	0.3
Electricity	0.9	1.1	1.4	1.6	2.1	1.7
Indirect Impact	2.4	2.6	2.6	2.6	2.2	2.1
Middle East & Central Asia						
Total Impact	12.0	10.5	10.3	9.6	8.8	9.6
Total Direct Impact	2.8	2.7	3.0	2.9	2.4	5.4
Gasoline	0.1	0.2	0.3	0.4	0.7	0.3
Kerosene	1.7	1.3	1.2	1.0	0.6	1.1
LPG	1.5	1.0	0.9	0.7	0.5	1.0
Electricity	3.2	2.7	2.6	2.4	2.2	2.7
Indirect Impact	6.1	5.0	4.6	4.2	4.2	4.2
All Regions						
Total Impact	6.4	6.2	6.2	6.3	6.4	6.2
Direct Impact	2.8	2.7	2.7	2.8	2.9	2.8
Gasoline	0.1	0.2	0.3	0.4	0.7	0.3
Kerosene	1.7	1.3	1.2	1.0	0.6	1.1
LPG	0.25	0.25	0.27	0.31	0.37	0.3
Electricity	0.8	0.9	1.0	1.1	1.2	1.1
Indirect Impact	3.6	3.5	3.5	3.5	3.5	3.3

Source: Authors' calculations based on country studies.

Note: Impacts are based on a \$0.25 per liter increase in fuel prices.

Appendix Table 4. Distribution of Subsidy Benefits by Consumption Group

	Consumption Quintiles					All Households
	Bottom	2	3	4	Top	
Africa						
Total Impact	7.8	11.5	15.3	21.2	44.2	100.0
Total Direct Impact	8.0	10.6	13.7	19.6	48.1	100.0
Gasoline	2.2	4.1	6.5	17.2	70.0	100.0
Kerosene	15.8	17.6	20.6	20.7	25.3	100.0
LPG	3.1	6.6	11.1	20.8	58.3	100.0
Indirect Impact	6.7	10.9	15.7	22.3	44.4	100.0
South & Central America						
Total Impact	5.2	10.8	17.3	24.8	41.8	100.0
Total Direct Impact	4.2	9.4	15.2	22.1	44.9	100.0
Gasoline	4.2	8.6	14.8	22.2	50.2	100.0
Kerosene	31.7	24.7	19.8	16.2	7.6	100.0
LPG	3.2	8.4	15.4	23.3	46.0	100.0
Indirect Impact	5.9	11.1	16.5	23.2	42.3	100.0
Others Regions						
Total Impact	7.6	12.1	17.3	22.8	40.2	100.0
Total Direct Impact	8.5	12.5	13.4	17.7	49.7	100.0
Gasoline	4.2	8.6	14.8	22.2	50.2	100.0
Kerosene	15.0	18.7	20.8	23.1	22.6	100.0
LPG	4.5	5.7	8.1	11.8	70.0	100.0
Indirect Impact	9.2	13.0	16.6	22.0	39.3	100.0
All Regions						
Total Impact	7.1	11.4	16.2	22.5	42.8	100.0
Total Direct Impact	7.1	10.7	14.0	19.9	47.6	100.0
Gasoline	3.0	5.7	9.7	19.4	61.3	100.0
Kerosene	19.0	19.7	20.6	20.1	20.6	100.0
LPG	3.8	7.6	12.6	20.8	53.8	100.0
Indirect Impact	7.3	11.7	16.3	22.6	42.0	100.0

Source: Authors' calculations based on country studies.

Appendix Table 5. Pass-Through of International Price Changes (2004–2008)

	Pass-through, End-2003 Base (Percent)				
	To 2004	To 2005	To 2006	To 2007	To Mid-2008
Africa	142	108	140	88	81
Burkina Faso	175	119	135	77	60
Cameroon	123	83	136	80	54
Central African Rep.	0	0	65	33	55
Congo, Rep. of	66	145	143	105	87
Gabon	0	0	22	45	42
Ghana	0	103	158	146	87
Madagascar	228	138	183	146	140
Mali	178	121	127	69	58
Mozambique	22	231	160	148	119
Senegal	226	120	169	172	151
Central & South America	155	121	124	94	54
Bolivia	53	37	33	18	12
El Salvador	168	132	109	119	109
Honduras	191	134	108	83	70
Peru	142	102	105	82	33
Asia & the Pacific	88	84	105	80	74
Bangladesh	17	74	93	67	68
Cambodia	193	136	159	122	79
India	85	74	78	47	30
Indonesia	6	61	116	66	31
Sri Lanka	85	76	82	59	54
Middle East	0	5	3	3	2
Jordan	28	59	146	72	95
Lebanon	73	46	62	75	94
All regions	100	102	122	80	58

Source: Dataset provided by Coady and others (2010).

Note: Regional observations are group medians based on larger country samples: Africa (43 countries), Central and South America (31 countries), Asia and the Pacific (15 countries), Middle East (12 countries).

References

- Adriamihaja, N., and G. Vecchi, 2007, "Madagascar: An Evaluation of the Welfare Impact of Higher Energy Prices in Madagascar," Africa Region Working Paper Series No. 106 (Washington: The World Bank).
- Bacon, R., S. Bhattacharya, and M. Kojima, 2010, *Expenditure of Low-Income Households on Energy: Evidence from Africa and Asia*, Extractive Industries for Development Series, No. 16, (Washington: The World Bank).
- Clements, B., H-S Jung, and S. Gupta, 2007, "Real and Distributive Effects of Petroleum Price Liberalization: The Case of Indonesia," *The Developing Economies*, Vol. 45, No. 2, pp. 220–37.
- Coady, D., and others, 2006, "The Magnitude and Distribution of Fuel Subsidies: Evidence from Bolivia, Ghana, Jordan, Mali, and Sri Lanka," IMF Working Paper No. 06/247 (Washington: International Monetary Fund).
- Coady, D., and others, 2010, "Petroleum Product Subsidies: Costly, inequitable, and Rising," IMF Staff Position Note, SPN/10/05 (Washington: International Monetary Fund).
- Federico, G., J. Daniel, and B. Bingham, 2001, "Domestic Petroleum Price Smoothing in Developing and Transition Countries," IMF Working Paper No. 01/75 (Washington: International Monetary Fund).
- Gupta, S., B. Clements, K. Fletcher, and G. Inchauste, 2003, "Issues in Domestic Petroleum Pricing in Oil Producing Countries," *Fiscal Policy Formulation and Implementation in Oil-Producing Countries*, ed. J.M. Davis, R. Ossowski, and A. Fedelino (Washington: International Monetary Fund).
- Gupta, S., and others, 2000, "Equity and Efficiency in the Reform of Price Subsidies: A Guide for Policymakers," (Washington: International Monetary Fund).
- International Energy Agency (IEA), 2009, *World Energy Outlook 2009* (Paris).